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September 29, 2011

Mr. Lowell Spackman, District 1 Supervisor
Wyoming Department of Environmental Quality
Land Quality Division
Herschler Building
122 West 25th Street
Cheyenne, WY 82002

RE: Highland Uranium Project, Permit No. 603, TFN 3 1/251
Submittal of Purge Storage Reservoir No. 2 Shallow Groundwater Characterization Plan and Work Plan for Installing Groundwater Monitoring Wells

Dear Mr. Spackman:

Power Resources, Inc. d/b/a Cameco Resources (Cameco) is herein submitting copies of the *Purge Storage Reservoir No. 2 Shallow Groundwater Characterization Plan* dated August 17, 2011 and *Work Plan for Installing Groundwater Monitoring Wells* dated August 30, 2011 as prepared by Cameco's contractor Golder Associates Inc. These plans were previously forwarded to LQD (Pam Rothwell and Steve Ingle) during an inspection at the Smith Ranch-Highland Uranium Project on September 7, 2011.

As previously discussed with LQD on September 7, 2011 and a subsequent discussion between LQD (Pam Rothwell) and Cameco (Scott Bakken) on September 13, 2011, these plans are being submitted as part of a formal response to LQD's review comment No. 23 from the 2007-08 Annual Report. Due to the timing of this submittal and the narrow window of opportunity to install additional monitoring wells during the fall of 2011, these plans are being submitted in advance of Cameco's formal responses to additional comments No. 24 through No. 34 from LQD's Golder Report Review dated May 7, 2010.

Upon submittal of these plans, it is Cameco's understanding that LQD is prepared to provide formal review comments in an expedited manner so that Cameco can take these comments into consideration and ensure that the final work plans for shallow well completions are consistent with LQD's recommendations. In the interim, Cameco will continue compiling responses to comments No. 24 through No. 34 for submittal at a later date.

Cameco appreciates the LQD's efforts in completing an expedited review so that Cameco can continue to move forward on this project in the near-term while meeting the expectations of both LQD and the NRC.

If you have questions, please feel free to contact me directly at 307-316-7588 or Scott Bakken at 307-316-7586.

Sincerely,

Josh Leftwich
Director, Radiation Safety & Licensing

JL/sb

Att: Purge Storage Reservoir No. 2 Shallow Groundwater Characterization Plan
Work Plan for Installing Groundwater Monitoring Wells

cc: File HUP 4.3.3.1
Doug Mandeville, NRC

ec: CR-Cheyenne

REPORT

PURGE STORAGE RESERVOIR NO. 2 SHALLOW GROUNDWATER CHARACTERIZATION PLAN

Smith Ranch – Highland Uranium Project

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August 17, 2011

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1.0 INTRODUCTION

Golder Associates Inc. (Golder) has prepared this groundwater characterization plan (Plan) for Cameco Resources in response to Wyoming Department of Environmental Quality's (WDEQ) 2007-2008 Annual Report Review and an unresolved item from the Nuclear Regulatory Commission (NRC) in their May, 2011 semi-annual inspection. Specifically, in comment number 23 regarding the shallow groundwater, WDEQ states, "selenium values in the South well are very elevated." This comment is in regards to the selenium concentrations reported for the well located south of Purge Storage Reservoir No. 2 (PSR-2). Background information on PSR-2 and monitoring groundwater in the vicinity is presented in Section 1.1. Implementation of this Plan will provide the data necessary to determine whether treated wastewater from PSR-2 is leaking into shallow groundwater and/or shallow sand units and, if so, whether adverse impacts to shallow groundwater has occurred within the vicinity of PSR-2. The May, 2011 semi-annual inspection by NRC indicated that a draft version of this Plan for additional studies was reviewed by the NRC and that Cameco Resources intended to finalize this Plan and proceed with additional work. This final version of that Plan has been prepared to address that unresolved item.

This Plan is a revision of the plan reviewed during the May 4, 2010 meeting between WDEQ, Cameco Resources and Golder and the one reviewed by NRC in their May, 2011 semi-annual inspection. The changes reflect responses to WDEQ's comments, incorporate data from the first six sampling events at newly installed monitoring wells around PSR-2 and include the evaluation of hydrogeologic and water quality data from the PSR-2 area.

1.1 Background

PSR-2 is located north of Wellfield C, approximately one-half mile north-northeast of Satellite 2 of Cameco Resources' Highland Operation (Figure 1). It was originally constructed in 1979 for use by Tennessee Valley Authority as a wastewater settling pond prior to discharge in accordance with a National Pollutant Discharge Elimination System permit. In 1994, Power Resources, Inc. took over operations of the area and PSR-2 was refurbished and permitted as a storage pond for a wastewater land-application facility. While the PSR-2 facility was designed to prevent adverse impacts to shallow ground water, it was not designed to be completely impermeable and was not subject to the design criteria of Regulatory Guide 3.11 in 1994. This was acknowledged by the NRC in their technical evaluation report on the PSR-2 facility (NRC, 1994).

PSR-2 temporarily stores waste water from Satellite No. 2 and Satellite No. 3 after the water has been treated for uranium, radium and selenium removal and before the water is disposed via land application at Irrigator No. 2. Waste streams feeding PSR-2 consist of wellfield purge and groundwater restoration waters (wellfield bleed, groundwater sweep, and reverse osmosis concentrate). According to information submitted by Power Resources, Inc. for the 1994 Permit, the wastewater met the WDEQ Class of Use limitations for Class III groundwater, except for selenium (WDEQ Water Quality Rules and Regulations, Chapter 8, Section 4(d); Cameco Resources 2009). The WDEQ Class III (livestock) limit for selenium is 0.05 milligrams per liter (mg/L), which is also the limit for Class I (domestic) waters.

Figure 2 shows selenium concentrations over time for Irrigator #2, which draws its water from PSR-2. Concentrations of selenium began decreasing in approximately 2000 and were less than 0.5 mg/L since that time except for a period during 2006 and 2007. As of September 23, 2009, a selenium treatment facility has been in operation at a location southwest of Satellite No. 2. Since that time selenium concentrations have decreased (Cameco Resources 2010) with the addition of treated water with selenium concentrations less than 0.05 mg/L as shown in measurements conducted from Irrigator #2 in 2010.

1.2 Groundwater Monitoring

The 1994 Permit (Permit No. 93-410, *Satellite #2 Wastewater Holding Pond and Land Application Facility)* required the construction of two shallow monitoring wells, known as the East and South shallow wells. The East and South wells were completed to depths of approximately 10 and 15 feet below ground surface (bgs), respectively. Baseline monitoring of these wells was not required; however, the wells have been routinely monitored since their installation. Figure 3 shows selenium concentrations at the East and South shallow wells since 2003. It should be noted that the South well had been dry for 4 out of the last 6 sampling events.

Due to concerns of water potentially leaking from PSR-2, Cameco Resources installed four new shallow monitoring wells in July 2009. Two of the new wells were installed next to the existing East and South wells (MW-4S and MW-3S, respectively). The other two wells were installed north (MW-2S) and west (MW-1S) of the reservoir.

Groundwater did not accumulate in boreholes during drilling at each of the four well locations. According to Cameco Resources (2009), each boring was dry when drilled and was then terminated at a depth of 50 feet in a gray shale. Wells were completed with a 20-foot screen section, from 29 to 49 feet bgs. After installation of wells MW-1S through MW-4S was completed, water accumulated in these wells. The wells were developed using pumps on September 10, 2009. All of the wells pumped dry after removal of one borehole volume of water at an approximate pumping rate of 2 to 3 gallons per minute (Cameco Resources, 2009). It is not clear from the available lithologic data whether the screened intervals from these four wells intersect a continuous permeable sand zone.

Based on water level data collected after installation of these four new wells (Figure 4), the groundwater flow direction in this shallow zone is assumed to be to the south-southeast (Cameco Resources 2009). However, this direction is heavily influenced by the presence of PSR-2 and may not be indicative of regional groundwater flow directions around PSR-2. Additional discussion of groundwater flow direction is provided in Section 2.0. The groundwater encountered in the shallow monitoring wells is considered to be perched and laterally discontinuous. The uppermost, continuous water-bearing zone is postulated to be at a depth of at least approximately 50 to 60 feet bgs based upon a review of historic hydrogeologic data from wells and borings completed in the area of PSR-2.

Groundwater samples were collected from the four new monitoring wells (MW-1S through MW-4S) just after their initial development in September 2009. Groundwater samples were collected on a quarterly basis from all 6 wells (the four new wells and the South and East wells) from March through March 2011. Results of selenium analyses on these samples are presented in Table 1. As shown in Table 1, concentrations are highest in samples from the South well and well MW-1S, located west of PSR-2. Concentrations are also greater than the WDEQ Class III limit of 0.05 mg/L at wells MW-3S, located south of PSR-2, and at well MW-4S, located east of PSR-2. The analytical results suggest that selenium concentrations in groundwater are elevated in the shallow sediments surrounding the reservoir, except in areas located upgradient (north) of the reservoir.

2.0 CHARACTERIZATION PLAN

Golder proposes a phased approach to characterizing the shallow groundwater near PSR-2, in which the results of initial phases will guide the approach for following phases. Data quality objectives of the characterization plan are described in section 2.1.

2.1 Data Quality Objectives

Data quality objectives (DQOs) are qualitative and quantitative statements that define the type, quality, and quantity of data necessary to support defensible risk management decision making. DQOs are used to develop an effective sampling plan which avoids the collection of data that are inconsequential to decision making (U.S. Department of Energy 1994). The seven steps of the DQO process are presented below.

2.1.1 Step 1 - Stated Problem

Selenium has been detected in groundwater samples from wells located near PSR-2. The detected concentrations are above the WDEQ Class III standard of 0.05 mg/L and may indicate leakage that could adversely impact groundwater and/or shallow sand units that underlie PSR-2.

2.1.2 Step 2 - Decision

Data collected from this study will help determine if PSR-2 is leaking and if adverse impacts to groundwater and/or shallow sand units are occurring.

2.1.3 Step 3 - Inputs to Decision

- Background Selenium Concentrations – Background concentrations of selenium and other water quality constituents will be needed to determine whether PSR-2 is leaking and if adverse impacts to shallow groundwater have occurred. To determine background concentrations, several additional inputs are required, as described below.
- Direction of Groundwater Flow – To determine background areas, the direction of groundwater flow is needed.
- Hydraulic Conductivity and Gradient – To determine background areas and for selecting the location of additional monitoring wells, hydraulic conductivity, to be determined from aquifer testing, and gradient data are needed to determine groundwater velocity. Groundwater velocity will be used to estimate the maximum area of potential impact from PSR-2.
- Selenium Concentrations – Selenium concentration data are needed from areas surrounding PSR-2 in order to define the vertical and horizontal extent of elevated selenium.

2.1.4 *Step 4 - Define the Study Boundaries*

The boundary is assumed to be approximately a 1,000-foot radius from the perimeter of PSR-2. After initial testing of aquifer properties, the study boundary may be adjusted to reflect the area for potential impact from PSR-2 based on the age of the reservoir and the groundwater velocity.

All available selenium data will be used in the characterization. Data from the older South and East wells will be qualified since installation and completion of the two older wells was not documented.

Sampling of the currently installed and proposed wells will occur quarterly for a year.

2.1.5 *Step 5 - Develop a Decision Rule*

A threshold level to assess whether adverse impacts have occurred will be developed in later phases of work and will be based on the higher value of either the WDEQ Class III limit of 0.05 mg/L or background selenium concentrations. If concentrations are found to be greater than determined threshold level, then the need for additional investigative and/or remediation activities will be undertaken in consultation with the WDEQ and NRC.

2.1.6 *Step 6 - Specify Acceptable Limits on Decision Errors*

The null hypothesis, as defined by the EPA in its DQO guidance, assumes the groundwater has elevated selenium concentrations relative to the Class of Use limitation (0.05 mg/L). A rejection of this hypothesis would lead to no further investigative or remediation activities while acceptance of this hypothesis would lead to additional actions. The chance of a false rejection will be controlled by comparing the mean concentrations of each well to the greater value of either an action level based on background selenium concentration or the Class III limit of 0.05 mg/L (action level). Additional investigation and/or remediation will be recommended if the concentrations in the groundwater are greater than the relevant action level and the hypothesis cannot be rejected.

2.1.7 *Step 7 - Optimize the Design*

The design for data collection that will meet the DQOs is described in detail in the following sections. In summary, the design includes the following phases:

- Testing the existing wells to determine hydraulic conductivity;
- Installation of additional monitoring wells to better define the vertical and horizontal extent of elevated selenium, hydraulic gradient, and direction of groundwater flow. The specific location of these wells will be determined based on the results of the groundwater characterization (hydraulic conductivity measurements, hydrogeologic data and water quality data). One of the new wells will serve as a background well;

- Monitoring of water chemistry and water levels in the existing and newly installed monitoring wells. Four quarters of data collection are recommended before analyses can be conducted to determine areas of elevated selenium.

2.2 Physical Properties of the Shallow Groundwater

Prior to installation of additional monitoring wells, the existing wells should be tested to estimate the hydraulic conductivity of the shallow sediments screened by existing wells. Testing will consist of either pumping tests or slug tests. For pumping tests, water will be pumped from the monitoring well and the rate of decline of the water level will be measured. Additionally, the rate of increase in the water level after pumping ceases will be analyzed. For "slug" testing, a known volume will be either removed from or added to the water column and the rate at which the water level falls or rises will be measured. The collected data will be analyzed to estimate the hydraulic conductivity. In vertically paired wells (MW-4S/East, MW-3S/South), pressure responses also may be monitored in the well not being tested.

Groundwater velocities and the potential extent of impact from PSR-2 will be estimated using the hydraulic conductivity, hydraulic gradient, and an estimated porosity. The estimated velocity and potential extent of impact will then be used to select locations for additional monitoring wells.

2.3 Installation of Additional Monitoring Wells

To evaluate the horizontal extent of elevated selenium concentrations and determine background selenium concentrations, Golder recommends installation of seven additional monitoring wells. Two of these wells will be shallow wells co-located with the East and South wells. These two shallow wells will be drilled and screened to the same depth as the South and East wells and used to determine if data from these older wells can be used in the groundwater characterization. Four of the remaining five wells will be located close to the reservoir and to the north, west, south, and east of the reservoir (Figure 1). The final well will be located further to the east away from the reservoir (Figure 1). The distance of the wells from the shoreline of the reservoir will be estimated based on the results of hydraulic testing of the existing wells and the resulting estimation of groundwater velocity. Using the estimated groundwater velocity, the wells should be installed at the outer boundary of the estimated zone of influence of PSR-2.

Because the new wells will be used to more accurately assess the direction of groundwater flow, selection of a background area cannot be determined until the new wells have already been installed. It is possible that one of the new wells may function as a background well. The well established with the goal of being upgradient will be placed sufficiently far enough from the reservoir to not be influenced by it. However, the appropriateness of the well as a background well will need to be re-evaluated after installation.

Based on information provided in the Monitoring Plan for Purge Storage Reservoir No. 2 (Cameco Resources 2009), gray shale was encountered in wells MW-1S, MW-2S, MW-3S, and MW-4S, which typically acts as a confining layer. These wells may not be completed in water bearing sand units that extend over any appreciable distance. The proposed wells, excluding the two very shallow wells, will be screened based upon geologic logging so that screened intervals are in water bearing units with appreciable transmissivity. Actual lengths and placements of screened sections for all new wells will be determined in the field based on conditions encountered during drilling.

The vertical extent of elevated selenium concentrations will be assessed using two potential well designs, which would allow samples to be collected at varying depths. One well design would involve screening the well over the entire depth of the aquifer and using a passive diffusion sampler, or snap sampler to collect samples from varying depths. The second well design option, though more expensive, would be to install nested wells that are completed at varying depths of the aquifer, but in the same general area. In the areas south and east of the reservoir, the South well and MW-3S, and the East well and MW-4S provide some data on vertical hydraulic gradients and the vertical variability of groundwater quality. The South and East wells are completed to approximately 15 feet bgs, compared to wells MW-3S and MW-4S, which are completed to approximately 50 feet bgs. Figure 1 shows the location of these existing wells.

In order to further characterize the subsurface and assess the distribution of selenium concentrations, it will be valuable to further understand if there is vertical variability in the concentrations of selenium. This information will be helpful in assessing any remediation measures that may be required.

In addition to defining the extent of elevated selenium, new and existing wells would also be used to establish the groundwater flow direction and further characterize the hydrogeologic environment near PSR-2. Figure 4 shows the groundwater elevations for selected shallow wells and the water-surface elevation of PSR-2. Based on these data, it is likely that hydraulic gradients, both horizontal and vertical, near PSR-2 are influenced by the water elevation in the reservoir. The existing monitoring wells may be located close enough to the reservoir to be influenced by the reservoir water level elevation.

Surface drainage appears to flow to the northwest, which suggests a potential for shallow groundwater to flow to the northwest if it mimics topography. Therefore, the new wells will provide additional data to more accurately evaluate groundwater flow directions. The presence of water bearing units and potential confining layers should be evaluated at the time of installing the new wells. To accomplish this, the lithology should be logged as the boreholes are advanced and this may involve drilling some wells deeper than actual screened intervals to assess geology before completing the well.

2.4 Groundwater Monitoring

Following development of the new wells, groundwater samples should be collected from the South well, East well, MW-1S, MW-2S, MW-3S, MW-4S, and the new wells using the methods described in the Monitoring Plan for Purge Storage Reservoir No. 2 (Cameco Resources 2009). In addition to the methods described in the Monitoring Plan, additional field parameters and laboratory analyses are recommended. Although analysis of additional parameters is not related to the data quality objectives above, the additional data will provide information that is necessary to assess potential impacts to underlying sand units.

Because selenium is a redox-sensitive element, additional geochemical characterization is necessary to evaluate its fate and potential attenuation in the subsurface. Field parameters collected during sampling should include pH, specific conductance, temperature, dissolved oxygen, and oxidation/reduction potential (ORP). These parameters will help define the basic geochemical conditions in the shallow groundwater. In addition to field parameters, the groundwater sample should be analyzed by an analytical laboratory for the following general chemistry parameters, major ions, redox parameters, and additional cations:

- General Chemistry Parameters:
  - Specific Conductivity
  - Total Dissolved Solids at 180° Celsius
- Major Ions:
  - Calcium
  - Magnesium
  - Sodium
  - Potassium
  - Total alkalinity (carbonate plus bicarbonate)
  - Fluoride
  - Chloride
- Redox Indicators
  - Sulfate and sulfide
  - Nitrate, nitrite, and ammonium
- Additional Cations:
  - Selenium
  - Barium
  - Arsenic
  - Boron
  - Uranium
  - Radium 226
  - Iron

Recommended methods for laboratory analysis of selenium are presented in Biogeochemistry and Analysis of Selenium and it's Species (Ralston et al. 2008). In previous monitoring events, the selenium detection limit was 0.001 mg/L. This detection limit is below the WDEQ limit of 0.05 mg/L and it is recommended that this detection limit be used in future monitoring events.

Four quarterly monitoring events are recommended before determining if PSR-2 is leaking and whether adverse impacts to shallow groundwater and/or shallow sand units have occurred. Four datasets will provide enough data to conduct statistical tests and evaluate seasonal variations. Tests for comparing two populations, such as the Wilcoxon Rank Sum and Welch's t-test, will be used to compare background selenium concentrations with concentrations in areas where selenium is potentially elevated.

2.5 Interpretation of Additional Data

It is anticipated that the additional data collected from the proposed monitoring efforts will help describe the hydrogeologic and geochemical environment near PSR-2 and allow for assessments of whether leakage is occurring from PSR-2 that is resulting in adverse impacts to shallow groundwater and/or shallow sand units beneath it. The data collected will allow the following work products to be developed for the PSR-2 area:

- Geologic cross-sections that show the lithology in the area beneath PSR-2;
- Potentiometric maps of sand water bearing units near PSR-2 that will show the direction of flow;
- Assessment of lateral and vertical hydraulic gradients near PSR-2 by evaluating differences in water levels in shallow wells and deeper wells and PSR-2;
- Hydraulic conductivity estimates for the sediments beneath PSR-2; and
- Plots of selenium and trilinear diagrams in specific sandy water bearing units as compared to PSR-2 to assess potential impacts from PSR-2 and background concentrations in sandy water bearing units.

3.0 SUMMARY OF CHARACTERIZATION RECOMMENDATIONS

Since 2003, selenium concentrations in the shallow well south of PSR-2 have ranged from 0.9 mg/L to 3.6 mg/L. In response to the elevated selenium concentrations in the South well, four additional monitoring wells (MW-1S, MW-2S, MW-3S, and MW-4S) were installed to the west, north, south, and east of PSR-2. Selenium concentrations in these wells in March 2010 ranged from 0.004 mg/L at well MW-2S north of the reservoir to 1.76 at well MW-1S, located west of the reservoir. For comparison, the regulatory limit for selenium in Class III groundwater is 0.05 mg/L. To determine the best strategy for determining if impacts to sand units beneath PSR-2 are occurring, additional characterization is recommended to further assess the hydrogeologic environment near PSR-2, evaluate hydraulic properties, and assess background selenium levels and the extent of groundwater potentially impacted by selenium. Included in this additional characterization will be the installation of five new monitoring wells; north, west, south and east (2 will be located east) of the reservoir and two very shallow wells collocated with the older South and East Wells. The distance of the new wells from the shoreline of the reservoir will be determined from testing of the existing wells to estimate the hydraulic conductivity of the shallow aquifer. Additionally, four quarterly monitoring events are recommended for the new and existing wells.

4.0 REFERENCES

Cameco Resources, 2009. Monitoring Plan for Purge Storage Reservoir No. 2, Shallow Wells MW-1S, MW-2S, MW-3S, and MW-4S, November 18, 2009.

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TABLES

GROUNDWATER SAMPLING RESULTS

	East Well								
Parameter	3/5/2009	6/26/2009	9/3/2009	11/12/2009	3/23/2010	6/25/2010	9/22/2010	11/18/2010	3/17/2011
General Chemistry									
Bicarbonate as HCO_3 (mg/L)	293	339	366	282	321	427	401	331	294
Chloride (mg/L)	401	480	414	368	376	502	442	409	409
Sulfate (mg/L)	2490	2390	2310	2440	2320	2340	2420	2390	2430
Specific Conductivity (umhos/cm)	5120	5310	5240	5070	5050	5280	5210	5090	5090
pH	7.52	7.51	7.51	7.9	7.29	7.36	7.47	7.5	7.3
Dissolved Metals and Radionuclides									
Barium (mg/L)	>0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Selenium (mg/L)	0.046	0.096	0.045	<0.0025	0.038	0.065	0.039	0.036	0.029
Uranium (uCi/mL)	3.78E-08	4.50E-08	5.99E-02	<6.77E-10	3.47E-08	5.57E-08	5.36E-08	4.43E-08	3.69E-08
Radium 226 (uCi/mL)	9.00E-10	9.60E-10	8.98E-10	8.1E-10	1.6E-09	7.70E-10	7.80E-10	8.40E-10	1.10E-09

ND= non-detect, detection limit not provided

NDP = no data provided

mg/L = milligrams per liter

umhos/cm = micromhos per centimeter

uCi/mL = microcuries per liter

[1] Second value given for Se on 9/11/09 sampling date represents data from Cameco Resources Laboratory

GROUNDWATER SAMPLING RESULTS

	South Well								
Parameter	**3/5/2009**	**6/26/2009**	**9/3/2009**	**11/12/2009**	**3/23/2010**	**6/25/2010**	**9/22/2010**	**11/18/2010**	**3/17/2011**
General Chemistry									
Bicarbonate as HCO_3 (mg/L)	352	385	384	dry well	343	310	dry well	dry well	dry well
Chloride (mg/L)	278	327	329	dry well	254	321	dry well	dry well	dry well
Sulfate (mg/L)	2370	2390	2270	dry well	2050	2190	dry well	dry well	dry well
Specific Conductivity (umhos/cm)	4740	4790	4890	dry well	4280	4400	dry well	dry well	dry well
pH	7.8	7.8	7.68	dry well	7.74	7.59	dry well	dry well	dry well
Dissolved Metals and Radionuclides									
Barium (mg/L)	<0.001	<0.001	<0.001	dry well	<0.1	<0.001	dry well	dry well	dry well
Selenium (mg/L)	1.78	1.63	1.46	dry well	2.21	2.02	dry well	dry well	dry well
Uranium (uCi/mL)	5.50E-07	5.37E-07	3.87E-07	dry well	2.48E-07	5.57E-08	dry well	dry well	dry well
Radium 226 (uCi/mL)	1.10E-09	7.70E-10	1.00E-09	dry well	2.40E-10	1.40E-09	dry well	dry well	dry well

ND= non-detect, detection limit not provided

NDP = no data provided

mg/L = milligrams per liter

umhos/cm = micromhos per centimeter

uCi/mL = microcuries per liter

[1] Second value given for Se on 9/11/09 sampling date represents data from Cameco Resources Laboratory

GROUNDWATER SAMPLING RESULTS

	MW-1S						MW-2S					
Parameter	**9/11/2009[1]**	**3/23/2010**	**6/30/2010**	**9/28/2010**	**11/18/2010**	**3/16/2011**	**9/11/2009[1]**	**3/23/2010**	**6/30/2010**	**9/28/2010**	**11/18/2010**	**3/16/2011**
General Chemistry												
Bicarbonate as HCO_3 (mg/L)	376	456	dry well	428	368	366	371	393	dry well	381	368	363
Chloride (mg/L)	298	269	dry well	279	307	317	64	70	dry well	69	72	73
Sulfate (mg/L)	1860	1870	dry well	1920	1930	1920	248	238	dry well	231	240	248
Specific Conductivity (umhos/cm)	NDP	4400	dry well	4340	4390	4430	NDP	1170	dry well	1160	1180	1170
pH	NDP	7.07	dry well	7.76	7.48	7.23	NDP	7.31	dry well	7.87	7.61	7.52
Dissolved Metals and Radionuclides												
Barium (mg/L)	<0.1	<0.1	dry well	ND	ND	ND	<0.1	<0.1	dry well	ND	ND	ND
Selenium (mg/L)	1.91 / 2.16	1.76	dry well	2.00	2.08	2.30	0.006 / 0.036	0.004	dry well	0.003	0.005	0.003
Uranium (uCi/mL)	3.22E-08	3.91E-08	dry well	4.40E-08	3.80E-08	3.40E-08	1.49E-09	8.124E-10	dry well	8.10E-10	1.20E-09	1.00E-09
Radium 226 (uCi/mL)	1.20E-09	8.1E-10	dry well	1.50E-09	2.90E-10	5.20E-10	7.80E-10	1.4E-10	dry well	7.00E-10	3.10E-10	2.00E-10

ND= non-detect, detection limit not provided

NDP = no data provided

mg/L = milligrams per liter

umhos/cm = micromhos per centimeter

uCi/mL = microcuries per liter

[1] Second value given for Se on 9/11/09 sampling date represents data from Cameco Resources Laboratory

GROUNDWATER SAMPLING RESULTS

	MW-3S						MW-4S					
Parameter	9/11/2009[1]	3/23/2010	6/30/2010	9/28/2010	11/18/2010	3/16/2011	9/11/2009[1]	3/23/2010	6/30/2010	9/28/2010	11/18/2010	3/16/2011
General Chemistry												
Bicarbonate as HCO_3 (mg/L)	382	404	dry well	408	396	402	532	590	548	553	504	497
Chloride (mg/L)	504	516	dry well	521	497	473	104	112	126	115	126	138
Sulfate (mg/L)	1080	952	dry well	972	1020	1040	1550	1790	1750	1680	1620	1730
Specific Conductivity (umhos/cm)	NDP	3490	dry well	3410	3410	3370	NDP	3840	NDP	3610	3410	3660
pH	NDP	7.4	dry well	7.85	7.6	7.51	NDP	7.03	NDP	7.8	7.59	7.24
Dissolved Metals and Radionuclides												
Barium (mg/L)	<0.1	<0.1	dry well	ND	ND	ND	<0.1	<0.1	<0.1	ND	ND	ND
Selenium (mg/L)	0.44 / 0.437	0.254	dry well	0.226	0.198	0.178	0.377 / 0.554	0.895	0.498	0.900	0.681	0.840
Uranium (uCi/mL)	4.70E-07	5.29E-07	dry well	5.70E-07	5.80E-07	5.60E-07	1.25E-07	1.2931E-07	8.87E-08	1.50E-07	1.90E-07	1.60E-07
Radium 226 (uCi/mL)	7.20E-10	1.2E-10	dry well	7.60E-10	2.70E-10	3.90E-10	3.50E-09	2.5E-10	2E-09	3.50E-09	2.10E-09	2.10E-09

ND= non-detect, detection limit not provided

NDP = no data provided

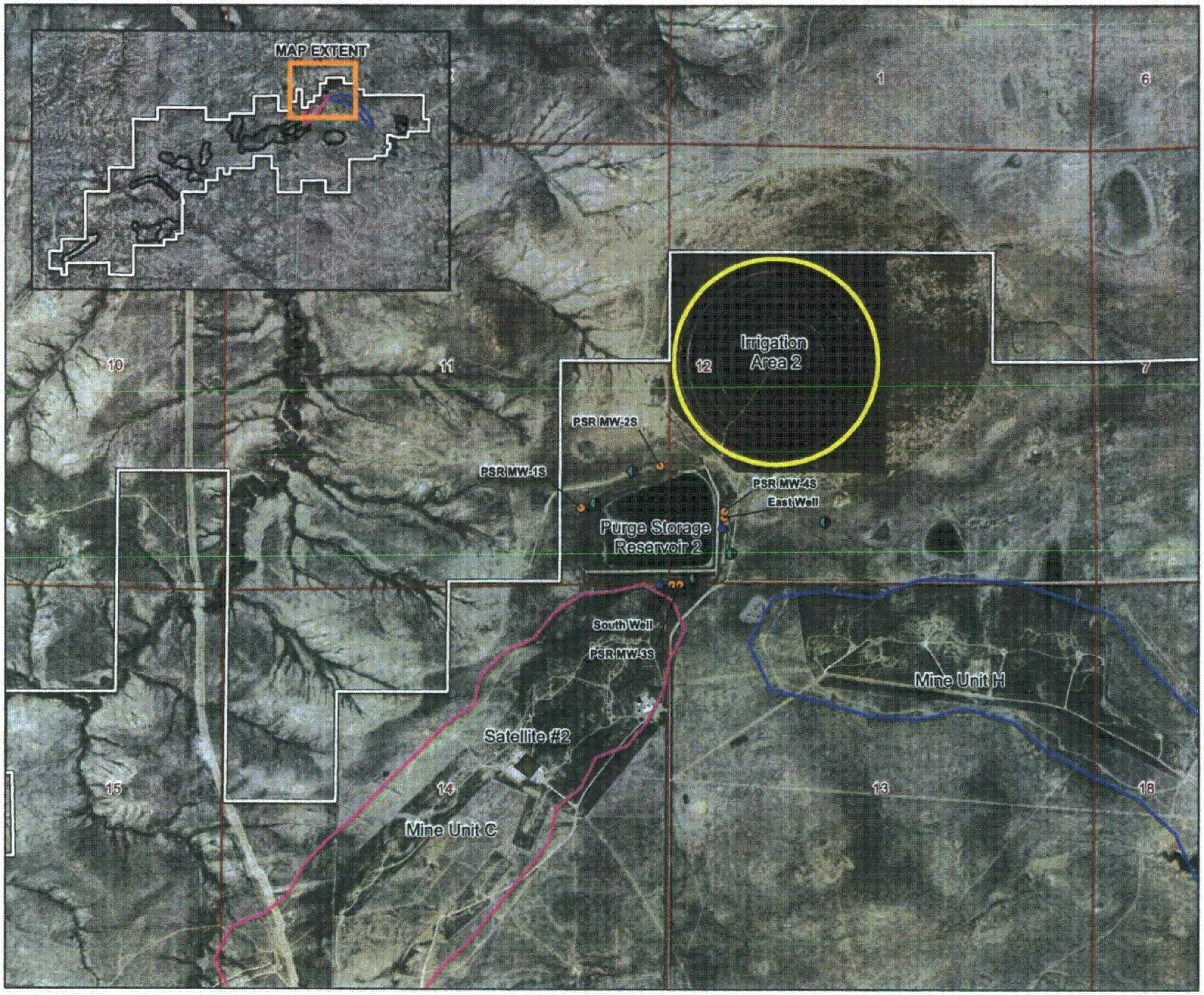
mg/L = milligrams per liter

umhos/cm = micromhos per centimeter

uCi/mL = microcuries per liter

[1] Second value given for Se on 9/11/09 sampling date represents data from Cameco Resources Laboratory

FIGURES



LEGEND

- Proposed Shallow Monitoring Well
- Proposed Montoring Well
- Shallow Monitoring Well
- Satellite #2
- Smith Ranch-Highland Uranium Project Boundary
- Mine Unit C
- Mine Unit H
- Irrigation Area 2
- Section

REFERENCES

Project and Mine Unit Boundaries: Base map provided by Cameco Resources to Golder Associates Inc. on August 28, 2009.
Coordinate System: NAD 1983 UTM Zone 13N.

N

1,500 750 0 1,500 FEET

SCALE 1:15,000 1 INCH = 1,250 FEET
WHEN PRODUCED AT SIZE 11X17IN

PROJECT

CAMECO RESOURCES
PURGE STORAGE RESERVOIR NO. 2
SHALLOW AQUIFER CHARACTERIZATION PLAN
CONVERSE COUNTY, WYOMING

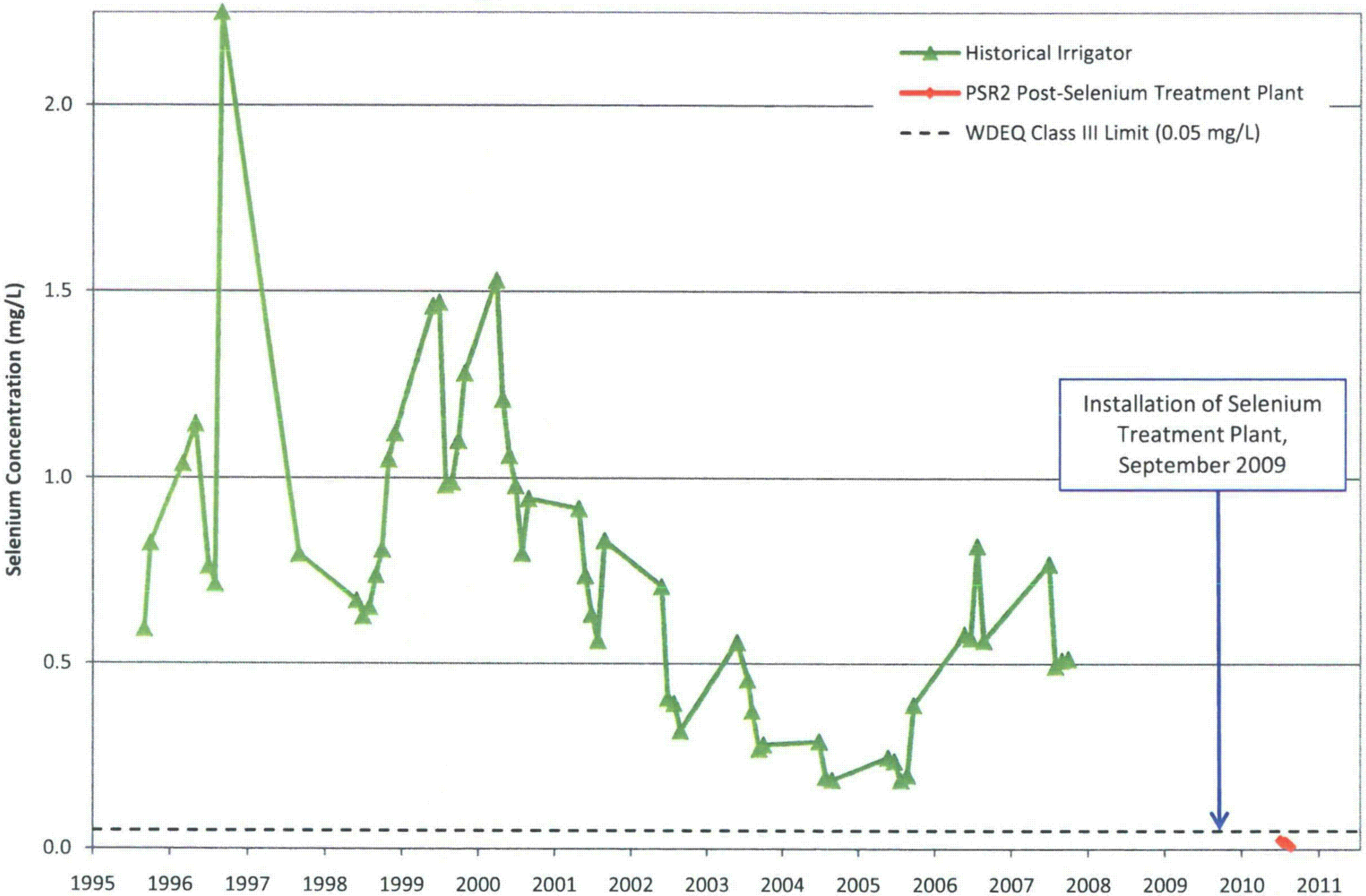
TITLE

APPROXIMATE LOCATIONS OF PROPOSED AND EXISTING MONITORING WELLS

Golder Associates
Denver, Colorado

PROJECT No.		103-81513	FILE No. 11x17_StorageRes_Rebuild2.mxd	
DESIGN	AJR	12/1/2009	SCALE AS SHOWN	REV 0
GIS	AJR	8/1/2011	FIGURE 1	
CHECK	WW	8/1/2011		
REVIEW	MM	8/1/2011		

M:\Cameco\ArcMap\11x17_StorageRes_Rebuild2.mxd | 8/1/2011 4:33:08 PM | AReiher



Golder Associates

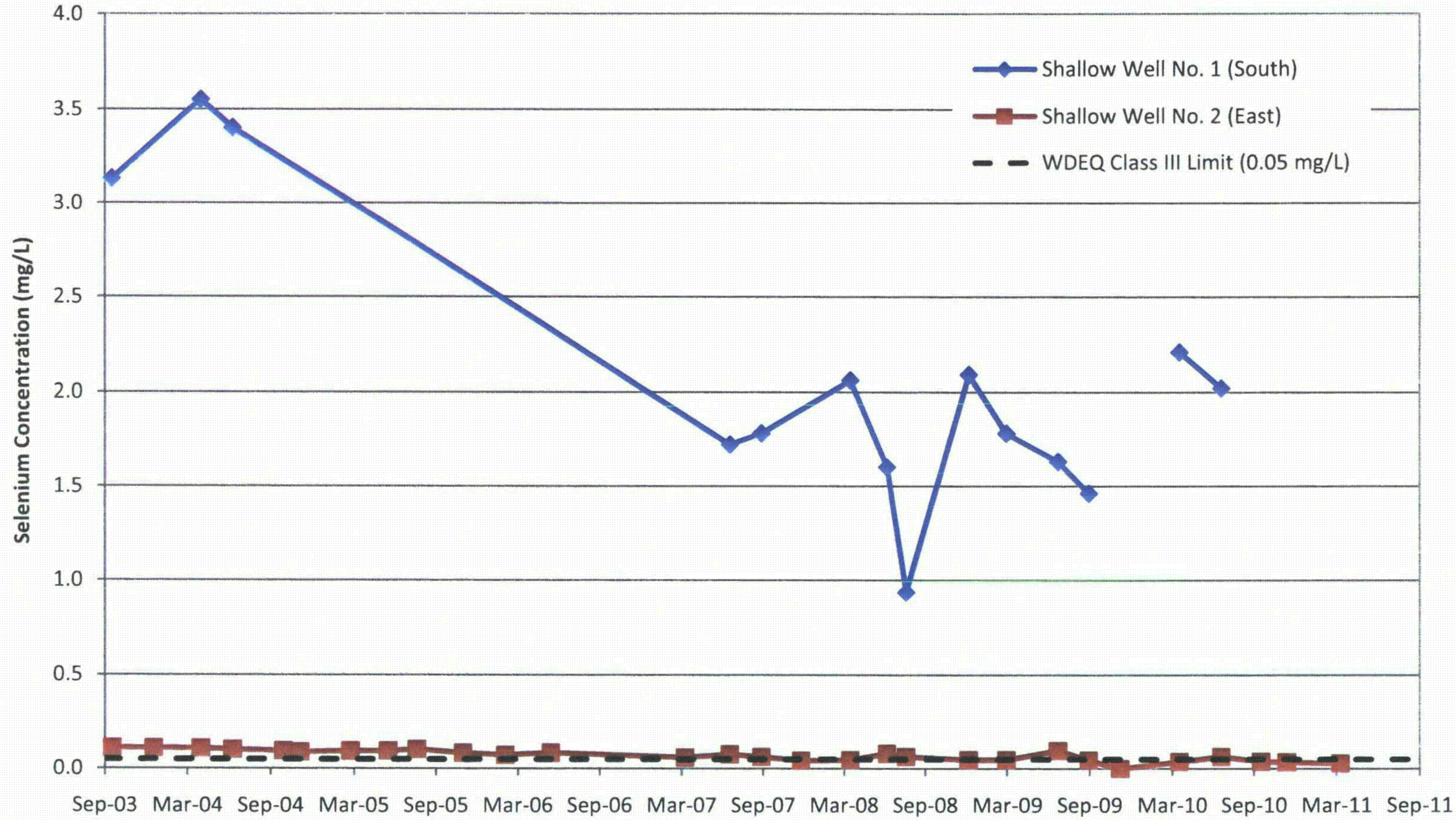
DENVER, COLORADO USA

Irrigator #2
Selenium Concentrations

CLIENT/PROJECT

Cameco Resources

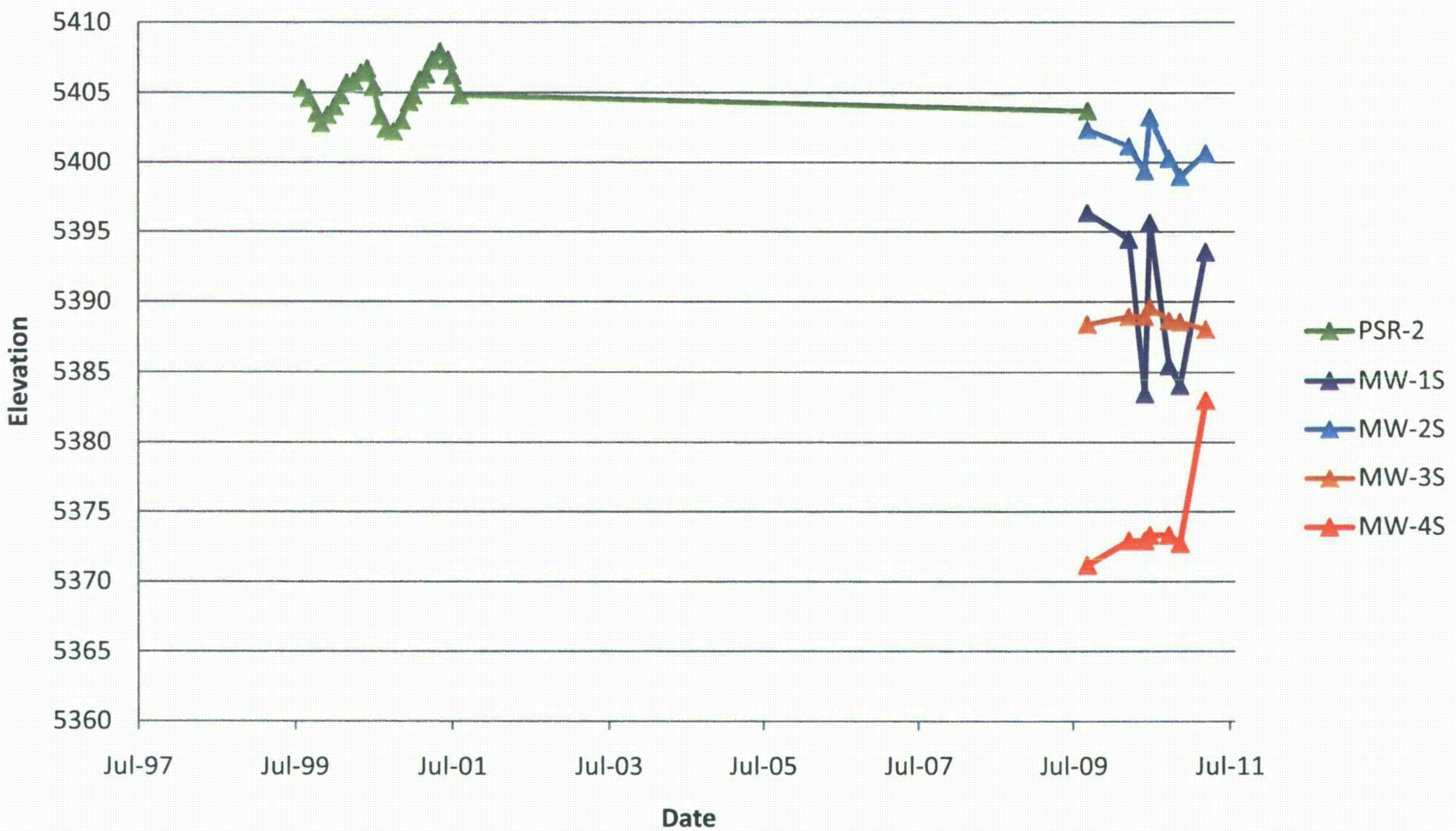
Date	Job No.
Aug-11	113-81734
File name: *Cameco Master Dataset.xlsx; Source: Irrigator 2 Fluid.xls*	Figure 2



Data obtained from Semi-Annual Effluent and Environmental Monitoring Reports for SUA-1548, second half 2003 through the first half of 2009.

Golder Associates DENVER, COLORADO USA	**East and South Shallow Wells** **Selenium Concentrations**

CLIENT/PROJECT	Date	Job No.
Cameco Resources	**Aug-11**	**113-81734**
	File name: *ShallowAquiferFigs.xlsx*	**Figure 3**



Golder Associates DENVER, COLORADO USA	**PSR-2 and Shallow Monitoring Wells Water Level Elevation**
CLIENT/PROJECT Cameco Resources	Date: **Aug-11** / Job No. **113-81734**
	File name: *Cameco Master Dataset.xlsx* / **Figure 4**