



275 – 3001 Wayburne Drive
Burnaby, BC V5G 4W3 Canada
T: 604.874.1245 • www.exp.com

Memorandum

Date: July 12, 2017
To: Ministry of Transportation and Infrastructure
Jennifer Davis, Project Manager
Scott Cosman, P.Eng.
cc: Salem Bahamdun, P.Eng.
Ministry of Transportation and Infrastructure
From: Matthew Munn, P.Eng.
Project: Inventory and Assessment of Water Supply Wells
Highway 7 Corridor Enhancements, 4-Laning Nelson to Silverdale, Mission, BC

Reference No.: VAN-00239389-A0
Total No. of Pages: 6 + Attachments
jennifer.davis@gov.bc.ca
scott.b.cosman@gov.bc.ca
salem.bahamdun@gov.bc.ca
matthew.munn@exp.com

1 INTRODUCTION

Exp Services Inc. (**exp**) was retained by the BC Ministry of Transportation and Infrastructure (the Ministry) to identify and assess existing water supply wells located adjacent to Highway 7, from Nelson Street to Silverdale Avenue (the Project), in the District of Mission, BC. The primary objective of **exp**'s work was to assemble a pre-construction inventory of water wells, based on a review of publicly available information and collection of field data, and to assess the potential for interaction of the Ministry's proposed Highway 7 works with wells.

This memorandum describes the methodology employed by **exp** to compile water well information and the approach used to assess potential Project interactions. All work was completed in agreement with scope summarized in **exp**'s Work Plan delivered to the Ministry on April 10, 2017.

2 BACKGROUND

District of Mission's water supply network does not extend to the Project area; therefore, the properties in vicinity of the Project are serviced by domestic water supply wells (i.e., drilled or shallowly excavated/dug). Prior to commencing Project construction, the potential for the Project to impact these residential infrastructure needs to be assessed. Accordingly, the water well inventory and assessment program was commissioned by the Ministry and implemented by **exp**, as described in the following sections.

3 METHODOLOGY

Work undertaken for the Highway 7 water well inventory and assessment included the following four primary tasks:

- Task 1 – Initial Data Review
- Task 2 – Property Access Arrangements
- Task 3 – Field Program
- Task 4 – Data Compilation (Inventory)



Memorandum (cont'd)

Assessment of Existing Water Supply Wells and Sewerage Systems
Highway 7 Widening, 4-Laning Nelson to Silverdale, Mission, BC
Project No.: VAN-00239389-A0
July 12, 2017

3.1 Task 1 – Initial Data Review

BC Ministry of Environment's (MOE) "Water Resources Atlas" provides access to Provincial databases that are the primary public source for registered water supply well information and aquifer mapping. The databases were reviewed and the mapped (approximate) locations of registered water supply wells identified for properties located either partly or wholly within a 150m offset¹ distance from the Project construction limits. Using this approach, it was determined that sixty-seven (67) properties were either partly or wholly located within the 150m offset. MOE records were available for registered wells on forty-three (43) of the properties. Copies of MOE "Detailed Well Records" for the registered wells were obtained and reviewed to confirm relevant well construction details (e.g., construction date, construction method, total depth, screen location) and geology information.

3.2 Task 2 – Property Access Arrangements

A Project "Introductory Letter" was prepared by **exp** and delivered on April 24, 2017 by mail to civic addresses corresponding to the 67 properties. The letter generally explained **exp**'s role in collecting water well information on behalf of the Ministry and provided notification that an **exp** technician would be visiting properties to deliver a "Questionnaire" that could be completed with assistance from **exp** field staff or completed later and returned to **exp** using a provided self-addressed envelope. The letter also invited residents to contact senior **exp** staff (office based) to discuss details of their water system. Contact information for the Ministry's Project Manager was also provided in the letter.

Hand delivery of the Questionnaires commenced April 28, 2017 and was completed by May 5, 2017. On June 9, 2017, **exp** field staff revisited all non-respondent properties and again delivered both the Introductory Letter and Questionnaire.

3.3 Task 3 – Field Program

Exp field staff visited properties on May 5, 18, 19 and June 9, 2017, and engaged residents in completing a water system Questionnaire and to confirm or collect the following property information:

- GPS locations of registered and unregistered water supply wells;
- Well construction, operational and groundwater chemistry information not available in MOE records or database of registered wells, and confirmation of well water treatment; and,
- Construction dates and Type information for certified and uncertified sewerage systems

Pre-construction baseline groundwater quality information was obtained by collecting water samples from operating wells and non-operating wells determined to be within the 150m offset distance. Samples were collected directly from non-operating wells using dedicated HDPE bailers and from operational wells using accessible taps located closest to the each source well. Water samples were submitted to an accredited analytical laboratory on the same day as sampling for "potability analysis" based on Guidelines for Canadian Drinking Water Quality (CDWQ) for the following prescribed parameters:

- Physical parameters: turbidity, pH, colour, conductivity, TDS, hardness;
- Bacteriological: total coliforms and *E.coli*;
- Chemical parameters: nitrate, nitrite, fluoride, sulphate, chloride, alkalinity; and,
- Total metals: aluminum, antimony, arsenic, barium, boron, cadmium, calcium, chromium, copper, iron, lead, magnesium, manganese, phosphorus, potassium, selenium, silicon, sodium, uranium, zinc.

¹ Offset distance conservatively derived from the Province of British Columbia's "Guidance Document for Determining Ground Water at Risk of Containing Pathogens" screening level methodology.



Memorandum (cont'd)

Assessment of Existing Water Supply Wells and Sewerage Systems
Highway 7 Widening, 4-Laning Nelson to Silverdale, Mission, BC
Project No.: VAN-00239389-A0
July 12, 2017

Laboratory analytical reports received by **exp** were not reviewed for compliance with CDWQ Guidelines. However, due to potential health hazards associated with microbes (i.e., coliforms and/or *E.coli*) in drinking water, residents with bacteria detected in their water were immediately notified. Copies of laboratory reports were delivered to each of the residents.

3.4 Task 4 – Data Compilation (Inventory)

Information obtained during the *Task 1 - Data Review* and *Task 3 - Field Program* is summarized in the attached inventory tables for water wells in vicinity of the Project (Tables 1 and 2). Copies of MOE well records, questionnaires completed by residents, and laboratory water quality reports are attached to this memorandum.

The 67 subject properties are identified in Tables 1 and 2 by an assigned Property Number and by PID number and civic address. Water well locations are identified using UTM coordinates and are also referenced to the Project centerline by orthogonal offset distance from the corresponding centerline chainage.

At the time of preparing this memorandum, twenty-one (21) properties were visited by **exp** field staff (Table 1). Locations of nineteen (19) water supply wells (operational and non-operational) were field-verified and groundwater quality samples obtained from twenty (20) wells.

Introductory Letter responses and/or completed Questionnaires were not received from residents of forty-six (46) properties (Table 2). Seventy-nine (79) registered and unregistered wells (Table 2) identified during the *Task 1 - Data Review* were neither located in the field nor sampled during the *Task 3 - Field Program* due to no responses from residents.

4 ASSESSMENT OF PROJECT INTERACTION

Ministry of Environment records indicate that registered water supply wells in vicinity (i.e., <150m) of Highway 7 are constructed either as shallow excavations (i.e., dug) into near-surface water bearing sediments or as open boreholes drilled into water bearing bedrock of the Mission Aquifer. Properties visited by **exp** field staff (Table 1) include fourteen (14) drilled wells and eight (8) dug wells. In the unsurveyed wells category (Table 2), there are thirty-eight (38) drilled wells, twenty-one (21) dug wells, and nineteen (19) wells of unknown construction type.

4.1 Dug Wells

Groundwater present in near-surface sediments primarily originates as precipitation and/or runoff that locally infiltrates ground surface and accumulates within the sediments prior to interception by dug well excavations. Activities that potentially alter the chemistry of infiltrating waters and/or alter the chemistry of the water present in the near-surface sediments can therefore potentially impact the quality of groundwater in dug wells.

It is understood that Project water management protocols will include construction-phase runoff source controls, which will reduce the potential for Project runoff to either infiltrate near-surface sediments and/or flow overland directly into dug well excavations. The effectiveness of source controls will primarily be a function of horizontal separation from dug wells. Construction vibrations related to heavy equipment movement, excavation activity, and fill placement and compaction can also potentially induce turbidity in shallow groundwater outside the Project construction area. The magnitude of potential turbidity effects and surface water infiltration effects will correlate with horizontal separation of the Project from dug wells. Accordingly, the potential for Project interactions with dug wells was assessed using horizontal offset distance from the Project construction limit as criteria. The dug well assessment matrix is summarized in Table 3.



Memorandum (cont'd)

Assessment of Existing Water Supply Wells and Sewerage Systems
 Highway 7 Widening, 4-Laning Nelson to Silverdale, Mission, BC
 Project No.: VAN-00239389-A0
 July 12, 2017

TABLE 3. DUG WELL ASSESSMENT MATRIX

CRITERIA (Offset Distance)	PROJECT INTERACTION POTENTIAL	RATIONALE
<1m	HIGH	<ul style="list-style-type: none"> • Potential for physical damage to well • Potential for runoff to directly enter well • Potential for excavations to intercept groundwater • Potential for construction vibrations to increase groundwater turbidity
1m – 10m	HIGH	<ul style="list-style-type: none"> • Potential for runoff to directly enter well • Potential for excavations to intercept groundwater • Potential for vibration-induced groundwater turbidity
>10m – 30m	MODERATE	<ul style="list-style-type: none"> • Reduced potential for excavations to intercept groundwater • Reduced potential for vibration-induced groundwater turbidity
>30m – 100m	LOW	<ul style="list-style-type: none"> • Significantly reduced potential for vibration-induced groundwater turbidity
>100m	NO INTERACTION	<ul style="list-style-type: none"> • No pathway for Project interaction with shallow groundwater

4.2 Drilled Wells

Groundwater present in the bedrock aquifer system originates as precipitation and/or runoff that infiltrates both locally and regionally over the full extent of the mapped aquifer area, which MOE estimates to be approximately 49 km². There is potential for surface water from the Project area to either directly infiltrate the deep aquifer in areas where bedrock is exposed at ground surface and/or directly enter the aquifer along the outside of steel well casings drilled into the aquifer. There is also potential for typical construction-related vibrations to induce turbidity in aquifer water outside the Project construction area. On this basis, the potential for Project interactions with drilled wells was assessed using horizontal offset distance from the Project construction limit as criteria. The drilled well assessment matrix is summarized in Table 4.

TABLE 4. DRILLED WELL ASSESSMENT MATRIX

CRITERIA (Offset Distance)	PROJECT INTERACTION POTENTIAL	RATIONALE
<1m	HIGH	<ul style="list-style-type: none"> • Potential for physical damage to well • Potential for runoff to directly enter well • Potential for construction vibrations to induce aquifer water turbidity
1m – 5m	MODERATE	<ul style="list-style-type: none"> • Reduced potential for runoff to directly enter well • Reduced potential for vibration-induced aquifer water turbidity
>5m – 30m	LOW	<ul style="list-style-type: none"> • Significantly reduced potential for runoff to directly enter well • Significantly reduced potential for vibration-induced aquifer water turbidity
>30m	NO INTERACTION	<ul style="list-style-type: none"> • No pathway for Project interaction with aquifer water



Memorandum (cont'd)

Assessment of Existing Water Supply Wells and Sewerage Systems
Highway 7 Widening, 4-Laning Nelson to Silverdale, Mission, BC
Project No.: VAN-00239389-A0
July 12, 2017

4.3 Assessment of Water Wells

Inventoried water supply wells (Tables 1 and 2) were assessed using the approaches outlined in the preceding sections. The resulting assessments of Project interaction for each well are summarized in Tables 1 and 2.

In the surveyed wells category (Table 1), no wells were assessed as “high” and one (1) well located on Property Number 20 was assessed as “moderate”. The location of a shared well servicing both Property Number 43 and Property Number 46 is unknown; therefore, the well was correspondingly assessed as “unknown” for both properties. The remaining nineteen (19) surveyed wells were assessed as either “low” or “no interaction”. Property Number 36 has no well and is serviced from an on-site tank that is filled using water delivered from off-site.

In the unsurveyed wells category (Table 2), three (3) wells were assessed as “high” on Property Number 23, Property Number 39 and Property Number 46 and two (2) wells assessed as “moderate” on Property Number 14 and Property Number 46. Fifty-eight (58) unsurveyed wells were assessed as either “low” or “no interaction”. Four (4) unsurveyed wells were necessarily assessed as “unknown” for properties that lacked both well location and construction information and had either a property boundary or a developed portion of the property within 30m of the Project construction limits. This 30m threshold for an “unknown” assessment was selected because this value is common for a “low” assessment of both dug wells and drilled wells. Nine (9) wells were assessed as “low” using this approach and are identified in Table 2 with an asterisk (i.e., low*).

5 BEDROCK BLASTING

The assessment of Project interactions described in the preceding section considers potential sources of water quality impact associated with typical roadway construction activities. These include construction area runoff either directly entering a well or infiltrating sediments or bedrock that provide water to a well, and elevated in-situ groundwater turbidity induced by vibrations from heavy equipment movement, excavation activity, and fill placement/compaction. These common construction activities will occur at a relatively high frequency along the entire alignment of the Project and, therefore, the associated sources of groundwater quality impact can be characterized as relative sustained (i.e., not instantaneous).

Bedrock blasting will occur along a relatively localized segment of approximately 230m length (from chainage 101+90 to 104+20) to deepen and/or widen ditches and to scale rock exposures. Unlike most other construction activities, blasting occurs as a series of “instantaneous” events of relatively low frequency over a schedule of several weeks or months. Each discrete blast event will generate a short duration wave that will radiate (subsurface) from the target bedrock area through the adjacent rockmass. Each event has potential to momentarily induce some turbidity in groundwater present in nearby rockmass, by liberating sediment or other fine material present in bedrock discontinuities. However, this potential water quality effect will likely be undetectable, due to the low frequency and short (i.e., instantaneous) duration.

Blasting could alter (i.e., fracture, dilate or compress) the rockmass adjacent to blasting areas, which has potential to alter the function of fractures as groundwater pathways. Accordingly, it is recommended that properties with drilled wells within a 100m offset of the blasting segment (101+90 to 104+20) be considered for pre-construction yield testing (i.e., water quantity testing), as part of the Ministry’s pending Phase 2 program to broaden the well inventory to include quantity baseline information for drilled wells potentially affected by blasting.

There are fifteen (15) properties either wholly or partly located within the 100m blasting segment offset. These include eight (8) respondent properties (Table 1), of which seven (7) are confirmed to have drilled wells (i.e., Property Numbers 8, 15, 20, 22, 25, 26 and 30). Another seven (7) non-respondent properties (Table 2) potentially have drilled wells (i.e., Property Numbers 11, 13, 14, 17, 19, 21 and 23) within the 100m offset.



Memorandum (cont'd)

Assessment of Existing Water Supply Wells and Sewerage Systems
Highway 7 Widening, 4-Laning Nelson to Silverdale, Mission, BC
Project No.: VAN-00239389-A0
July 12, 2017

Throughout the blasting schedule, it is recommended a vibration monitoring program be implemented to establish a continuous record of measurements for each blasting event at well locations and other sites prescribed based on the Ministry's pending (Phase 2) identification and inventorying of drilled wells in vicinity of the blasting segment.

6 CLOSURE

We trust the content of this memorandum satisfies your current requirements. If you have any questions, please contact the undersigned.

Submitted by:

Reviewed by:

exp Services Inc.



M. D. Munn

Matthew D. Munn, P.Eng.
Senior Hydrogeologist

Don Sargent, P.Eng.
Senior Engineer

Attachments: Table 1 - Water Well Inventory
Table 2 - Unsurveyed Water Well Summary
Property Information – Ministry Records and Laboratory Reports

MDM:mdm

**TABLE 1. SURVEYED WATER WELL SUMMARY**

PROPERTY INFORMATION			WELL CONSTRUCTION AND LOCATION DETAILS ¹										WATER SAMPLING DETAILS					PROJECT INTERACTION (Potential)		
Property Number	PID	Civic Address	Source	WTN	Date	Method	Depth (m-bg)	Screen/Source Interval (m-bg)	Source Material	Coordinates ² (m)		Offset from Project ⁴ (m)	Hwy No. 7 Offset ³		Date	Well in Use?	Sample ID		Treatment System?	Sampling Location
										North	East		Distance (m)	Chainage						
SURVEYED WELLS																				
1	010436286	29666 Loughheed Hwy	Questionnaire	n/a	1972	Dug	5.5	Unknown	Surficial	5445290.27	543587.06	106	47	n/a	18-May-17	Yes	Well 1-1	No	Interior Kitchen Tap	NO INTERACTION
7	011450363	8631 Foote St	Questionnaire	n/a	1987	Dug	11.9	Unknown	Surficial	5445298.50	543744.77	78	97	101+50	19-May-17	Yes	Well 7-1	Yes	Interior Kitchen Tap	LOW
8	011282720	29739 Silverdale Ave	Questionnaire	n/a	1992	Drilled	48.8	Unknown	Bedrock	5445234.31	543742.58	30	67	101+08	5-May-17	Yes	Well 8-1	Yes	Exterior Garage Tap	LOW
12	08057770	29759 Silverdale Ave	Questionnaire	n/a	Unknown	Dug	4.3	Unknown	Surficial	5445220.81	543775.55	74	86	101+26	18-May-17	Yes	Well 12-1	No	Exterior Residence Tap	LOW
			Questionnaire	n/a	Unknown	Dug	4.9	Unknown	Surficial	5445231.86	543794.51	96	108	101+32	18-May-17	Yes	Well 12-2	No	Well (bailer)	NO INTERACTION
15	011450304	29791 Silverdale Ave	Questionnaire and MOE	38223	21-Sep-77	Drilled	61.0	1.0 - 61.0	Bedrock	5445140.63	543829.29	62	83	102+15	9-Jun-17	Yes	Well 15-1	Yes	Interior Residence Tap	NO INTERACTION
16	017929890	8575 Gagliardi St	MOE	101281	14-Nov-90	Drilled	63.4	16.7 - 63.4	Bedrock	5445217.54	543856.83	135	152	101+80	27-Apr-17	Yes	Well 16-1	Yes	Interior Residence Tap	NO INTERACTION
20	013801147	29760 Loughheed Hwy	MOE	40666	23-Sep-78	Drilled	74.7	0.9 - 74.7	Bedrock	5445054.46	543763.64	5	21	102+70	5-May-17	Yes	Well 20-1	Unknown	Exterior Residence Tap	MODERATE
22	012877867	29816 Silverdale Ave	Questionnaire	n/a	1993	Drilled	112.8	Unknown	Bedrock	5445050.15	543897.45	57	69	103+54	18-May-17	Yes	Well 22-1	NR	Exterior Landscape Tap	NO INTERACTION
25	011626691	29784 Loughheed Hwy	Questionnaire and MOE	42553	6-Jun-79	Drilled	117.3	2.4 - 117.3	Bedrock	5444971.12	543807.70	35	47	103+41	5-May-17	Yes	Well 25-1	Yes	Interior Kitchen Tap	NO INTERACTION
26	000653021	29868 Silverdale Ave	Questionnaire and MOE	94727	15-Nov-82	Drilled	123.4	1.8 - 123.4	Bedrock	544499.00	543973.00	62	75	104+32	5-May-17	Yes	Well 26-1	Yes	Exterior Pumphouse Tap	NO INTERACTION
30	000539309	29880 Silverdale Ave	Questionnaire and MOE	27278	20-Feb-09	Drilled	105.2	1.2 - 105.2	Bedrock	5444902.00	544000.00	12	30	105+31	21-Mar-12	Yes	Well 30-1	Yes	NR	LOW
															18-May-17	Yes	Well 30-1	Yes	Exterior Residence Tap	
32	008692165	29932 Silverdale Ave	Questionnaire and MOE	95064	~1991	Drilled	103.6	Unknown	Bedrock	5444927.50	544080.25	78	103	105+80	5-May-17	Yes	Well 32-1	Yes	Exterior Residence Tap	NO INTERACTION
36	001998307	29954 Silverdale Ave	Phone	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	NO WELL
39	006219039	30010 Silverdale Ave	MOE	33078	31-Jul-75	Drilled	50.0	1.2 - 50.0	Bedrock	5444756.33	544279.17	58	82	108+54	5-May-17	Yes	Well 39-1	No	Interior Basement Tap	NO INTERACTION
43	013337688	30015 Gunn Ave	See Property 46	n/a	-	Dug	-	n/a	Surficial	Unknown	Unknown	Unknown	Unknown	Unknown	-	Unknown	-	-	-	UNKNOWN
44	023324902	30013 Silverdale Ave	None	n/a	Unknown	Drilled	-	Unknown	Bedrock	5444823.49	544280.55	112	138	108+12	5-May-17	Yes	Well 44-1	Unknown	Exterior Residence Tap	NO INTERACTION
45	016052366	30087 Silverdale Ave	MOE	111316	4-Apr-16	Drilled	84.7	3.6 - 84.7	Bedrock	Unknown	Unknown	>58	Unknown	Unknown	n/a	No	n/a	n/a	n/a	NO INTERACTION
			Questionnaire	n/a	1967	Dug	5.5	Unknown	Surficial	5444667.54	544476.09	85	107	111+70	5-May-17	Yes	Well 45-1	No	Well (bailer)	LOW
46	001722549	30050 Silverdale Ave	Questionnaire	n/a	Unknown	Dug	Unknown	Unknown	Surficial	Unknown	Unknown	Unknown	Unknown	Unknown	9-Jun-17	Yes	Well 46-1	No	Exterior Residence Tap	UNKNOWN
49	002072394	30199 Silverdale Ave	Questionnaire and MOE	101248	17-Oct-86	Drilled	73.8	NR	Bedrock	5444682.65	544662.39	>150	218	110+66	18-May-17	Yes	Well 49-1	No	Exterior Residence Tap	NO INTERACTION
52	003949168	30305 Silverdale Ave	Questionnaire	n/a	1987	Dug	3.7	NR	Surficial	5444481.19	544931.06	>150	186	115+48	18-May-17	Yes	Well 52-1	No	Interior Kitchen Tap	NO INTERACTION
54	003577783	30286 Silverdale Ave	Phone	n/a	2014	Drilled	88.4	NR	Bedrock	5444389.66	544862.18	58	76	115+40	18-May-17	Yes	Well 54-1	Yes	Interior Kitchen Tap	NO INTERACTION

NOTES:

- 1) Based on both Ministry of Environment records and field observations
- 2) Coordinates for "Surveyed Wells" are field confirmed (Zone 10U)
- 3) Orthogonal distance from Highway 7 centreline provided for referencing purposes.
- 4) Offset from Project measured to nearest Project limit/boundary
- 5) Properties #43 and #46 are serviced by a single dug well of unknown location. Water quality results for Property #46 are considered representative of well water for both properties.
- 6) NR = not reported
- 7) n/a = not applicable



TABLE 2. UNSURVEYED WATER WELL SUMMARY

PROPERTY INFORMATION			WELL CONSTRUCTION AND LOCATION DETAILS ¹											PROJECT INTERACTION (Potential)	
Property Number	PID	Civic Address	Source	WTN	Date	Method	Depth (m-bg)	Screen/Source Interval (m-bg)	Source Material	Coordinates ² (m)		Hwy No. 7 Offset ³			Offset from Project ⁴ (m)
										North	East	Distance (m)	Chainage		
UNSURVEYED WELLS⁵															
2	012877662	29684 Lougheed Hwy	MOE	57524	2-Oct-87	Drilled	153.9	29 - 154	Bedrock	5445249.61	543616.77	38	101+82	54	NO INTERACTION
3	010436294	8539 McLean St	n/a	-	-	Unknown	-	-		-	-	Unknown	Unknown	Unknown	UNKNOWN
4	008263914	8511 McLean St	n/a	-	-	Unknown	-	-		-	-	Unknown	Unknown	Unknown	UNKNOWN
5	000789682	29705 Lougheed Hwy	MOE	57260	15-Jul-87	Drilled	48.8	4 - 49	Bedrock	5445255.29	543687.24	27	101+48	16	LOW
6	008165408	29729 Silverdale Ave	MOE	9412	1-Jan-50	Dug	4.3	NR	Surficial	5445314.67	543691.10	57	n/a	74	LOW
8	011282720	29739 Silverdale Ave	MOE	58347	15-Aug-88	Drilled	60.3	9.4 - 60.3	Bedrock	5445252.77	543723.02	58	101+38	25	LOW
			MOE	9411	1-Jan-50	Dug	7.3	NR	Surficial	5445280.48	543730.90	77	101+46	48	LOW
			MOE	67213	13-Jan-88	Drilled	32.0	16.1 - 32.0	Bedrock	5445288.39	543752.63	100	101+44	69	NO INTERACTION
9	011224967	8630 Foote St	MOE	58348	16-Aug-88	Drilled	24.7	19.2 - 20.4	Bedrock	5445313.74	543783.66	140	101+46	109	NO INTERACTION
10	000447366	8610 Foote St	n/a	n/a	Unknown	Unknown	n/a	n/a	n/a	Unknown	Unknown	Unknown	Unknown	>150	NO INTERACTION
11	011450312	8590 Foote St	MOE	58902	27-Jun-89	Drilled	66.1	14.0 - 66.1	Bedrock	5445256.28	543770.33	101	101+39	95	NO INTERACTION
			MOE	15031	1-Jan-57	Dug	1.8	NR	Surficial	5445255.64	543834.63	155	101+90	138	NO INTERACTION
13	002115701	29746 Silverdale Ave	MOE	9435	1-Jan-50	Dug	1.5	NR	Surficial	5445192.37	543746.34	48	101+36	33	LOW
14	009725393	29760 Silverdale Ave	MOE	15450	1-Jan-58	Dug	3.7	NR	Surficial	5445156.65	543757.65	36	101+74	17	MODERATE
16	017929890	8575 Gaglardi St	MOE	31299	21-Sep-74	Drilled	62.2	3.0 - 62.1	Bedrock	5445219.67	543922.92	260	102+18	>150	NO INTERACTION
			MOE	9417	1-Jan-50	Dug	1.8	NR	Surficial	5445229.41	543990.19	205	102+32	>150	NO INTERACTION
17	017929911	8541 Gaglardi St	MOE	101229	8-Nov-90	Drilled	82.3	3.0 - 82.3	Bedrock	5445124.98	543925.95	144	103+20	133	NO INTERACTION
18	017929903	8535 Gaglardi St	MOE	101233	13-Nov-90	Drilled	76.2	0.0 - 76.2	Bedrock	5445177.73	543961.19	206	103+80	>150	NO INTERACTION
			MOE	9393	1-Jan-50	Dug	6.1	NR	Surficial	5445147.48	543988.61	204	103+60	>150	NO INTERACTION
19	012877786	8514 McLean St	MOE	15451	1-Jan-58	Dug	4.6	NR	Surficial	5445064.46	543674.10	85	101+94	82	LOW
			MOE	36651	3-Feb-77	Drilled	86.0	0.9 - 86.0	Bedrock	5445020.68	543697.67	93	102+18	66	NO INTERACTION
20	013801147	29760 Lougheed Hwy	MOE	58910	1-Jul-89	Drilled	56.1	8.5 - 56.1	Bedrock	5445000.89	543770.82	54	102+98	41	NO INTERACTION
21	009725326	29781 Lougheed Hwy	MOE	16381	1-Jan-60	Drilled	10.1	2.4 - 10.1	Bedrock	5445084.09	543854.59	64	102+95	52	NO INTERACTION
			MOE	9427	1-Jan-50	Drilled	45.7	NR	Bedrock	5445069.22	543872.74	67	103+20	53	NO INTERACTION
23	009748741	8506 Gaglardi St	MOE	16848	1-Jan-61	Dug	1.2	NR	Surficial	5445057.60	543930.68	99	103+72	119	NO INTERACTION
			MOE	14261	1-Jan-54	Drilled	26.5	2.4 - 26.5	Bedrock	5445041.69	543996.53	131	104+28	84	NO INTERACTION
			MOE	19430	1-Sep-65	Drilled	41.2	NR	Bedrock	5445082.10	544001.30	165	104+12	0	HIGH
24	001722557	8421 McLean St	MOE	17538	01-Jul-62	Drilled	43.9	13.7 - 43.9	Bedrock	5444926.86	543720.05	140	103+16	128	NO INTERACTION
27	009439323	29907 Silverdale Ave	MOE	55819	15-Mar-86	Drilled	121.9	0.9 - 121.9	Bedrock	5444997.29	544054.93	140	150+00	121	NO INTERACTION
28	009439307	8514 Gaglardi St	MOE	9416	1-Jan-50	Dug	3.4	NR	Surficial	5445079.70	544024.91	180	104+26	>150	NO INTERACTION
29	012039098	29929 Silverdale Ave	n/a	n/a	Unknown	Unknown	n/a	n/a	n/a	Unknown	Unknown	Unknown	Unknown	>110	NO INTERACTION
31	000532894	29912 Silverdale Ave	n/a	n/a	Unknown	Unknown	n/a	n/a	n/a	Unknown	Unknown	Unknown	Unknown	Unknown	UNKNOWN
33	001722549	29920 Lougheed Hwy	MOE	17435	1-Jan-62	Drilled	42.7	NR	Bedrock	5444828.80	543870.01	110	104+83	88	NO INTERACTION
			MOE	16847	1-Jan-61	Drilled	43.9	NR	Bedrock	5444798.74	543869.17	132	105+80	108	NO INTERACTION
			MOE	2830	1-Jan-47	Drilled	19.8	NR	Bedrock	5444781.78	543894.40	128	105+30	104	NO INTERACTION
			MOE	2405	1-Jan-45	Drilled	38.4	NR	Bedrock	5444758.22	543985.13	85	106+90	63	NO INTERACTION



TABLE 2. UNSURVEYED WATER WELL SUMMARY

PROPERTY INFORMATION			WELL CONSTRUCTION AND LOCATION DETAILS ¹											PROJECT INTERACTION (Potential)	
Property Number	PID	Civic Address	Source	WTN	Date	Method	Depth (m-bg)	Screen/Source Interval (m-bg)	Source Material	Coordinates ² (m)		Hwy No. 7 Offset ³			Offset from Project ⁴ (m)
										North	East	Distance (m)	Chainage		
UNSURVEYED WELLS⁵															
34	009222553	29940 Silverdale Ave	MOE	59951	14-Mar-92	Drilled	105.2	1.4 - 105.2	Bedrock	5444915.81	544115.53	119	106+15	92	NO INTERACTION
35	009222588	29939 Lougheed Hwy	MOE	101245	7-Nov-89	Drilled	86.9	36.5 - 86.9	Bedrock	5444807.75	544117.82	37	106+85	7	LOW
37	012877921	No Street No.	MOE	67293	17-Mar-88	Drilled	80.8	3.9 - 80.8	Bedrock	5444888.76	544169.84	126	106+83	103	NO INTERACTION
38	012877883	29990 Silverdale Ave	n/a	n/a	Unknown	Unknown	n/a	n/a	n/a	Unknown	Unknown	Unknown	Unknown	>30	LOW*
39	006219039	30010 Silverdale Ave	MOE	2829	01-Jan-47	Drilled	21.3	NR	Bedrock	5444764.37	544173.23	33	107+55	9	LOW
			MOE	9390	01-Jan-50	Dug	NR	NR	Surficial	5444754.80	544180.15	29	107+68	0	HIGH
40	004629388	29951 Silverdale Ave	MOE	53811	26-Jul-84	Drilled	80.5	0.8 - 80.5	Bedrock	5444907.91	544190.83	160	106+79	132	NO INTERACTION
41	003766632 000599867	29967 and 29979 Silverdale Ave	MOE	13608	1-Jan-51	Dug	1.8	NR	Surficial	5444900.96	544220.89	172	107+15	151	NO INTERACTION
42	003766641	30007 Gunn Ave	n/a	n/a	Unknown	Unknown	n/a	n/a	n/a	Unknown	Unknown	Unknown	Unknown	>100	NO INTERACTION
46	002308622	30050 Silverdale Ave	MOE	2604	1-Jan-46	Drilled	38.4	NR	Bedrock	5444696.79	544263.05	23	108+68	7	LOW
			MOE	9396	1-Jan-50	Dug	3.1	n/a	Surficial	5444719.44	544278.79	50	108+70	23	MODERATE
			MOE	13610	1-Jan-51	Drilled	26.5	NR	Bedrock	5444707.68	544291.63	47	108+88	18	LOW
			MOE	9400	1-Jan-50	Dug	3.7	NR	Surficial	5444690.17	544296.92	35	109+00	0	HIGH
			MOE	9399	1-Jan-50	Dug	2.4	NR	Surficial	5444700.65	544320.71	56	109+14	29	MODERATE
47	000440671	No Street No.	n/a	n/a	Unknown	Unknown	n/a	n/a	n/a	Unknown	Unknown	Unknown	Unknown	>30	LOW*
48	003949125	30161 Silverdale Ave	n/a	n/a	Unknown	Unknown	n/a	n/a	n/a	Unknown	Unknown	Unknown	Unknown	>30	LOW*
49	002072394	30199 Silverdale Ave	MOE	33615	13-Oct-75	Drilled	53.3	.12 - 53.3	Bedrock	5444576.78	544680.15	140	112+88	117	NO INTERACTION
50	003949176	30251 Silverdale Ave	n/a	n/a	Unknown	Unknown	n/a	n/a	n/a	Unknown	Unknown	Unknown	Unknown	>30	LOW*
51	002820251	30283 Silverdale Ave	n/a	n/a	Unknown	Unknown	n/a	n/a	n/a	Unknown	Unknown	Unknown	Unknown	>30	LOW*
52	003949168	30305 Silverdale Ave	MOE	17948	01-Jan-63	Drilled	32.0	NR	Bedrock	5444527.46	544936.37	230	115+22	>150	NO INTERACTION
53	003949150	30355 Silverdale Ave	n/a	n/a	Unknown	Unknown	n/a	n/a	n/a	Unknown	Unknown	Unknown	Unknown	>150	NO INTERACTION
54	3577783	30286 Silverdale Ave	MOE	18147	01-Jul-63	Drilled	38.7	NR	Bedrock	5444273.83	545026.27	63	117+40	46	NO INTERACTION
55	014842386	29960 Lougheed Hwy	n/a	n/a	Unknown	Unknown	n/a	n/a	n/a	Unknown	Unknown	Unknown	Unknown	>30	LOW*
56	000502243	30313 Cooper Ave	MOE	2831	1-Jan-47	Drilled	20.4	NR	NR	5444354.31	544313.29	242	111+10	>150	NO INTERACTION
			MOE	9403	1-Jan-50	Dug	3.7	NR	Surficial	5444272.43	544408.76	262	112+20	>150	NO INTERACTION
			MOE	9303	1-Jan-50	Dug	5.5	NR	Surficial	5444145.82	544567.79	283	112+10	>150	NO INTERACTION
57	000489930	30302 Cooper Ave	MOE	15997	1-Jan-59	Dug	4.0	NR	Surficial	5443936.23	544713.52	388	116+80	>150	NO INTERACTION
58	012815411	30367 Cooper Ave	n/a	n/a	Unknown	Unknown	n/a	n/a	n/a	Unknown	Unknown	Unknown	Unknown	Unknown	UNKNOWN
59	013337637	30492 Silverdale Ave	MOE	9386	1-Jan-50	Dug	3.7	NR	Surficial	5444216.19	545218.11	114	119+32	95	LOW
60	009313737	30720 Silverdale Ave	n/a	n/a	Unknown	Unknown	n/a	n/a	n/a	Unknown	Unknown	Unknown	Unknown	>30	LOW*
61-62	005028850	7770 Chester St	MOE	9603	1-Jan-50	Dug	6.7	NR	Surficial	5443825.85	545420.73	111	123+10	80	LOW
			MOE	72460	17-Jul-96	Drilled	30.8	1.2 - 30.8	Sand	5443634.96	545310.58	330	123+25	>150	NO INTERACTION



TABLE 2. UNSURVEYED WATER WELL SUMMARY

PROPERTY INFORMATION			WELL CONSTRUCTION AND LOCATION DETAILS ¹											PROJECT INTERACTION (Potential)	
Property Number	PID	Civic Address	Source	WTN	Date	Method	Depth (m-bg)	Screen/Source Interval (m-bg)	Source Material	Coordinates ² (m)		Hwy No. 7 Offset ³			Offset from Project ⁴ (m)
										North	East	Distance (m)	Chainage		
UNSURVEYED WELLS⁵															
63	000639648	7277 Nelson St	MOE	67229	3-Oct-87	Drilled	24.1	22.8 - 24.1	Sand	<i>5442766.94</i>	<i>546445.72</i>	473	n/a	>150	NO INTERACTION
			MOE	67230	3-Oct-87	Drilled	13.4	7.6 - 13.4	Sand	<i>5442771.32</i>	<i>546476.38</i>	464	n/a	>150	NO INTERACTION
			MOE	67231	3-Oct-87	Drilled	13.7	11.5 - 13.7	Sand	<i>5442778.12</i>	<i>546493.13</i>	450	n/a	>150	NO INTERACTION
			MOE	763	Unknown	Drilled	18.3	NR	NR	<i>5442703.69</i>	<i>546179.09</i>	670	n/a	>150	NO INTERACTION
			MOE	67303	Unknown	NR	NR	NR	NR	<i>5442582.65</i>	<i>546400.25</i>	650	n/a	>150	NO INTERACTION
			MOE	10068	1-Jan-50	Dug	9.1	NR	NR	<i>5442602.37</i>	<i>5442602.37</i>	525	n/a	>150	NO INTERACTION
			MOE	100956	15-Jun-00	Drilled	23.2	16.7 - 23.2	Gravel	<i>5442800.43</i>	<i>546144.96</i>	604	n/a	>150	NO INTERACTION
64	003706494	31042 Silverdale Ave	n/a	n/a	Unknown	Unknown	n/a	n/a	n/a	Unknown	Unknown	Unknown	Unknown	>30	LOW*
65	001064991	29945 Silverdale Ave	n/a	n/a	Unknown	Unknown	n/a	n/a	n/a	Unknown	Unknown	Unknown	Unknown	>30	LOW*
66	009737529	8449 McLean Street	n/a	n/a	Unknown	Unknown	n/a	n/a	n/a	Unknown	Unknown	Unknown	Unknown	>30	LOW*
67	004066197	8642 Foote Street	n/a	n/a	Unknown	Unknown	n/a	n/a	n/a	Unknown	Unknown	Unknown	Unknown	>30	LOW*

NOTES:
 1) Based on both Ministry of Environment records and field observations
 2) Coordinates for "Surveyed Wells" are field confirmed (Zone 10U)
 3) Orthogonal distance from Highway 7 centreline provided for referencing purposes.
 4) Offset from Project measured orthogonally from nearest Project limit/boundary
 5) Italicized coordinate values are approximated from Ministry of Environment records and are not field confirmed
 6) Asterisk indicates "Low" assessment based on 30m offset criteria common to both drilled wells and dug wells
 7) NR = not reported
 8) n/a = not applicable