

Public Works Government Services Canada
Monitoring Well Installation/Sampling & Capping
of Waste Disposal Middens
Bar U Ranch National Historic Site, Longview, Alberta

Prepared by:

AECOM Canada Ltd.

17203 103rd Avenue, Edmonton, AB, Canada T5S 1J4
T 780.488.6800 F 780.488.2121 www.aecom.com

Project Number:

106547-03

Date:

April 8, 2009

Statement of Qualifications and Limitations

© 2009 AECOM CANADA LTD. OR CLIENT (IF COPYRIGHT ASSIGNED TO CLIENT). ALL RIGHTS RESERVED. THIS DOCUMENT IS PROTECTED BY COPYRIGHT AND TRADE SECRET LAW AND MAY NOT BE REPRODUCED IN ANY MANNER, EXCEPT BY CLIENT FOR ITS OWN USE, OR WITH THE WRITTEN PERMISSION OF AECOM CANADA LTD. OR CLIENT (IF COPYRIGHT ASSIGNED TO CLIENT).

The attached Report (the "Report") has been prepared by AECOM Canada Ltd. ("Consultant") for the benefit of the client ("Client") in accordance with the agreement between Consultant and Client, including the scope of work detailed therein (the "Agreement").

The information, data, recommendations and conclusions contained in the Report:

- are subject to the budgetary, time, scope, and other constraints and limitations in the Agreement and the qualifications contained in the Report (the "Limitations");
- represent Consultants' professional judgement in light of the Limitations and industry standards for the preparation of similar reports;
- may be based on information provided to Consultant which has not been independently verified;
- have not been updated since the date of issuance of the Report and their accuracy is limited to the time period and circumstances in which they were collected, processed, made or issued;
- must be read as a whole and sections thereof should not be read out of such context;
- were prepared for the specific purposes described in the Report and the Agreement;
- in the case of subsurface, environmental or geotechnical conditions, may be based on limited testing and on the assumption that such conditions are uniform and not variable either geographically or over time.

Unless expressly stated to the contrary in the Report or the Agreement, Consultant:

- shall not be responsible for any events or circumstances that may have occurred since the date on which the Report was prepared or for any inaccuracies contained in information that was provided to Consultant;
- makes no representations whatsoever with respect to the Report or any part thereof, other than that the Report represents Consultant's professional judgement as described above, and is intended only for the specific purpose described in the Report and the Agreement;
- in the case of subsurface, environmental or geotechnical conditions, is not responsible for variability in such conditions geographically or over time.

Except as required by law or otherwise agreed by Consultant and Client, the Report:

- is to be treated as confidential;
- may not be used or relied upon by third parties.

Any use of this Report is subject to this Statement of Qualifications and Limitations. Any damages arising from improper use of the Report or parts thereof shall be borne by the party making such use.

This Statement of Qualifications and Limitations is attached to and forms part of the Report.

THIS DOCUMENTATION IS SUPPLIED TO CLIENT BY CONSULTANT AND CONSTITUTES CONFIDENTIAL TRADE SECRETS, OR COMMERCIAL, FINANCIAL, SCIENTIFIC, OR TECHNICAL INFORMATION. THIS DOCUMENTATION IS SUBMITTED TO CLIENT IN CONFIDENCE. IT HAS SIGNIFICANT ECONOMIC VALUE TO CONSULTANT AND ITS DISCLOSURE, WITHOUT THE EXPRESS CONSENT OF CONSULTANT, COULD REASONABLY BE EXPECTED TO LEAD TO SIGNIFICANT AND UNDUE FINANCIAL AND OTHER HARM TO CONSULTANT, INCLUDING HARM TO CONSULTANT'S COMPETITIVE AND NEGOTIATING POSITIONS, AND UNDUE FINANCIAL GAIN TO ONE OR MORE THIRD PARTIES.

AECOM

17203 103rd Avenue, Edmonton, AB, Canada T5S 1J4
T 780.488.6800 F 780.488.2121 www.aecom.com

April 8, 2009

Project Number: 106547-03

Ms. Laurie Washington
Senior Environmental Specialist
Environmental Services, Western Region
Public Works Government Services Canada
Telus Plaza North
10025 Jasper Avenue
Edmonton, Alberta T5J 1S6

Dear Ms. Washington:

**Re: Monitoring Well Installation/Sampling & Capping of
Waste Disposal Middens Bar U Ranch National Historic Site, Longview, Alberta**

Please find attached three (3) copies and two (2) DC of the final report for the Monitoring Well Installation/Sampling and Capping of Waste Disposal Middens.

If you have comments or questions regarding the above, please contact the undersigned at (780) 453-0710.

Sincerely,

AECOM Canada Ltd.



Gordon Woollett, P.Eng.
gordon.woollett@aecom.com

GW:vad
Encl.

Distribution List

# of Copies	Association / Company Name	PDF	Hard Copy
1	Public Works Government Services Canada	X	

Revision Log

Revision #	Revised By	Date	Issue / Revision Description
1	Gordon Woollett	March 9, 2009	Draft Report – Monitoring Well Installation/Sampling & Capping of Waste Disposal Middens – Bar U Ranch National Historic Site, Longview, Alberta
3	Gordon Woollett	April 8, 2009	Final Report – Monitoring Well Installation/Sampling & Capping of Waste Disposal Middens – Bar U Ranch National Historic Site, Longview, Alberta

Signature Page

Report Prepared By:

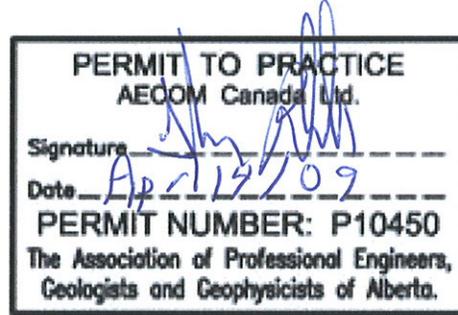
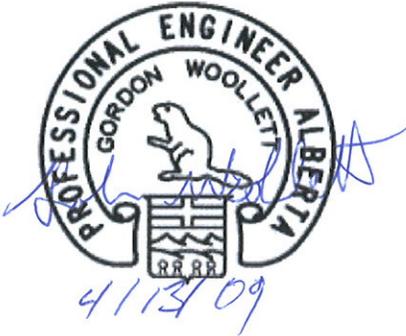


Mitch Bliss, E.I.T.

Report Reviewed By:



Gordon Woollett, P.Eng.



Executive Summary

AECOM was retained by Public Works and Government Services Canada to provide engineering services to assist with the remedial activities at the abandoned waste middens located at Bar U Ranch.

The remedial action included the capping of the two middens, the installation of four additional groundwater monitoring wells and the completion of a groundwater monitoring event of all onsite wells. AECOM was also responsible for contractor supervision and a quantity survey to track the amount of material being moved.

Groundwater samples were taken at the top and bottom of each waste midden as well as two downstream background samples. The sampling program included measuring groundwater levels in each of the wells and collecting groundwater samples from selected wells for dissolved metals, PAHs, pesticides and routine parameters analysis.

Blue Ridge Excavating Limited was awarded a contract to cap the two disposal middens. During the capping process, approximately of 2200 m³ of clay fill material was hauled from a local borrow site to the two (2) midden sites. The ground contours of the final clay cap show that the disposal areas have been filled and the final grade of the coulees blends in with the natural grades of the adjacent slopes. Based on the final grades, there should be positive drainage away from the two (2) waste disposal sites and there should be no ponding of water in the areas where wastes have been deposited.

Groundwater results were compared to the *CCME Drinking Water Guidelines (2006)* and the *Alberta Tier 1 Soil and Groundwater Remediation Guidelines (2008.)* Based on the results from this remedial program and groundwater investigation, the following conclusions can be made:

- Groundwater retrieved from wells within both waste middens showed exceedances of the CCME aesthetic objectives for sodium, iron and manganese. The wells which exceeded are MW1, MW3, MW4 and MW6.
- Groundwater concentrations for sodium, iron and manganese in the down gradient monitoring wells (ET-MW 14 and ET-MW16) were 2-3 orders of magnitude lower than the concentrations recorded in the wells in and adjacent to the two waste middens.
- Groundwater retrieved from ET-MW14 downstream of waste midden #1 showed exceedances of the applied criteria for manganese and TDS.
- Pesticide and PAH concentrations in all the analyzed groundwater samples were below the applicable remediation criteria and/or laboratory detection limits.

Based on the results from this investigation, the following recommendations can be made:

- Due to the elevated concentrations of metals in the groundwater samples collected around the two midden sites and the use of groundwater for drinking water purposes, it is recommended that an annual groundwater sampling event be completed to confirm that metal, PAH and pesticide concentrations remain stable and/or decrease. If concentrations are stable or decrease after three (3) consecutive sampling events, it is recommended that the monitoring program be halted and that the monitoring wells be decommissioned.

Table of Contents

Statement of Qualifications and Limitations

Letter of Transmittal

Distribution List

Executive Summary

	page
1. Introduction	1
2. Background	1
3. Scope of Work	1
3.1 AECOM Scope of Work.....	1
3.2 Contractor Scope of Work	2
4. Physical Site Description	3
4.1 Property Description	3
4.2 Soil, Topography and Drainage.....	3
4.3 Groundwater Usage	3
5. Summary of Remedial Activities.....	4
6. Methodology	5
6.1 Monitoring Well Installation and Groundwater Sampling.....	5
6.2 Laboratory Analysis.....	5
6.3 Regulatory Criteria.....	5
7. Groundwater Sampling Results.....	6
8. Conclusions and Recommendations	11
9. Closure	11

List of Tables

Table 1 Water Well Search Results.....	3
Table 2 Groundwater Elevation Data	6
Table 3 Summary of Metals Analysis	7
Table 4 Summary of Polycyclic Aromatic Hydrocarbon Analysis.....	8
Table 5 Summary of Pesticide Analysis	9
Table 6 Summary of Routine Parameter Analysis	10

Appendices

- A. Figures
- B. Photographs
- C. Topographic Surveys
- D. Borehole Logs
- E. Water Well Records
- F. Laboratory Reports
- G. Special Provisions – Environmental Site Services

1. Introduction

AECOM was retained by Public Works and Government Services Canada to provide engineering services to assist with groundwater monitoring and remedial activities at the abandoned waste middens located at Bar U Ranch. (Hereinafter referred to as the "Site"). A location plan and site plan are shown in **Appendix A**.

The remedial action included the capping of the two middens, the installation of four additional groundwater monitoring wells and the completion of a groundwater monitoring event. AECOM was also responsible for contractor supervision and a quantity survey to track the amount of material being moved to cap the two (2) abandoned waste disposal Sites.

This report presents a summary of the field data and observations gathered by AECOM.

2. Background

Bar U Ranch was in operation as an active ranch from 1881 to 1991 and has since become a National Historic Site under the management of Parks Canada. The Site is located between sloping foothills and the Rocky Mountains, approximately 14 kilometers south of Longview, Alberta. Bar U Ranch consists of thirty-five (35) structures and a visitor orientation centre illustrating various stages of ranching development. Onsite buildings include barns, sheds, pens and various other support structures.

The areas of interest are the two (2) waste middens located in coulees on the north portion of the ranch. The middens are approximately 100 meters apart and slope towards the southeast. Midden # 1 is the dumpsite furthest to the west and measures approximately 35 m x 8 m; Midden # 2 is east of the first midden and measures approximately 60 m x 10 m. The land surrounding the middens is primarily undulating agricultural land used for grazing. Pekisko Creek is located approximately 300 m southeast of the waste middens.

Based on the results of previous environmental site assessments and the development of a Risk Management Plan, a decision was made to complete a number of remedial activities at the two (2) midden sites. The activities included the capping of both dump sites as well as completion of a groundwater monitoring event.

3. Scope of Work

3.1 AECOM Scope of Work

AECOM was retained to provide engineering services to assist with the remedial activities at the abandoned waste middens located at Bar U Ranch. The engineering services are described generally below:

- **Task 1 - Project Setup**
 - Completion of a Health and Safety Plan;
 - Development of field program methodologies.
- **Task 2 - Drilling and Monitoring Well Installation / Extension**
 - Location of underground utilities;
 - Installation of four monitoring wells at the base of the two midden areas;
 - Extension of wells, where required, to bring them up to the surface grade of the midden caps.

- **Task 3 - Groundwater Sampling**

- Sampling of the specified wells on Site for the analysis of the specified analytical parameters.

- **Task 4 - Quantity Survey**

- Completion of a topographic survey of the borrow pit and waste midden areas before and after backfill activities to provide an estimated volume of material moved.

- **Task 5 - Contractor Supervision**

- Provide contractor supervision services during backfill activities;
- Confirm excavation and backfill activities are being performed as per project specifications.

- **Task 6 - Final Report**

- Preparation of a summary report with a volume estimate for the amount of earth moved in addition to an analysis of laboratory results and all relevant figures.

3.2 Contractor Scope of Work

Following a MERX tendering process, Blue Ridge Excavating Limited was retained by Parks Canada to complete all the earthworks necessary to stockpile topsoil and complete the capping of the waste middens. The contractors' services are described generally below:

- **Task 1 – Mobilization / Demobilization**

- Mobilization and demobilization of all personnel, equipment, support facilities and materials required for earthworks.

- **Task 2 – Upgrade of Hauling Route / Borrow Source Arrangements**

- Placement of gravel fill in required areas of the haul route.
- Contractor responsible for contacting the property owner of the borrow source and making all necessary arrangements to utilize the borrow source.

- **Task 3 – Topsoil Stockpiling**

- Excavation of topsoil from the borrow area and transporting it near the Midden areas to be stockpiled for later use by Parks Canada.
- The borrow source was located on privately owned land located northwest of the Bar U Ranch.

- **Task 4 – Capping of the Waste Middens**

- Excavation and transport of approximately 2200 m³ of soil from the borrow source area to the waste midden areas to be used for the capping of the middens;
- Waste debris in the vicinity of the waste middens to be placed within the middens for capping. This includes rolls of mesh wire material currently on-site;
- Backfilling operations at the waste middens to include backfilling around the risers of the groundwater monitoring wells currently on-site.

Field work and reporting for this project was completed by Gordon Woollett, P.Eng., Mitch Bliss, E.I.T. and Jon Nhieu, P.Eng. with Gordon Woollett, P.Eng. providing senior technical review.

4. Physical Site Description

An assessment of the subsurface conditions and characteristics was previously completed by Jacques Whitford Limited. The findings are presented in the *Waste Dump Sites Assessment*, which was prepared and submitted to Parks Canada in 2004. The information in Section 4.2 has been extracted from the 2004 Jacques Whitford report. **Photos 1-6 in Appendix B** show the two (2) waste disposal middens and the surface debris.

4.1 Property Description

The two waste disposal middens are located in the northern portion of Bar U Ranch approximately 300 m northwest of Pekisko Creek. Midden # 1 is the dumpsite furthest to the west and measures approximately 35 m x 8 m; Midden # 2 is east of the first midden and measures approximately 60 m x 10 m. The waste middens are roughly 100 m apart and slope towards the southeast. Waste generated by historic ranching activities at Bar U Ranch during its 100+ years of operation has been placed in these naturally occurring coulees. The waste middens are suspected to contain unknown quantities of waste oil and fuel containers, pesticide and herbicide containers, glycol, batteries, creosote and CCA treated lumber, scrap metal, vehicles and paint containers. The land surrounding the middens is primarily undulating agricultural land used for grazing.

4.2 Soil, Topography and Drainage

Based on available surficial geology maps, the native surficial soils at the Site likely consist of till of even thickness with minor amounts of water-sorted material. Fine sediments consisting of sand, silt and clay with minor gravel beds are present adjacent to Pekisko Creek. Soils observed by Jacques Whitford were similarly classified. Regional surface drainage appears to be southeast towards Pekisko Creek, located approximately 300 meters southeast of the dump sites.

4.3 Groundwater Usage

A search of the Alberta Environment database for records of water wells located within a 1 km radius of the site was conducted. The provincial records indicated there were twenty-two (22) data records (water well reports) within 1 km of the site. It should be noted that the database states *"The list is not intended to be a true reflection of the exact number and location of the water wells for the area. The report may also appear as if certain records are duplicated. The same record will appear multiple times on the summary sheet each time a different well test is conducted"*. This indicates the well locations are not necessarily accurate but are close to the location of interest. **Table 1** outlines the details of each of the wells.

Table 1 Water Well Search Results

Well ID	Drill Date	Approximate Distance from Site	Depth of Well	Anticipated Use
0350122	1990/03/16	0 m	9.8 m	Domestic
0360180	1991/08/23	429 m	48.8 m	Domestic
0360181	1991/08/23	429 m	54.9 m	Domestic & Stock
0361384	1991/08/19	580 m	Unknown	Domestic
0369429	1993/09/28	580 m	64.0 m	Domestic
0370152	1993/09/28	580 m	61.0 m	Domestic
0370153	1993/09/28	429 m	64.0 m	Domestic
0378438	1994/05/30	0 m	73.2 m	Municipal

Well ID	Drill Date	Approximate Distance from Site	Depth of Well	Anticipated Use
0378440	1994/05/30	0 m	61.0 m	Municipal
0378441	1994/05/30	0 m	36.6 m	Municipal
0385172	1989/09/29	580 m	82.3 m	Unknown
0385186	1975/10/14	429 m	27.4 m	Domestic
0385187	1976/02/06	429 m	152.4 m	Investigation
0385209	1986/02/18	411 m	61.0 m	Stock
0385226	1987/11/19	411 m	59.4 m	Stock
0385232	1975/05/07	0 m	Unknown	Unknown
0385233	1975/05/07	0 m	18.3 m	Unknown
0385953	1994/08/16	424 m	67.1 m	Domestic & Stock
0385959	1994/08/16	350 m	97.5 m	Domestic & Stock
0385961	1994/08/16	344 m	70.1 m	Domestic & Stock
0385965	1994/08/16	386 m	67.1 m	Domestic & Stock
0467773	1997/09/17	392 m	54.9 m	Domestic

Previous environmental assessments confirmed that privately owned groundwater wells are located within 500 m and Parks Canada drinking water wells are approximately 700 m from the middens. Therefore, the groundwater ingestion pathway remediation criteria will be applied to the subject property. The copies of the water well reports are presented in **Appendix E**.

5. Summary of Remedial Activities

Blue Ridge Excavating Limited made arrangements with a local landowner to obtain the fill material required for the project. A dugout was excavated northwest of the waste middens on the adjacent section of land to supply the necessary fill material to cap the waste middens. The final dimensions of the borrow pit were approximately 30 m x 30 m with a depth ranging from 2 m to 3 m. These dimensions are consistent with the contractors' estimate of 2200 m³ of fill material moved during the backfill operations. It should be noted that the borrow pit filled with water and froze before the surveyors could perform the final topographic survey of the bottom of the borrow pit; therefore, the quantity of fill material was not confirmed with a quantity survey. Photos of the borrow site are presented in **Appendix B**.

The initial and final topographic surveys of the borrow pit are presented in **Figures 2 and 3 in Appendix C**. **Figures 2 and 3** also show the ground contours at both midden sites before and after the placement of the clay cap. As indicated in **Figure 3**, the final contours show that the disposal areas have been filled and the final grade of the coulees blends in with the natural grades of the adjacent slopes. Based on the final grades, there should be positive drainage away from the two (2) waste disposal sites and there should be no ponding of water in the areas where wastes have been deposited.

Clay material excavated from the dugout was hauled by truck to the Site and dumped into the coulees to fully cover all the specified waste materials. A track dozer was used to compact the fill material and to provide a final grade which transitioned smoothly to the surrounding landscape. Affected wells were raised and re-capped to ensure accessibility in the future. Photos taken during the capping of the middens are included in **Appendix B**. Initial and final topographic surveys were performed at the waste middens and can be seen in **Appendix C**.

In addition to the excavation of the borrow pit and capping of the waste middens minor upgrades were made to the haul route between the two (2) locations. The gravel road connecting the waste middens to the borrow pit site had several ruts and uneven areas and were filled in with gravel by Blue Ridge Excavating. A damaged culvert was in place in a low area along the route and was replaced with a new larger one to ensure that any heavy equipment attempting to cross in the future could do so safely and without further damaging the road.

6. Methodology

6.1 Monitoring Well Installation and Groundwater Sampling

Four (4) additional monitoring wells were installed by BECK Drilling and Environmental Services Limited to better assess the background groundwater conditions on Site. Two (2) of the wells (ET-MW14 and ET-MW15) were installed down gradient of Waste Midden # 1 and the other two wells (ET-MW16 and ET-MW17) were installed down gradient of Waste Midden # 2. Where necessary, groundwater wells were extended using PVC couplers and 50-mm diameter PVC pipe. The extended wells were then re-set in place with Redi-Mix concrete to ensure they were stabilized and flush with the new grades of the Middens. MW11 was removed from the Site as it was found to be damaged.

Groundwater monitoring wells were installed according to CCME document EPC-NCSR-48E March 1994; entitled Subsurface Assessment Handbook for Contaminated Sites. Each groundwater monitoring well was equipped with a permanent standpipe. The standpipe consisted of a 50-mm diameter machine slotted (0.020 slot) PVC well screen. The annulus around and just above the screened portion was backfilled with silica # 9 sand. The remainder of the borehole was backfilled with bentonite and cement to prevent infiltration of surface water. A flush mounted bolt-down steel casing protector was also used to protect the monitoring wells. The detailed completion of each monitoring well is recorded in the borehole logs in **Appendix D**.

The water levels were measured using an electronic water level tape on November 27 and 28, 2008 and are further discussed in Section 7.1. The groundwater monitoring wells were purged by bailing three (3) well volumes using a one-litre capacity dedicated PVC bailer prior to sampling. Groundwater samples for laboratory analysis were stored in laboratory provided glass and/or plastic containers and then delivered to ALS Laboratory Group for analysis.

6.2 Laboratory Analysis

Selected groundwater samples were submitted to ALS Laboratory Group for analysis of benzene, toluene, ethylbenzene, xylenes (BTEX), F1 to F4 hydrocarbon fractions, PAHs (Polycyclic Aromatic Hydrocarbons), pesticides and routine parameters. ALS Laboratory Group is a member of the Canadian Association of Environmental Analytical Laboratories (CAEAL) and is accredited by the Standards Council of Canada (SCC). Copies of the ALS analytical reports are reproduced in **Appendix F**.

6.3 Regulatory Criteria

Selection of appropriate assessment/remediation criteria is based on the most sensitive allowable land use. Groundwater wells in the vicinity of the Site are suspected to be in use by the local residents and therefore residential land-use criteria will be applied.

In an effort to be consistent with previous environmental assessments of this Site *CCME Drinking Water Guidelines (2006)* are used. The results of laboratory analyses were also compared to *Alberta Tier 1 Soil and Groundwater Remediation Guidelines (2008)*. The Alberta Tier I guidelines provide additional remediation objectives for PAHs and pesticides and allow for a better assessment of groundwater conditions.

7. Groundwater Sampling Results

Groundwater samples were taken at the top and bottom of each waste midden as well as two (2) downstream background samples. The sampling program included measuring groundwater levels in each of the wells and collecting groundwater samples from selected wells for dissolved metals, PAHs, pesticides and routine parameter analysis. **Table 2** presents a summary of the groundwater elevation data and it was determined that groundwater generally flows southeast towards Pekisko Creek.

Table 2 Groundwater Elevation Data

Well ID	Depth to Water (m)	Depth to Bottom (m)
MW1	1.883	14.186
MW2	2.928	5.888
MW3	2.463	2.906
MW4	5.728	11.634
MW5	-	2.873
MW6	1.704	2.738
MW7	3.294	6.083
MW8	1.947	6.052
MW9	2.002	2.993
MW10	3.333	6.039
MW11	-	2.360
MW12	1.928	3.093
MW13	2.837	4.558
ET-MW14	1.933	4.048
ET-MW15	1.787	3.698
ET-MW16	2.015	4.387
ET-MW17	2.182	4.411

Table 3 on the following page presents a summary of the metals analysis for the groundwater samples collected from the monitoring wells. This table indicates that sodium exceedances above criteria were identified in wells MW1 and MW4, iron exceedances in wells MW4 and MW6, manganese exceedances in wells MW1, MW3, MW4, MW6 and ET-MW14, and an aluminum exceedance in MW4. It should be noted that all of these exceedances were above CCME aesthetic criteria. It was also noted that in the newly installed down gradient wells, the only metal exceedance above criteria was manganese in ET-MW14, there were no exceedances in ET-MW16.

Table 4 shows a summary of the polycyclic aromatic hydrocarbon (PAH) analysis of groundwater collected from the monitoring wells. No exceedances above criteria were identified in the analyzed samples and many of the PAH compounds were below laboratory detection limits.

Table 5 shows a summary of the pesticide analysis, as indicated in this table, the pesticide concentrations were all below the laboratory detection limits.

Table 6 shows a summary of the routine parameter analysis of groundwater collected from selected groundwater monitoring wells. It shows a TDS exceedance above drinking water criteria in ET-MW14.

A copy of all laboratory results for groundwater analysis can be found in **Appendix F**.

Monitoring Well Installation/Sampling & Capping
of Waste Disposal Middens
Bar U Ranch National Historic Site, Longview, Alberta

Table 3 Summary of Metals Analysis

Parameter	CCME Guidelines ¹	AB Tier I Guidelines ²	Range of Values From Previous Assessments ³	Units	Well Identification					
					MW1	MW3	MW4	MW6	ET - MW14	ET - MW16
Calcium	-	-	161 - 620	mg/L	529	167	367	195	107	65.9
Potassium	-	-	5.9 - 22.2	mg/L	9.9	4.1	14.4	6.6	6.9	3.3
Magnesium	-	-	95.1 - 1480	mg/L	404	102	402	161	37.4	15.2
Sodium	200*	200	< 0.005 - 766	mg/L	537	60.2	1040	166	32.7	7.1
Iron	0.3*	0.3	< 0.005 - 0.089	mg/L	0.117	0.006	2.88	1.17	0.006	<0.005
Manganese	0.05*	0.05	< 0.005 - 1.46	mg/L	2.74	0.152	2.63	0.282	0.113	0.008
Silver	-	0.0001	< 0.0001 - 0.0002	mg/L	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Aluminum	0.1*	0.1	< 0.0005	mg/L	0.05	<0.01	0.1	0.01	<0.01	<0.01
Boron	5	5	0.046 - 0.19	mg/L	0.12	0.06	0.17	0.08	0.05	<0.05
Barium	1	1	0.047 - 0.256	mg/L	0.026	0.043	0.035	0.053	0.093	0.11
Beryllium	-	-	< 0.0005	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Cadmium	0.005	0.005	< 0.0001 - 0.0002	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Cobalt	-	-	< 0.0001 - 0.0048	mg/L	0.005	<0.002	0.012	<0.002	<0.002	<0.002
Chromium	0.05	0.05	< 0.005 - 0.007	mg/L	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Copper	1*	1	< 0.005 - 0.012	mg/L	0.007	0.002	0.008	0.002	0.002	<0.001
Molybdenum	-	-	< 0.05 - 0.012	mg/L	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Nickel	-	0.15	< 0.001 - 0.021	mg/L	0.028	0.005	0.057	0.005	0.003	0.003
Lead	0.01	0.01	< 0.0005	mg/L	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Tin	-	-	< 0.001 - 0.001	mg/L	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Strontium	-	-	1.31 - 5.89	mg/L	7.54	1.52	9.18	2.09	0.624	0.353
Titanium	-	-	0.003	mg/L	0.004	<0.001	0.005	<0.001	<0.001	<0.001
Thallium	-	-	< 0.0001	mg/L	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Vanadium	-	-	< 0.0005 - 0.0024	mg/L	<0.001	<0.001	0.001	0.001	<0.001	<0.001
Zinc	5*	0.03	< 0.005 - 0.052	mg/L	0.004	0.003	0.007	0.002	<0.002	<0.002

Notes:

¹ CCME Drinking Water Guidelines (2006), based on Health Canada's Guidelines for Canadian Drinking Water Quality.

² Alberta Tier I Guidelines (2007), Groundwater Remediation Guideline Values for Residential/Parkland - All Water Uses.

³ Values taken from "Waste Dump Sites Assessment" - Jacques Whitford (2004) and "Human and Ecological Risk Assessment Former Waste Disposal Middens" - Meridian Environmental Inc. (2007).

* Criteria based on aesthetic objectives.

Shaded values indicate an exceedance to CCME criteria.

Monitoring Well Installation/Sampling & Capping
of Waste Disposal Middens
Bar U Ranch National Historic Site, Longview, Alberta

Table 4 Summary of Polycyclic Aromatic Hydrocarbon Analysis

Parameter	CCME Guidelines ¹	AB Tier I Guidelines ²	Range of Values From Previous Assessments ³	Units	Well Identification					
					MW1	MW3	MW4	MW6	ET - MW14	ET - MW16
Naphthalene	-	0.0011	< 0.00001 - 0.000178	mg/L	<0.00001	<0.00001	<0.00001	0.00003	0.00003	0.00002
Quinoline	-	-	-	mg/L	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Acenaphthene	-	0.0011	< 0.00001	mg/L	<0.00001	<0.00001	<0.00001	<0.00001	0.00002	<0.00001
Fluorene	-	0.0011	< 0.00001 - 0.000099	mg/L	<0.00001	<0.00001	<0.00001	<0.00001	0.00004	0.00002
Phenanthrene	-	0.0011	< 0.00001 - 0.000346	mg/L	0.00003	<0.00001	<0.00001	0.00003	0.00012	0.00003
Anthracene	-	0.0012	< 0.00001 - 0.00002	mg/L	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Acridine	-	-	-	mg/L	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Fluoranthene	-	0.0014	< 0.00001 - 0.000053	mg/L	<0.00001	<0.00001	<0.00001	<0.00001	0.00003	<0.00001
Pyrene	-	0.0016	< 0.00001 - 0.000116	mg/L	<0.00001	<0.00001	<0.00001	<0.00001	0.00007	0.00003
Benzo(a)anthracene	-	-	< 0.00001 - 0.00002	mg/L	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Chrysene	-	-	< 0.00001 - 0.000078	mg/L	<0.00001	<0.00001	<0.00001	<0.00001	0.00002	<0.00001
Benzo(b&j)fluoranthene	-	-	-	mg/L	<0.00001	<0.00001	<0.00001	<0.00001	0.00002	<0.00001
Benzo(k)fluoranthene	-	-	< 0.00001 - 0.000013	mg/L	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Benzo(a)pyrene	-	0.000015	< 0.00001 - 0.000024	mg/L	<0.00001	<0.00001	<0.00001	<0.00001	0.00002	<0.00001
Indeno(1,2,3-cd)pyrene	-	-	< 0.00001 - 0.000015	mg/L	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Dibenzo(a,h)anthracene	-	-	< 0.00001 - 0.000012	mg/L	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001

Notes:

¹ CCME Drinking Water Guidelines (2006), based on Health Canada's Guidelines for Canadian Drinking Water Quality.

² Alberta Tier I Guidelines (2007), Groundwater Remediation Guideline Values for Residential/Parkland - All Water Uses.

³ Values taken from "Waste Dump Sites Assessment" - Jacques Whitford (2004) and "Human and Ecological Risk Assessment Former Waste Disposal Middens" - Meridian Environmental Inc. (2007).

Monitoring Well Installation/Sampling & Capping
of Waste Disposal Middens
Bar U Ranch National Historic Site, Longview, Alberta

Table 5 Summary of Pesticide Analysis

Parameter	CCME Guidelines ¹	AB Tier I Guidelines ²	Range of Values From Previous Assessments ³	Units	Well Identification		
					MW1	MW3	ET - MW14
p,p' - DDD	-	-	< 0.004	mg/L	<0.0001	<0.0001	<0.0001
p,p' - DDE	-	-	< 0.002	mg/L	<0.0001	<0.0001	<0.0001
p,p' - DDT	-	0.000001	< 0.004	mg/L	<0.0001	<0.0001	<0.0001
Aldrin	0.0007	0.0007	< 0.002	mg/L	<0.0001	<0.0001	<0.0001
alpha - BHC	-	-	< 0.002	mg/L	<0.0001	<0.0001	<0.0001
beta - BHC	-	-	< 0.002	mg/L	<0.0001	<0.0001	<0.0001
gamma - BHC (Lindane)	-	0.00001	< 0.002	mg/L	<0.0001	<0.0001	<0.0001
Quintozine (PCNB)	-	-	-	mg/L	<0.0001	<0.0001	<0.0001
cis - Chlordane	-	-	< 0.002	mg/L	<0.0001	<0.0001	<0.0001
trans - Chlordane	-	-	< 0.002	mg/L	<0.0001	<0.0001	<0.0001
Dieldrin	-	0.000056	< 0.002	mg/L	<0.0001	<0.0001	<0.0001
Endosulfan I	-	0.00002	< 0.004	mg/L	<0.0001	<0.0001	<0.0001
Endosulfan II	-	0.00002	< 0.004	mg/L	<0.0001	<0.0001	<0.0001
Endrin	-	0.000036	< 0.004	mg/L	<0.0001	<0.0001	<0.0001
Heptachlor	-	0.0000038	< 0.002	mg/L	<0.0001	<0.0001	<0.0001
Methoxychlor	-	0.00003	< 0.04	mg/L	<0.0002	<0.0002	<0.0002
Mirex	-	-	< 0.004	mg/L	<0.0001	<0.0001	<0.0001
Nonachlor	-	-	-	mg/L	<0.0001	<0.0001	<0.0001
Oxychlordane	-	-	-	mg/L	<0.0001	<0.0001	<0.0001

Notes:

¹ CCME Drinking Water Guidelines (2006), based on Health Canada's Guidelines for Canadian Drinking Water Quality

² Alberta Tier I Guidelines (2007), Groundwater Remediation Guideline Values for Residential/Parkland - All Water Uses

³ Values taken from "Waste Dump Sites Assessment" - Jacques Whitford (2004) and "Human and Ecological Risk Assessment Former Waste Disposal Middens" - Meridian Environmental Inc. (2007)

Table 6 Summary of Routine Parameter Analysis

Parameter	CCME Guidelines ¹	AB Tier I Guidelines ²	Range of Values From Previous Assessments ³	Units	Well Identification	
					ET - MW14	ET - MW16
Chloride	250*	230	1.7 - 50.6	mg/L	6.8	1.2
Total Dissolved Solids (TDS)	500*	500	1260 - 12000	mg/L	606	294
Hardness (as CaCO ₃)	-	-	806 - 7640	mg/L	451	256
Nitrate and Nitrite (as N)	-	-	< 0.07 - 1.00	mg/L	6.36	0.21
Nitrate - N	45	45	< 0.05 - 1.00	mg/L	6.36	0.21
Nitrite - N	-	-	< 0.05	mg/L	<0.05	<0.05
Sulphate	500*	500	647 - 8390	mg/L	184	47.4
pH	6.5 - 8.5*	6.5 - 8.5	6.17 - 9.29	pH	8.0	8.09
Conductivity	-	-	1.42 - 10000	µS/cm	918	494
Bicarbonate	-	-	514 - 1100	mg/L	393	287
Carbonate	-	-	< 5	mg/L	<5	<5
Hydroxide	-	-	< 5	mg/L	<5	<5
Total Alkalinity (as CaCO ₃)	-	-	421 - 899	mg/L	322	236

Notes:

¹ CCME Drinking Water Guidelines (2006), based on Health Canada's Guidelines for Canadian Drinking Water Quality.

² Alberta Tier I Guidelines (2007), Groundwater Remediation Guideline Values for Residential/Parkland - All Water Uses.

³ Values taken from "Waste Dump Sites Assessment" - Jacques Whitford (2004) and "Human and Ecological Risk Assessment Former Waste Disposal Middens" - Meridian Environmental Inc. (2007).

* Criteria based on aesthetic objectives.

Shaded values indicate an exceedance of CCME criteria.

8. Conclusions and Recommendations

Groundwater results were compared to the *CCME Drinking Water Guidelines (2006)* and the *Alberta Tier 1 Soil and Groundwater Remediation Guidelines (2008)*. Based on the results from this remedial program and groundwater investigation, the following conclusions can be made:

- Both midden sites were successfully capped and re-graded with clay material hauled to the site from a local borrow site.
- Groundwater retrieved from wells within both waste middens showed exceedances of the CCME aesthetic objectives for sodium, iron and manganese. The wells which exceeded are MW1, MW3, MW4 and MW6.
- Groundwater concentrations for sodium, iron and manganese in the down gradient monitoring wells (ET-MW 14 and ET-MW16) were 2-3 orders of magnitude lower than the concentrations recorded in the wells in and adjacent to the two waste middens.
- Groundwater retrieved from ET-MW14 downstream of waste midden #1 showed exceedances of the applied criteria for manganese and TDS.
- Pesticide and PAH concentrations in all the analyzed groundwater samples were below the applicable remediation criteria and/or laboratory detection limits.

Based on the results from this program, the following recommendations can be made:

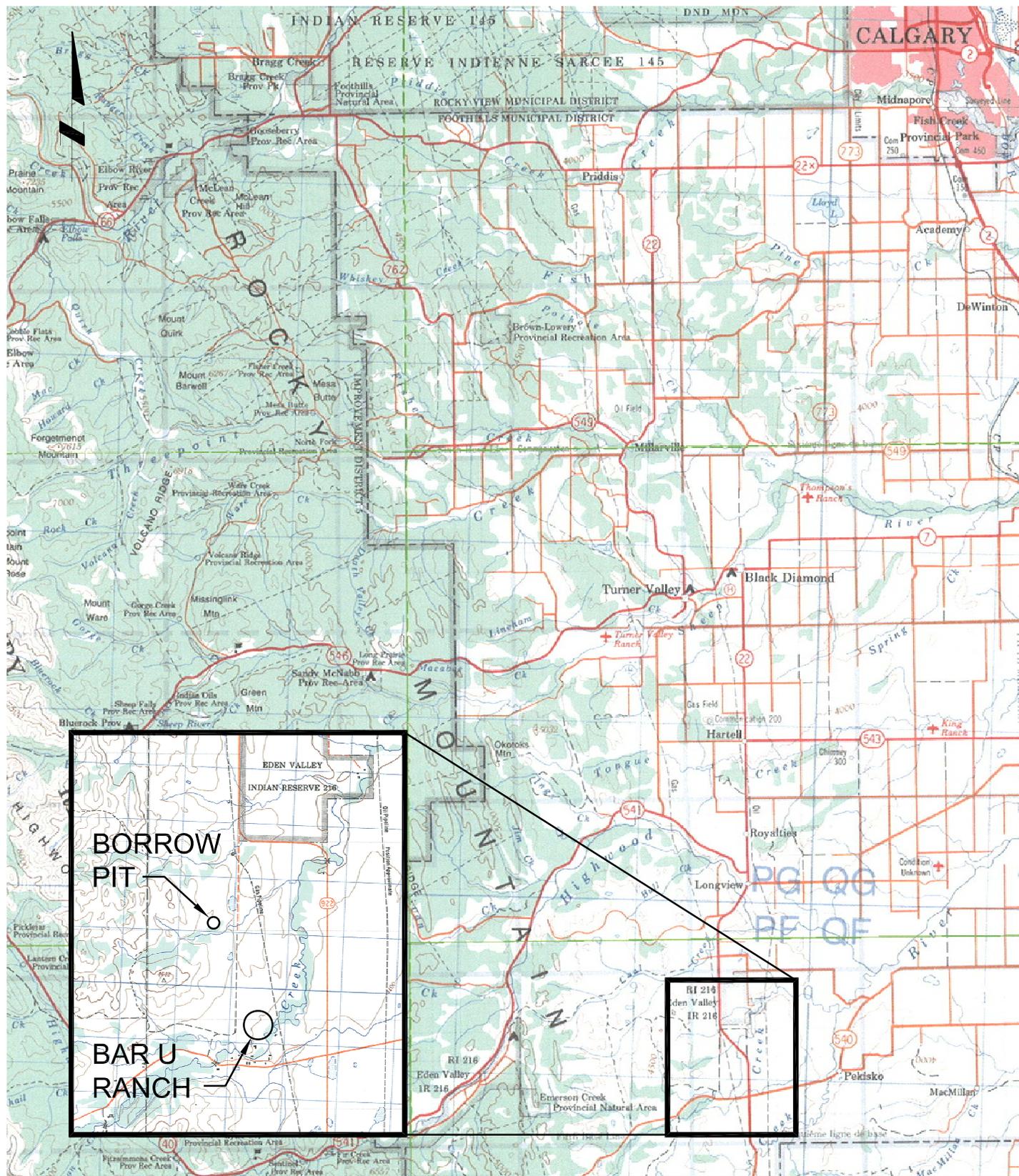
- Due to the elevated concentrations of metals in the groundwater samples collected around the two (2) midden sites and the use of groundwater for drinking water purposes, it is recommended that an annual groundwater sampling event be completed to confirm that metal concentrations remain stable and/or decrease. If concentrations are stable or decrease after three (3) consecutive sample events, it is recommended that the monitoring program be halted and that the monitoring wells be decommissioned.

9. Closure

The use of this report is governed by the standard AECOM document Special Provisions - Environmental Site Services which is included in **Appendix G**.

Appendices

Appendix A
Figures



SCALE: NTS

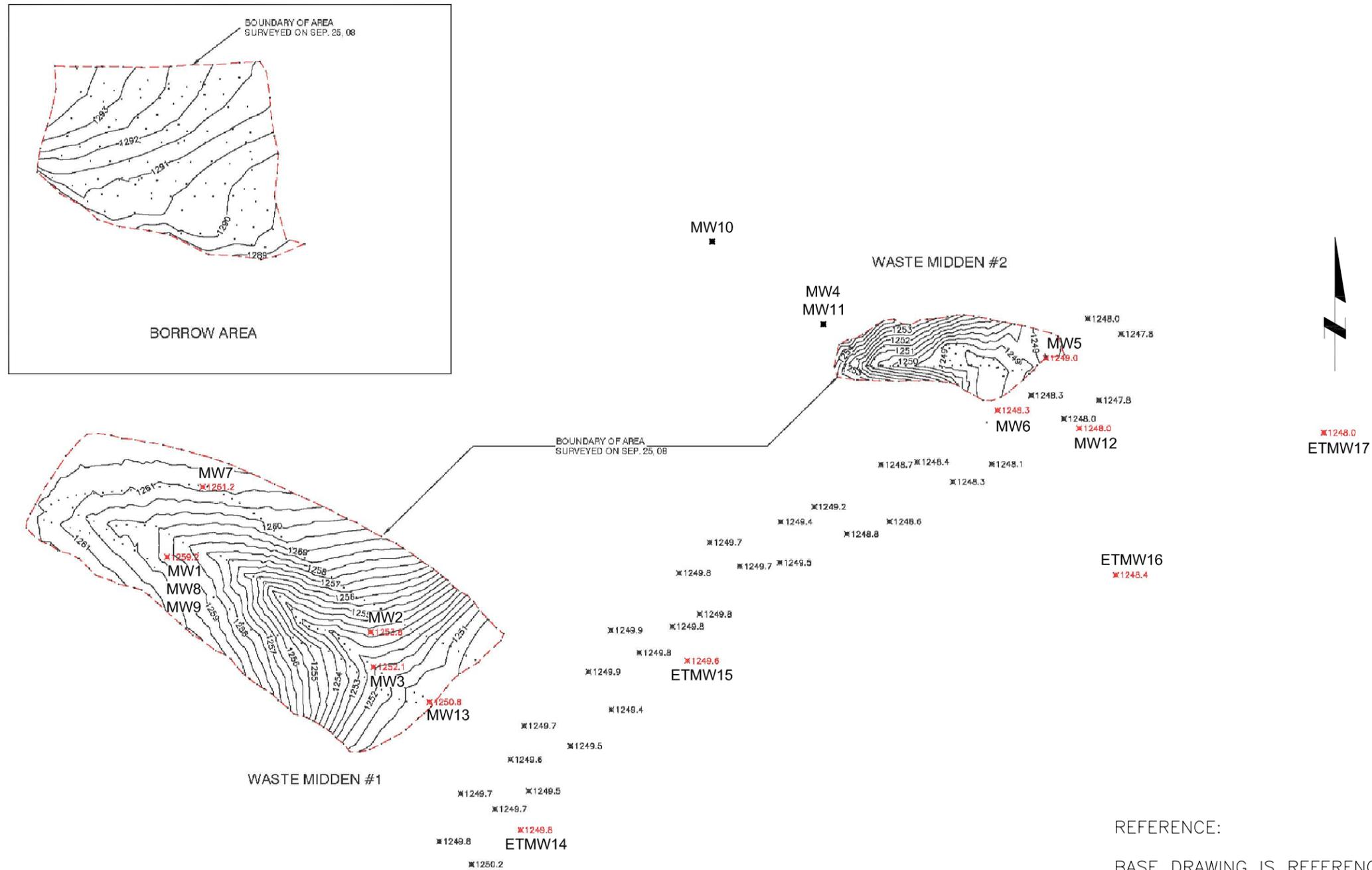
Bar U Ranch National Historical Site, AB
Waste Disposal Site Closure

AECOM

SITE LOCATION

March, 2009

Figure 1



REFERENCE:

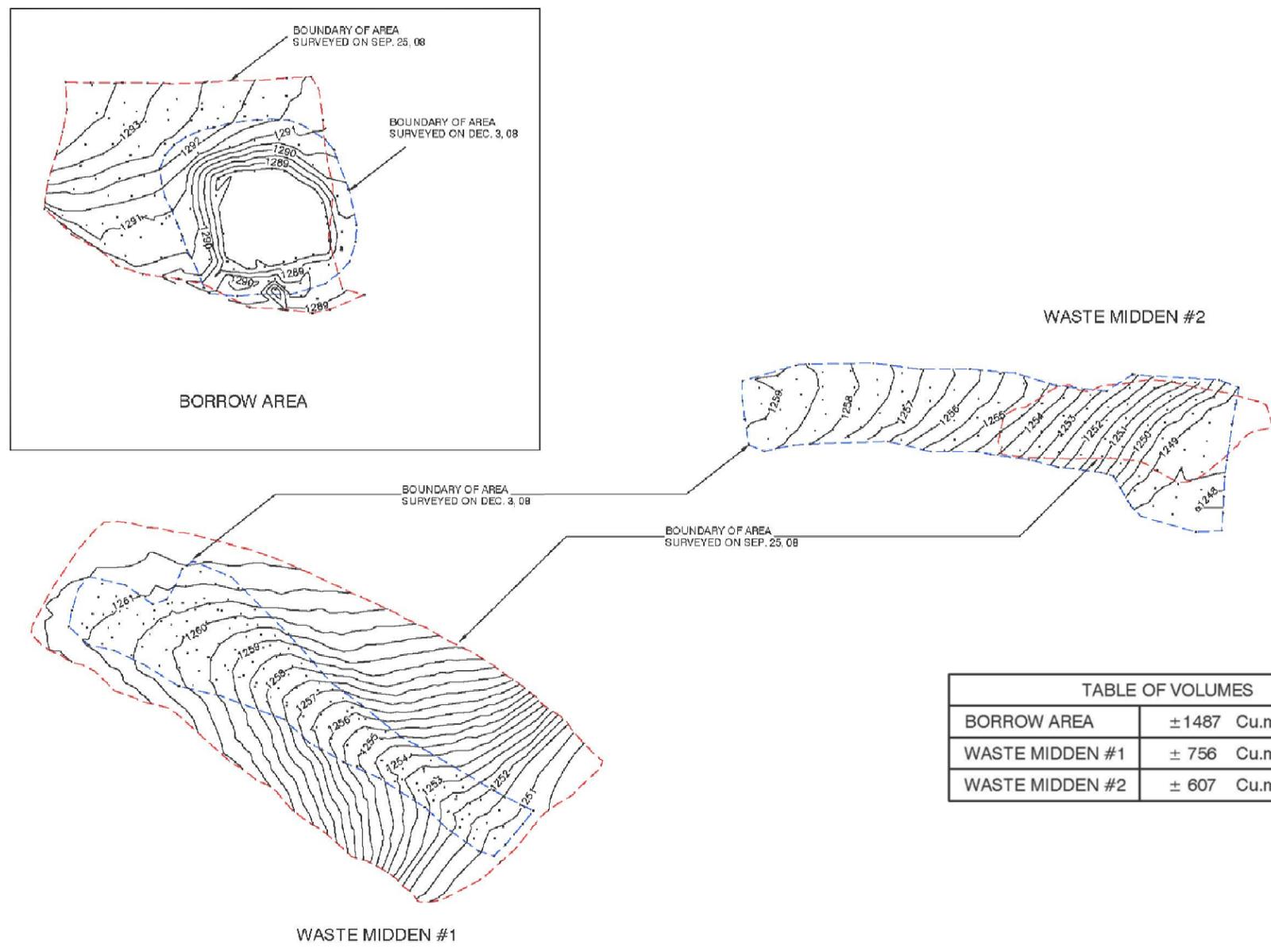
BASE DRAWING IS REFERENCED FROM FOCUS SURVEYS LTD'S "TOPOGRAPHIC INFORMATION BAR U RANCH NATIONAL HISTORIC SITE" DRAWING 1 OF 2 DATED DEC. 8, 2008 (FILE: 020300 149-Dec5-08.dwg). ORIGINAL GROUND SURVEYED ON SEPT. 25, 2008.

SCALE: NTS

Bar U Ranch National Historical Site, AB
Waste Disposal Site Closure

AECOM

ORIGINAL DISPOSAL SITE PLAN



Appendix B
Photographs

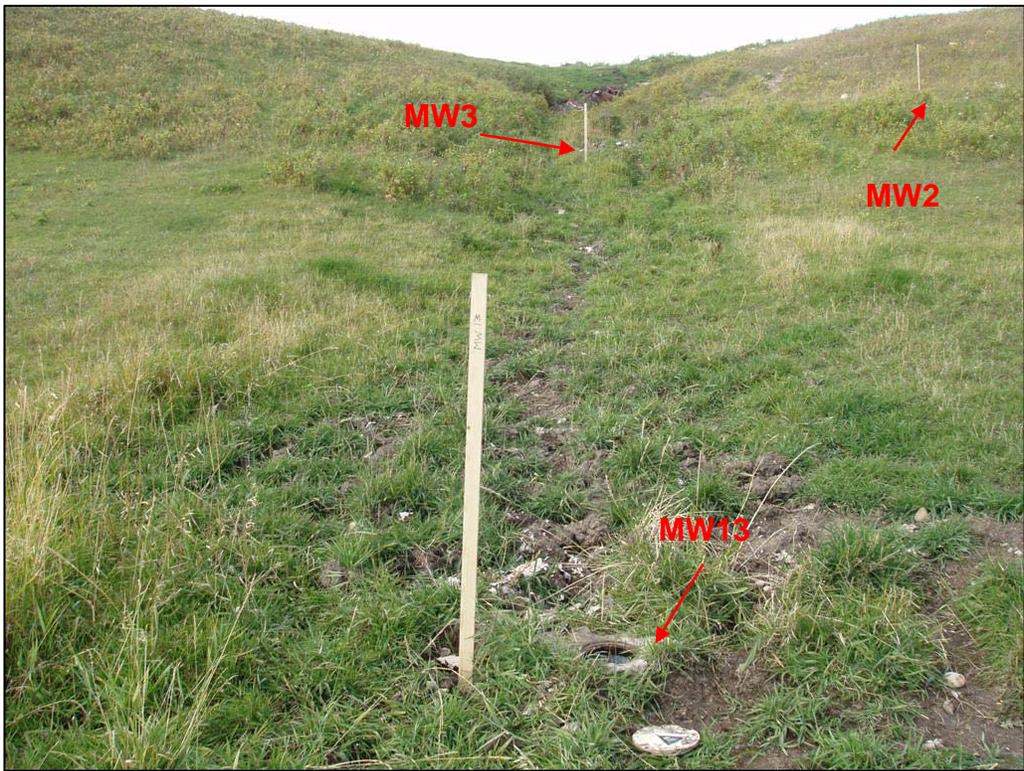


Photo 1: Looking northwest up waste midden #1



Photo 2: Visible contents of waste midden #1



Photo 3: Looking southeast down waste midden #1



Photo 4: Looking north towards waste midden #2



Photo 5: Looking southeast down waste midden #2



Photo 6: Rolls of scrap wire at the base of waste midden #2



Photo 7: Finished borrow pit



Photo 8: Borrow pit when final topographic survey performed

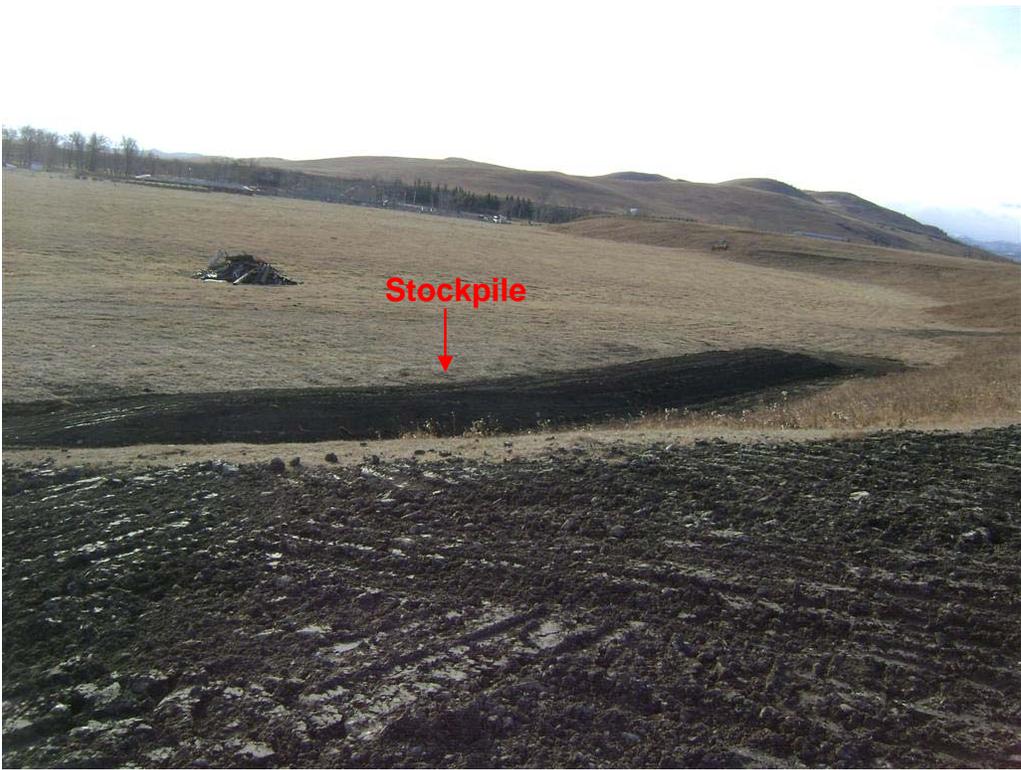


Photo 9: Topsoil stockpile looking east from waste midden #2

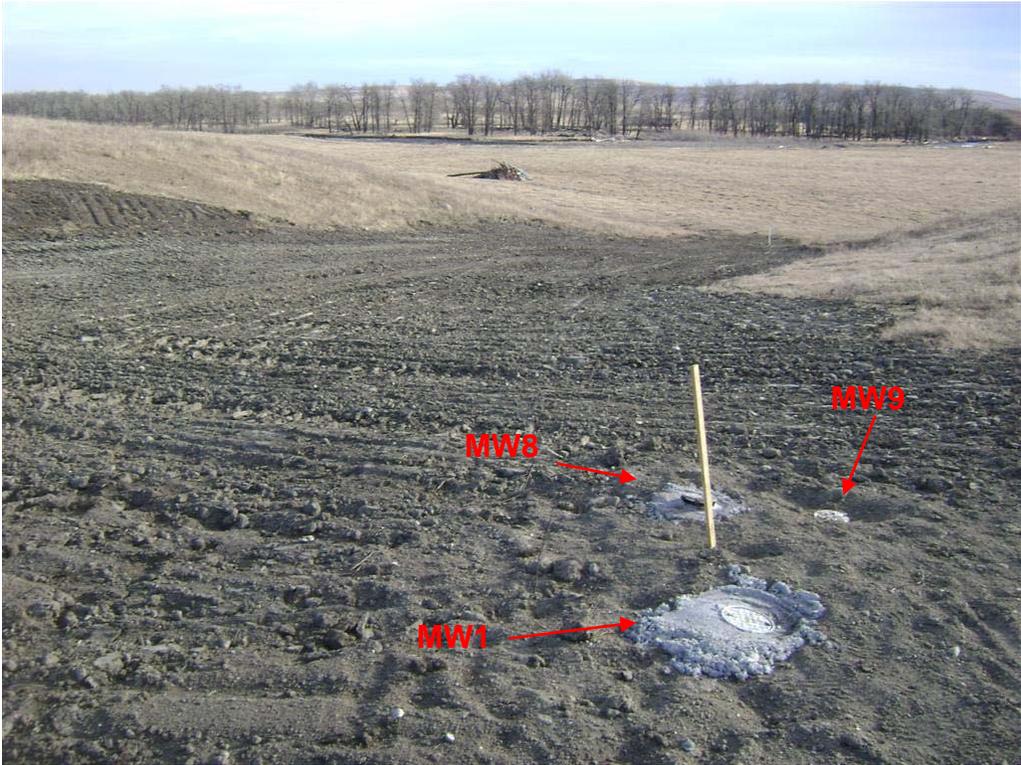


Photo 10: Looking southeast down capped waste midden #1



Photo 11: Looking northwest up capped waste midden #1



Photo 12: Looking northeast towards capped waste midden #2

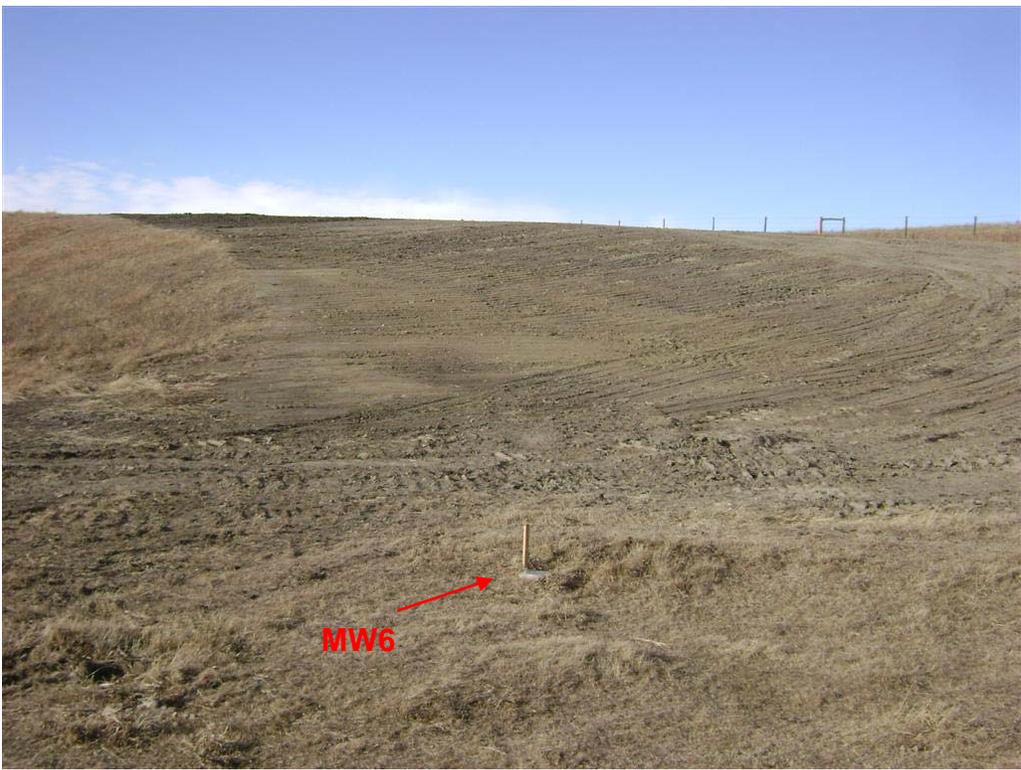


Photo 13: Looking northeast up capped waste midden #2



Photo 14: Looking northeast further up waste midden #2



Photo 15: Gravel fill placed in rough section of haul road



Photo 16: Gravel fill placed along low area over culvert, looking east



Photo 17: Looking west at gravel fill over new culvert



Photo 18: New culvert installed on haul road to borrow pit

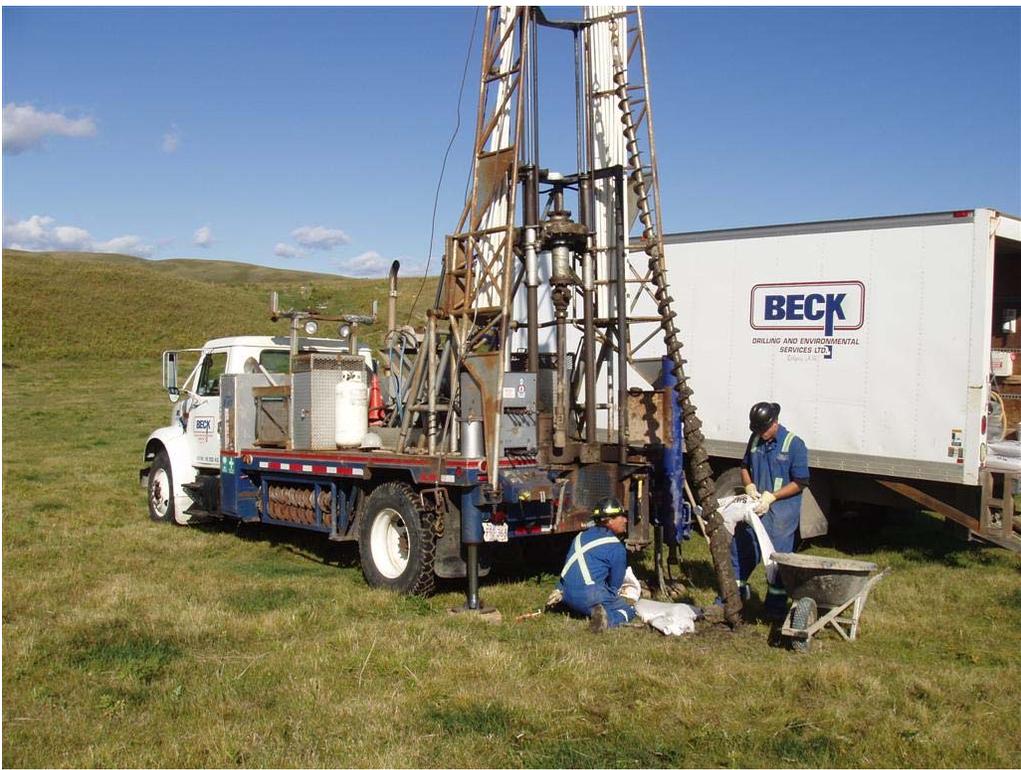


Photo 19: Drilling and groundwater monitoring well installation

Appendix C
Topographic Surveys

Appendix D
Borehole Logs

Project Name: Bar U Ranch
Client: Public Works Government Services Canada
Location: Longview, Alberta
Project Number: 106547

Borehole ID: ET-MW14

Logged By: GW
 Reviewed By: GW

Depth (m)	Soil Type	Soil Description	Elevation	Sample Number	Sample Type	Lab	Headspace Concentration (%LEL)			Well Details	Comments
							25	50	75		
0 - 0.2		Topsoil black, dry, loose									
0.2 - 1.5		Clay silty, loose @ 0.6 m moist, dense									
1.5 - 1.8		Gravel grey-black, some clay, moist @ 1.5 m very wet									
1.8 - 4.6		@ 1.8 m sloughing									
4.6 - 5.0		Siltstone grey, dense, stiff to very stiff									
5.0		EOH @ 4.6 m									

AECOM

17203 - 103 Ave
 Edmonton, Alberta
 T5S 1J4, Canada

Tel. (780) 488-6800
 Fax. (780) 488-2121

Drill Method: Solid Stem Auger
Drill Date: September 25, 2008
Driller: BECK Drilling and Environmental Services Ltd.

Sheet 1 of 1

Project Name: Bar U Ranch
Client: Public Works Government Services Canada
Location: Longview, Alberta
Project Number: 106547

Borehole ID: ET-MW15

Logged By: GW
 Reviewed By: GW

Depth (m)	Soil Type	Soil Description	Elevation	Sample Number	Sample Type	Lab	Headspace Concentration (%LEL)			Well Details	Comments
							25	50	75		
0 - 0.2		Topsoil brown, sandy, dry, loose									
0.2 - 1.8		Clay grey-black, silty, dense									
1.8 - 2.5		Gravel sandy @ 1.5 m cobbles, wet @ 1.8 m sloughing									
2.5 - 4.6		Siltstone grey, dense, very stiff									
4.6 - 5.0		EOH @ 4.6 m									

AECOM

17203 - 103 Ave
 Edmonton, Alberta
 T5S 1J4, Canada

Tel. (780) 488-6800
 Fax. (780) 488-2121

Drill Method: Solid Stem Auger
Drill Date: September 25, 2008
Driller: BECK Drilling and Environmental Services Ltd.

Sheet 1 of 1

Project Name: Bar U Ranch
Client: Public Works Government Services Canada
Location: Longview, Alberta
Project Number: 106547

Borehole ID: ET-MW16

Logged By: GW
 Reviewed By: GW

Depth (m)	Soil Type	Soil Description	Elevation	Sample Number	Sample Type	Lab	Headspace Concentration (%LEL)			Well Details	Comments
							25	50	75		
0	Topsoil	brown-black, dry, loose									
0.5	Clay	grey-black, dense									
1.5	Gravel	sandy, dry, loose									
2.1		@ 2.1 m wet									
3.0		@ 3.0 m sloughing									
4.0	Siltstone	grey, dense, very stiff									
4.6		EOH @ 4.6 m									

AECOM

17203 - 103 Ave
 Edmonton, Alberta
 T5S 1J4, Canada

Tel. (780) 488-6800
 Fax. (780) 488-2121

Drill Method: Solid Stem Auger
Drill Date: September 25, 2008
Driller: BECK Drilling and Environmental Services Ltd.

Sheet 1 of 1

Project Name: Bar U Ranch
Client: Public Works Government Services Canada
Location: Longview, Alberta
Project Number: 106547

Borehole ID: ET-MW17

Logged By: GW
 Reviewed By: GW

Depth (m)	Soil Type	Soil Description	Elevation	Sample Number	Sample Type	Lab	Headspace Concentration (%LEL)			Well Details	Comments
							25	50	75		
0	Topsoil	brown, dry, loose									
0.8	Clay	grey-black, silty, loose									
0.8		@ 0.8 m dense									
2.1	Gravel	sandy									
2.1		@ 2.1 m cobbles, wet									
3.0		@ 3.0 m sloughing									
4.6	Siltstone	grey, dense, very stiff									
4.6		EOH @ 4.6 m									

AECOM

17203 - 103 Ave
 Edmonton, Alberta
 T5S 1J4, Canada

Tel. (780) 488-6800
 Fax. (780) 488-2121

Drill Method: Solid Stem Auger
Drill Date: September 25, 2008
Driller: BECK Drilling and Environmental Services Ltd.

Sheet 1 of 1

Appendix E
Water Well Records



Water Well Drilling Report

The data contained in this report is supplied by the Driller. The province disclaims responsibility for its accuracy.

Well I.D.: 0350122
 Map Verified: Map
 Date Report: 1990/03/16
 Received:
 Measurements: Imperial

1. Contractor & Well Owner Information		2. Well Location	
Company Name: NIEMANS DRILLING (1980) LTD.	Drilling Company Approval No.: 119079	1/4 or Sec Twp Rge West of LSD M NW 08 017 02 5	Location in Quarter 0 FT from Boundary 0 FT from Boundary
Mailing Address: BOX 5564	City or Town: HIGH RIVER AB CA	Postal Code: T0E 1M6	Lot Block Plan
Well Owner's Name: NELSON, BOB	Well Location Identifier:	Well Elev: FT	How Obtain: Not Obtain
P.O. Box Number:	Mailing Address: RR2, HIGH RIVER	Postal Code:	
City:	Province:	Country:	
3. Drilling Information		6. Well Yield	
Type of Work: New Well Reclaimed Well	Proposed well use: Domestic Anticipated Water Requirements/day 0 Gallons	Test Date (yyyy/mm/dd): 1990/02/27	Start Time: 0:00 AM
Date Reclaimed:	Materials Used:	Test Method: Bailer	Non pumping static level: 8 FT
Method of Drilling: Rotary	Rate: Gallons Oil Present:	Rate of water removal: 7 Gallons/Min	Depth of pump intake: 0 FT
Flowing Well: No		Water level at end of pumping: 32 FT	Distance from top of casing to ground level: Inches
Gas Present:		Depth To water level (feet) Elapsed Time	Drawdown Minutes:Sec Recovery Total Drawdown: 24 FT
4. Formation Log		5. Well Completion	
Depth from ground level (feet)	Lithology Description	Date Started(yyyy/mm/dd): 1990/02/27	Date Completed (yyyy/mm/dd): 1990/02/27
1	Clay	Well Depth: 32 FT	Borehole Diameter: 0 Inches
10	Gravel	Casing Type: Steel	Liner Type: Plastic
12	Clay	Size OD: 5.56 Inches	Size OD: 4.5 Inches
32	Shale	Wall Thickness: 0.156 Inches	Wall Thickness: 0.214 Inches
		Bottom at: 13 FT	Top: 12 FT Bottom: 32 FT
		Perforations from: 8 FT to: 23 FT from: 0 FT to: 0 FT from: 0 FT to: 0 FT	Perforations Size: 0.125 Inches x 10 Inches 0 Inches x 0 Inches 0 Inches x 0 Inches
		Perforated by: Torch	
		Seal: Sand & Gravel from: 0 FT to: 0 FT	
		Seal: from: 0 FT to: 0 FT	
		Seal: from: 0 FT to: 0 FT	
		Screen Type: from: 0 FT to: 0 FT	Screen ID: 0 Inches Slot Size: 0 Inches
		Screen Type: from: 0 FT to: 0 FT	Screen ID: 0 Inches Slot Size: 0 Inches
		Screen Installation Method:	
		Fittings Top: Bottom:	
		Pack: Grain Size: Amount: 0	
		Geophysical Log Taken: Retained on Files:	
		Additional Test and/or Pump Data Chemistries taken By Driller: No Held: 0 Documents Held: 1	
		Pitless Adapter Type: Drop Pipe Type: Length: FT Diameter: Inches	
		Comments: Litho depth 1/2 is entered as 1. Perforation also other and saw.	
		7. Contractor Certification	
		Driller's Name: Certification No.:	UNKNOWN DRILLER VA5635
		This well was constructed in accordance with the Water Well regulation of the Alberta Environmental Protection & Enhancement Act. All information in this report is true.	
		Signature	Yr Mo Day



Water Well Drilling Report

The data contained in this report is supplied by the Driller. The province disclaims responsibility for its accuracy.

Well I.D.:	0360180
Map Verified:	Map
Date Report Received:	1991/08/23
Measurements:	Imperial

1. Contractor & Well Owner Information		2. Well Location	
Company Name: VINO'S WATER WELL DRILLING		Drilling Company Approval No.:	
Mailing Address:		City or Town:	
Well Owner's Name: BAKER, ALLEN #WELL 2		Well Location Identifier:	
P.O. Box Number:		Mailing Address: LONGVIEW	
City:		Province:	
3. Drilling Information		6. Well Yield	
Type of Work: New Well		Test Date (yyyy/mm/dd): 1991/05/18	
Reclaimed Well		Start Time: 11:00 AM	
Date Reclaimed:		Test Method: Bailer	
Method of Drilling: Rotary		Non pumping static level: 25 FT	
Flowing Well: No		Rate of water removal: 4 Gallons/Min	
Gas Present: No		Depth of pump intake: 100 FT	
4. Formation Log		Water level at end of pumping: 60 FT	
Depth from ground level (feet)		Distance from top of casing to ground level:	
40 Sand & Gravel		Depth To water level (feet) Elapsed Time	
127 Black Clay & Shale		Drawdown Minutes: Sec Recovery	
160 Dark Water Bearing Shale & Sandstone		Total Drawdown: 35 FT	
		if water removal was less than 2 hr duration, reason why:	
		Recommended pumping rate: 4 Gallons/Min	
		Recommended pump intake: 110 FT	
		Type Pump Installed	
		Pump Type: SUB	
		Pump Model:	
		H.P.: .75	
		Any further pump test information?	
5. Well Completion			
Date Started (yyyy/mm/dd): 1991/05/16		Date Completed (yyyy/mm/dd): 1991/05/18	
Well Depth: 160 FT		Borehole Diameter: 0 Inches	
Casing Type:		Liner Type: Plastic	
Size OD: 0 Inches		Size OD: 5 Inches	
Wall Thickness: 0 Inches		Wall Thickness: 0.5 Inches	
Bottom at: 0 FT		Top: 0 FT Bottom: 145 FT	
Perforations from: 31 FT to: 147 FT		Perforations Size: 0.25 Inches x 6 Inches	
Perforations from: 0 FT to: 0 FT		Perforations Size: 0 Inches x 0 Inches	
Perforations from: 0 FT to: 0 FT		Perforations Size: 0 Inches x 0 Inches	
Perforated by: Saw			
Seal: Shale Trap from: 0 FT to: 30 FT			
Seal: from: 0 FT to: 0 FT			
Seal: from: 0 FT to: 0 FT			
Screen Type: from: 0 FT to: 0 FT		Screen ID: 0 Inches Slot Size: 0 Inches	
Screen Type: from: 0 FT to: 0 FT		Screen ID: 0 Inches Slot Size: 0 Inches	
Screen Installation Method:			
Fittings Top: Bottom:			
Pack: Grain Size: Amount: 0			
Geophysical Log Taken: Retained on Files:			
Additional Test and/or Pump Data			
Chemistries taken By Driller: No			
Held: 0 Documents Held: 1			
Pitless Adapter Type:			
Drop Pipe Type: 4" Length: 110 FT Diameter: 1 Inches			
Comments:			
7. Contractor Certification			
Driller's Name: UNKNOWN DRILLER			
Certification No.: VC7929			
This well was constructed in accordance with the Water Well regulation of the Alberta Environmental Protection & Enhancement Act. All information in this report is true.			
Signature		Yr Mo Day	



Water Well Drilling Report

The data contained in this report is supplied by the Driller. The province disclaims responsibility for its accuracy.

Well I.D.:	0360181
Map Verified:	Map
Date Report Received:	1991/08/23
Measurements:	Imperial

1. Contractor & Well Owner Information		2. Well Location	
Company Name: VINO'S WATER WELL DRILLING		Drilling Company Approval No.:	
Mailing Address:		City or Town:	
Well Owner's Name: BAKER, ALLEN #WELL 1		Well Location Identifier:	
P.O. Box Number:		Mailing Address: LONGVIEW	
City:		Province:	
3. Drilling Information		6. Well Yield	
Type of Work: New Well		Test Date (yyyy/mm/dd): 1991/05/20	
Reclaimed Well		Start Time: 11:00 AM	
Date Reclaimed:		Test Method: Bailer	
Method of Drilling: Rotary		Non pumping static level: 25 FT	
Flowing Well: No		Rate of water removal: 4 Gallons/Min	
Gas Present: No		Depth of pump intake: 100 FT	
4. Formation Log		Water level at end of pumping: 60 FT	
Depth from ground level (feet)		Distance from top of casing to ground level:	
25 Sand & Gravel		Depth To water level (feet) Elapsed Time	
40 Dark Blue Shale		Drawdown Minutes: Sec Recovery	
120 Black Shale		Total Drawdown: 35 FT	
127 Blue Shale		if water removal was less than 2 hr duration, reason why:	
180 Light Brown Shale & Sandstone		Recommended pumping rate: 4 Gallons/Min	
5. Well Completion		Recommended pump intake: 100 FT	
Date Started (yyyy/mm/dd): 1991/05/18		Type Pump Installed	
Well Depth: 180 FT		Pump Type: SUB	
Casing Type:		Pump Model:	
Size OD: 0 Inches		H.P.: .75	
Wall Thickness: 0 Inches		Any further pump test information?	
Bottom at: 0 FT			
Perforations from: 42 FT to: 147 FT			
Perforations Size: 0.25 Inches x 6 Inches			
Perforations from: 0 FT to: 0 FT			
Perforations Size: 0 Inches x 0 Inches			
Perforations from: 0 FT to: 0 FT			
Perforations Size: 0 Inches x 0 Inches			
Perforated by: Saw			
Seal: Shale Trap			
Seal from: 0 FT to: 40 FT			
Seal from: 0 FT to: 0 FT			
Seal from: 0 FT to: 0 FT			
Screen Type:			
Screen ID: 0 Inches			
Screen Type:			
Screen ID: 0 Inches			
Screen Installation Method:			
Fittings			
Pack:			
Grain Size:			
Amount: 0			
Geophysical Log Taken:			
Retained on Files:			
Additional Test and/or Pump Data			
Chemistries taken By Driller: No			
Held: 0 Documents Held: 1			
Pitless Adapter Type:			
Drop Pipe Type:			
Length: 100 FT			
Diameter: 1 Inches			
Comments:			
STEEL CALVERT 8'			
7. Contractor Certification			
Driller's Name: UNKNOWN DRILLER			
Certification No.: VC7989			
This well was constructed in accordance with the Water Well regulation of the Alberta Environmental Protection & Enhancement Act. All information in this report is true.			
Signature		Yr Mo Day	



Water Well Drilling Report

The data contained in this report is supplied by the Driller. The province disclaims responsibility for its accuracy.

Well I.D.: 0361384
 Map Verified: Map
 Date Report: 1991/08/19
 Received:
 Measurements: Imperial

1. Contractor & Well Owner Information		2. Well Location	
Company Name: UNKNOWN DRILLER	Drilling Company Approval No.: 99999	1/4 or Sec Twp Rge West of LSD SE 07 017 02 5 M	Location in Quarter 0 FT from Boundary 0 FT from Boundary
Mailing Address: UNKNOWN	City or Town: UNKNOWN AB CA	Postal Code:	Lot Block Plan
Well Owner's Name: MCPHERSON, HUGH	Well Location Identifier:		Well Elev: FT
P.O. Box Number:	Mailing Address: RR2, HIGH RIVER	Postal Code: T0L 1B0	How Obtain: Not Obtain
City:	Province:	Country:	
3. Drilling Information		6. Well Yield	
Type of Work: Chemistry Reclaimed Well	Proposed well use: Domestic	Test Date (yyyy/mm/dd):	Start Time:
Date Reclaimed:	Materials Used:	Anticipated Water Requirements/day 0 Gallons	Test Method: Non pumping FT static level:
Method of Drilling: Unknown	Flowing Well: No Gas Present:	Rate: Gallons Oil Present:	Rate of water removal: Gallons/Min
4. Formation Log		5. Well Completion	
Depth from ground level (feet)	Lithology Description	Date Started(yyyy/mm/dd):	Date Completed (yyyy/mm/dd):
		Well Depth: 0 FT	Borehole Diameter: 0 Inches
		Casing Type:	Liner Type:
		Size OD: 0 Inches	Size OD: 0 Inches
		Wall Thickness: 0 Inches	Wall Thickness: 0 Inches
		Bottom at: 0 FT	Top: 0 FT Bottom: 0 FT
		Perforations from: 0 FT to: 0 FT from: 0 FT to: 0 FT from: 0 FT to: 0 FT	Perforations Size: 0 inches x 0 inches 0 inches x 0 inches 0 inches x 0 inches
		Perforated by:	
		Seal: from: 0 FT to: 0 FT	
		Seal: from: 0 FT to: 0 FT	
		Seal: from: 0 FT to: 0 FT	
		Screen Type: from: 0 FT to: 0 FT	Screen ID: 0 Inches Slot Size: 0 Inches
		Screen Type: from: 0 FT to: 0 FT	Screen ID: 0 Inches Slot Size: 0 Inches
		Screen Installation Method:	
		Fittings Top: Bottom:	
		Pack: Grain Size: Amount: 0	
		Geophysical Log Taken: Retained on Files:	
		Additional Test and/or Pump Data Chemistries taken By Driller: No Held: 1 Documents Held: 1	
		Pitless Adapter Type: Drop Pipe Type: Length: Diameter:	
		Comments:	
		7. Contractor Certification	
		Driller's Name: Certification No.:	UNKNOWN DRILLER
		This well was constructed in accordance with the Water Well regulation of the Alberta Environmental Protection & Enhancement Act. All information in this report is true.	
		Signature	Yr Mo Day
		Total Drawdown: FT If water removal was less than 2 hr duration, reason why:	
		Recommended pumping rate: Gallons/Min	
		Recommended pump intake: FT	
		Type pump installed Pump type: Pump model: H.P.:	
		Any further pump test information?	



Water Well Drilling Report

The data contained in this report is supplied by the Driller. The province disclaims responsibility for its accuracy.

Well I.D.: 0369429
 Map Verified: Map
 Date Report: 1993/09/28
 Received:
 Measurements: Imperial

1. Contractor & Well Owner Information		2. Well Location	
Company Name: GOODISON WATER WELL DRILLING		Drilling Company Approval No.:	
Mailing Address: City or Town: Postal Code:		1/4 or Sec Twp Rge West of LSD M SE 07 017 02 5	
Well Owner's Name: MCPHERSON, HUGH		Well Location Identifier:	
P.O. Box Number: Mailing Address: RR1, HIGH RIVER		Postal Code:	
City: Province: Country:		Location in Quarter: 0 FT from Boundary 0 FT from Boundary	
		Lot Block Plan	
		Well Elev: FT How Obtain: Not Obtain	
3. Drilling Information		6. Well Yield	
Type of Work: New Well Reclaimed Well		Proposed well use: Domestic Anticipated Water Requirements/day 400 Gallons	
Date Reclaimed: Materials Used:		Test Date (yyyy/mm/dd): 1993/09/09 Start Time: 11:00 AM	
Method of Drilling: Rotary		Test Method: Air	
Flowing Well: No Rate: Gallons Oil Present: No		Non pumping static level: 25 FT	
		Rate of water removal: 10 Gallons/Min	
4. Formation Log		5. Well Completion	
Depth from ground level (feet)		Date Started (yyyy/mm/dd): 1993/09/08 Date Completed (yyyy/mm/dd): 1993/09/09	
Lithology Description		Well Depth: 210 FT Borehole Diameter: 0 Inches	
53 Clay & Rocks		Casing Type: Steel Liner Type: Plastic	
74 Shale		Size OD: 5.56 Inches Size OD: 4.5 Inches	
80 Sandstone		Wall Thickness: 0.188 inches Wall Thickness: 0.214 Inches	
101 Shale		Bottom at: 55 FT Top: 50 FT Bottom: 210 FT	
111 Sandstone		Perforations from: 190 FT to: 210 FT Perforations Size: 0.125 Inches x 6 Inches	
124 Shale		from: 0 FT to: 0 FT 0 Inches x 0 Inches	
131 Sandstone		from: 0 FT to: 0 FT 0 Inches x 0 Inches	
138 Shale		Perforated by: Saw	
156 Sandstone		Seal: Driven from: 0 FT to: 55 FT	
166 Shale		Seal: from: 0 FT to: 0 FT	
175 Sandstone		Seal: from: 0 FT to: 0 FT	
181 Shale		Screen Type: from: 0 FT to: 0 FT Screen ID: 0 Inches Slot Size: 0 Inches	
207 Sandstone		Screen Type: from: 0 FT to: 0 FT Screen ID: 0 Inches Slot Size: 0 Inches	
210 Shale		Screen Installation Method:	
		Fittings Top: Bottom:	
		Pack: Grain Size: Amount:	
		Geophysical Log Taken: Retained on Files:	
		Additional Test and/or Pump Data Chemistries taken By Driller: No Held: 0 Documents Held: 1	
		Pitless Adapter Type: Drop Pipe Type: Length: FT Diameter: Inches	
		Comments:	
		7. Contractor Certification	
		Driller's Name: UNKNOWN DRILLER Certification No.: AD2129	
		This well was constructed in accordance with the Water Well regulation of the Alberta Environmental Protection & Enhancement Act. All information in this report is true.	
		Signature Yr Mo Day	



Water Well Drilling Report

The data contained in this report is supplied by the Driller. The province disclaims responsibility for its accuracy.

Well I.D.: 0370153
 Map Verified: Map
 Date Report: 1993/09/28
 Received:
 Measurements: Imperial

1. Contractor & Well Owner Information		2. Well Location	
Company Name: GOODISON WATER WELL DRILLING		Drilling Company Approval No.:	
Mailing Address: City or Town: Postal Code:		1/4 or Sec Twp Rge West of LSD M SE 08 017 02 5	
Well Owner's Name: BAKER, A.J.		Well Location Identifier:	
P.O. Box Number: Mailing Address: RR2, HIGH RIVER		Location in Quarter: 0 FT from Boundary 0 FT from Boundary	
City: Province: Country:		Lot Block Plan	
3. Drilling Information		6. Well Yield	
Type of Work: New Well		Test Date: Start Time:	
Reclaimed Well		(yyyy/mm/dd): 1993/09/02 11:00 AM	
Date Reclaimed: Materials Used:		Test Method: Pump	
Method of Drilling: Rotary		Non pumping static level: 78 FT	
Flowing Well: No Rate: Gallons		Rate of water removal: 4 Gallons/Min	
Gas Present: No Oil Present: No		Depth of pump intake: 160 FT	
4. Formation Log		5. Well Completion	
Depth from ground level (feet)		Date Started (yyyy/mm/dd): 1993/08/12	
Lithology Description		Date Completed (yyyy/mm/dd): 1993/09/02	
40 Unknown		Well Depth: 210 FT Borehole Diameter: 0 inches	
131 Shale & Sandstone Ledges		Casing Type: Steel Liner Type: Plastic	
142 Sandstone		Size OD: 5.56 inches Size OD: 4.5 inches	
158 Shale		Wall Thickness: 0.188 inches Wall Thickness: 0.214 inches	
169 Sandstone		Bottom at: 180 FT Top: 175 FT Bottom: 210 FT	
184 Shale		Perforations from: 180 FT to: 210 FT Perforations Size: 0.125 inches x 6 inches	
191 Sandstone		from: 0 FT to: 0 FT 0 inches x 0 inches	
210 Shale		from: 0 FT to: 0 FT 0 inches x 0 inches	
		Perforated by: Saw	
		Seal: Driven from: 0 FT to: 180 FT	
		Seal: from: 0 FT to: 0 FT	
		Seal: from: 0 FT to: 0 FT	
		Screen Type: from: 0 FT to: 0 FT Screen ID: 0 inches Slot Size: 0 inches	
		Screen Type: from: 0 FT to: 0 FT Screen ID: 0 inches Slot Size: 0 inches	
		Screen Installation Method:	
		Fittings Top: Bottom:	
		Pack: Grain Size: Amount:	
		Geophysical Log Taken: Retained on Files:	
		Additional Test and/or Pump Data	
		Chemistries taken By Driller: No Held: 0 Documents Held: 1	
		Pitless Adapter Type: Drop Pipe Type: Length: FT Diameter: Inches	
		Comments:	
		7. Contractor Certification	
		Driller's Name: UNKNOWN DRILLER	
		Certification No.: AD2129	
		This well was constructed in accordance with the Water Well regulation of the Alberta Environmental Protection & Enhancement Act. All information in this report is true.	
		Signature Yr Mo Day	
		Test Date: Start Time:	
		(yyyy/mm/dd): 1993/09/02 11:00 AM	
		Test Method: Pump	
		Non pumping static level: 78 FT	
		Rate of water removal: 4 Gallons/Min	
		Depth of pump intake: 160 FT	
		Water level at end of pumping: 140 FT	
		Distance from top of casing to ground level: Inches	
		Depth To water level (feet) Elapsed Time	
		Drawdown Minutes: Sec Recovery	
		Total Drawdown: 42 FT	
		If water removal was less than 2 hr duration, reason why:	
		Recommended pumping rate: 4 Gallons/Min	
		Recommended pump intake: 170 FT	
		Type Pump Installed	
		Pump Type:	
		Pump Model:	
		H.P.:	
		Any further pump test information?	



Water Well Drilling Report

The data contained in this report is supplied by the Driller. The province disclaims responsibility for its accuracy.

Well I.D.:	0378438
Map Verified:	Not Verified
Date Report Received:	1994/05/30
Measurements:	Imperial

1. Contractor & Well Owner Information		2. Well Location	
Company Name: PETER NIEMANS WATER WELL DRILLING		Drilling Company Approval No.: 119926	
Mailing Address: BOX 5024		City or Town: HIGH RIVER AB CA	
Well Owner's Name: PARKS CAN#1		Postal Code: T1V 1M3	
P.O. Box Number:		Mailing Address: 552 220 4 AVE SE, CALGARY	
City:		Postal Code: T2P 3H8	
Province:		Country:	
3. Drilling Information		6. Well Yield	
Type of Work: Test Hole-Abandoned Reclaimed Well		Proposed well use: Municipal	
Date Reclaimed: 1994/04/12		Anticipated Water Requirements/day: 0 Gallons	
Method of Drilling: Rotary		Rate: Gallons	
Flowing Well: No		Oil Present: No	
4. Formation Log		5. Well Completion	
Depth from ground level (feet)	Lithology Description	Date Started (yyyy/mm/dd): 1994/04/11	Date Completed (yyyy/mm/dd): 1994/04/12
1	Topsoil	Well Depth: 240 FT	Borehole Diameter: 0 Inches
38	Brown Dry Clay & Rocks	Casing Type:	Liner Type:
84	Gray Shale	Size OD: 0 Inches	Size OD: 0 Inches
86	Gray Water Bearing Sandstone	Wall Thickness: 0 Inches	Wall Thickness: 0 Inches
240	Dark Gray Shale	Bottom at: 0 FT	Top: 0 FT Bottom: 0 FT
		Perforations from: 0 FT to: 0 FT	Perforations Size: 0 Inches x 0 Inches
		Perforations from: 0 FT to: 0 FT	Perforations Size: 0 Inches x 0 Inches
		Perforations from: 0 FT to: 0 FT	Perforations Size: 0 Inches x 0 Inches
		Perforated by:	
		Seal: from: 0 FT to: 0 FT	
		Seal: from: 0 FT to: 0 FT	
		Seal: from: 0 FT to: 0 FT	
		Screen Type: from: 0 FT to: 0 FT	Screen ID: 0 Inches Slot Size: 0 Inches
		Screen Type: from: 0 FT to: 0 FT	Screen ID: 0 Inches Slot Size: 0 Inches
		Screen Installation Method:	
		Fittings Top: Bottom:	
		Pack: Grain Size: Amount:	
		Geophysical Log Taken: Retained on Files:	
		Additional Test and/or Pump Data Chemistries taken By Driller: No Held: 0 Documents Held: 1	
		Pitless Adapter Type: Drop Pipe Type: Length: Diameter:	
		Comments: DRILLER REPORT 86'- .5 GPM.	
		7. Contractor Certification	
		Driller's Name: UNKNOWN DRILLER Certification No.: 3631AD	
		This well was constructed in accordance with the Water Well regulation of the Alberta Environmental Protection & Enhancement Act. All information in this report is true.	
		Signature	Yr Mo Day
		Test Date (yyyy/mm/dd):	Start Time:
		Test Method:	
		Non pumping static level:	FT
		Rate of water removal:	Gallons/Min
		Depth of pump intake:	FT
		Water level at end of pumping:	FT
		Distance from top of casing to ground level:	Inches
		Depth To water level (feet) Elapsed Time	
		Drawdown Minutes:Sec Recovery	
		Total Drawdown: FT	
		If water removal was less than 2 hr duration, reason why:	
		Recommended pumping rate:	Gallons/Min
		Recommended pump intake:	FT
		Type pump installed	
		Pump type:	
		Pump model:	
		H.P.:	
		Any further pump test information?	



Water Well Drilling Report

The data contained in this report is supplied by the Driller. The province disclaims responsibility for its accuracy.

Well I.D.:	0378440
Map Verified:	Not Verified
Date Report	1994/05/30
Received:	
Measurements:	Imperial

1. Contractor & Well Owner Information		2. Well Location	
Company Name: PETER NIEMANS WATER WELL DRILLING		Drilling Company Approval No.: 119926	
Mailing Address: BOX 5024		City or Town: HIGH RIVER AB CA	
WellOwner's Name: PARKS CAN#2		Postal Code: T1V 1M3	
P.O. Box Number:		Well Location Identifier:	
Mailing Address: 552 220 4 AVE SE, CALGARY		Postal Code: T2P 3H8	
City:		Country:	
3. Drilling Information		6. Well Yield	
Type of Work: Test Hole-Abandoned		Proposed well use: Municipal	
Reclaimed Well		Anticipated Water Requirements/day	
Date Reclaimed: 1994/04/21		0 Gallons	
Method of Drilling: Rotary		Rate: Gallons	
Flowing Well: No		Oil Present: Yes	
4. Formation Log		5. Well Completion	
Depth from ground level (feet)		Date Started (yyyy/mm/dd): 1994/04/20	
Lithology Description		Date Completed (yyyy/mm/dd): 1994/04/20	
1 Topsoil		Well Depth: 200 FT	
37 Brown Sandy Clay & Rocks		Borehole Diameter: 0 Inches	
58 Gray Shale		Casing Type:	
59 Gray Water Bearing Sandstone		Liner Type:	
150 Gray Shale		Size OD: 0 Inches	
153 Gray Interbedded Shale & Sandstone		Wall Thickness: 0 Inches	
200 Dark Gray Shale		Bottom at: 0 FT	
		Top: 0 FT Bottom: 0 FT	
		Perforations from: 0 FT to: 0 FT	
		Perforations Size: 0 Inches x 0 Inches	
		Perforations from: 0 FT to: 0 FT	
		Perforations Size: 0 Inches x 0 Inches	
		Perforations from: 0 FT to: 0 FT	
		Perforations Size: 0 Inches x 0 Inches	
		Perforated by:	
		Seal: from: 0 FT to: 0 FT	
		Seal: from: 0 FT to: 0 FT	
		Seal: from: 0 FT to: 0 FT	
		Screen Type: from: 0 FT to: 0 FT	
		Screen ID: 0 Inches	
		Screen Type: from: 0 FT to: 0 FT	
		Screen ID: 0 Inches	
		Screen Installation Method:	
		Fittings Top: Bottom:	
		Pack: Grain Size: Amount:	
		Geophysical Log Taken: Retained on Files:	
		Additional Test and/or Pump Data	
		Chemistries taken By Driller: No	
		Held: 0 Documents Held: 1	
		Pitless Adapter Type:	
		Drop Pipe Type: Length: Diameter:	
		Comments: DRILLER REPORT 59'- 1.5 GPM, 150'- OILY LOOKING AT TIMES.	
7. Contractor Certification		Total Drawdown: FT	
Driller's Name: UNKNOWN DRILLER		If water removal was less than 2 hr duration, reason why:	
Certification No.: 3631AD		Recommended pumping rate: Gallons/Min	
This well was constructed in accordance with the Water Well regulation of the Alberta Environmental Protection & Enhancement Act. All information in this report is true.		Recommended pump intake: FT	
Signature		Type pump installed	
Yr Mo Day		Pump type:	
		Pump model:	
		H.P.:	
		Any further pumptest information?	



Water Well Drilling Report

The data contained in this report is supplied by the Driller. The province disclaims responsibility for its accuracy.

Well I.D.: 0385172
 Map Verified: Map
 Date Report Received: 1989/09/29
 Measurements: Imperial

1. Contractor & Well Owner Information		2. Well Location	
Company Name: NIEMANS DRILLING (1980) LTD.		Drilling Company Approval No.: 119079	
Mailing Address: BOX 5564		City or Town: HIGH RIVER AB CA	
Well Owner's Name: MCPHERSON, HUGH		Postal Code: T0E 1M6	
P.O. Box Number:		Well Location Identifier:	
Mailing Address: RR2, HIGH RIVER		Location in Quarter	
City:		0 FT from Boundary	
Province:		0 FT from Boundary	
Country:		Lot Block Plan	
		Well Elev: FT	
		How Obtain: Not Obtain	
3. Drilling Information		6. Well Yield	
Type of Work: Test Hole-Abandoned Reclaimed Well		Test Date (yyyy/mm/dd): 1989/08/22	
Date Reclaimed: 1989/08/22		Start Time: 11:00 AM	
Method of Drilling: Rotary		Test Method: Air	
Flowing Well: No		Non pumping static level: 0 FT	
Gas Present: No		Rate of water removal: 1.5 Gallons/Min	
Rate: Gallons		Depth of pump intake: 270 FT	
Oil Present: No		Water level at end of pumping: FT	
4. Formation Log		Distance from top of casing to ground level: Inches	
Depth from ground level (feet)		Depth To water level (feet) Elapsed Time	
Lithology Description		Drawdown Minutes:Sec Recovery	
36 Clay & Rocks		Total Drawdown: 0 FT	
45 Sandstone		If water removal was less than 2 hr duration, reason why:	
57 Shale		Recommended pumping rate: 0 Gallons/Min	
63 Shale & Sandstone		Recommended pump intake: 0 FT	
71 Shale		Type Pump Installed	
74 Shale & Sandstone		Pump Type:	
79 Shale		Pump Model:	
83 Sandstone		H.P.:	
125 Shale & Sandstone Ledges		Any further pumptest information?	
138 Shale & Sandstone			
163 Sandstone			
174 Shale			
179 Sandstone			
193 Shale			
204 Sandstone			
270 Shale			
5. Well Completion			
Date Started (yyyy/mm/dd): 1989/08/22		Date Completed (yyyy/mm/dd): 1989/08/22	
Well Depth: 270 FT		Borehole Diameter: 0 Inches	
Casing Type:		Liner Type:	
Size OD: 0 Inches		Size OD: 0 Inches	
Wall Thickness: 0 Inches		Wall Thickness: 0 Inches	
Bottom at: 0 FT		Top: 0 FT Bottom: 0 FT	
Perforations from: 0 FT to: 0 FT		Perforations Size: 0 Inches x 0 Inches	
Perforations from: 0 FT to: 0 FT		Perforations Size: 0 Inches x 0 Inches	
Perforations from: 0 FT to: 0 FT		Perforations Size: 0 Inches x 0 Inches	
Perforated by:			
Seal: from: 0 FT to: 0 FT			
Seal: from: 0 FT to: 0 FT			
Seal: from: 0 FT to: 0 FT			
Screen Type: from: 0 FT to: 0 FT		Screen ID: 0 Inches Slot Size: 0 Inches	
Screen Type: from: 0 FT to: 0 FT		Screen ID: 0 Inches Slot Size: 0 Inches	
Screen Installation Method:			
Fittings Top: Bottom:			
Pack: Grain Size: Amount:			
Geophysical Log Taken: Retained on Files:			
Additional Test and/or Pump Data			
Chemistries taken By Driller: No			
Held: 0 Documents Held: 1			
Pitless Adapter Type:			
Drop Pipe Type: Length: FT Diameter: Inches			
Comments:			
7. Contractor Certification			
Driller's Name: UNKNOWN DRILLER			
Certification No.: VA5635			
This well was constructed in accordance with the Water Well regulation of the Alberta Environmental Protection & Enhancement Act. All information in this report is true.			
Signature Yr Mo Day			



Water Well Drilling Report

The data contained in this report is supplied by the Driller. The province disclaims responsibility for its accuracy.

Well I.D.: 0385187
 Map Verified: Field
 Date Report: 1976/02/06
 Received:
 Measurements: Imperial

1. Contractor & Well Owner Information		2. Well Location	
Company Name: Drilling Company Approval No.: WARNKE BROS		1/4 or Sec Twp Rge Westof LSD M SE 08 017 02 5	
Mailing Address: City or Town: Postal Code:		Location in Quarter 0 FT from Boundary 0 FT from Boundary	
WellOwner's Name: Well Location Identifier: ARC/PEKISKO #1		Lot Block Plan	
P.O. Box Number: Mailing Address: Postal Code: 11315 87 AVE, EDMONTON		Well Elev: How Obtain: 4090 FT Estimated	
City: Province: Country:			
3. Drilling Information		6. Well Yield	
Type of Work: Test Hole Reclaimed Well Date Reclaimed: Materials Used: Method of Drilling: Rotary Flowing Well: No Rate: Gallons Gas Present: No Oil Present: No		Test Date Start Time: (yyyy/mm/dd): 1975/09/22 8:30 AM Test Method: Pump Non pumping 10.9 FT static level: Rate of water 1.6 removal: Gallons/Min Depth of pump 135 FT intake: Water level at FT end of pumping: Distance from top of Inches casing to ground level: Depth To water level (feet) Elapsed Time Drawdown Minutes:Sec Recovery 10.86 0:00 0.78 0:00 0.95 0:15 0:15 40.31 11.32 0:30 39.85 1.03 0:30 1.15 0:45 0:45 39.66 11.49 1:00 39.03 1.24 1:00 11.68 1:30 38.8 1.47 1:30 11.88 2:00 38.57 1.68 2:00 1.87 2:30 40.12 12 2:30 38.52 2.06 3:00 12.28 3:00 38.47 12.47 3:30 38.43 2.25 3:30 12.65 4:00 38.28 2.44 4:00 39.82 2.64 4:30 12.74 4:30 38.3 12.98 5:00 38.25	
4. Formation Log		5. Well Completion	
Depth from ground level (feet) Lithology Description		Date Started(yyyy/mm/dd): Date Completed (yyyy/mm/dd): 1975/09/18	
25 Light Brown Clay		Well Depth: 500 FT Borehole Diameter: 0 Inches	
70 Blue Shale		Casing Type: Steel Liner Type:	
75 Gray Fine Grained Sandstone		Size OD: 6.62 Inches Size OD: 0 Inches	
90 Blue Shale		Wall Thickness: 0.125 Inches Wall Thickness: 0 Inches	
95 Light Gray Fine Grained Sandstone		Bottom at: 43 FT Top: 0 FT Bottom: 0 FT	
115 Black Shale		Perforations Perforations Size: from: 0 FT to: 0 FT 0 Inches x 0 Inches	
210 Gray Fine Grained Sandstone		from: 0 FT to: 0 FT 0 Inches x 0 Inches	
215 Black Shale		from: 0 FT to: 0 FT 0 Inches x 0 Inches	
250 Light Gray Sandstone		Perforated by:	
300 Black Shale		Seal: Driven	
310 Light Fine Grained Sandstone		from: 43 FT to: 0 FT	
325 Black Fine Grained Sandstone		Seal:	
360 Black Shale		from: 0 FT to: 0 FT	
410 Gray Fine Grained Sandstone		Seal:	
435 Brown Shale & Coal		from: 0 FT to: 0 FT	
495 Black Shale		Screen Type: Screen ID: 0 Inches from: 0 FT to: 0 FT Slot Size: 0 Inches	
500 Brown Shale		Screen Type: Screen ID: 0 Inches from: 0 FT to: 0 FT Slot Size: 0 Inches	
		Screen Installation Method:	
		Fittings Top: Bottom:	
		Pack: Grain Size: Amount:	
		Geophysical Log Taken: Retained on Files:	
		Additional Test and/or Pump Data Chemistries taken By Driller: Yes Held: 2 Documents Held: 7	
		Pitless Adapter Type: Drop Pipe Type: Length: FT Diameter: Inches	
		Comments: DRILLER REPORTS HARD WATER COMPLETE LITH ON FILE	
		Recommended pumping rate: 0 Gallons/Min Recommended pump intake: 0 FT Type Pump Installed Pump Type: Pump Model: H.P.: Any further pump test information?	
7. Contractor Certification			
Driller's Name: UNKNOWN DRILLER Certification No.: This well was constructed in accordance with the Water Well regulation of the Alberta Environmental Protection & Enhancement Act. All information in this report is true. Signature Yr Mo Day			



Water Well Drilling Report

The data contained in this report is supplied by the Driller. The province disclaims responsibility for its accuracy.

Well I.D.: 0385209
 Map Verified: Map
 Date Report: 1986/02/18
 Received:
 Measurements: Imperial

1. Contractor & Well Owner Information		2. Well Location	
Company Name: NIEMANS DRILLING (1980) LTD.		Drilling Company Approval No.: 119079	
Mailing Address: BOX 5564		City or Town: HIGH RIVER AB CA	
Well Owner's Name: BAR U RANCH LTD/BAKER, ALLAN		Postal Code: T0E 1M6	
P.O. Box Number:		Well Location Identifier:	
Mailing Address: RR2, HIGH RIVER		Postal Code:	
City:		Country:	
3. Drilling Information		6. Well Yield	
Type of Work: Deepened		Test Date (yyyy/mm/dd): 1985/12/05	
Reclaimed Well		Start Time: 11:00 AM	
Date Reclaimed:		Test Method: Pump	
Method of Drilling: Rotary		Non pumping static level: 45 FT	
Flowing Well: No		Rate of water removal: 3 Gallons/Min	
Gas Present: No		Depth of pump intake: 65 FT	
4. Formation Log		Water level at end of pumping: FT	
Depth from ground level (feet)	Lithology Description	Distance from top of casing to ground level: Inches	
14	Sandy Clay & Rocks	Depth To water level (feet) Elapsed Time	
42	Clay & Rocks	Drawdown Minutes: Sec Recovery	
68	Hard Sandstone	Total Drawdown: 0 FT	
73	Shale	if water removal was less than 2 hr duration, reason why:	
200	Shale	Recommended pumping rate: 2 Gallons/Min	
5. Well Completion		Recommended pump intake: 65 FT	
Date Started (yyyy/mm/dd): 1980/03/13		Type Pump Installed	
Well Depth: 200 FT		Pump Type:	
Casing Type: Steel		Pump Model:	
Size OD: 6.62 Inches		H.P.:	
Wall Thickness: 0.188 Inches		Any further pump test information?	
Bottom at: 22 FT		Perforations	
Top: 0 FT Bottom: 73 FT		from: 38 FT to: 68 FT	
Perforations Size: 0.125 Inches x 10 Inches		from: 0 FT to: 0 FT	
Perforations Size: 0 Inches x 0 Inches		from: 0 FT to: 0 FT	
Perforations Size: 0 Inches x 0 Inches		Perforated by: Torch	
Seal: Driven		Seal: Driven	
from: 21 FT to: 0 FT		from: 21 FT to: 0 FT	
Seal:		Seal:	
from: 0 FT to: 0 FT		from: 0 FT to: 0 FT	
Seal:		Seal:	
from: 0 FT to: 0 FT		from: 0 FT to: 0 FT	
Screen Type:		Screen Type:	
from: 0 FT to: 0 FT		from: 0 FT to: 0 FT	
Screen ID: 0 Inches		Screen ID: 0 Inches	
Slot Size: 0 Inches		Slot Size: 0 Inches	
Screen Installation Method:		Screen Installation Method:	
Fittings		Fittings	
Top: Bottom:		Top: Bottom:	
Pack:		Pack:	
Grain Size: Amount:		Grain Size: Amount:	
Geophysical Log Taken:		Geophysical Log Taken:	
Retained on Files:		Retained on Files:	
Additional Test and/or Pump Data		Additional Test and/or Pump Data	
Chemistries taken By Driller: No		Chemistries taken By Driller: No	
Held: 0 Documents Held: 2		Held: 0 Documents Held: 2	
Pitless Adapter Type:		Pitless Adapter Type:	
Drop Pipe Type:		Drop Pipe Type:	
Length: FT Diameter: Inches		Length: FT Diameter: Inches	
Comments:		Comments:	
WELL DEEPENED FROM 73'-200', TEST HOLE		WELL DEEPENED FROM 73'-200', TEST HOLE	
7. Contractor Certification		7. Contractor Certification	
Driller's Name: UNKNOWN DRILLER		Driller's Name: UNKNOWN DRILLER	
Certification No.: VA5635		Certification No.: VA5635	
This well was constructed in accordance with the Water Well regulation of the Alberta Environmental Protection & Enhancement Act. All information in this report is true.		This well was constructed in accordance with the Water Well regulation of the Alberta Environmental Protection & Enhancement Act. All information in this report is true.	
Signature		Signature	
Yr Mo Day		Yr Mo Day	



Water Well Drilling Report

The data contained in this report is supplied by the Driller. The province disclaims responsibility for its accuracy.

Well I.D.:	0385226
Map Verified:	Map
Date Report Received:	1987/11/19
Measurements:	Imperial

1. Contractor & Well Owner Information		2. Well Location	
Company Name: GOODISON WATER WELL DRILLING		Drilling Company Approval No.:	
Mailing Address: City or Town: Postal Code:		1/4 or Sec Twp Rge West of LSD M SW 08 017 02 5	
Well Owner's Name: BAR U RANCH		Well Location Identifier:	
P.O. Box Number: Mailing Address: RR2, HIGH RIVER		Location in Quarter: 0 FT from Boundary 0 FT from Boundary	
City: Province: Country:		Lot Block Plan	
3. Drilling Information		6. Well Yield	
Type of Work: New Well Reclaimed Well		Test Date (yyyy/mm/dd): 1987/10/23	
Date Reclaimed: Method of Drilling: Rotary		Start Time: 11:00 AM	
Flowing Well: No Gas Present: No		Test Method: Air	
Rate: Gallons Oil Present: No		Non pumping static level: 32 FT	
4. Formation Log		Rate of water removal: 8 Gallons/Min	
Depth from ground level (feet)		Depth of pump intake: 180 FT	
Lithology Description		Water level at end of pumping: FT	
65 Clay		Distance from top of casing to ground level: Inches	
87 Sandstone		Depth To water level (feet) Elapsed Time	
163 Shale & Sandstone		Drawdown Minutes: Sec Recovery	
178 Sandstone		Total Drawdown: 148 FT	
195 Shale		if water removal was less than 2 hr duration, reason why:	
5. Well Completion		Recommended pumping rate: 0 Gallons/Min	
Date Started (yyyy/mm/dd): 1987/10/21		Recommended pump intake: 0 FT	
Date Completed (yyyy/mm/dd): 1987/10/23		Type Pump Installed	
Well Depth: 195 FT		Pump Type:	
Casing Type: Steel		Pump Model:	
Size OD: 5.56 inches		H.P.:	
Wall Thickness: 0.188 Inches		Any further pump test information?	
Bottom at: 20 FT		Perforations	
Perforations from: 80 FT to: 100 FT		Perforations Size: 0.125 inches x 6 inches	
Perforations from: 170 FT to: 190 FT		Perforations Size: 0 inches x 0 inches	
Perforations from: 0 FT to: 0 FT		Perforations Size: 0 inches x 0 inches	
Perforated by: Machine		Screen Type:	
Seal: Driven from: 20 FT to: 0 FT		Screen ID: 0 inches	
Seal: from: 0 FT to: 0 FT		Slot Size: 0 inches	
Seal: from: 0 FT to: 0 FT		Screen Type:	
Screen Type: from: 0 FT to: 0 FT		Screen ID: 0 inches	
Screen Type: from: 0 FT to: 0 FT		Slot Size: 0 inches	
Screen Installation Method:		Fittings	
Fittings Top: Bottom:		Pack:	
Pack: Grain Size: Amount:		Geophysical Log Taken:	
Retained on Files:		Additional Test and/or Pump Data	
Chemistries taken By Driller: No		Held: 0 Documents Held: 1	
Pitless Adapter Type:		Drop Pipe Type:	
Length: FT Diameter: inches		Comments:	
7. Contractor Certification		Driller's Name: UNKNOWN DRILLER	
Certification No.: 3665AD		This well was constructed in accordance with the Water Well regulation of the Alberta Environmental Protection & Enhancement Act. All information in this report is true.	
Signature		Yr Mo Day	



Water Well Drilling Report

The data contained in this report is supplied by the Driller. The province disclaims responsibility for its accuracy.

Well I.D.:	0385232
Map Verified:	Map
Date Report Received:	1975/05/07
Measurements:	Imperial

1. Contractor & Well Owner Information		2. Well Location	
Company Name: UNKNOWN DRILLER	Drilling Company Approval No.: 99999	1/4 or LSD 13 08 017	Rge West of 02 M 5
Mailing Address: UNKNOWN	City or Town: UNKNOWN AB CA	Postal Code:	Location in Quarter 0 FT from Boundary 0 FT from Boundary
Well Owner's Name: BAR U RANCH/BAKER, A.	Well Location Identifier:	Lot	Block Plan
P.O. Box Number:	Mailing Address: RR2, HIGH RIVER	Postal Code:	Well Elev: 4050 FT
City:	Province:	Country:	How Obtain: Estimated
3. Drilling Information		6. Well Yield	
Type of Work: Spring Reclaimed Well	Proposed well use: Unknown	Test Date (yyyy/mm/dd):	Start Time:
Date Reclaimed:	Materials Used:	Test Method:	
Method of Drilling: Not Applicable		Non pumping static level:	FT
Flowing Well: No	Rate: Gallons	Rate of water removal:	Gallons/Min
Gas Present: No	Oil Present: No	Depth of pump intake:	FT
4. Formation Log		5. Well Completion	
Depth from ground level (feet)	Lithology Description	Date Started (yyyy/mm/dd):	Date Completed (yyyy/mm/dd):
		Well Depth: 0 FT	Borehole Diameter: 0 Inches
		Casing Type:	Liner Type:
		Size OD: 0 Inches	Size OD: 0 Inches
		Wall Thickness: 0 Inches	Wall Thickness: 0 Inches
		Bottom at: 0 FT	Top: 0 FT Bottom: 0 FT
		Perforations from: 0 FT to: 0 FT	Perforations Size: 0 Inches x 0 Inches
		Perforations from: 0 FT to: 0 FT	Perforations Size: 0 Inches x 0 Inches
		Perforations from: 0 FT to: 0 FT	Perforations Size: 0 Inches x 0 Inches
		Perforated by:	
		Seal: from: 0 FT to: 0 FT	
		Seal: from: 0 FT to: 0 FT	
		Seal: from: 0 FT to: 0 FT	
		Screen Type: from: 0 FT to: 0 FT	Screen ID: 0 Inches Slot Size: 0 Inches
		Screen Type: from: 0 FT to: 0 FT	Screen ID: 0 Inches Slot Size: 0 Inches
		Screen Installation Method:	
		Fittings Top: Bottom:	
		Pack: Grain Size: Amount:	
		Geophysical Log Taken: Retained on Files:	
		Additional Test and/or Pump Data	
		Chemistries taken By Driller: No	
		Held: 1 Documents Held: 2	
		Pitless Adapter Type:	
		Drop Pipe Type: Length: Diameter:	
		Comments:	
7. Contractor Certification			
Driller's Name: UNKNOWN DRILLER			
Certification No.:			
This well was constructed in accordance with the Water Well regulation of the Alberta Environmental Protection & Enhancement Act. All information in this report is true.			
Signature		Yr Mo Day	



Water Well Drilling Report

The data contained in this report is supplied by the Driller. The province disclaims responsibility for its accuracy.

Well I.D.: 0385233
 Map Verified: Map
 Date Report: 1975/05/07
 Received:
 Measurements: Imperial

1. Contractor & Well Owner Information		2. Well Location	
Company Name: UNKNOWN DRILLER	Drilling Company Approval No.: 99999	1/4 or Sec Twp Rge Westof LSD M NW 08 017 02 5	
Mailing Address: UNKNOWN	City or Town: UNKNOWN AB CA	Postal Code:	Location in Quarter 0 FT from Boundary 0 FT from Boundary
Well Owner's Name: BAR U RANCH	Well Location Identifier:		Lot Block Plan
P.O. Box Number:	Mailing Address: RR2, HIGH RIVER	Postal Code:	Well Elev: 4050 FT
City:	Province:	Country:	How Obtain: Estimated
3. Drilling Information		6. Well Yield	
Type of Work: Well Inventory Reclaimed Well	Proposed well use: Unknown	Test Date (yyyy/mm/dd): 1975/05/07	Start Time: 11:00 AM
Date Reclaimed:	Materials Used:	Anticipated Water Requirements/day 0 Gallons	Test Method: Pump
Method of Drilling: Unknown		Flowing Well: No	Non pumping static level: 12 FT
Gas Present: No	Rate: Gallons Oil Present: No		Rate of water removal: Gallons/Min
4. Formation Log		5. Well Completion	
Depth from ground level (feet)	Lithology Description	Date Started(yyyy/mm/dd):	Date Completed (yyyy/mm/dd):
		Well Depth: 60 FT	Borehole Diameter: 0 Inches
		Casing Type: Unknown	Liner Type:
		Size OD: 5 Inches	Size OD: 0 Inches
		Wall Thickness: 0 Inches	Wall Thickness: 0 Inches
		Bottom at: 50 FT	Top: 0 FT Bottom: 0 FT
		Perforations from: 0 FT to: 0 FT from: 0 FT to: 0 FT from: 0 FT to: 0 FT	Perforations Size: 0 Inches x 0 Inches 0 Inches x 0 Inches 0 Inches x 0 Inches
		Perforated by:	
		Seal: from: 0 FT to: 0 FT	
		Seal: from: 0 FT to: 0 FT	
		Seal: from: 0 FT to: 0 FT	
		Screen Type: from: 0 FT to: 0 FT	Screen ID: 0 Inches Slot Size: 0 Inches
		Screen Type: from: 0 FT to: 0 FT	Screen ID: 0 Inches Slot Size: 0 Inches
		Screen Installation Method:	
		Fittings Top: Bottom:	
		Pack: Grain Size: Amount:	
		Geophysical Log Taken: Retained on Files:	
		Additional Test and/or Pump Data Chemistries taken By Driller: No Held: 1 Documents Held: 2	
		Pitless Adapter Type: Drop Pipe Type: Length: FT Diameter: Inches	
		Comments: WELL HAS RUN DRY	
		7. Contractor Certification	
		Driller's Name: Certification No.:	UNKNOWN DRILLER
		This well was constructed in accordance with the Water Well regulation of the Alberta Environmental Protection & Enhancement Act. All information in this report is true.	
		Signature	Yr Mo Day

Report 1 Pump Test 1



Water Well Drilling Report

The data contained in this report is supplied by the Driller. The province disclaims responsibility for its accuracy.

Well I.D.:	0385953
Map Verified:	Map
Date Report Received:	1994/08/16
Measurements:	Imperial

1. Contractor & Well Owner Information

Company Name: PETER NIEMANS WATER WELL DRILLING		Drilling Company Approval No.: 119926
Mailing Address: BOX 5024	City or Town: HIGH RIVER AB CA	Postal Code: T1V 1M3
WellOwner's Name: BAKER, ALLEN/BAR U RANCH	Well Location Identifier:	
P.O. Box Number:	Mailing Address: RR2, HIGH RIVER	Postal Code: T1V 1N2
City:	Province:	Country:

2. Well Location

1/4 or LSD	Sec	Twp	Rge	Westof
03	08	017	02	M 5
Location in Quarter				
1350 FT from		N	Boundary	
500 FT from		E	Boundary	
Lot	Block	Plan		
Well Elev: FT	How Obtain: Not Obtain			

3. Drilling Information

Type of Work: New Well Reclaimed Well	Proposed well use: Domestic & Stock Anticipated Water Requirements/day 1000 Gallons
Date Reclaimed:	Materials Used:
Method of Drilling: Rotary	
Flowing Well: No	Rate: Gallons
Gas Present: No	Oil Present: No

6. Well Yield

Test Date (yyyy/mm/dd): 1994/05/25	Start Time: 11:00 AM
Test Method: Pump	
Non pumping static level:	64.8 FT
Rate of water removal:	5 Gallons/Min
Depth of pump intake:	160 FT
Water level at end of pumping:	138 FT
Distance from top of casing to ground level:	inches

4. Formation Log

Depth from ground level (feet)	Lithology Description
1	Topsoil
18	Brown Clay & Rocks
46	Brown Shale
49	Gray Shale
51	Gray Sandstone
61	Gray Shale
64	Sandstone
75	Gray Interbedded Shale & Sandstone
197	Gray Thin Shale & Sandstone Ledges
212	Gray Water Bearing Sandstone
220	Gray Shale

5. Well Completion

Date Started(yyyy/mm/dd): 1994/05/24	Date Completed (yyyy/mm/dd): 1994/05/25
Well Depth: 220 FT	Borehole Diameter: 0 Inches
Casing Type: Steel	Liner Type: Plastic
Size OD: 6.62 Inches	Size OD: 4.5 Inches
Wall Thickness: 0.188 Inches	Wall Thickness: 0.237 Inches
Bottom at: 20 FT	Top: 14 FT Bottom: 215 FT
Perforations from: 200 FT to: 213 FT from: 0 FT to: 0 FT from: 0 FT to: 0 FT	Perforations Size: 0.125 Inches x 7 Inches 0 Inches x 0 Inches 0 Inches x 0 Inches
Perforated by: Saw	
Seal: Driven & Bentonite from: 180 FT to: 198 FT	
Seal: from: 0 FT to: 0 FT	
Seal: from: 0 FT to: 0 FT	
Screen Type: from: 0 FT to: 0 FT	Screen ID: 0 Inches Slot Size: 0 Inches
Screen Type: from: 0 FT to: 0 FT	Screen ID: 0 Inches Slot Size: 0 Inches
Screen Installation Method:	
Fittings Top: Bottom:	
Pack: Grain Size: Amount:	
Geophysical Log Taken: Retained on Files:	
Additional Test and/or Pump Data Chemistries taken By Driller: No Held: 0 Documents Held: 1	
Pitless Adapter Type: Drop Pipe Type: Length: FT Diameter: Inches	
Comments: DRILLER REPORT AIR TEST 6.5-7 GPM FOR 3 HRS. PUMP TEST FOR MAY 26 AND 27 8.5 HRS @ 5 GPM WATER LEVEL HELD @ 155'.	

Depth To water level (feet)	Elapsed Time	Drawdown Minutes:Sec	Recovery
64.83	0:00	138	
69	1:00	133.92	
71.67	2:00	131	
74	3:00	128.88	
76.25	4:00	127	
78.5	5:00	125.42	
80.58	6:00	123.75	
82.38	7:00	122	
84.17	8:00	120.33	
85.92	9:00	118.83	
87.58	10:00	117.29	
90.08	12:00	114.63	
92.46	14:00	112	
94.92	16:00	109.83	
99.5	20:00	106.29	
105.17	25:00	101.33	
110	30:00	97.83	
113.38	35:00	94.75	
116	40:00	92	
120.75	50:00	88.5	
124.83	60:00	84.92	
129.42	75:00	81.42	
133	90:00	78.75	
135.83	105:00	77	
138	120:00	75.67	

Total Drawdown: 73 FT
If water removal was less than 2 hr duration, reason why:

Recommended pumping rate: 5 Gallons/Min
Recommended pump intake: 185 FT
Type Pump Installed
Pump Type:
Pump Model:
H.P.:
Any further pump test information?

7. Contractor Certification

Driller's Name: Certification No.:	UNKNOWN DRILLER 3631AD
This well was constructed in accordance with the Water Well regulation of the Alberta Environmental Protection & Enhancement Act. All information in this report is true.	
Signature	Yr Mo Day



Water Well Drilling Report

The data contained in this report is supplied by the Driller. The province disclaims responsibility for its accuracy.

Well I.D.:	0385959
Map Verified:	Map
Date Report Received:	1994/08/16
Measurements:	Imperial

1. Contractor & Well Owner Information		2. Well Location	
Company Name: PETER NIEMANS WATER WELL DRILLING		Drilling Company Approval No.: 119926	
Mailing Address: BOX 5024		City or Town: HIGH RIVER AB CA	
Well Owner's Name: BAKER, ALLAN/ BAR U RANCH #1		Postal Code: T1V 1M3	
P.O. Box Number:		Well Location Identifier:	
City:		Postal Code: T1V 1N2	
Province:		Country:	
3. Drilling Information		6. Well Yield	
Type of Work: Test Hole-Abandoned Reclaimed Well		Proposed well use: Domestic & Stock Anticipated Water Requirements/day 0 Gallons	
Date Reclaimed: 1994/05/21		Materials Used: Cuttings	
Method of Drilling: Rotary		Rate: Gallons Oil Present: No	
4. Formation Log		5. Well Completion	
Depth from ground level (feet)		Date Started (yyyy/mm/dd): 1994/05/20	
Lithology Description		Date Completed (yyyy/mm/dd): 1994/05/20	
1 Topsoil		Well Depth: 320 FT	
6 Brown Sandy Clay		Borehole Diameter: 0 Inches	
17 Brown Sandy Clay & Sand		Casing Type:	
36 Brown Clay & Rocks		Liner Type:	
64 Gray Shale		Size OD: 0 Inches	
65 Gray Water Bearing Sandstone		Wall Thickness: 0 Inches	
91 Gray Shale		Bottom at: 0 FT	
96 Gray Sandstone		Top: 0 FT Bottom: 0 FT	
113 Gray Shale		Perforations	
116 Gray Sandstone		from: 0 FT to: 0 FT	
118 Dark Brown Shale		from: 0 FT to: 0 FT	
130 Gray Shale		from: 0 FT to: 0 FT	
134 Dark Shale		Perforated by:	
168 Gray Shale		Seal:	
175 Dark Gray Shale		from: 0 FT to: 0 FT	
177 Gray Shale		Screen Type:	
178 Gray Sandstone		from: 0 FT to: 0 FT	
320 Dark Gray Shale		Screen ID: 0 Inches	
		Slot Size: 0 Inches	
		Screen Installation Method:	
		Fittings	
		Top: Bottom:	
		Pack:	
		Grain Size: Amount:	
		Geophysical Log Taken:	
		Retained on Files:	
		Additional Test and/or Pump Data	
		Chemistries taken By Driller: No	
		Held: 0 Documents Held: 1	
		Pitless Adapter Type:	
		Drop Pipe Type:	
		Length: Diameter:	
		Comments:	
		7. Contractor Certification	
		Driller's Name: UNKNOWN DRILLER	
		Certification No.: 3631AD	
		This well was constructed in accordance with the Water Well regulation of the Alberta Environmental Protection & Enhancement Act. All information in this report is true.	
		Signature Yr Mo Day	
		Test Date (yyyy/mm/dd):	
		Start Time:	
		Test Method:	
		Non pumping FT static level:	
		Rate of water removal: Gallons/Min	
		Depth of pump intake: FT	
		Water level at end of pumping: FT	
		Distance from top of casing to ground level: Inches	
		Depth To water level (feet) Elapsed Time	
		Drawdown Minutes:Sec Recovery	
		Total Drawdown: FT	
		If water removal was less than 2 hr duration, reason why:	
		Recommended pumping rate: Gallons/Min	
		Recommended pump intake: FT	
		Type pump installed	
		Pump type:	
		Pump model:	
		H.P.:	
		Any further pump test information?	



Water Well Drilling Report

The data contained in this report is supplied by the Driller. The province disclaims responsibility for its accuracy.

Well I.D.: 0385961
 Map Verified: Map
 Date Report: 1994/08/16
 Received:
 Measurements: Imperial

1. Contractor & Well Owner Information

Company Name: PETER NIEMANS WATER WELL DRILLING
 Mailing Address: BOX 5024
 Well Owner's Name: BAKER, ALLAN/ BAR U RANCH #2
 P.O. Box Number:
 City:
 City or Town: HIGH RIVER AB CA
 Well Location Identifier:
 Mailing Address: RR2, HIGH RIVER
 Province:
 Drilling Company Approval No.: 119926
 Postal Code: T1V 1M3
 Postal Code: T1V 1N2
 Country:

2. Well Location

1/4 or Sec Twp Rge West of
 LSD M
 06 08 017 02 5
 Location in Quarter
 1200 FT from N Boundary
 500 FT from E Boundary
 Lot Block Plan
 Well Elev: FT
 How Obtain: Not Obtain

3. Drilling Information

Type of Work: Test Hole-Abandoned
 Reclaimed Well
 Date Reclaimed: 1994/05/21
 Method of Drilling: Rotary
 Flowing Well: No
 Gas Present: No
 Materials Used: Bentonite Product
 Rate: Gallons
 Oil Present: No

Proposed well use:
 Domestic & Stock
 Anticipated Water
 Requirements/day
 0 Gallons

6. Well Yield

Test Date (yyyy/mm/dd):
 Start Time:
 Test Method:
 Non pumping FT
 static level:
 Rate of water removal: Gallons/Min

4. Formation Log

Depth from ground level (feet)	Lithology Description
1	Topsoil
49	Brown Clay & Rocks
51	Brown Shale
58	Gray Interbedded Shale & Sandstone
69	Gray Shale
70	Gray Water Bearing Sandstone
131	Gray Thin Shale & Sandstone Ledges
230	Gray Thin Shale & Sandstone Ledges

5. Well Completion

Date Started(yyyy/mm/dd): 1994/05/21
 Date Completed(yyyy/mm/dd): 1994/05/21
 Well Depth: 230 FT
 Borehole Diameter: 0 Inches
 Casing Type:
 Liner Type:
 Size OD: 0 Inches
 Size OD: 0 Inches
 Wall Thickness: 0 Inches
 Wall Thickness: 0 Inches
 Bottom at: 0 FT
 Top: 0 FT Bottom: 0 FT
 Perforations from: 0 FT to: 0 FT
 Perforations Size: 0 Inches x 0 Inches
 from: 0 FT to: 0 FT
 Perforations Size: 0 Inches x 0 Inches
 from: 0 FT to: 0 FT
 Perforations Size: 0 Inches x 0 Inches
 Perforated by:
 Seal: from: 0 FT to: 0 FT
 Seal: from: 0 FT to: 0 FT
 Seal: from: 0 FT to: 0 FT
 Screen Type: from: 0 FT to: 0 FT
 Screen ID: 0 Inches
 Slot Size: 0 Inches
 Screen Type: from: 0 FT to: 0 FT
 Screen ID: 0 Inches
 Slot Size: 0 Inches
 Screen Installation Method:
 Fittings Top: Bottom:
 Pack: Grain Size: Amount:
 Geophysical Log Taken:
 Retained on Files:
 Additional Test and/or Pump Data
 Chemistries taken By Driller: No
 Held: 0 Documents Held: 1
 Pitless Adapter Type:
 Drop Pipe Type: Length: Diameter:
 Comments:

Depth of pump intake: FT
 Water level at end of pumping: FT
 Distance from top of casing to ground level: Inches
 Depth To water level (feet)
 Elapsed Time
 Drawdown Minutes:Sec Recovery

Total Drawdown: FT
 If water removal was less than 2 hr duration, reason why:
 Recommended pumping rate: Gallons/Min
 Recommended pump intake: FT
 Type pump installed
 Pump type:
 Pump model:
 H.P.:
 Any further pump test information?

7. Contractor Certification

Driller's Name: UNKNOWN DRILLER
 Certification No.: 3631AD
 This well was constructed in accordance with the Water Well regulation of the Alberta Environmental Protection & Enhancement Act. All information in this report is true.
 Signature Yr Mo Day



Water Well Drilling Report

The data contained in this report is supplied by the Driller. The province disclaims responsibility for its accuracy.

Well I.D.: 0385965
 Map Verified: Map
 Date Report: 1994/08/16
 Received:
 Measurements: Imperial

1. Contractor & Well Owner Information		2. Well Location	
Company Name: PETER NIEMANS WATER WELL DRILLING		Drilling Company Approval No.: 119926	
Mailing Address: BOX 5024		City or Town: HIGH RIVER AB CA	
Well Owner's Name: BAKER, ALLAN/ BAR U RANCH #3		Postal Code: T1V 1M3	
P.O. Box Number:		Well Location Identifier:	
City:		Postal Code: T1V 1N2	
Province:		Country:	
3. Drilling Information		6. Well Yield	
Type of Work: Test Hole-Abandoned		Proposed well use: Domestic & Stock	
Reclaimed Well		Anticipated Water Requirements/day	
Date Reclaimed: 1994/05/23		0 Gallons	
Method of Drilling: Rotary		Test Date (yyyy/mm/dd):	
Flowing Well: No		Start Time:	
Gas Present: No		Test Method: Non pumping FT static level:	
4. Formation Log		Rate of water removal: Gallons/Min	
5. Well Completion		Depth of pump intake: FT	
Date Started (yyyy/mm/dd): 1994/05/23		Water level at end of pumping: FT	
Well Depth: 220 FT		Distance from top of casing to ground level: Inches	
Casing Type:		Depth To water level (feet) Elapsed Time	
Size OD: 0 Inches		Drawdown Minutes: Sec Recovery	
Wall Thickness: 0 Inches		Total Drawdown: FT	
Bottom at: 0 FT		If water removal was less than 2 hr duration, reason why:	
Perforations from: 0 FT to: 0 FT		Recommended pumping rate: Gallons/Min	
Perforations Size: 0 Inches x 0 Inches		Recommended pump intake: FT	
Perforations from: 0 FT to: 0 FT		Type pump installed	
Perforations from: 0 FT to: 0 FT		Pump type:	
Perforated by:		Pump model:	
Seal: from: 0 FT to: 0 FT		H.P.:	
Seal: from: 0 FT to: 0 FT		Any further pumptest information?	
Seal: from: 0 FT to: 0 FT			
Screen Type: from: 0 FT to: 0 FT			
Screen ID: 0 Inches			
Slot Size: 0 Inches			
Screen Type: from: 0 FT to: 0 FT			
Screen ID: 0 Inches			
Slot Size: 0 Inches			
Screen Installation Method:			
Fittings Top: Bottom:			
Pack: Grain Size: Amount:			
Geophysical Log Taken: Retained on Files:			
Additional Test and/or Pump Data			
Chemistries taken By Driller: No			
Held: 0 Documents Held: 1			
Pitless Adapter Type:			
Drop Pipe Type: Length: Diameter:			
Comments:			
7. Contractor Certification			
Driller's Name: UNKNOWN DRILLER			
Certification No.: 3631AD			
This well was constructed in accordance with the Water Well regulation of the Alberta Environmental Protection & Enhancement Act. All information in this report is true.			
Signature Yr Mo Day			



Water Well Drilling Report

The data contained in this report is supplied by the Driller. The province disclaims responsibility for its accuracy.

Well I.D.:	0467773
Map Verified:	Not Verified
Date Report Received:	1997/09/17
Measurements:	Imperial

1. Contractor & Well Owner Information		2. Well Location																																																																																		
Company Name: NIEMANS DRILLING (1980) LTD.		Drilling Company Approval No.: 119079																																																																																		
Mailing Address: BOX 5564	City or Town: HIGH RIVER AB CA	Postal Code: T0E 1M6																																																																																		
WellOwner's Name: NELSON, JASON		Well Location Identifier:																																																																																		
P.O. Box Number: 5967	Mailing Address: HIGH RIVER	Postal Code: T1V 1P6																																																																																		
City:	Province:	Country:																																																																																		
3. Drilling Information		6. Well Yield																																																																																		
Type of Work: New Well	Reclaimed Well	Proposed well use: Domestic Anticipated Water Requirements/day 500 Gallons																																																																																		
Date Reclaimed:	Materials Used:	Test Date (yyyy/mm/dd): 1997/08/17																																																																																		
Method of Drilling: Rotary	Flowing Well: No	Start Time: 11:00 AM																																																																																		
Gas Present: No	Rate: Gallons Oil Present: No	Test Method: Pump																																																																																		
4. Formation Log		Non pumping static level: 7.6 FT																																																																																		
Depth from ground level (feet)	Lithology Description	Rate of water removal: 6.5 Gallons/Min																																																																																		
2	Silty Clay	Depth of pump intake: 170 FT																																																																																		
13	Silty Till & Gravel	Water level at end of pumping: 143.7 FT																																																																																		
25	Clay & Rocks	Distance from top of casing to ground level:																																																																																		
46	Shale	<table border="1"> <thead> <tr> <th colspan="3">Depth To water level (feet) Elapsed Time</th> </tr> <tr> <th>Drawdown</th> <th>Minutes:Sec</th> <th>Recovery</th> </tr> </thead> <tbody> <tr> <td>7.677</td> <td>0:00</td> <td></td> </tr> <tr> <td>10.498</td> <td>1:00</td> <td>139.597</td> </tr> <tr> <td>13.714</td> <td>2:00</td> <td>132.74</td> </tr> <tr> <td>16.338</td> <td>3:00</td> <td>129.853</td> </tr> <tr> <td>19.029</td> <td>4:00</td> <td>126.966</td> </tr> <tr> <td>21.161</td> <td>5:00</td> <td>124.341</td> </tr> <tr> <td>22.933</td> <td>6:00</td> <td>121.946</td> </tr> <tr> <td>24.868</td> <td>7:00</td> <td>119.814</td> </tr> <tr> <td>26.312</td> <td>8:00</td> <td>117.616</td> </tr> <tr> <td>28.084</td> <td>9:00</td> <td>115.746</td> </tr> <tr> <td>29.626</td> <td>10:00</td> <td>113.81</td> </tr> <tr> <td>33.3</td> <td>12:00</td> <td>110.398</td> </tr> <tr> <td>36.482</td> <td>14:00</td> <td>107.248</td> </tr> <tr> <td>40.485</td> <td>16:00</td> <td>104.23</td> </tr> <tr> <td>52.558</td> <td>20:00</td> <td>99.015</td> </tr> <tr> <td>65.353</td> <td>25:00</td> <td>93.503</td> </tr> <tr> <td>72.374</td> <td>30:00</td> <td>88.845</td> </tr> <tr> <td>79.986</td> <td>35:00</td> <td>84.744</td> </tr> <tr> <td>85.399</td> <td>40:00</td> <td>80.675</td> </tr> <tr> <td>93.241</td> <td>50:00</td> <td>75.131</td> </tr> <tr> <td>101.375</td> <td>60:00</td> <td>70.439</td> </tr> <tr> <td>112.662</td> <td>75:00</td> <td>67.256</td> </tr> <tr> <td>123.29</td> <td>90:00</td> <td>59.252</td> </tr> <tr> <td>132.543</td> <td>105:00</td> <td>52.722</td> </tr> <tr> <td>143.731</td> <td>120:00</td> <td>46.784</td> </tr> </tbody> </table>		Depth To water level (feet) Elapsed Time			Drawdown	Minutes:Sec	Recovery	7.677	0:00		10.498	1:00	139.597	13.714	2:00	132.74	16.338	3:00	129.853	19.029	4:00	126.966	21.161	5:00	124.341	22.933	6:00	121.946	24.868	7:00	119.814	26.312	8:00	117.616	28.084	9:00	115.746	29.626	10:00	113.81	33.3	12:00	110.398	36.482	14:00	107.248	40.485	16:00	104.23	52.558	20:00	99.015	65.353	25:00	93.503	72.374	30:00	88.845	79.986	35:00	84.744	85.399	40:00	80.675	93.241	50:00	75.131	101.375	60:00	70.439	112.662	75:00	67.256	123.29	90:00	59.252	132.543	105:00	52.722	143.731	120:00	46.784
Depth To water level (feet) Elapsed Time																																																																																				
Drawdown	Minutes:Sec	Recovery																																																																																		
7.677	0:00																																																																																			
10.498	1:00	139.597																																																																																		
13.714	2:00	132.74																																																																																		
16.338	3:00	129.853																																																																																		
19.029	4:00	126.966																																																																																		
21.161	5:00	124.341																																																																																		
22.933	6:00	121.946																																																																																		
24.868	7:00	119.814																																																																																		
26.312	8:00	117.616																																																																																		
28.084	9:00	115.746																																																																																		
29.626	10:00	113.81																																																																																		
33.3	12:00	110.398																																																																																		
36.482	14:00	107.248																																																																																		
40.485	16:00	104.23																																																																																		
52.558	20:00	99.015																																																																																		
65.353	25:00	93.503																																																																																		
72.374	30:00	88.845																																																																																		
79.986	35:00	84.744																																																																																		
85.399	40:00	80.675																																																																																		
93.241	50:00	75.131																																																																																		
101.375	60:00	70.439																																																																																		
112.662	75:00	67.256																																																																																		
123.29	90:00	59.252																																																																																		
132.543	105:00	52.722																																																																																		
143.731	120:00	46.784																																																																																		
54	Shale & Sandstone Ledges	Total Drawdown: 136 FT																																																																																		
68	Sandstone	If water removal was less than 2 hr duration, reason why:																																																																																		
73	Shale & Sandstone	Recommended pumping rate: 4 Gallons/Min																																																																																		
85	Sandstone	Recommended pump intake: 170 FT																																																																																		
91	Shale & Sandstone	Type Pump Installed																																																																																		
105	Shale	Pump Type:																																																																																		
111	Sandstone	Pump Model:																																																																																		
118	Sandstone & Shale Ledges	H.P.:																																																																																		
129	Sandstone	Any further pump test information?																																																																																		
144	Shale & Sandstone																																																																																			
162	Sandstone & Shale Ledges																																																																																			
166	Shale & Sandstone																																																																																			
180	Shale																																																																																			
5. Well Completion		7. Contractor Certification																																																																																		
Date Started(yyyy/mm/dd): 1997/07/07	Date Completed(yyyy/mm/dd): 1997/07/08	Driller's Name: UNKNOWN DRILLER																																																																																		
Well Depth: 180 FT	Borehole Diameter: 0 Inches	Certification No.: VA5635																																																																																		
Casing Type: Steel	Liner Type: Plastic	This well was constructed in accordance with the Water Well regulation of the Alberta Environmental Protection & Enhancement Act. All information in this report is true.																																																																																		
Size OD: 6.62 inches	Size OD: 4.5 Inches	Signature																																																																																		
Wall Thickness: 0.188 Inches	Wall Thickness: 0.237 Inches	Yr Mo Day																																																																																		
Bottom at: 28 FT	Top: 20 FT Bottom: 180 FT																																																																																			
Perforations from: 140 FT to: 160 FT	Perforations Size: 0.125 Inches x 8 Inches																																																																																			
from: 0 FT to: 0 FT	0 Inches x 0 Inches																																																																																			
from: 0 FT to: 0 FT	0 Inches x 0 Inches																																																																																			
Perforated by: Saw	Seal: Driven & Bentonite																																																																																			
Seal: from: 10 FT to: 28 FT	Seal: from: 0 FT to: 0 FT																																																																																			
Seal: from: 0 FT to: 0 FT	Screen Type: from: 0 FT to: 0 FT																																																																																			
Screen Type: from: 0 FT to: 0 FT	Screen ID: 0 Inches																																																																																			
Slot Size: 0 Inches	Screen Installation Method:																																																																																			
Fittings	Top: Bottom:																																																																																			
Pack: Grain Size: Amount:	Geophysical Log Taken: Retained on Files:																																																																																			
Additional Test and/or Pump Data	Chemistries taken By Driller: No																																																																																			
Held: 0 Documents Held: 1	Pitless Adapter Type:																																																																																			
Drop Pipe Type: Length: FT Diameter: Inches	Comments:																																																																																			
DRILLER REPORTS DISTANCE FROM TOP OF CASING TO GROUND LEVEL: 2'. SH TRAP 135'.																																																																																				

Appendix F
Laboratory Reports



Environmental Division

Certificate of Analysis

EARTH TECH (AECOM)

ATTN: GORDON WOOLLETT

PWGSC C/O EARTH TECH
5TH FLOOR 10025 JASPER AVE
EDMONTON AB T5J 1S6

Reported On: 18-DEC-08 04:07 PM

Revision: 1

Lab Work Order #: **L713299**

Date Received: **28-NOV-08**

Project P.O. #: NOT SUBMITTED

Job Reference: 106524

Legal Site Desc: BAR U RANCH

CofC Numbers: 08-065080

Other Information:

Comments:



JOHN FORBES
Account Manager

THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE WRITTEN AUTHORITY OF THE LABORATORY.
ALL SAMPLES WILL BE DISPOSED OF AFTER 30 DAYS FOLLOWING ANALYSIS. PLEASE CONTACT THE LAB IF YOU
REQUIRE ADDITIONAL SAMPLE STORAGE TIME.

ALS Canada Ltd. (formerly ETL Chemspec Analytical Ltd.)
Part of the **ALS Laboratory Group**

Bay 2, 1313-44 Ave. N.E., Calgary, AB T2E 6L5
Phone: +1 403 291 9897 Fax: +1 403 291 0298 www.alsglobal.com
A Campbell Brothers Limited Company

ALS LABORATORY GROUP ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	By	Batch
L713299-1 MW1								
Sampled By: MB/JN on 28-NOV-08								
Matrix: WATER								
Dissolved Metals								
Dissolved Major Metals								
Calcium (Ca)	529		0.5	mg/L		05-DEC-08	BOC	R766049
Potassium (K)	9.9		0.1	mg/L		05-DEC-08	BOC	R766049
Magnesium (Mg)	404		0.01	mg/L		05-DEC-08	BOC	R766049
Sodium (Na)	537		0.5	mg/L		05-DEC-08	BOC	R766049
Iron (Fe)	0.117		0.005	mg/L		05-DEC-08	BOC	R766049
Manganese (Mn)	2.74		0.001	mg/L		05-DEC-08	BOC	R766049
Dissolved Trace Metals								
Silver (Ag)	<0.005		0.005	mg/L		04-DEC-08	SYF	R765487
Aluminum (Al)	0.05		0.01	mg/L		04-DEC-08	SYF	R765487
Boron (B)	0.12		0.05	mg/L		04-DEC-08	SYF	R765487
Barium (Ba)	0.026		0.003	mg/L		04-DEC-08	SYF	R765487
Beryllium (Be)	<0.001		0.001	mg/L		04-DEC-08	SYF	R765487
Cadmium (Cd)	<0.001		0.001	mg/L		04-DEC-08	SYF	R765487
Cobalt (Co)	0.005		0.002	mg/L		04-DEC-08	SYF	R765487
Chromium (Cr)	<0.005		0.005	mg/L		04-DEC-08	SYF	R765487
Copper (Cu)	0.007		0.001	mg/L		04-DEC-08	SYF	R765487
Molybdenum (Mo)	<0.005		0.005	mg/L		04-DEC-08	SYF	R765487
Nickel (Ni)	0.028		0.002	mg/L		04-DEC-08	SYF	R765487
Lead (Pb)	<0.005		0.005	mg/L		04-DEC-08	SYF	R765487
Tin (Sn)	<0.05		0.05	mg/L		04-DEC-08	SYF	R765487
Strontium (Sr)	7.54		0.005	mg/L		04-DEC-08	SYF	R765487
Titanium (Ti)	0.004		0.001	mg/L		04-DEC-08	SYF	R765487
Thallium (Tl)	<0.05		0.05	mg/L		04-DEC-08	SYF	R765487
Vanadium (V)	<0.001		0.001	mg/L		04-DEC-08	SYF	R765487
Zinc (Zn)	0.004		0.002	mg/L		04-DEC-08	SYF	R765487
CCME PAHs								
Naphthalene	<0.00001	RAMB	0.00001	mg/L	02-DEC-08	04-DEC-08	PCL	R764567
Quinoline	<0.00001		0.00001	mg/L	02-DEC-08	04-DEC-08	PCL	R764567
Acenaphthene	<0.00001		0.00001	mg/L	02-DEC-08	04-DEC-08	PCL	R764567
Fluorene	<0.00001		0.00001	mg/L	02-DEC-08	04-DEC-08	PCL	R764567
Phenanthrene	0.00003	RAMB	0.00001	mg/L	02-DEC-08	04-DEC-08	PCL	R764567
Anthracene	<0.00001		0.00001	mg/L	02-DEC-08	04-DEC-08	PCL	R764567
Acridine	<0.00001		0.00001	mg/L	02-DEC-08	04-DEC-08	PCL	R764567
Fluoranthene	<0.00001	RAMB	0.00001	mg/L	02-DEC-08	04-DEC-08	PCL	R764567
Pyrene	<0.00001	RAMB	0.00001	mg/L	02-DEC-08	04-DEC-08	PCL	R764567
Benzo(a)anthracene	<0.00001		0.00001	mg/L	02-DEC-08	04-DEC-08	PCL	R764567
Chrysene	<0.00001		0.00001	mg/L	02-DEC-08	04-DEC-08	PCL	R764567
Benzo(b&j)fluoranthene	<0.00001		0.00001	mg/L	02-DEC-08	04-DEC-08	PCL	R764567
Benzo(k)fluoranthene	<0.00001		0.00001	mg/L	02-DEC-08	04-DEC-08	PCL	R764567
Benzo(a)pyrene	<0.00001		0.00001	mg/L	02-DEC-08	04-DEC-08	PCL	R764567
Indeno(1,2,3-cd)pyrene	<0.00001		0.00001	mg/L	02-DEC-08	04-DEC-08	PCL	R764567
Dibenzo(a,h)anthracene	<0.00001		0.00001	mg/L	02-DEC-08	04-DEC-08	PCL	R764567
Surr: Nitrobenzene d5	68		24-132	%	02-DEC-08	04-DEC-08	PCL	R764567
Surr: 2-Fluorobiphenyl	68		37-123	%	02-DEC-08	04-DEC-08	PCL	R764567
Surr: p-Terphenyl d14	60		41-143	%	02-DEC-08	04-DEC-08	PCL	R764567
OC Screen GC/ECD								
p,p'-DDD	<0.0001		0.0001	mg/L		04-DEC-08	BF	R766902
p,p'-DDE	<0.0001		0.0001	mg/L		04-DEC-08	BF	R766902
p,p'-DDT	<0.0001		0.0001	mg/L		04-DEC-08	BF	R766902
Aldrin	<0.0001		0.0001	mg/L		04-DEC-08	BF	R766902

ALS LABORATORY GROUP ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	By	Batch
L713299-1 MW1 Sampled By: MB/JN on 28-NOV-08 Matrix: WATER								
OC Screen GC/ECD								
alpha-BHC	<0.0001		0.0001	mg/L		04-DEC-08	BF	R766902
beta-BHC	<0.0001		0.0001	mg/L		04-DEC-08	BF	R766902
gamma-BHC (Lindane)	<0.0001		0.0001	mg/L		04-DEC-08	BF	R766902
Quintozine (PCNB)	<0.0001		0.0001	mg/L		04-DEC-08	BF	R766902
cis-Chlordane	<0.0001		0.0001	mg/L		04-DEC-08	BF	R766902
trans-Chlordane	<0.0001		0.0001	mg/L		04-DEC-08	BF	R766902
Dieldrin	<0.0001		0.0001	mg/L		04-DEC-08	BF	R766902
Endosulfan I	<0.0001		0.0001	mg/L		04-DEC-08	BF	R766902
Endosulfan II	<0.0001		0.0001	mg/L		04-DEC-08	BF	R766902
Endrin	<0.0001		0.0001	mg/L		04-DEC-08	BF	R766902
Heptachlor	<0.0001		0.0001	mg/L		04-DEC-08	BF	R766902
Methoxychlor	<0.0002		0.0002	mg/L		04-DEC-08	BF	R766902
Mirex	<0.0001		0.0001	mg/L		04-DEC-08	BF	R766902
Nonachlor	<0.0001		0.0001	mg/L		04-DEC-08	BF	R766902
Oxychlordane	<0.0001		0.0001	mg/L		04-DEC-08	BF	R766902
L713299-2 MW3 Sampled By: MB/JN on 28-NOV-08 Matrix: WATER								
Dissolved Metals								
Dissolved Major Metals								
Calcium (Ca)	167		0.5	mg/L		05-DEC-08	BOC	R766049
Potassium (K)	4.1		0.1	mg/L		05-DEC-08	BOC	R766049
Magnesium (Mg)	102		0.01	mg/L		05-DEC-08	BOC	R766049
Sodium (Na)	60.2		0.5	mg/L		05-DEC-08	BOC	R766049
Iron (Fe)	0.006		0.005	mg/L		05-DEC-08	BOC	R766049
Manganese (Mn)	0.152		0.001	mg/L		05-DEC-08	BOC	R766049
Dissolved Trace Metals								
Silver (Ag)	<0.005		0.005	mg/L		04-DEC-08	SYF	R765487
Aluminum (Al)	<0.01		0.01	mg/L		04-DEC-08	SYF	R765487
Boron (B)	0.06		0.05	mg/L		04-DEC-08	SYF	R765487
Barium (Ba)	0.043		0.003	mg/L		04-DEC-08	SYF	R765487
Beryllium (Be)	<0.001		0.001	mg/L		04-DEC-08	SYF	R765487
Cadmium (Cd)	<0.001		0.001	mg/L		04-DEC-08	SYF	R765487
Cobalt (Co)	<0.002		0.002	mg/L		04-DEC-08	SYF	R765487
Chromium (Cr)	<0.005		0.005	mg/L		04-DEC-08	SYF	R765487
Copper (Cu)	0.002		0.001	mg/L		04-DEC-08	SYF	R765487
Molybdenum (Mo)	<0.005		0.005	mg/L		04-DEC-08	SYF	R765487
Nickel (Ni)	0.005		0.002	mg/L		04-DEC-08	SYF	R765487
Lead (Pb)	<0.005		0.005	mg/L		04-DEC-08	SYF	R765487
Tin (Sn)	<0.05		0.05	mg/L		04-DEC-08	SYF	R765487
Strontium (Sr)	1.52		0.005	mg/L		04-DEC-08	SYF	R765487
Titanium (Ti)	<0.001		0.001	mg/L		04-DEC-08	SYF	R765487
Thallium (Tl)	<0.05		0.05	mg/L		04-DEC-08	SYF	R765487
Vanadium (V)	<0.001		0.001	mg/L		04-DEC-08	SYF	R765487
Zinc (Zn)	0.003		0.002	mg/L		04-DEC-08	SYF	R765487
CCME PAHs								
Naphthalene	<0.00001	RAMB	0.00001	mg/L	02-DEC-08	04-DEC-08	PCL	R764567
Quinoline	<0.00001		0.00001	mg/L	02-DEC-08	04-DEC-08	PCL	R764567
Acenaphthene	<0.00001		0.00001	mg/L	02-DEC-08	04-DEC-08	PCL	R764567

ALS LABORATORY GROUP ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	By	Batch
L713299-2 MW3 Sampled By: MB/JN on 28-NOV-08 Matrix: WATER								
CCME PAHs								
Fluorene	<0.00001		0.00001	mg/L	02-DEC-08	04-DEC-08	PCL	R764567
Phenanthrene	<0.00001	RAMB	0.00001	mg/L	02-DEC-08	04-DEC-08	PCL	R764567
Anthracene	<0.00001		0.00001	mg/L	02-DEC-08	04-DEC-08	PCL	R764567
Acridine	<0.00001		0.00001	mg/L	02-DEC-08	04-DEC-08	PCL	R764567
Fluoranthene	<0.00001		0.00001	mg/L	02-DEC-08	04-DEC-08	PCL	R764567
Pyrene	<0.00001	RAMB	0.00001	mg/L	02-DEC-08	04-DEC-08	PCL	R764567
Benzo(a)anthracene	<0.00001		0.00001	mg/L	02-DEC-08	04-DEC-08	PCL	R764567
Chrysene	<0.00001		0.00001	mg/L	02-DEC-08	04-DEC-08	PCL	R764567
Benzo(b&j)fluoranthene	<0.00001		0.00001	mg/L	02-DEC-08	04-DEC-08	PCL	R764567
Benzo(k)fluoranthene	<0.00001		0.00001	mg/L	02-DEC-08	04-DEC-08	PCL	R764567
Benzo(a)pyrene	<0.00001		0.00001	mg/L	02-DEC-08	04-DEC-08	PCL	R764567
Indeno(1,2,3-cd)pyrene	<0.00001		0.00001	mg/L	02-DEC-08	04-DEC-08	PCL	R764567
Dibenzo(a,h)anthracene	<0.00001		0.00001	mg/L	02-DEC-08	04-DEC-08	PCL	R764567
Surr: Nitrobenzene d5	66		24-132	%	02-DEC-08	04-DEC-08	PCL	R764567
Surr: 2-Fluorobiphenyl	63		37-123	%	02-DEC-08	04-DEC-08	PCL	R764567
Surr: p-Terphenyl d14	59		41-143	%	02-DEC-08	04-DEC-08	PCL	R764567
OC Screen GC/ECD								
p,p'-DDD	<0.0001		0.0001	mg/L		04-DEC-08	BF	R766902
p,p'-DDE	<0.0001		0.0001	mg/L		04-DEC-08	BF	R766902
p,p'-DDT	<0.0001		0.0001	mg/L		04-DEC-08	BF	R766902
Aldrin	<0.0001		0.0001	mg/L		04-DEC-08	BF	R766902
alpha-BHC	<0.0001		0.0001	mg/L		04-DEC-08	BF	R766902
beta-BHC	<0.0001		0.0001	mg/L		04-DEC-08	BF	R766902
gamma-BHC (Lindane)	<0.0001		0.0001	mg/L		04-DEC-08	BF	R766902
Quintozine (PCNB)	<0.0001		0.0001	mg/L		04-DEC-08	BF	R766902
cis-Chlordane	<0.0001		0.0001	mg/L		04-DEC-08	BF	R766902
trans-Chlordane	<0.0001		0.0001	mg/L		04-DEC-08	BF	R766902
Dieldrin	<0.0001		0.0001	mg/L		04-DEC-08	BF	R766902
Endosulfan I	<0.0001		0.0001	mg/L		04-DEC-08	BF	R766902
Endosulfan II	<0.0001		0.0001	mg/L		04-DEC-08	BF	R766902
Endrin	<0.0001		0.0001	mg/L		04-DEC-08	BF	R766902
Heptachlor	<0.0001		0.0001	mg/L		04-DEC-08	BF	R766902
Methoxychlor	<0.0002		0.0002	mg/L		04-DEC-08	BF	R766902
Mirex	<0.0001		0.0001	mg/L		04-DEC-08	BF	R766902
Nonachlor	<0.0001		0.0001	mg/L		04-DEC-08	BF	R766902
Oxychlordane	<0.0001		0.0001	mg/L		04-DEC-08	BF	R766902
L713299-3 MW4 Sampled By: MB/JN on 28-NOV-08 Matrix: WATER								
Dissolved Metals								
Dissolved Major Metals								
Calcium (Ca)	367		0.5	mg/L		05-DEC-08	BOC	R766049
Potassium (K)	14.4		0.1	mg/L		05-DEC-08	BOC	R766049
Magnesium (Mg)	402		0.01	mg/L		05-DEC-08	BOC	R766049
Sodium (Na)	1040		0.5	mg/L		05-DEC-08	BOC	R766049
Iron (Fe)	2.88		0.005	mg/L		05-DEC-08	BOC	R766049
Manganese (Mn)	2.63		0.001	mg/L		05-DEC-08	BOC	R766049
Dissolved Trace Metals								
Silver (Ag)	<0.005		0.005	mg/L		04-DEC-08	SYF	R765487
Aluminum (Al)	0.10		0.01	mg/L		04-DEC-08	SYF	R765487

ALS LABORATORY GROUP ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	By	Batch
L713299-3 MW4 Sampled By: MB/JN on 28-NOV-08 Matrix: WATER								
Dissolved Metals								
Dissolved Trace Metals								
Boron (B)	0.17		0.05	mg/L		04-DEC-08	SYF	R765487
Barium (Ba)	0.035		0.003	mg/L		04-DEC-08	SYF	R765487
Beryllium (Be)	<0.001		0.001	mg/L		04-DEC-08	SYF	R765487
Cadmium (Cd)	<0.001		0.001	mg/L		04-DEC-08	SYF	R765487
Cobalt (Co)	0.012		0.002	mg/L		04-DEC-08	SYF	R765487
Chromium (Cr)	<0.005		0.005	mg/L		04-DEC-08	SYF	R765487
Copper (Cu)	0.008		0.001	mg/L		04-DEC-08	SYF	R765487
Molybdenum (Mo)	<0.005		0.005	mg/L		04-DEC-08	SYF	R765487
Nickel (Ni)	0.057		0.002	mg/L		04-DEC-08	SYF	R765487
Lead (Pb)	<0.005		0.005	mg/L		04-DEC-08	SYF	R765487
Tin (Sn)	<0.05		0.05	mg/L		04-DEC-08	SYF	R765487
Strontium (Sr)	9.18		0.005	mg/L		04-DEC-08	SYF	R765487
Titanium (Ti)	0.005		0.001	mg/L		04-DEC-08	SYF	R765487
Thallium (Tl)	<0.05		0.05	mg/L		04-DEC-08	SYF	R765487
Vanadium (V)	0.001		0.001	mg/L		04-DEC-08	SYF	R765487
Zinc (Zn)	0.007		0.002	mg/L		04-DEC-08	SYF	R765487
CCME PAHs								
Naphthalene	<0.00001	RAMB	0.00001	mg/L	02-DEC-08	04-DEC-08	PCL	R764567
Quinoline	<0.00001		0.00001	mg/L	02-DEC-08	04-DEC-08	PCL	R764567
Acenaphthene	<0.00001		0.00001	mg/L	02-DEC-08	04-DEC-08	PCL	R764567
Fluorene	<0.00001		0.00001	mg/L	02-DEC-08	04-DEC-08	PCL	R764567
Phenanthrene	<0.00001	RAMB	0.00001	mg/L	02-DEC-08	04-DEC-08	PCL	R764567
Anthracene	<0.00001		0.00001	mg/L	02-DEC-08	04-DEC-08	PCL	R764567
Acridine	<0.00001		0.00001	mg/L	02-DEC-08	04-DEC-08	PCL	R764567
Fluoranthene	<0.00001		0.00001	mg/L	02-DEC-08	04-DEC-08	PCL	R764567
Pyrene	<0.00001		0.00001	mg/L	02-DEC-08	04-DEC-08	PCL	R764567
Benzo(a)anthracene	<0.00001		0.00001	mg/L	02-DEC-08	04-DEC-08	PCL	R764567
Chrysene	<0.00001		0.00001	mg/L	02-DEC-08	04-DEC-08	PCL	R764567
Benzo(b&j)fluoranthene	<0.00001		0.00001	mg/L	02-DEC-08	04-DEC-08	PCL	R764567
Benzo(k)fluoranthene	<0.00001		0.00001	mg/L	02-DEC-08	04-DEC-08	PCL	R764567
Benzo(a)pyrene	<0.00001		0.00001	mg/L	02-DEC-08	04-DEC-08	PCL	R764567
Indeno(1,2,3-cd)pyrene	<0.00001		0.00001	mg/L	02-DEC-08	04-DEC-08	PCL	R764567
Dibenzo(a,h)anthracene	<0.00001		0.00001	mg/L	02-DEC-08	04-DEC-08	PCL	R764567
Surr: Nitrobenzene d5	67		24-132	%	02-DEC-08	04-DEC-08	PCL	R764567
Surr: 2-Fluorobiphenyl	60		37-123	%	02-DEC-08	04-DEC-08	PCL	R764567
Surr: p-Terphenyl d14	54		41-143	%	02-DEC-08	04-DEC-08	PCL	R764567
L713299-4 MW6 Sampled By: MB/JN on 28-NOV-08 Matrix: WATER								
Dissolved Metals								
Dissolved Major Metals								
Calcium (Ca)	195		0.5	mg/L		05-DEC-08	BOC	R766049
Potassium (K)	6.6		0.1	mg/L		05-DEC-08	BOC	R766049
Magnesium (Mg)	161		0.01	mg/L		05-DEC-08	BOC	R766049
Sodium (Na)	166		0.5	mg/L		05-DEC-08	BOC	R766049
Iron (Fe)	1.17		0.005	mg/L		05-DEC-08	BOC	R766049
Manganese (Mn)	0.282		0.001	mg/L		05-DEC-08	BOC	R766049
Dissolved Trace Metals								
Silver (Ag)	<0.005		0.005	mg/L		04-DEC-08	SYF	R765487

ALS LABORATORY GROUP ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	By	Batch
L713299-5 ET-MW14								
Sampled By: MB/JN on 28-NOV-08								
Matrix: WATER								
Dissolved Metals								
Dissolved Trace Metals								
Silver (Ag)	<0.005		0.005	mg/L		04-DEC-08	SYF	R765487
Aluminum (Al)	<0.01		0.01	mg/L		04-DEC-08	SYF	R765487
Boron (B)	0.05		0.05	mg/L		04-DEC-08	SYF	R765487
Barium (Ba)	0.093		0.003	mg/L		04-DEC-08	SYF	R765487
Beryllium (Be)	<0.001		0.001	mg/L		04-DEC-08	SYF	R765487
Cadmium (Cd)	<0.001		0.001	mg/L		04-DEC-08	SYF	R765487
Cobalt (Co)	<0.002		0.002	mg/L		04-DEC-08	SYF	R765487
Chromium (Cr)	<0.005		0.005	mg/L		04-DEC-08	SYF	R765487
Copper (Cu)	0.002		0.001	mg/L		04-DEC-08	SYF	R765487
Molybdenum (Mo)	<0.005		0.005	mg/L		04-DEC-08	SYF	R765487
Nickel (Ni)	0.003		0.002	mg/L		04-DEC-08	SYF	R765487
Lead (Pb)	<0.005		0.005	mg/L		04-DEC-08	SYF	R765487
Tin (Sn)	<0.05		0.05	mg/L		04-DEC-08	SYF	R765487
Strontium (Sr)	0.624		0.005	mg/L		04-DEC-08	SYF	R765487
Titanium (Ti)	<0.001		0.001	mg/L		04-DEC-08	SYF	R765487
Thallium (Tl)	<0.05		0.05	mg/L		04-DEC-08	SYF	R765487
Vanadium (V)	<0.001		0.001	mg/L		04-DEC-08	SYF	R765487
Zinc (Zn)	<0.002		0.002	mg/L		04-DEC-08	SYF	R765487
CCME PAHs								
Naphthalene	0.00003	RAMB	0.00001	mg/L	02-DEC-08	04-DEC-08	PCL	R764567
Quinoline	<0.00001		0.00001	mg/L	02-DEC-08	04-DEC-08	PCL	R764567
Acenaphthene	0.00002		0.00001	mg/L	02-DEC-08	04-DEC-08	PCL	R764567
Fluorene	0.00004		0.00001	mg/L	02-DEC-08	04-DEC-08	PCL	R764567
Phenanthrene	0.00012	RAMB	0.00001	mg/L	02-DEC-08	04-DEC-08	PCL	R764567
Anthracene	<0.00001		0.00001	mg/L	02-DEC-08	04-DEC-08	PCL	R764567
Acridine	<0.00001		0.00001	mg/L	02-DEC-08	04-DEC-08	PCL	R764567
Fluoranthene	0.00003		0.00001	mg/L	02-DEC-08	04-DEC-08	PCL	R764567
Pyrene	0.00007		0.00001	mg/L	02-DEC-08	04-DEC-08	PCL	R764567
Benzo(a)anthracene	<0.00001	RAMB	0.00001	mg/L	02-DEC-08	04-DEC-08	PCL	R764567
Chrysene	0.00002		0.00001	mg/L	02-DEC-08	04-DEC-08	PCL	R764567
Benzo(b&j)fluoranthene	0.00002		0.00001	mg/L	02-DEC-08	04-DEC-08	PCL	R764567
Benzo(k)fluoranthene	<0.00001		0.00001	mg/L	02-DEC-08	04-DEC-08	PCL	R764567
Benzo(a)pyrene	0.00002		0.00001	mg/L	02-DEC-08	04-DEC-08	PCL	R764567
Indeno(1,2,3-cd)pyrene	<0.00001		0.00001	mg/L	02-DEC-08	04-DEC-08	PCL	R764567
Dibenzo(a,h)anthracene	<0.00001		0.00001	mg/L	02-DEC-08	04-DEC-08	PCL	R764567
Surr: Nitrobenzene d5	69		24-132	%	02-DEC-08	04-DEC-08	PCL	R764567
Surr: 2-Fluorobiphenyl	64		37-123	%	02-DEC-08	04-DEC-08	PCL	R764567
Surr: p-Terphenyl d14	58		41-143	%	02-DEC-08	04-DEC-08	PCL	R764567
OC Screen GC/ECD								
p,p'-DDD	<0.0001		0.0001	mg/L		04-DEC-08	BF	R766902
p,p'-DDE	<0.0001		0.0001	mg/L		04-DEC-08	BF	R766902
p,p'-DDT	<0.0001		0.0001	mg/L		04-DEC-08	BF	R766902
Aldrin	<0.0001		0.0001	mg/L		04-DEC-08	BF	R766902
alpha-BHC	<0.0001		0.0001	mg/L		04-DEC-08	BF	R766902
beta-BHC	<0.0001		0.0001	mg/L		04-DEC-08	BF	R766902
gamma-BHC (Lindane)	<0.0001		0.0001	mg/L		04-DEC-08	BF	R766902
Quintozine (PCNB)	<0.0001		0.0001	mg/L		04-DEC-08	BF	R766902
cis-Chlordane	<0.0001		0.0001	mg/L		04-DEC-08	BF	R766902
trans-Chlordane	<0.0001		0.0001	mg/L		04-DEC-08	BF	R766902
Dieldrin	<0.0001		0.0001	mg/L		04-DEC-08	BF	R766902

ALS LABORATORY GROUP ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	By	Batch
L713299-5 ET-MW14								
Sampled By: MB/JN on 28-NOV-08								
Matrix: WATER								
OC Screen GC/ECD								
Endosulfan I	<0.0001		0.0001	mg/L		04-DEC-08	BF	R766902
Endosulfan II	<0.0001		0.0001	mg/L		04-DEC-08	BF	R766902
Endrin	<0.0001		0.0001	mg/L		04-DEC-08	BF	R766902
Heptachlor	<0.0001		0.0001	mg/L		04-DEC-08	BF	R766902
Methoxychlor	<0.0002		0.0002	mg/L		04-DEC-08	BF	R766902
Mirex	<0.0001		0.0001	mg/L		04-DEC-08	BF	R766902
Nonachlor	<0.0001		0.0001	mg/L		04-DEC-08	BF	R766902
Oxychlordane	<0.0001		0.0001	mg/L		04-DEC-08	BF	R766902
Routine Water Analysis								
Chloride (Cl)	6.8		0.1	mg/L		01-DEC-08	SCL	R764138
Ion Balance Calculation								
Ion Balance	97.0			%		03-DEC-08		
TDS (Calculated)	606			mg/L		03-DEC-08		
Hardness (as CaCO3)	451			mg/L		03-DEC-08		
Nitrate and Nitrite as N	6.36		0.07	mg/L		02-DEC-08		
Nitrate-N	6.36		0.05	mg/L		01-DEC-08	SCL	R764138
Nitrite-N	<0.05		0.05	mg/L		01-DEC-08	SCL	R764138
Sulphate (SO4)	184		0.5	mg/L		01-DEC-08	SCL	R764138
pH, Conductivity and Total Alkalinity								
pH	8.00		0.01	pH		01-DEC-08	GK	R764159
Conductivity (EC)	918		3	uS/cm		01-DEC-08	GK	R764159
Bicarbonate (HCO3)	393		5	mg/L		01-DEC-08	GK	R764159
Carbonate (CO3)	<5		5	mg/L		01-DEC-08	GK	R764159
Hydroxide (OH)	<5		5	mg/L		01-DEC-08	GK	R764159
Alkalinity, Total (as CaCO3)	322		5	mg/L		01-DEC-08	GK	R764159
L713299-6 ET-MW16								
Sampled By: MB/JN on 28-NOV-08								
Matrix: WATER								
Dissolved Metals								
Dissolved Major Metals								
Calcium (Ca)	65.9		0.5	mg/L		05-DEC-08	BOC	R766049
Potassium (K)	3.3		0.1	mg/L		05-DEC-08	BOC	R766049
Magnesium (Mg)	15.2		0.01	mg/L		05-DEC-08	BOC	R766049
Sodium (Na)	7.1		0.5	mg/L		05-DEC-08	BOC	R766049
Iron (Fe)	<0.005		0.005	mg/L		05-DEC-08	BOC	R766049
Manganese (Mn)	0.008		0.001	mg/L		05-DEC-08	BOC	R766049
Dissolved Trace Metals								
Silver (Ag)	<0.005		0.005	mg/L		05-DEC-08	SYF	R765487
Aluminum (Al)	<0.01		0.01	mg/L		05-DEC-08	SYF	R765487
Boron (B)	<0.05		0.05	mg/L		05-DEC-08	SYF	R765487
Barium (Ba)	0.110		0.003	mg/L		05-DEC-08	SYF	R765487
Beryllium (Be)	<0.001		0.001	mg/L		05-DEC-08	SYF	R765487
Cadmium (Cd)	<0.001		0.001	mg/L		05-DEC-08	SYF	R765487
Cobalt (Co)	<0.002		0.002	mg/L		05-DEC-08	SYF	R765487
Chromium (Cr)	<0.005		0.005	mg/L		05-DEC-08	SYF	R765487
Copper (Cu)	<0.001		0.001	mg/L		05-DEC-08	SYF	R765487
Molybdenum (Mo)	<0.005		0.005	mg/L		05-DEC-08	SYF	R765487
Nickel (Ni)	0.003		0.002	mg/L		05-DEC-08	SYF	R765487
Lead (Pb)	<0.005		0.005	mg/L		05-DEC-08	SYF	R765487
Tin (Sn)	<0.05		0.05	mg/L		05-DEC-08	SYF	R765487

ALS LABORATORY GROUP ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	By	Batch
L713299-6 ET-MW16								
Sampled By: MB/JN on 28-NOV-08								
Matrix: WATER								
Dissolved Metals								
Dissolved Trace Metals								
Strontium (Sr)	0.353		0.005	mg/L		05-DEC-08	SYF	R765487
Titanium (Ti)	<0.001		0.001	mg/L		05-DEC-08	SYF	R765487
Thallium (Tl)	<0.05		0.05	mg/L		05-DEC-08	SYF	R765487
Vanadium (V)	<0.001		0.001	mg/L		05-DEC-08	SYF	R765487
Zinc (Zn)	<0.002		0.002	mg/L		05-DEC-08	SYF	R765487
CCME PAHs								
Naphthalene	0.00002	RAMB	0.00001	mg/L	02-DEC-08	04-DEC-08	PCL	R764567
Quinoline	<0.00001		0.00001	mg/L	02-DEC-08	04-DEC-08	PCL	R764567
Acenaphthene	<0.00001		0.00001	mg/L	02-DEC-08	04-DEC-08	PCL	R764567
Fluorene	0.00002		0.00001	mg/L	02-DEC-08	04-DEC-08	PCL	R764567
Phenanthrene	0.00003	RAMB	0.00001	mg/L	02-DEC-08	04-DEC-08	PCL	R764567
Anthracene	<0.00001		0.00001	mg/L	02-DEC-08	04-DEC-08	PCL	R764567
Acridine	<0.00001		0.00001	mg/L	02-DEC-08	04-DEC-08	PCL	R764567
Fluoranthene	<0.00001	RAMB	0.00001	mg/L	02-DEC-08	04-DEC-08	PCL	R764567
Pyrene	0.00003		0.00001	mg/L	02-DEC-08	04-DEC-08	PCL	R764567
Benzo(a)anthracene	<0.00001		0.00001	mg/L	02-DEC-08	04-DEC-08	PCL	R764567
Chrysene	<0.00001		0.00001	mg/L	02-DEC-08	04-DEC-08	PCL	R764567
Benzo(b&j)fluoranthene	<0.00001		0.00001	mg/L	02-DEC-08	04-DEC-08	PCL	R764567
Benzo(k)fluoranthene	<0.00001		0.00001	mg/L	02-DEC-08	04-DEC-08	PCL	R764567
Benzo(a)pyrene	<0.00001		0.00001	mg/L	02-DEC-08	04-DEC-08	PCL	R764567
Indeno(1,2,3-cd)pyrene	<0.00001		0.00001	mg/L	02-DEC-08	04-DEC-08	PCL	R764567
Dibenzo(a,h)anthracene	<0.00001		0.00001	mg/L	02-DEC-08	04-DEC-08	PCL	R764567
Surr: Nitrobenzene d5	61		24-132	%	02-DEC-08	04-DEC-08	PCL	R764567
Surr: 2-Fluorobiphenyl	53		37-123	%	02-DEC-08	04-DEC-08	PCL	R764567
Surr: p-Terphenyl d14	50		41-143	%	02-DEC-08	04-DEC-08	PCL	R764567
Routine Water Analysis								
Chloride (Cl)	1.2		0.1	mg/L		01-DEC-08	SCL	R764138
Ion Balance Calculation								
Ion Balance	96.6			%		03-DEC-08		
TDS (Calculated)	294			mg/L		03-DEC-08		
Hardness (as CaCO3)	256			mg/L		03-DEC-08		
Nitrate and Nitrite as N	0.21		0.07	mg/L		02-DEC-08		
Nitrate-N	0.21		0.05	mg/L		01-DEC-08	SCL	R764138
Nitrite-N	<0.05		0.05	mg/L		01-DEC-08	SCL	R764138
Sulphate (SO4)	47.4		0.5	mg/L		01-DEC-08	SCL	R764138
pH, Conductivity and Total Alkalinity								
pH	8.09		0.01	pH		01-DEC-08	GK	R764159
Conductivity (EC)	494		3	uS/cm		01-DEC-08	GK	R764159
Bicarbonate (HCO3)	287		5	mg/L		01-DEC-08	GK	R764159
Carbonate (CO3)	<5		5	mg/L		01-DEC-08	GK	R764159
Hydroxide (OH)	<5		5	mg/L		01-DEC-08	GK	R764159
Alkalinity, Total (as CaCO3)	236		5	mg/L		01-DEC-08	GK	R764159

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

Reference Information

Sample Parameter Qualifier key listed:

Qualifier	Description
DLA	Detection Limit Adjusted For required dilution
RAMB	Result Adjusted For Method Blank

Methods Listed (if applicable):

ALS Test Code	Matrix	Test Description	Preparation Method Reference(Based On)	Analytical Method Reference(Based On)
CL-CL	Water	Chloride (Cl)		APHA 4110 B-Ion Chromatography
IONBALANCE-CL	Water	Ion Balance Calculation		APHA 1030E
MET1-DIS-ED	Water	Dissolved Trace Metals		EPA 6020
MET2-DIS-ED	Water	Dissolved Major Metals		EPA 200.7
N2N3-CALC-CL	Water	Nitrate+Nitrite		CALCULATION
NO2-CL	Water	Nitrite-N		APHA 4110 B-Ion Chromatography
NO3-IC-CL	Water	Nitrate-N		APHA 4110 B-Ion Chromatography
OCSCREEN-ED	Water	OC Screen GC/ECD		EPA 8081-GC/ECD
PAH-CCME-ED	Water	CCME PAHs		EPA 3510/8270-GC/MS
PH/EC/ALK-CL	Water	pH, Conductivity and Total Alkalinity		APHA 4500H,2510,2320
SO4-CL	Water	Sulfate (SO4)		APHA 4110 B-Ion Chromatography

** Laboratory Methods employed follow in-house procedures, which are generally based on nationally or internationally accepted methodologies.

Chain of Custody numbers:

08-065080

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location	Laboratory Definition Code	Laboratory Location
CL	ALS LABORATORY GROUP - CALGARY, ALBERTA, CANADA	ED	ALS LABORATORY GROUP - EDMONTON, ALBERTA, CANADA

GLOSSARY OF REPORT TERMS

Surr - A surrogate is an organic compound that is similar to the target analyte(s) in chemical composition and behavior but not normally detected in environmental samples. Prior to sample processing, samples are fortified with one or more surrogate compounds. The reported surrogate recovery value provides a measure of method efficiency. The Laboratory control limits are determined under column heading D.L.

mg/kg (units) - unit of concentration based on mass, parts per million.

mg/L (units) - unit of concentration based on volume, parts per million.

< - Less than.

D.L. - The reporting limit.

N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.

UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.

UNLESS OTHERWISE STATED, SAMPLES ARE NOT CORRECTED FOR CLIENT FIELD BLANKS.

Although test results are generated under strict QA/QC protocols, any unsigned test reports, faxes, or emails are considered preliminary.

ALS Laboratory Group has an extensive QA/QC program where all analytical data reported is analyzed using approved referenced procedures followed by checks and reviews by senior managers and quality assurance personnel. However, since the results are obtained from chemical measurements and thus cannot be guaranteed, ALS Laboratory Group assumes no liability for the use or interpretation of the results.



L713299

Report to: Gordon Woollett
 Company: AECOM
 Contact: same
 Address: 17203 - 103 ave, Edm, AB
 Phone: (780) 488-6800 Fax: (780) 488-2101
 Invoice To: Same as Report? NO Yes / No?
 Company: PWGSC
 Contact: Laurie Washington
 Address: 5th Floor, 10085 Jasper Ave
 Phone: (780) 497-3892 Fax: (780) 497-3842
 Lab/Work Order # (lab use only)

Report Format / Distribution
 Standard: Other:
 Select: PDF Excel Digital
 Email 1: gordon.woollett@aecom.com
 Email 2: mitchell.bliss@aecom.com
 Client / Project Information:
 Job #: 106524
 PO / A/E:
 Legal Site Description: Bar U Ranch
 Standing offer PWGSC →
 Quote #: E0211-023196/001/EDM
 ALS Contact: MB / JN

Sample #	Sample Identification		Date	Time	Sample Type	Analysis Request		Number of Containers
	(This description will appear on the report)					(Indicate Filtered or Preserved, FIP)		
1	MW1		Nov 28/08		Water	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	4
2	MW3					<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	2
3	MW4					<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	2
4	MW6					<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	2
5	ET-MW14					<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	4
6	ET-MW16					<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	3

Special instructions / Regulations / Hazardous Details
 dissolved metals have been field filtered and preserved; invoice to Laurie Washington of PWGSC.

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY.
 By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.
 Released by: Mitch Bliss
 Date & Time: Nov 28/08 4:55 PM
 Received by: M. My
 Date & Time: 28-Nov-08 4:53
 Observations: Yes / No? If Yes attach SIF
 Temperature:
 SHIPMENT RECEPTION (lab use only)
 SHIPMENT RELEASE (client use)
 WHITE - REPORT COPY, PINK - FILE COPY, YELLOW - CLIENT COPY
 REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION
 GENF 18.00 Front



Environmental Division

Sample Integrity Form

Date: 28-Nov-08

Client: AECOM

ALS Contact: _____

COC #: 08-065080

Phone #: _____

Work Order #: _____

Please note the following observations that prevent your samples from being processed.
ALS is attempting to contact you for further instructions.
If our attempts fail, please contact us as soon as possible to ensure your analytical needs are met.

Observation	Details
-------------	---------

<input type="checkbox"/>	Temperature < freezing point	actual temp. (breakdown by cooler):
<input type="checkbox"/>	Temperature ≥ 10 Celsius	actual temp. (breakdown by cooler):
<input type="checkbox"/>	Containers broken in transit	details:
<input type="checkbox"/>	Sample integrity compromised	details:
<input type="checkbox"/>	Regulatory non-compliance	details:
<input type="checkbox"/>	No COC with shipment	details:
<input checked="" type="checkbox"/>	Discrepancy between COC and label	Labels MWB - COC MWB
<input type="checkbox"/>	COC incomplete or unclear	details:
<input type="checkbox"/>	Container incompatible with test	details:
<input type="checkbox"/>	Volume is insufficient for test	details:
<input type="checkbox"/>	Preservation incompatible with test	details:
<input type="checkbox"/>	No preservation	details:
<input checked="" type="checkbox"/>	Other observation	details:

Additional Information (list all affected sample portions):

-6 No Metals BH.
-5 -2x Metals. BH.

Appendix G

The production and use of this Report is conditional upon the following agreement by the Client and Others who may use or rely upon it.

1. MANDATE OF AECOM CANADA LTD.

This Report has been prepared pursuant to the instructions of the Client and is subject to the constraints imposed by those instructions. AECOM Canada Ltd. ("AECOM") and the Client are aware of these instructions and constraints. Others, who wish to rely upon this Report in any manner, should inquire of the Client for the terms of AECOM's mandate in preparing this Report.

2. BASIS OF REPORT

2.1 Representations to AECOM by Client

This Report has been prepared for the specific site, development, design objective, and purpose described to AECOM by the Client and is specifically based on all of the aforesaid.

Inaccuracies or alternations, of any of the matters upon which this Report is based, will affect the reliability and applicability of this Report.

2.2 Representations to AECOM by Other Persons

AECOM may have relied upon the representations or opinions of persons other than the Client in the course of preparing this Report. AECOM may not have checked the accuracy of such representations or opinions except where directed to do so by the Client. The accuracy of these representations and opinions will affect the accuracy of this Report.

2.3 Time Sensitivity of Report

The findings expressed in this Report by AECOM were valid, in accordance with generally accepted engineering practice and procedures, at the time that they were made. The Client and Others are advised that the conditions upon which such findings were based, and the findings themselves may be subject to change as a result of the passage of time.

3. USE OF REPORT BY THE CLIENT

The Client recognizes that projects involving pollutants and hazardous waste, as defined below, create extraordinary risks. In consideration of the said extraordinary risks and in consideration of AECOM providing the services to the Client in connection with the project on which pollutants and hazardous wastes are involved, the Client agrees that AECOM's liability to the Client, including liability resulting from claims by Third Parties upon the Client, with respect to any matter in any way arising out of AECOM's involvement with pollutants and hazardous wastes associated shall be limited to or otherwise protected as provided in paragraphs (a) and (b) below.

- (a) AECOM's liability to the Client in connection with pollutants and hazardous waste is absolutely limited, both in contract and in tort for any and all claims arising out of or in connection with the project to a total maximum aggregate amount not to exceed the cost of reperformance of the services at the sole cost of AECOM for that portion of the services proven to be in error.

It is further agreed that such limitation shall be exclusive of the liability of AECOM to the Client which may otherwise be provided for in this Agreement for claims unrelated to pollutants and hazardous wastes.

In further consideration of AECOM providing the services to the Client in connection with the project in which pollutants and hazardous wastes are involved, the Client agrees that in connection with incidents and claims initiated by Third Parties involving pollutants and hazardous wastes, the Client shall indemnify, defend and hold harmless AECOM of and from any and all suits, actions, legal and administrative or arbitration proceedings, claims, demands, damages, penalties, fines, losses, costs and expenses of whatsoever kind or character, arising or alleged to arise out of the services of AECOM or any claim against AECOM arising or alleged to arise from acts, omissions or work of others. Such indemnification shall apply to the fullest extent permitted by law, regardless of fault or

breach of contract by AECOM and shall include the fees and charges of lawyers in defending or advising AECOM as to such claims under the Agreement.

Without limiting the generality of the foregoing, such indemnity extends to claims which arise out of the actual or threatened dispersal, discharge, escape, release or saturation (whether sudden or gradual) of any pollutant to hazardous waste in or into the atmosphere, or on, on to, in or into the surface or subsurface, soils, water or water courses, persons, objects or any other tangible matter.

- (b) Nothing herein shall relieve AECOM from their obligations to provide the services required by this Agreement and generally as required by standard engineering practice current as of the date of the performance of the services.

- (c) For all purposes of this statement of limitations, "pollutants and hazardous waste" shall mean any solid, liquid, gaseous or thermal irritant or contaminant, including without limitation smoke, vapour, soot, fumes, acids, alkalis, chemicals and wastes, including without limitation, pollutants, hazardous or special waste as defined in any federal, provincial or municipal laws.

4. SUBCONSULTANTS AND SUBCONTRACTORS

As a result of its mandate, AECOM may hire companies or individuals with special expertise or services not available within AECOM. These services are for the Client's benefit. The Client agrees to pay for the services of subconsultants and subcontractors. The Client also agrees to indemnify AECOM for any damage in any way resulting from the error, omission or negligent act of such subconsultants or subcontractors, including, without limiting the generality of the foregoing, the laboratory testing by subconsultants.

5. JOB SITE SAFETY

AECOM is only responsible for the activities of its employees on the job site and is not responsible for the supervision of any other persons whatsoever. The presence of AECOM personnel on the site shall not be construed in any way to relieve the Client or any other persons on site from their responsibilities for job site safety.

6. HAZARDOUS CONDITIONS AND EMERGENCY PROCEDURE

The Client undertakes to inform AECOM of all hazardous conditions, or possible hazardous conditions which are known to it. The Client recognizes that the activities of AECOM may uncover previously unknown hazardous materials or conditions and that such a discovery may result in the necessity to undertake emergency procedures to protect AECOM employees as well as other persons and the environment. These procedures may involve additional costs outside of any budgets previously agreed to. The Client agrees to pay AECOM for any expenses incurred as a result of such discoveries and to compensate AECOM through payment of additional fees and expenses for time spent by AECOM to deal with the consequences of such discoveries.

7. NOTIFICATION OF AUTHORITIES

The Client acknowledges that in certain instances the discovery of hazardous substances or conditions and materials may require that government bodies, and other persons, be informed and the Client agrees that notification to such bodies or persons as required may be done by AECOM in its reasonably exercised discretion.

8. USE OF REPORTS BY OTHERS

Others wishing to rely upon this Report in any manner may do so only upon condition that such use, and the consequences of such use, are entirely at their own risk and that they understand fully the terms of the Mandate and Basis of this Report.

It is further agreed by such Others that AECOM will not be liable to them in any manner including any liability in contract or in tort for any damages whatsoever arising from such use.