

Appendix 2-A *Tenas Deposit Meteorological Station Daily Data,
January 1, 2017 to December 31, 2018*

Appendix 2-A. Tenas Deposit Meteorological Station Daily Data, January 1, 2017 to December 9, 2019

Date	Mean Air Temperature (°C)	Maximum Air Temperature (°C)	Minimum Air Temperature (°C)	Mean Relative Humidity (%)	Mean Wind Speed (m/s)	Maximum Wind Speed (m/s)	Mean Solar Radiation (W/m ²)	1-Hour Maximum Solar Radiation (W/m ²)	Mean Barometric Pressure at Station Elevation (kPa)	Mean Snow Depth (cm)	Total Precipitation (mm)	Total Rainfall (mm)	Total Snow-Water-Equivalent (mm)	Total Evaporation (mm)
1-Jan-17	-13.4	-8.0	-18.8	-	-	-	-	-	-	-	0.0	0.0	0.0	-
2-Jan-17	-17.0	-13.0	-20.9	-	-	-	-	-	-	-	0.0	0.0	0.0	-
3-Jan-17	-16.1	-11.4	-20.8	-	-	-	-	-	-	-	0.0	0.0	0.0	-
4-Jan-17	-14.9	-10.6	-19.3	-	-	-	-	-	-	-	0.0	0.0	0.0	-
5-Jan-17	-14.9	-10.4	-19.4	-	-	-	-	-	-	-	2.1	0.0	2.1	-
6-Jan-17	-8.8	-6.5	-11.1	-	-	-	-	-	-	-	8.0	0.0	8.0	-
7-Jan-17	-9.5	-6.5	-12.6	-	-	-	-	-	-	-	0.0	0.0	0.0	-
8-Jan-17	-12.2	-10.9	-13.6	-	-	-	-	-	-	-	2.5	0.0	2.5	-
9-Jan-17	-14.9	-9.8	-19.9	-	-	-	-	-	-	-	1.0	0.0	1.0	-
10-Jan-17	-20.5	-16.1	-24.9	-	-	-	-	-	-	-	0.0	0.0	0.0	-
11-Jan-17	-21.1	-16.2	-26.0	-	-	-	-	-	-	-	0.0	0.0	0.0	-
12-Jan-17	-20.1	-15.5	-24.6	-	-	-	-	-	-	-	0.0	0.0	0.0	-
13-Jan-17	-10.2	-2.5	-17.8	-	-	-	-	-	-	-	0.0	0.0	0.0	-
14-Jan-17	-3.6	0.3	-7.3	-	-	-	-	-	-	-	0.0	0.0	0.0	-
15-Jan-17	-1.7	1.3	-4.6	-	-	-	-	-	-	-	0.0	0.0	0.0	-
16-Jan-17	-0.9	2.6	-4.3	-	-	-	-	-	-	-	8.9	0.0	8.9	-
17-Jan-17	-0.9	0.1	-1.9	-	-	-	-	-	-	-	10.0	0.0	10.0	-
18-Jan-17	0.9	3.1	-1.2	-	-	-	-	-	-	-	1.6	0.8	0.9	-
19-Jan-17	-0.3	1.4	-2.0	-	-	-	-	-	-	-	1.0	0.0	1.0	-
20-Jan-17	-1.4	0.6	-3.5	-	-	-	-	-	-	-	0.0	0.0	0.0	-
21-Jan-17	-2.2	-1.4	-2.9	-	-	-	-	-	-	-	0.0	0.0	0.0	-
22-Jan-17	-3.2	-2.3	-4.1	-	-	-	-	-	-	-	0.0	0.0	0.0	-
23-Jan-17	-6.1	-2.9	-9.3	-	-	-	-	-	-	-	0.0	0.0	0.0	-
24-Jan-17	-5.5	-3.1	-7.9	-	-	-	-	-	-	-	0.0	0.0	0.0	-
25-Jan-17	-3.3	-0.7	-5.9	-	-	-	-	-	-	-	0.0	0.0	0.0	-
26-Jan-17	-1.4	2.1	-4.8	-	-	-	-	-	-	-	1.0	0.0	1.0	-
27-Jan-17	0.8	2.2	-0.6	-	-	-	-	-	-	-	4.1	1.7	2.3	-
28-Jan-17	2.4	4.3	0.4	-	-	-	-	-	-	-	4.3	4.3	0.0	-
29-Jan-17	-0.3	1.0	-1.7	-	-	-	-	-	-	-	0.0	0.0	0.0	-
30-Jan-17	-3.2	-1.3	-5.2	-	-	-	-	-	-	-	0.0	0.0	0.0	-
31-Jan-17	-8.2	-4.8	-11.7	-	-	-	-	-	-	-	0.0	0.0	0.0	-
1-Feb-17	-11.6	-7.6	-15.7	-	-	-	-	-	-	-	0.0	0.0	0.0	-
2-Feb-17	-12.3	-8.6	-16.0	-	-	-	-	-	-	-	0.0	0.0	0.0	-
3-Feb-17	-11.7	-7.6	-15.8	-	-	-	-	-	-	-	0.0	0.0	0.0	-
4-Feb-17	-12.6	-7.0	-18.1	-	-	-	-	-	-	-	0.0	0.0	0.0	-
5-Feb-17	-12.7	-7.1	-18.3	-	-	-	-	-	-	-	0.0	0.0	0.0	-
6-Feb-17	-13.7	-8.5	-18.9	-	-	-	-	-	-	-	0.0	0.0	0.0	-
7-Feb-17	-15.5	-11.2	-19.9	-	-	-	-	-	-	-	0.0	0.0	0.0	-
8-Feb-17	-16.1	-11.0	-21.0	-	-	-	-	-	-	-	0.0	0.0	0.0	-
9-Feb-17	-15.1	-10.9	-19.3	-	-	-	-	-	-	-	0.0	0.0	0.0	-
10-Feb-17	-10.4	-5.8	-14.9	-	-	-	-	-	-	-	0.0	0.0	0.0	-
11-Feb-17	-4.1	1.6	-9.8	-	-	-	-	-	-	-	0.0	0.0	0.0	-
12-Feb-17	1.1	4.0	-1.9	-	-	-	-	-	-	-	0.0	0.0	0.0	-
13-Feb-17	1.4	5.9	-3.3	-	-	-	-	-	-	-	0.0	0.0	0.0	-
14-Feb-17	0.5	4.9	-3.9	-	-	-	-	-	-	-	1.9	0.5	1.4	-

Notes:

Dashes (-) indicate that not enough data were available or were erroneous.

Underlined values indicate data that were gap-filled.

Appendix 2-A. Teras Deposit Meteorological Station Daily Data, January 1, 2017 to December 9, 2019

Date	Mean Air Temperature (°C)	Maximum Air Temperature (°C)	Minimum Air Temperature (°C)	Mean Relative Humidity (%)	Mean Wind Speed (m/s)	Maximum Wind Speed (m/s)	Mean Solar Radiation (W/m ²)	1-Hour Maximum Solar Radiation (W/m ²)	Mean Barometric Pressure at Station Elevation (kPa)	Mean Snow Depth (cm)	Total Precipitation (mm)	Total Rainfall (mm)	Total Snow-Water-Equivalent (mm)	Total Evaporation (mm)
15-Feb-17	<u>2.5</u>	<u>6.3</u>	<u>-1.2</u>	-	-	-	-	-	-	-	6.5	6.5	0.0	-
16-Feb-17	<u>-0.6</u>	<u>0.4</u>	<u>-1.6</u>	-	-	-	-	-	-	-	3.4	0.0	3.4	-
17-Feb-17	<u>-2.4</u>	<u>-0.9</u>	<u>-3.8</u>	-	-	-	-	-	-	-	0.0	0.0	0.0	-
18-Feb-17	<u>-2.2</u>	<u>0.0</u>	<u>-4.4</u>	-	-	-	-	-	-	-	0.0	0.0	0.0	-
19-Feb-17	<u>-2.1</u>	<u>-0.5</u>	<u>-3.7</u>	-	-	-	-	-	-	-	1.6	0.0	1.6	-
20-Feb-17	<u>-2.0</u>	<u>-0.4</u>	<u>-3.6</u>	-	-	-	-	-	-	-	1.0	0.0	1.0	-
21-Feb-17	<u>-2.4</u>	<u>0.4</u>	<u>-5.1</u>	-	-	-	-	-	-	-	0.0	0.0	0.0	-
22-Feb-17	<u>-4.2</u>	<u>-0.5</u>	<u>-7.9</u>	-	-	-	-	-	-	-	0.0	0.0	0.0	-
23-Feb-17	<u>-7.3</u>	<u>-2.5</u>	<u>-12.1</u>	-	-	-	-	-	-	-	0.0	0.0	0.0	-
24-Feb-17	<u>-6.3</u>	<u>-1.6</u>	<u>-10.9</u>	-	-	-	-	-	-	-	0.0	0.0	0.0	-
25-Feb-17	<u>-8.2</u>	<u>-3.5</u>	<u>-12.7</u>	-	-	-	-	-	-	-	1.0	0.0	1.0	-
26-Feb-17	<u>-8.2</u>	<u>-1.6</u>	<u>-14.6</u>	-	-	-	-	-	-	-	0.0	0.0	0.0	-
27-Feb-17	<u>-5.9</u>	<u>-0.9</u>	<u>-10.9</u>	-	-	-	-	-	-	-	0.0	0.0	0.0	-
28-Feb-17	<u>-9.2</u>	<u>-4.3</u>	<u>-13.9</u>	-	-	-	-	-	-	-	0.0	0.0	0.0	-
1-Mar-17	<u>-6.5</u>	<u>-0.5</u>	<u>-12.4</u>	-	-	-	-	-	-	-	0.0	0.0	0.0	-
2-Mar-17	<u>1.7</u>	<u>5.8</u>	<u>-2.4</u>	-	-	-	-	-	-	-	0.0	0.0	0.0	-
3-Mar-17	<u>-2.9</u>	<u>0.3</u>	<u>-6.1</u>	-	-	-	-	-	-	-	0.0	0.0	0.0	-
4-Mar-17	<u>-6.5</u>	<u>-2.5</u>	<u>-10.4</u>	-	-	-	-	-	-	-	0.0	0.0	0.0	-
5-Mar-17	<u>-6.2</u>	<u>-2.6</u>	<u>-9.8</u>	-	-	-	-	-	-	-	0.0	0.0	0.0	-
6-Mar-17	<u>-7.0</u>	<u>-2.5</u>	<u>-11.4</u>	-	-	-	-	-	-	-	0.0	0.0	0.0	-
7-Mar-17	<u>-7.2</u>	<u>-5.4</u>	<u>-9.1</u>	-	-	-	-	-	-	-	0.0	0.0	0.0	-
8-Mar-17	<u>-8.7</u>	<u>-7.4</u>	<u>-9.9</u>	-	-	-	-	-	-	-	0.0	0.0	0.0	-
9-Mar-17	<u>-10.2</u>	<u>-7.8</u>	<u>-12.5</u>	-	-	-	-	-	-	-	0.0	0.0	0.0	-
10-Mar-17	<u>-9.1</u>	<u>-6.5</u>	<u>-11.6</u>	-	-	-	-	-	-	-	1.2	0.0	1.2	-
11-Mar-17	<u>-9.7</u>	<u>-8.2</u>	<u>-11.1</u>	-	-	-	-	-	-	-	2.5	0.0	2.5	-
12-Mar-17	<u>-7.4</u>	<u>-4.9</u>	<u>-9.8</u>	-	-	-	-	-	-	-	2.1	0.0	2.1	-
13-Mar-17	<u>-1.3</u>	<u>8.2</u>	<u>-10.7</u>	-	-	-	-	-	-	-	0.0	0.0	0.0	-
14-Mar-17	<u>2.5</u>	<u>7.0</u>	<u>-2.0</u>	-	-	-	-	-	-	-	0.0	0.0	0.0	-
15-Mar-17	<u>0.3</u>	<u>3.3</u>	<u>-2.9</u>	-	-	-	-	-	-	-	0.0	0.0	0.0	-
16-Mar-17	<u>-0.4</u>	<u>3.3</u>	<u>-4.2</u>	-	-	-	-	-	-	-	0.0	0.0	0.0	-
17-Mar-17	<u>-0.3</u>	<u>2.5</u>	<u>-3.1</u>	-	-	-	-	-	-	-	0.0	0.0	0.0	-
18-Mar-17	<u>-1.2</u>	<u>2.1</u>	<u>-4.5</u>	-	-	-	-	-	-	-	0.0	0.0	0.0	-
19-Mar-17	<u>-1.5</u>	<u>2.9</u>	<u>-5.9</u>	-	-	-	-	-	-	-	0.0	0.0	0.0	-
20-Mar-17	<u>-2.5</u>	<u>4.6</u>	<u>-9.6</u>	-	-	-	-	-	-	-	0.0	0.0	0.0	-
21-Mar-17	<u>-1.8</u>	<u>4.2</u>	<u>-7.7</u>	-	-	-	-	-	-	-	1.4	0.0	1.4	-
22-Mar-17	<u>2.0</u>	<u>5.4</u>	<u>-1.6</u>	-	-	-	-	-	-	-	1.0	0.9	0.0	-
23-Mar-17	<u>-0.3</u>	<u>4.0</u>	<u>-4.5</u>	-	-	-	-	-	-	-	1.4	0.0	1.4	-
24-Mar-17	<u>0.4</u>	<u>2.7</u>	<u>-1.9</u>	-	-	-	-	-	-	-	2.5	0.5	2.0	-
25-Mar-17	<u>1.5</u>	<u>4.8</u>	<u>-1.7</u>	-	-	-	-	-	-	-	0.0	0.0	0.0	-
26-Mar-17	<u>0.2</u>	<u>4.5</u>	<u>-4.2</u>	-	-	-	-	-	-	-	0.0	0.0	0.0	-
27-Mar-17	<u>2.0</u>	<u>6.1</u>	<u>-2.2</u>	-	-	-	-	-	-	-	0.0	0.0	0.0	-
28-Mar-17	<u>2.0</u>	<u>5.4</u>	<u>-1.4</u>	-	-	-	-	-	-	-	1.4	1.4	0.0	-
29-Mar-17	<u>1.2</u>	<u>6.3</u>	<u>-4.0</u>	-	-	-	-	-	-	-	0.0	0.0	0.0	-
30-Mar-17	<u>1.6</u>	<u>7.3</u>	<u>-4.2</u>	-	-	-	-	-	-	-	1.2	1.0	0.2	-
31-Mar-17	<u>4.0</u>	<u>8.5</u>	<u>-0.6</u>	-	-	-	-	-	-	-	0.0	0.0	0.0	-

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Date	Mean Air Temperature (°C)	Maximum Air Temperature (°C)	Minimum Air Temperature (°C)	Mean Relative Humidity (%)	Mean Wind Speed (m/s)	Maximum Wind Speed (m/s)	Mean Solar Radiation (W/m ²)	1-Hour Maximum Solar Radiation (W/m ²)	Mean Barometric Pressure at Station Elevation (kPa)	Mean Snow Depth (cm)	Total Precipitation (mm)	Total Rainfall (mm)	Total Snow-Water-Equivalent (mm)	Total Evaporation (mm)
1-Apr-17	<u>2.1</u>	<u>5.9</u>	<u>-1.6</u>	-	-	-	-	-	-	-	<u>1.2</u>	<u>1.2</u>	<u>0.0</u>	-
2-Apr-17	<u>0.6</u>	<u>5.8</u>	<u>-4.6</u>	-	-	-	-	-	-	-	<u>0.0</u>	<u>0.0</u>	<u>0.0</u>	-
3-Apr-17	<u>1.4</u>	<u>7.7</u>	<u>-5.1</u>	-	-	-	-	-	-	-	<u>0.0</u>	<u>0.0</u>	<u>0.0</u>	-
4-Apr-17	<u>1.3</u>	<u>7.8</u>	<u>-5.4</u>	-	-	-	-	-	-	-	<u>3.8</u>	<u>2.4</u>	<u>1.4</u>	-
5-Apr-17	<u>3.1</u>	<u>7.5</u>	<u>-1.2</u>	-	-	-	-	-	-	-	<u>0.0</u>	<u>0.0</u>	<u>0.0</u>	-
6-Apr-17	<u>1.5</u>	<u>8.2</u>	<u>-5.2</u>	-	-	-	-	-	-	-	<u>0.0</u>	<u>0.0</u>	<u>0.0</u>	-
7-Apr-17	<u>3.7</u>	<u>8.7</u>	<u>-1.3</u>	-	-	-	-	-	-	-	<u>1.0</u>	<u>1.0</u>	<u>0.0</u>	-
8-Apr-17	<u>3.6</u>	<u>6.5</u>	<u>0.7</u>	-	-	-	-	-	-	-	<u>3.2</u>	<u>3.2</u>	<u>0.0</u>	-
9-Apr-17	<u>2.9</u>	<u>9.1</u>	<u>-3.4</u>	-	-	-	-	-	-	-	<u>0.0</u>	<u>0.0</u>	<u>0.0</u>	-
10-Apr-17	<u>2.1</u>	<u>9.3</u>	<u>-5.2</u>	-	-	-	-	-	-	-	<u>1.0</u>	<u>1.0</u>	<u>0.0</u>	-
11-Apr-17	<u>1.6</u>	<u>6.2</u>	<u>-3.0</u>	-	-	-	-	-	-	-	<u>1.0</u>	<u>0.8</u>	<u>0.2</u>	-
12-Apr-17	<u>3.3</u>	<u>7.1</u>	<u>-0.5</u>	-	-	-	-	-	-	-	<u>0.0</u>	<u>0.0</u>	<u>0.0</u>	-
13-Apr-17	<u>4.3</u>	<u>8.1</u>	<u>0.6</u>	-	-	-	-	-	-	-	<u>0.0</u>	<u>0.0</u>	<u>0.0</u>	-
14-Apr-17	<u>2.3</u>	<u>5.0</u>	<u>-0.5</u>	-	-	-	-	-	-	-	<u>3.6</u>	<u>3.6</u>	<u>0.0</u>	-
15-Apr-17	<u>3.7</u>	<u>7.3</u>	<u>0.2</u>	-	-	-	-	-	-	-	<u>0.0</u>	<u>0.0</u>	<u>0.0</u>	-
16-Apr-17	<u>2.8</u>	<u>9.9</u>	<u>-4.4</u>	-	-	-	-	-	-	-	<u>0.0</u>	<u>0.0</u>	<u>0.0</u>	-
17-Apr-17	<u>2.7</u>	<u>8.9</u>	<u>-3.5</u>	-	-	-	-	-	-	-	<u>0.0</u>	<u>0.0</u>	<u>0.0</u>	-
18-Apr-17	<u>1.5</u>	<u>4.1</u>	<u>-1.1</u>	-	-	-	-	-	-	-	<u>0.0</u>	<u>0.0</u>	<u>0.0</u>	-
19-Apr-17	<u>3.7</u>	<u>9.3</u>	<u>-1.8</u>	-	-	-	-	-	-	-	<u>1.2</u>	<u>1.2</u>	<u>0.0</u>	-
20-Apr-17	<u>3.5</u>	<u>10.1</u>	<u>-3.1</u>	-	-	-	-	-	-	-	<u>0.0</u>	<u>0.0</u>	<u>0.0</u>	-
21-Apr-17	<u>4.1</u>	<u>12.0</u>	<u>-3.8</u>	-	-	-	-	-	-	-	<u>0.0</u>	<u>0.0</u>	<u>0.0</u>	-
22-Apr-17	<u>3.7</u>	<u>10.4</u>	<u>-2.9</u>	-	-	-	-	-	-	-	<u>0.0</u>	<u>0.0</u>	<u>0.0</u>	-
23-Apr-17	<u>3.6</u>	<u>8.6</u>	<u>-1.3</u>	-	-	-	-	-	-	-	<u>0.0</u>	<u>0.0</u>	<u>0.0</u>	-
24-Apr-17	<u>5.2</u>	<u>10.4</u>	<u>0.0</u>	-	-	-	-	-	-	-	<u>0.0</u>	<u>0.0</u>	<u>0.0</u>	-
25-Apr-17	<u>4.2</u>	<u>11.5</u>	<u>-3.3</u>	-	-	-	-	-	-	-	<u>0.0</u>	<u>0.0</u>	<u>0.0</u>	-
26-Apr-17	<u>7.2</u>	<u>10.0</u>	<u>4.4</u>	-	-	-	-	-	-	-	<u>0.0</u>	<u>0.0</u>	<u>0.0</u>	-
27-Apr-17	<u>4.5</u>	<u>8.4</u>	<u>0.5</u>	-	-	-	-	-	-	-	<u>0.0</u>	<u>0.0</u>	<u>0.0</u>	-
28-Apr-17	<u>2.9</u>	<u>8.2</u>	<u>-2.5</u>	-	-	-	-	-	-	-	<u>0.0</u>	<u>0.0</u>	<u>0.0</u>	-
29-Apr-17	<u>0.3</u>	<u>4.4</u>	<u>-4.0</u>	-	-	-	-	-	-	-	<u>1.9</u>	<u>0.2</u>	<u>1.6</u>	-
30-Apr-17	<u>4.4</u>	<u>9.4</u>	<u>-0.7</u>	-	-	-	-	-	-	-	<u>1.6</u>	<u>1.6</u>	<u>0.0</u>	-
1-May-17	<u>3.8</u>	<u>7.8</u>	<u>-0.2</u>	-	-	-	-	-	-	-	<u>0.0</u>	<u>0.0</u>	<u>0.0</u>	-
2-May-17	<u>3.6</u>	<u>11.5</u>	<u>-4.3</u>	-	-	-	-	-	-	-	<u>1.0</u>	<u>1.0</u>	<u>0.0</u>	-
3-May-17	<u>7.1</u>	<u>12.2</u>	<u>2.0</u>	-	-	-	-	-	-	-	<u>2.1</u>	<u>2.1</u>	<u>0.0</u>	-
4-May-17	<u>1.7</u>	<u>4.1</u>	<u>-0.7</u>	-	-	-	-	-	-	-	<u>12.4</u>	<u>10.5</u>	<u>1.9</u>	-
5-May-17	<u>4.0</u>	<u>6.6</u>	<u>1.4</u>	-	-	-	-	-	-	-	<u>11.8</u>	<u>11.8</u>	<u>0.0</u>	-
6-May-17	<u>4.5</u>	<u>7.2</u>	<u>1.7</u>	-	-	-	-	-	-	-	<u>0.0</u>	<u>0.0</u>	<u>0.0</u>	-
7-May-17	<u>4.6</u>	<u>9.1</u>	<u>0.0</u>	-	-	-	-	-	-	-	<u>1.6</u>	<u>1.6</u>	<u>0.0</u>	-
8-May-17	<u>6.7</u>	<u>11.5</u>	<u>1.9</u>	-	-	-	-	-	-	-	<u>0.0</u>	<u>0.0</u>	<u>0.0</u>	-
9-May-17	<u>3.9</u>	<u>10.0</u>	<u>-2.2</u>	-	-	-	-	-	-	-	<u>1.4</u>	<u>1.4</u>	<u>0.0</u>	-
10-May-17	<u>6.2</u>	<u>13.0</u>	<u>-0.4</u>	-	-	-	-	-	-	-	<u>0.0</u>	<u>0.0</u>	<u>0.0</u>	-
11-May-17	<u>5.1</u>	<u>6.0</u>	<u>4.2</u>	-	-	-	-	-	-	-	<u>28.7</u>	<u>28.7</u>	<u>0.0</u>	-
12-May-17	<u>3.3</u>	<u>5.3</u>	<u>1.2</u>	-	-	-	-	-	-	-	<u>27.6</u>	<u>27.6</u>	<u>0.0</u>	-
13-May-17	<u>3.5</u>	<u>7.5</u>	<u>-0.6</u>	-	-	-	-	-	-	-	<u>2.7</u>	<u>2.7</u>	<u>0.0</u>	-
14-May-17	<u>5.7</u>	<u>9.4</u>	<u>2.0</u>	-	-	-	-	-	-	-	<u>2.5</u>	<u>2.5</u>	<u>0.0</u>	-
15-May-17	<u>4.7</u>	<u>7.4</u>	<u>1.9</u>	-	-	-	-	-	-	-	<u>7.8</u>	<u>7.8</u>	<u>0.0</u>	-

Notes:

Dashes (-) indicate that not enough data were available or were erroneous.

Underlined values indicate data that were gap-filled.

Appendix 2-A. Tenas Deposit Meteorological Station Daily Data, January 1, 2017 to December 9, 2019

Date	Mean Air Temperature (°C)	Maximum Air Temperature (°C)	Minimum Air Temperature (°C)	Mean Relative Humidity (%)	Mean Wind Speed (m/s)	Maximum Wind Speed (m/s)	Mean Solar Radiation (W/m ²)	1-Hour Maximum Solar Radiation (W/m ²)	Mean Barometric Pressure at Station Elevation (kPa)	Mean Snow Depth (cm)	Total Precipitation (mm)	Total Rainfall (mm)	Total Snow-Water-Equivalent (mm)	Total Evaporation (mm)
16-May-17	7.1	12.4	1.9	-	-	-	-	-	-	-	0.0	0.0	0.0	-
17-May-17	8.4	12.6	4.2	-	-	-	-	-	-	-	0.0	0.0	0.0	-
18-May-17	7.4	13.4	1.4	-	-	-	-	-	-	-	0.0	0.0	0.0	-
19-May-17	7.3	15.0	-0.4	-	-	-	-	-	-	-	0.0	0.0	0.0	-
20-May-17	9.0	17.1	0.9	-	-	-	-	-	-	-	0.0	0.0	0.0	-
21-May-17	11.7	16.8	6.6	-	-	-	-	-	-	-	0.0	0.0	0.0	-
22-May-17	10.0	14.1	5.9	-	-	-	-	-	-	-	0.0	0.0	0.0	-
23-May-17	7.8	11.0	4.5	-	-	-	-	-	-	-	2.3	2.3	0.0	-
24-May-17	8.7	13.7	3.8	-	-	-	-	-	-	-	0.0	0.0	0.0	-
25-May-17	9.9	17.2	2.6	-	-	-	-	-	-	-	0.0	0.0	0.0	-
26-May-17	12.1	18.8	5.3	-	-	-	-	-	-	-	0.0	0.0	0.0	-
27-May-17	11.4	19.4	3.3	-	-	-	-	-	-	-	0.0	0.0	0.0	-
28-May-17	12.9	22.5	3.3	-	-	-	-	-	-	-	0.0	0.0	0.0	-
29-May-17	13.7	21.4	5.9	-	-	-	-	-	-	-	0.0	0.0	0.0	-
30-May-17	12.1	18.9	5.2	-	-	-	-	-	-	-	6.9	6.9	0.0	-
31-May-17	10.7	14.9	6.4	-	-	-	-	-	-	-	1.0	1.0	0.0	-
1-Jun-17	11.0	15.1	6.9	-	-	-	-	-	-	-	1.2	1.2	0.0	-
2-Jun-17	9.3	14.1	4.4	-	-	-	-	-	-	-	1.6	1.6	0.0	-
3-Jun-17	7.1	11.1	3.1	-	-	-	-	-	-	-	1.6	1.6	0.0	-
4-Jun-17	5.3	13.1	-2.4	-	-	-	-	-	-	-	0.0	0.0	0.0	-
5-Jun-17	8.3	11.9	4.8	-	-	-	-	-	-	-	1.2	1.2	0.0	-
6-Jun-17	10.4	17.6	3.1	-	-	-	-	-	-	-	0.0	0.0	0.0	-
7-Jun-17	14.3	22.7	6.0	-	-	-	-	-	-	-	0.0	0.0	0.0	-
8-Jun-17	14.2	20.4	8.0	-	-	-	-	-	-	-	26.1	26.1	0.0	-
9-Jun-17	5.6	8.1	3.1	-	5.6	-	-	-	-	-	23.9	23.9	0.0	-
10-Jun-17	7.5	11.1	3.7	-	-	-	-	-	-	-	0.0	0.0	0.0	-
11-Jun-17	10.8	15.2	6.4	-	-	-	-	-	-	-	0.0	0.0	0.0	-
12-Jun-17	8.1	12.9	3.2	-	-	-	-	-	-	-	0.0	0.0	0.0	-
13-Jun-17	7.0	12.6	1.3	-	-	-	-	-	-	-	0.0	0.0	0.0	-
14-Jun-17	7.5	13.0	1.9	-	-	-	-	-	-	-	0.0	0.0	0.0	-
15-Jun-17	7.6	10.0	5.0	-	-	-	-	-	-	-	4.5	4.5	0.0	-
16-Jun-17	8.7	12.3	5.2	-	-	-	-	-	-	-	1.0	1.0	0.0	-
17-Jun-17	7.0	14.0	-0.1	-	-	-	-	-	-	-	0.0	0.0	0.0	-
18-Jun-17	8.1	15.7	0.4	-	-	-	-	-	-	-	2.5	2.5	0.0	-
19-Jun-17	10.8	13.8	7.7	-	-	-	-	-	-	-	4.1	4.1	0.0	-
20-Jun-17	7.5	11.1	3.8	-	-	-	-	-	-	-	1.0	1.0	0.0	-
21-Jun-17	7.6	11.7	3.6	-	-	-	-	-	-	-	0.0	0.0	0.0	-
22-Jun-17	7.7	15.1	0.3	-	-	-	-	-	-	-	0.0	0.0	0.0	-
23-Jun-17	10.0	17.8	2.1	-	-	-	-	-	-	-	0.0	0.0	0.0	-
24-Jun-17	9.9	17.1	2.7	-	-	-	-	-	-	-	0.0	0.0	0.0	-
25-Jun-17	13.6	20.2	6.9	-	-	-	-	-	-	-	0.0	0.0	0.0	-
26-Jun-17	8.3	12.8	3.7	-	-	-	-	-	-	-	3.4	3.4	0.0	-
27-Jun-17	10.0	14.3	5.8	-	-	-	-	-	-	-	0.0	0.0	0.0	-
28-Jun-17	12.1	20.0	4.2	-	-	-	-	-	-	-	0.0	0.0	0.0	-
29-Jun-17	15.3	20.5	10.1	-	-	-	-	-	-	-	0.0	0.0	0.0	-

Notes:

Dashes (-) indicate that not enough data were available or were erroneous.

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Appendix 2-A. Tensas Deposit Meteorological Station Daily Data, January 1, 2017 to December 9, 2019

Date	Mean Air Temperature (°C)	Maximum Air Temperature (°C)	Minimum Air Temperature (°C)	Mean Relative Humidity (%)	Mean Wind Speed (m/s)	Maximum Wind Speed (m/s)	Mean Solar Radiation (W/m²)	1-Hour Maximum Solar Radiation (W/m²)	Mean Barometric Pressure at Station Elevation (kPa)	Mean Snow Depth (cm)	Total Precipitation (mm)	Total Rainfall (mm)	Total Snow-Water-Equivalent (mm)	Total Evaporation (mm)
30-Jun-17	<u>12.7</u>	<u>19.9</u>	<u>5.5</u>	-	-	-	-	-	-	-	0.0	0.0	0.0	-
1-Jul-17	<u>10.8</u>	<u>15.8</u>	<u>5.7</u>	-	-	-	-	-	-	-	0.0	0.0	0.0	-
2-Jul-17	<u>12.0</u>	<u>16.2</u>	<u>7.6</u>	-	-	-	-	-	-	-	2.5	2.5	0.0	-
3-Jul-17	<u>9.3</u>	<u>13.5</u>	<u>5.2</u>	-	-	-	-	-	-	-	0.0	0.0	0.0	-
4-Jul-17	<u>8.1</u>	<u>13.4</u>	<u>2.6</u>	-	-	-	-	-	-	-	0.0	0.0	0.0	-
5-Jul-17	<u>10.2</u>	<u>19.4</u>	<u>1.0</u>	-	-	-	-	-	-	-	0.0	0.0	0.0	-
6-Jul-17	<u>14.2</u>	<u>23.9</u>	<u>4.4</u>	-	-	-	-	-	-	-	0.0	0.0	0.0	-
7-Jul-17	<u>14.3</u>	<u>21.6</u>	<u>6.9</u>	-	-	-	-	-	-	-	3.2	3.2	0.0	-
8-Jul-17	<u>12.2</u>	<u>19.1</u>	<u>5.3</u>	-	-	-	-	-	-	-	1.4	1.4	0.0	-
9-Jul-17	<u>10.1</u>	<u>13.4</u>	<u>6.8</u>	-	-	-	-	-	-	-	2.5	2.5	0.0	-
10-Jul-17	<u>8.2</u>	<u>14.6</u>	<u>1.7</u>	-	-	-	-	-	-	-	0.0	0.0	0.0	-
11-Jul-17	<u>9.2</u>	<u>13.9</u>	<u>4.3</u>	-	-	-	-	-	-	-	2.1	2.1	0.0	-
12-Jul-17	<u>10.5</u>	<u>14.1</u>	<u>6.9</u>	-	-	-	-	-	-	-	5.4	5.4	0.0	-
13-Jul-17	<u>9.7</u>	<u>13.2</u>	<u>6.0</u>	-	-	-	-	-	-	-	3.4	3.4	0.0	-
14-Jul-17	<u>10.5</u>	<u>15.2</u>	<u>5.9</u>	-	-	-	-	-	-	-	0.0	0.0	0.0	-
15-Jul-17	<u>9.3</u>	<u>13.7</u>	<u>5.0</u>	-	-	-	-	-	-	-	3.8	3.8	0.0	-
16-Jul-17	<u>9.6</u>	<u>13.9</u>	<u>5.2</u>	-	-	-	-	-	-	-	0.0	0.0	0.0	-
17-Jul-17	<u>10.5</u>	<u>14.2</u>	<u>6.8</u>	-	-	-	-	-	-	-	0.0	0.0	0.0	-
18-Jul-17	<u>11.1</u>	<u>19.1</u>	<u>3.1</u>	-	-	-	-	-	-	-	0.0	0.0	0.0	-
19-Jul-17	<u>12.3</u>	<u>20.5</u>	<u>4.2</u>	-	-	-	-	-	-	-	0.0	0.0	0.0	-
20-Jul-17	<u>11.6</u>	<u>18.8</u>	<u>4.5</u>	-	-	-	-	-	-	-	0.0	0.0	0.0	-
21-Jul-17	<u>9.0</u>	<u>14.7</u>	<u>3.3</u>	-	-	-	-	-	-	-	5.2	5.2	0.0	-
22-Jul-17	<u>11.5</u>	<u>15.2</u>	<u>7.8</u>	-	-	-	-	-	-	-	4.7	4.7	0.0	-
23-Jul-17	<u>9.5</u>	<u>12.7</u>	<u>6.2</u>	-	-	-	-	-	-	-	0.0	0.0	0.0	-
24-Jul-17	<u>10.5</u>	<u>18.9</u>	<u>2.0</u>	-	-	-	-	-	-	-	0.0	0.0	0.0	-
25-Jul-17	<u>13.0</u>	<u>20.8</u>	<u>5.1</u>	-	-	-	-	-	-	-	3.0	3.0	0.0	-
26-Jul-17	<u>13.3</u>	<u>16.5</u>	<u>10.1</u>	-	-	-	-	-	-	-	0.0	0.0	0.0	-
27-Jul-17	<u>10.6</u>	<u>15.0</u>	<u>6.2</u>	-	-	-	-	-	-	-	3.4	3.4	0.0	-
28-Jul-17	<u>10.4</u>	<u>15.3</u>	<u>5.3</u>	-	-	-	-	-	-	-	2.5	2.5	0.0	-
29-Jul-17	<u>12.9</u>	<u>18.8</u>	<u>6.9</u>	-	-	-	-	-	-	-	1.6	1.6	0.0	-
30-Jul-17	<u>8.7</u>	<u>14.2</u>	<u>3.1</u>	-	-	-	-	-	-	-	0.0	0.0	0.0	-
31-Jul-17	<u>10.4</u>	<u>17.0</u>	<u>3.6</u>	-	-	-	-	-	-	-	0.0	0.0	0.0	-
1-Aug-17	<u>12.0</u>	<u>21.4</u>	<u>2.5</u>	-	-	-	-	-	-	-	0.0	0.0	0.0	-
2-Aug-17	<u>14.1</u>	<u>23.3</u>	<u>4.8</u>	-	-	-	-	-	-	-	0.0	0.0	0.0	-
3-Aug-17	<u>14.3</u>	<u>22.4</u>	<u>6.0</u>	-	-	-	-	-	-	-	0.0	0.0	0.0	-
4-Aug-17	<u>15.3</u>	<u>24.3</u>	<u>6.3</u>	-	-	-	-	-	-	-	0.0	0.0	0.0	-
5-Aug-17	<u>16.2</u>	<u>25.2</u>	<u>7.1</u>	-	-	-	-	-	-	-	0.0	0.0	0.0	-
6-Aug-17	<u>16.5</u>	<u>25.3</u>	<u>7.6</u>	-	-	-	-	-	-	-	0.0	0.0	0.0	-
7-Aug-17	<u>16.1</u>	<u>23.8</u>	<u>8.4</u>	-	-	-	-	-	-	-	0.0	0.0	0.0	-
8-Aug-17	<u>16.4</u>	<u>24.6</u>	<u>8.1</u>	-	-	-	-	-	-	-	0.0	0.0	0.0	-
9-Aug-17	<u>15.8</u>	<u>22.9</u>	<u>8.6</u>	-	-	-	-	-	-	-	0.0	0.0	0.0	-
10-Aug-17	<u>17.5</u>	<u>25.4</u>	<u>9.5</u>	-	-	-	-	-	-	-	0.0	0.0	0.0	-
11-Aug-17	<u>16.2</u>	<u>23.9</u>	<u>8.5</u>	-	-	-	-	-	-	-	0.0	0.0	0.0	-
12-Aug-17	<u>13.1</u>	<u>19.9</u>	<u>6.2</u>	-	-	-	-	-	-	-	0.0	0.0	0.0	-
13-Aug-17	<u>11.8</u>	<u>16.6</u>	<u>7.0</u>	-	-	-	-	-	-	-	0.0	0.0	0.0	-

Notes:

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Date	Mean Air Temperature (°C)	Maximum Air Temperature (°C)	Minimum Air Temperature (°C)	Mean Relative Humidity (%)	Mean Wind Speed (m/s)	Maximum Wind Speed (m/s)	Mean Solar Radiation (W/m ²)	1-Hour Maximum Solar Radiation (W/m ²)	Mean Barometric Pressure at Station Elevation (kPa)	Mean Snow Depth (cm)	Total Precipitation (mm)	Total Rainfall (mm)	Total Snow-Water-Equivalent (mm)	Total Evaporation (mm)
14-Aug-17	<u>10.2</u>	<u>15.2</u>	<u>5.2</u>	-	-	-	-	-	-	-	0.0	0.0	0.0	-
15-Aug-17	<u>9.2</u>	<u>13.7</u>	<u>4.6</u>	-	-	-	-	-	-	-	0.0	0.0	0.0	-
16-Aug-17	<u>12.5</u>	<u>17.2</u>	<u>7.7</u>	-	-	-	-	-	-	-	0.0	0.0	0.0	-
17-Aug-17	<u>9.8</u>	<u>14.2</u>	<u>5.3</u>	-	-	-	-	-	-	-	3.6	3.6	0.0	-
18-Aug-17	<u>9.7</u>	<u>13.0</u>	<u>6.4</u>	-	-	-	-	-	-	-	1.2	1.2	0.0	-
19-Aug-17	<u>7.6</u>	<u>11.2</u>	<u>4.0</u>	-	-	-	-	-	-	-	1.6	1.6	0.0	-
20-Aug-17	<u>8.2</u>	<u>10.5</u>	<u>5.9</u>	-	-	-	-	-	-	-	5.8	5.8	0.0	-
21-Aug-17	<u>12.7</u>	<u>16.6</u>	<u>8.6</u>	-	-	-	-	-	-	-	3.6	3.6	0.0	-
22-Aug-17	<u>11.2</u>	<u>17.7</u>	<u>4.7</u>	-	-	-	-	-	-	-	1.2	1.2	0.0	-
23-Aug-17	<u>10.4</u>	<u>15.2</u>	<u>5.6</u>	-	-	-	-	-	-	-	0.0	0.0	0.0	-
24-Aug-17	<u>8.3</u>	<u>13.8</u>	<u>2.8</u>	-	-	-	-	-	-	-	1.0	1.0	0.0	-
25-Aug-17	<u>8.7</u>	<u>12.7</u>	<u>4.8</u>	-	-	-	-	-	-	-	0.0	0.0	0.0	-
26-Aug-17	<u>12.8</u>	<u>17.2</u>	<u>8.4</u>	-	-	-	-	-	-	-	2.7	2.7	0.0	-
27-Aug-17	<u>8.7</u>	<u>10.6</u>	<u>6.6</u>	-	-	-	-	-	-	-	4.3	4.3	0.0	-
28-Aug-17	<u>11.9</u>	<u>16.4</u>	<u>7.4</u>	-	-	-	-	-	-	-	0.0	0.0	0.0	-
29-Aug-17	<u>12.1</u>	<u>19.5</u>	<u>4.6</u>	-	-	-	-	-	-	-	0.0	0.0	0.0	-
30-Aug-17	<u>13.2</u>	<u>18.1</u>	<u>8.2</u>	-	-	-	-	-	-	-	0.0	0.0	0.0	-
31-Aug-17	<u>10.0</u>	<u>14.0</u>	<u>6.0</u>	-	-	-	-	-	-	-	1.0	1.0	0.0	-
1-Sep-17	<u>10.4</u>	<u>15.1</u>	<u>5.5</u>	-	-	-	-	-	-	-	5.2	5.2	0.0	-
2-Sep-17	<u>10.4</u>	<u>14.3</u>	<u>6.5</u>	-	-	-	-	-	-	-	1.6	1.6	0.0	-
3-Sep-17	<u>10.4</u>	<u>16.9</u>	<u>3.9</u>	-	-	-	-	-	-	-	0.0	0.0	0.0	-
4-Sep-17	<u>12.3</u>	<u>21.6</u>	<u>3.1</u>	-	-	-	-	-	-	-	0.0	0.0	0.0	-
5-Sep-17	<u>14.2</u>	<u>23.2</u>	<u>5.2</u>	-	-	-	-	-	-	-	0.0	0.0	0.0	-
6-Sep-17	<u>13.7</u>	<u>21.7</u>	<u>5.7</u>	-	-	-	-	-	-	-	1.0	1.0	0.0	-
7-Sep-17	<u>13.1</u>	<u>18.2</u>	<u>8.0</u>	-	-	-	-	-	-	-	0.0	0.0	0.0	-
8-Sep-17	<u>8.4</u>	<u>15.6</u>	<u>1.2</u>	-	-	-	-	-	-	-	0.0	0.0	0.0	-
9-Sep-17	<u>9.8</u>	<u>14.6</u>	<u>5.1</u>	-	-	-	-	-	-	-	1.4	1.4	0.0	-
10-Sep-17	<u>6.8</u>	<u>8.5</u>	<u>5.0</u>	-	-	-	-	-	-	-	52.5	52.5	0.0	-
11-Sep-17	<u>8.7</u>	<u>11.6</u>	<u>5.6</u>	-	-	-	-	-	-	-	2.5	2.5	0.0	-
12-Sep-17	<u>6.5</u>	<u>11.1</u>	<u>1.9</u>	-	-	-	-	-	-	-	0.0	0.0	0.0	-
13-Sep-17	<u>5.3</u>	<u>12.2</u>	<u>-1.6</u>	-	-	-	-	-	-	-	0.0	0.0	0.0	-
14-Sep-17	<u>6.3</u>	<u>14.6</u>	<u>-2.1</u>	-	-	-	-	-	-	-	0.0	0.0	0.0	-
15-Sep-17	<u>7.0</u>	<u>14.7</u>	<u>-0.6</u>	-	-	-	-	-	-	-	0.0	0.0	0.0	-
16-Sep-17	<u>7.0</u>	<u>13.8</u>	<u>0.1</u>	-	-	-	-	-	-	-	0.0	0.0	0.0	-
17-Sep-17	<u>5.9</u>	<u>9.1</u>	<u>2.8</u>	-	-	-	-	-	-	-	8.5	8.5	0.0	-
18-Sep-17	<u>4.6</u>	<u>8.8</u>	<u>0.3</u>	-	-	-	-	-	-	-	0.0	0.0	0.0	-
19-Sep-17	<u>5.5</u>	<u>9.6</u>	<u>1.4</u>	-	-	-	-	-	-	-	2.7	2.7	0.0	-
20-Sep-17	<u>8.3</u>	<u>12.4</u>	<u>4.2</u>	-	-	-	-	-	-	-	0.0	0.0	0.0	-
21-Sep-17	<u>7.6</u>	<u>12.4</u>	<u>2.9</u>	-	-	-	-	-	-	-	0.0	0.0	0.0	-
22-Sep-17	<u>4.3</u>	<u>6.5</u>	<u>2.1</u>	-	-	-	-	-	-	-	2.7	2.7	0.0	-
23-Sep-17	<u>6.8</u>	<u>8.5</u>	<u>5.1</u>	-	-	-	-	-	-	-	1.2	1.2	0.0	-
24-Sep-17	<u>8.5</u>	<u>10.3</u>	<u>6.6</u>	-	-	-	-	-	-	-	1.2	1.2	0.0	-
25-Sep-17	<u>9.9</u>	<u>13.5</u>	<u>6.4</u>	-	-	-	-	-	-	-	3.6	3.6	0.0	-
26-Sep-17	<u>10.9</u>	<u>14.1</u>	<u>7.6</u>	-	-	-	-	-	-	-	0.0	0.0	0.0	-
27-Sep-17	<u>11.5</u>	<u>16.7</u>	<u>6.2</u>	-	-	-	-	-	-	-	0.0	0.0	0.0	-

Notes:

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Appendix 2-A. Tenas Deposit Meteorological Station Daily Data, January 1, 2017 to December 9, 2019

Date	Mean Air Temperature (°C)	Maximum Air Temperature (°C)	Minimum Air Temperature (°C)	Mean Relative Humidity (%)	Mean Wind Speed (m/s)	Maximum Wind Speed (m/s)	Mean Solar Radiation (W/m ²)	1-Hour Maximum Solar Radiation (W/m ²)	Mean Barometric Pressure at Station Elevation (kPa)	Mean Snow Depth (cm)	Total Precipitation (mm)	Total Rainfall (mm)	Total Snow-Water-Equivalent (mm)	Total Evaporation (mm)
28-Sep-17	8.8	<u>11.1</u>	<u>6.5</u>	-	-	-	-	-	-	-	<u>9.6</u>	<u>9.6</u>	<u>0.0</u>	-
29-Sep-17	<u>6.4</u>	<u>9.7</u>	<u>3.0</u>	-	-	-	-	-	-	-	<u>8.0</u>	<u>8.0</u>	<u>0.0</u>	-
30-Sep-17	4.3	9.0	1.1	75.0	2.2	6.8	76.0	293.6	89.9	0.0	0.0	0.0	0.0	-
1-Oct-17	4.0	9.2	-0.4	72.3	1.1	4.2	109.6	460.8	90.7	0.0	0.0	0.0	0.0	-
2-Oct-17	2.5	9.0	-2.9	68.5	1.2	5.6	150.3	549.9	91.3	0.0	0.0	0.0	0.0	-
3-Oct-17	2.3	9.5	-3.5	68.5	0.7	2.8	121.4	488.7	91.0	0.0	0.0	0.0	0.0	-
4-Oct-17	5.5	13.7	-0.1	67.1	0.6	2.3	145.5	537.3	90.6	0.0	0.0	0.0	0.0	-
5-Oct-17	6.5	14.2	-0.5	62.7	1.2	8.2	136.8	536.6	90.1	0.0	0.5	0.5	0.0	-
6-Oct-17	4.4	7.5	1.0	79.0	2.1	11.0	102.4	505.3	88.8	0.0	2.8	2.8	0.0	-
7-Oct-17	2.6	7.5	0.0	84.6	1.3	5.4	63.4	253.4	89.4	0.0	0.2	0.2	0.0	-
8-Oct-17	2.5	7.5	-3.0	81.6	1.4	8.9	90.1	370.6	90.3	0.0	0.1	0.1	0.0	-
9-Oct-17	1.9	5.5	-2.2	89.4	1.4	7.5	51.9	225.8	89.9	0.0	1.9	1.8	0.1	-
10-Oct-17	0.1	5.0	-2.8	85.3	0.9	4.0	98.5	449.5	89.9	0.0	0.1	0.0	0.1	-
11-Oct-17	-0.4	4.6	-4.6	82.4	0.8	6.2	95.8	411.0	89.9	0.1	0.9	0.0	0.9	-
12-Oct-17	-0.6	4.0	-3.9	83.8	1.1	6.6	85.5	612.5	89.9	0.2	0.2	0.0	0.2	-
13-Oct-17	-0.9	4.2	-5.9	71.1	1.0	5.2	93.6	401.8	90.4	0.0	0.5	0.0	0.5	-
14-Oct-17	3.3	8.8	-1.1	88.8	1.2	7.1	70.4	371.4	90.0	0.0	1.0	1.0	0.0	-
15-Oct-17	4.4	6.9	0.6	85.2	3.0	12.2	53.3	314.6	89.4	0.0	5.9	5.9	0.0	-
16-Oct-17	0.8	3.3	-0.2	94.4	-	6.5	14.6	84.2	89.0	1.6	16.3	6.4	9.9	-
17-Oct-17	0.2	3.1	-1.5	91.6	-	5.4	59.2	470.2	89.0	8.6	9.0	1.0	8.0	-
18-Oct-17	-0.4	2.0	-1.5	96.4	1.2	6.9	34.2	204.9	87.9	7.6	2.5	0.0	2.5	-
19-Oct-17	1.4	5.5	-1.5	84.9	1.3	8.9	86.0	495.0	87.5	7.3	0.0	0.0	0.0	-
20-Oct-17	-0.8	3.6	-4.4	89.5	0.9	5.6	44.6	245.9	88.4	7.2	1.3	0.0	1.3	-
21-Oct-17	-2.5	-1.0	-4.4	95.5	0.8	3.1	-	-	88.3	11.8	8.0	0.0	8.0	-
22-Oct-17	0.4	3.4	-2.9	94.3	0.9	6.0	-	-	89.0	15.9	0.9	0.2	0.7	-
23-Oct-17	2.3	8.6	-0.7	95.8	1.6	11.0	-	-	90.2	13.5	21.4	21.4	0.0	-
24-Oct-17	2.7	8.7	-0.5	96.4	-	8.8	-	-	90.0	8.3	72.8	72.8	0.0	-
25-Oct-17	1.1	4.7	-2.3	93.6	1.5	13.3	53.2	278.5	90.3	9.4	0.6	0.3	0.2	-
26-Oct-17	-0.5	3.4	-3.7	95.2	0.7	2.6	69.1	486.5	91.0	9.1	0.3	0.0	0.3	-
27-Oct-17	4.6	10.5	-1.2	87.1	0.6	2.5	81.3	402.6	90.7	8.1	0.0	0.0	0.0	-
28-Oct-17	4.6	8.8	-1.6	85.1	1.5	5.4	71.0	370.4	90.5	6.4	0.0	0.0	0.0	-
29-Oct-17	0.4	5.9	-2.9	68.0	0.8	3.2	72.6	370.5	91.3	5.6	0.0	0.0	0.0	-
30-Oct-17	0.8	9.3	-4.0	71.0	1.0	6.2	62.6	333.2	90.9	5.6	0.0	0.0	0.0	-
31-Oct-17	6.4	10.1	1.8	68.9	2.6	10.3	36.4	163.1	89.6	1.7	0.0	0.0	0.0	-
1-Nov-17	-3.1	2.5	-8.9	84.1	2.8	10.6	13.1	64.6	89.9	3.1	5.5	0.0	5.5	-
2-Nov-17	-9.6	-6.8	-12.0	53.6	3.5	11.5	48.3	278.2	90.9	5.3	0.0	0.0	0.0	-
3-Nov-17	-10.3	-7.2	-15.3	63.6	0.7	4.1	48.7	217.1	90.5	4.6	0.8	0.0	0.8	-
4-Nov-17	-9.0	-7.1	-11.2	89.1	0.8	3.6	12.6	50.8	90.1	6.7	0.9	0.0	0.9	-
5-Nov-17	-9.8	-5.0	-13.4	82.5	0.9	3.1	28.0	151.6	90.5	5.9	0.0	0.0	0.0	-
6-Nov-17	-10.6	-7.9	-14.4	87.1	0.6	2.0	-	-	90.4	6.2	2.8	0.0	2.8	-
7-Nov-17	-6.4	-4.1	-8.3	91.1	1.1	6.6	-	-	90.4	15.2	8.7	0.0	8.7	-
8-Nov-17	-6.1	-4.6	-8.2	90.6	1.6	9.2	-	-	90.2	14.8	0.2	0.0	0.2	-
9-Nov-17	-7.2	-4.6	-10.1	92.4	0.6	2.4	-	-	89.4	13.8	0.0	0.0	0.0	-
10-Nov-17	-7.8	-4.0	-11.0	92.7	0.5	2.2	-	-	89.5	12.8	0.0	0.0	0.0	-
11-Nov-17	-3.8	-1.5	-7.6	96.8	0.7	3.1	-	-	89.4	15.1	5.4	0.0	5.4	-

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Appendix 2-A. Tenas Deposit Meteorological Station Daily Data, January 1, 2017 to December 9, 2019

Date	Mean Air Temperature (°C)	Maximum Air Temperature (°C)	Minimum Air Temperature (°C)	Mean Relative Humidity (%)	Mean Wind Speed (m/s)	Maximum Wind Speed (m/s)	Mean Solar Radiation (W/m ²)	1-Hour Maximum Solar Radiation (W/m ²)	Mean Barometric Pressure at Station Elevation (kPa)	Mean Snow Depth (cm)	Total Precipitation (mm)	Total Rainfall (mm)	Total Snow-Water-Equivalent (mm)	Total Evaporation (mm)
12-Nov-17	-2.4	0.5	-6.8	96.2	0.9	3.8	-	-	89.3	19.6	0.7	0.0	0.7	-
13-Nov-17	-3.9	-3.1	-6.1	96.3	1.4	6.4	-	-	88.6	21.1	6.4	0.0	6.4	-
14-Nov-17	-5.0	-4.0	-6.1	96.3	1.2	6.1	-	-	89.1	26.6	5.2	0.0	5.2	-
15-Nov-17	-8.2	-6.1	-10.6	90.3	2.1	7.0	-	-	88.8	32.8	5.3	0.0	5.3	-
16-Nov-17	-11.8	-9.4	-15.9	88.6	0.6	2.8	-	-	88.8	30.9	0.0	0.0	0.0	-
17-Nov-17	-9.6	-4.8	-15.0	89.7	0.5	2.4	-	-	89.3	28.9	0.4	0.0	0.4	-
18-Nov-17	-2.6	-1.1	-4.8	97.2	-	3.0	-	-	89.0	39.8	33.1	0.0	33.1	-
19-Nov-17	-3.4	-0.9	-9.2	93.8	-	4.5	-	-	88.2	46.8	2.1	0.0	2.1	-
20-Nov-17	-8.0	-5.1	-10.5	91.0	0.7	4.0	-	-	89.3	43.8	0.0	0.0	0.0	-
21-Nov-17	-7.2	-5.4	-10.6	93.0	0.7	4.1	-	-	89.7	42.7	10.1	0.0	10.1	-
22-Nov-17	-3.5	1.3	-6.4	97.1	-	2.4	-	-	88.7	45.1	16.8	0.0	16.8	-
23-Nov-17	-0.4	1.9	-3.3	95.5	-	5.8	-	-	88.2	42.8	3.8	0.0	3.8	-
24-Nov-17	-2.7	0.3	-5.3	93.3	1.4	7.8	-	-	88.5	43.2	4.3	0.0	4.3	-
25-Nov-17	-3.6	-2.3	-5.2	96.0	0.4	2.6	-	-	89.1	46.5	5.7	0.0	5.7	-
26-Nov-17	-1.9	1.2	-3.5	95.0	1.3	7.6	-	-	87.6	56.2	10.5	0.0	10.5	-
27-Nov-17	-3.5	-1.6	-5.5	91.9	1.2	9.9	-	-	88.8	57.8	2.9	0.0	2.9	-
28-Nov-17	-2.2	-0.5	-3.8	97.1	1.0	5.3	-	-	88.4	60.4	1.2	0.0	1.2	-
29-Nov-17	-1.4	1.7	-4.1	86.2	1.7	10.5	-	-	89.4	-	0.0	0.0	0.0	-
30-Nov-17	-3.3	-0.8	-5.9	91.4	0.9	8.1	-	-	89.3	-	1.3	0.0	1.3	-
1-Dec-17	-3.6	-1.3	-6.9	85.8	1.3	5.6	-	-	89.0	-	0.4	0.0	0.4	-
2-Dec-17	-7.5	-5.1	-10.8	87.8	1.0	3.7	-	-	89.7	-	0.0	0.0	0.0	-
3-Dec-17	-5.1	-1.7	-10.4	82.4	1.2	6.3	-	-	90.3	-	0.0	0.0	0.0	-
4-Dec-17	-0.7	1.9	-3.4	86.6	1.4	6.9	-	-	90.9	-	0.1	0.0	0.1	-
5-Dec-17	-1.3	1.8	-3.2	96.3	0.6	2.3	-	-	91.8	-	0.0	0.0	0.0	-
6-Dec-17	-4.2	-2.3	-6.4	97.1	0.4	2.1	-	-	92.1	-	0.0	0.0	0.0	-
7-Dec-17	-9.4	-5.7	-11.5	93.4	0.4	1.8	-	-	91.7	-	0.0	0.0	0.0	-
8-Dec-17	-10.0	-7.4	-12.2	91.7	0.3	1.4	-	-	91.2	-	0.0	0.0	0.0	-
9-Dec-17	-6.4	-2.2	-10.6	94.3	0.3	2.7	-	-	90.7	-	0.1	0.0	0.1	-
10-Dec-17	-1.5	0.2	-4.5	98.9	0.7	2.6	-	-	91.1	-	0.1	0.0	0.1	-
11-Dec-17	-1.7	0.5	-3.6	98.8	0.6	5.3	26.7	106.7	90.8	45.0	0.0	0.0	0.0	-
12-Dec-17	-0.3	3.4	-2.7	95.2	0.8	8.3	17.0	103.3	91.0	45.2	0.5	0.0	0.5	-
13-Dec-17	-1.2	0.7	-3.1	98.9	0.8	4.7	16.4	81.3	91.4	45.2	0.0	0.0	0.0	-
14-Dec-17	-0.4	2.2	-2.4	96.7	1.2	11.2	9.9	52.9	90.5	44.7	1.3	0.0	1.3	-
15-Dec-17	-2.4	0.0	-5.5	81.0	1.8	6.3	15.3	113.3	90.2	44.2	0.0	0.0	0.0	-
16-Dec-17	-2.3	1.5	-5.3	87.3	1.4	4.8	16.1	103.1	89.5	44.0	1.1	0.0	1.1	-
17-Dec-17	-2.3	0.8	-5.6	77.5	1.9	8.4	18.6	115.0	89.3	45.2	0.3	0.0	0.3	-
18-Dec-17	-5.0	-1.8	-6.7	80.6	1.0	4.7	12.8	93.2	89.8	44.8	0.1	0.0	0.1	-
19-Dec-17	-8.6	-5.5	-13.3	92.5	0.8	3.3	12.6	78.0	90.2	44.6	0.2	0.0	0.2	-
20-Dec-17	-11.0	-2.6	-15.4	87.5	0.7	6.0	12.1	73.7	90.6	44.3	0.0	0.0	0.0	-
21-Dec-17	-7.3	-2.6	-12.9	90.3	1.4	4.3	-	-	90.9	46.8	2.1	0.0	2.1	-
22-Dec-17	-14.7	-10.9	-17.3	87.7	0.7	3.4	-	-	91.4	47.4	0.0	0.0	0.0	-
23-Dec-17	-15.5	-12.1	-17.4	86.4	0.4	1.7	-	-	91.5	46.8	0.0	0.0	0.0	-
24-Dec-17	-18.2	-15.7	-20.0	85.1	0.9	3.1	-	-	91.0	46.7	0.0	0.0	0.0	-
25-Dec-17	-19.1	-16.1	-21.2	84.0	0.5	2.3	-	-	91.0	47.3	0.0	0.0	0.0	-
26-Dec-17	-18.4	-16.0	-22.6	85.4	0.4	2.3	-	-	90.6	48.5	1.3	0.0	1.3	-

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Date	Mean Air Temperature (°C)	Maximum Air Temperature (°C)	Minimum Air Temperature (°C)	Mean Relative Humidity (%)	Mean Wind Speed (m/s)	Maximum Wind Speed (m/s)	Mean Solar Radiation (W/m ²)	1-Hour Maximum Solar Radiation (W/m ²)	Mean Barometric Pressure at Station Elevation (kPa)	Mean Snow Depth (cm)	Total Precipitation (mm)	Total Rainfall (mm)	Total Snow-Water-Equivalent (mm)	Total Evaporation (mm)
27-Dec-17	-19.0	-16.1	-23.8	83.6	0.8	3.2	-	-	90.9	50.9	0.6	0.0	0.6	-
28-Dec-17	-20.5	-18.3	-24.9	80.8	1.8	8.2	-	-	90.6	50.8	0.9	0.0	0.9	-
29-Dec-17	-19.7	-18.8	-20.2	78.1	2.0	8.0	-	-	90.5	50.3	0.0	0.0	0.0	-
30-Dec-17	-20.9	-18.5	-23.4	79.3	0.6	2.1	-	-	90.5	50.1	0.0	0.0	0.0	-
31-Dec-17	-18.9	-17.1	-21.3	85.0	0.4	2.0	-	-	91.0	51.4	0.4	0.0	0.4	-
1-Jan-18	-14.9	-9.4	-18.9	87.5	0.6	2.2	-	-	91.0	51.9	0.8	0.0	0.8	-
2-Jan-18	-9.5	-7.2	-13.2	91.5	0.6	3.1	-	-	91.1	51.5	0.0	0.0	0.0	-
3-Jan-18	-7.1	-4.8	-10.7	93.5	0.4	2.1	-	-	90.6	51.2	0.0	0.0	0.0	-
4-Jan-18	-4.1	-2.7	-6.2	95.6	0.7	2.7	-	-	89.8	51.1	2.6	0.0	2.6	-
5-Jan-18	-2.4	0.1	-4.3	95.0	0.9	5.9	-	-	89.4	51.0	1.6	0.0	1.6	-
6-Jan-18	-3.6	-1.3	-6.2	85.0	1.2	8.3	-	-	89.8	50.9	0.1	0.0	0.1	-
7-Jan-18	-2.9	-1.9	-3.7	95.8	0.7	3.9	-	-	89.2	52.6	5.0	0.0	5.0	-
8-Jan-18	-2.6	-0.1	-5.6	95.8	0.9	5.1	-	-	88.6	56.2	1.2	0.0	1.2	-
9-Jan-18	-8.2	-4.4	-14.5	91.5	1.0	4.0	-	-	88.8	56.4	0.5	0.0	0.5	-
10-Jan-18	-17.6	-14.5	-19.7	86.3	0.7	3.9	-	-	90.0	57.1	0.0	0.0	0.0	-
11-Jan-18	-22.0	-18.4	-24.7	79.9	0.6	2.3	-	-	90.3	57.0	0.0	0.0	0.0	-
12-Jan-18	-19.7	-16.8	-24.1	82.8	0.5	2.0	-	-	90.6	57.3	1.5	0.0	1.5	-
13-Jan-18	-13.7	-10.1	-17.1	88.8	0.5	2.3	-	-	90.8	57.7	1.3	0.0	1.3	-
14-Jan-18	-6.8	-4.2	-10.2	95.1	0.6	3.5	-	-	90.8	57.5	0.1	0.0	0.1	-
15-Jan-18	-3.6	-2.1	-4.8	96.0	0.7	5.4	-	-	90.1	57.5	0.5	0.0	0.5	-
16-Jan-18	-2.8	-1.4	-4.7	96.3	0.9	6.4	-	-	89.6	57.5	0.0	0.0	0.0	-
17-Jan-18	-3.6	-2.4	-5.3	97.3	0.9	4.2	-	-	88.7	60.7	6.5	0.0	6.5	-
18-Jan-18	-1.3	0.8	-2.9	98.0	0.7	2.7	-	-	88.1	63.4	0.7	0.0	0.7	-
19-Jan-18	-4.6	-1.1	-8.3	96.8	0.4	1.9	-	-	88.7	63.1	0.0	0.0	0.0	-
20-Jan-18	-5.7	-3.3	-8.9	95.3	0.4	2.1	-	-	88.7	63.8	3.6	0.0	3.6	-
21-Jan-18	-4.2	-1.2	-6.6	95.4	0.7	3.8	-	-	88.2	71.4	5.8	0.0	5.8	-
22-Jan-18	-5.6	-1.9	-8.4	90.6	1.1	8.2	-	-	89.4	71.0	0.0	0.0	0.0	-
23-Jan-18	-7.4	-6.1	-9.5	93.3	1.0	4.6	-	-	89.2	72.2	7.4	0.0	7.4	-
24-Jan-18	-6.1	-3.8	-8.3	94.4	0.7	2.8	-	-	88.6	76.8	4.0	0.0	4.0	-
25-Jan-18	-6.2	-3.4	-9.6	93.9	0.5	3.0	-	-	88.5	78.2	1.4	0.0	1.4	-
26-Jan-18	-7.5	-5.8	-8.5	93.5	0.6	2.8	-	-	89.6	77.0	0.3	0.0	0.3	-
27-Jan-18	-9.5	-6.7	-13.3	91.1	0.5	2.3	-	-	90.3	75.0	0.2	0.0	0.2	-
28-Jan-18	-12.5	-11.2	-15.1	89.1	1.2	5.9	-	-	90.2	76.9	4.3	0.0	4.3	-
29-Jan-18	-9.2	-4.3	-14.8	90.6	-	5.4	-	-	88.7	78.0	0.6	0.0	0.6	-
30-Jan-18	-5.0	-1.8	-8.7	92.8	-	6.3	-	-	88.7	76.4	0.2	0.0	0.2	-
31-Jan-18	-4.5	-2.6	-7.2	83.7	1.2	8.1	-	-	89.7	75.8	0.1	0.0	0.1	-
1-Feb-18	-7.4	-5.2	-10.1	92.8	0.6	3.2	-	-	89.9	75.9	7.2	0.0	7.2	-
2-Feb-18	-7.3	-2.6	-9.7	93.7	1.1	5.1	-	-	89.2	82.6	7.1	0.0	7.1	-
3-Feb-18	-13.4	-7.8	-16.1	87.8	1.3	6.2	-	-	90.8	86.7	7.5	0.0	7.5	-
4-Feb-18	-15.7	-14.5	-16.7	87.7	0.5	2.8	-	-	90.2	95.8	31.2	0.0	31.2	-
5-Feb-18	-14.2	-11.1	-16.4	88.7	0.3	2.2	-	-	90.5	99.0	0.5	0.0	0.5	-
6-Feb-18	-11.9	-10.3	-13.1	91.0	0.3	2.6	-	-	90.4	97.4	3.3	0.0	3.3	-
7-Feb-18	-9.5	-8.1	-11.5	91.9	0.4	3.4	-	-	90.0	107.1	65.0	0.0	65.0	-
8-Feb-18	-11.3	-8.7	-17.7	83.8	1.7	6.7	-	-	90.9	121.7	1.6	0.0	1.6	-
9-Feb-18	-16.6	-10.1	-20.1	84.1	0.5	2.1	-	-	91.4	117.3	0.0	0.0	0.0	-

Notes:

Dashes (-) indicate that not enough data were available or were erroneous.

Underlined values indicate data that were gap-filled.

Appendix 2-A. Tenas Deposit Meteorological Station Daily Data, January 1, 2017 to December 9, 2019

Date	Mean Air Temperature (°C)	Maximum Air Temperature (°C)	Minimum Air Temperature (°C)	Mean Relative Humidity (%)	Mean Wind Speed (m/s)	Maximum Wind Speed (m/s)	Mean Solar Radiation (W/m ²)	1-Hour Maximum Solar Radiation (W/m ²)	Mean Barometric Pressure at Station Elevation (kPa)	Mean Snow Depth (cm)	Total Precipitation (mm)	Total Rainfall (mm)	Total Snow-Water-Equivalent (mm)	Total Evaporation (mm)
10-Feb-18	-14.5	-7.9	-18.9	85.3	0.7	3.2	-	-	90.6	113.8	0.0	0.0	0.0	-
11-Feb-18	-15.7	-9.9	-19.9	83.9	1.1	4.1	-	-	90.7	110.7	0.0	0.0	0.0	-
12-Feb-18	-12.5	-3.1	-19.3	87.1	0.7	4.3	-	-	90.5	108.4	0.0	0.0	0.0	-
13-Feb-18	-2.1	-0.2	-3.9	90.7	2.2	9.0	-	-	89.2	108.0	4.4	0.0	4.4	-
14-Feb-18	-6.5	-2.2	-13.1	86.0	1.2	6.8	70.1	410.5	90.3	107.2	0.0	0.0	0.0	-
15-Feb-18	-9.6	-5.3	-14.5	88.9	0.7	3.2	37.3	188.5	90.4	105.1	0.0	0.0	0.0	-
16-Feb-18	-7.0	-2.9	-10.9	88.6	1.2	7.3	32.8	141.2	90.1	104.8	1.0	0.0	1.0	-
17-Feb-18	-10.3	-8.7	-14.9	84.5	2.5	9.9	33.7	172.1	89.9	103.6	0.3	0.0	0.3	-
18-Feb-18	-15.8	-10.1	-20.3	75.2	1.4	4.3	94.2	451.2	90.8	102.6	0.0	0.0	0.0	-
19-Feb-18	-16.9	-10.4	-21.0	77.5	0.7	2.4	65.3	301.4	90.4	101.2	0.0	0.0	0.0	-
20-Feb-18	-14.0	-8.3	-19.6	74.6	0.6	2.7	98.9	460.3	90.6	100.0	0.0	0.0	0.0	-
21-Feb-18	-8.7	-3.7	-12.7	76.3	1.4	5.5	71.8	429.1	90.5	99.5	0.0	0.0	0.0	-
22-Feb-18	-8.8	-3.4	-16.2	69.2	1.0	5.0	103.1	453.9	90.6	98.1	0.0	0.0	0.0	-
23-Feb-18	-3.1	2.2	-6.3	78.7	1.6	8.1	96.2	540.6	89.2	98.3	0.6	0.0	0.6	-
24-Feb-18	-4.2	-1.0	-6.8	77.5	1.8	7.1	65.2	293.9	88.8	97.9	0.7	0.0	0.7	-
25-Feb-18	-4.3	0.2	-7.4	71.2	1.8	6.7	84.6	439.2	88.4	97.7	0.0	0.0	0.0	-
26-Feb-18	-3.7	-0.3	-7.8	71.0	2.2	10.5	71.6	323.6	89.1	97.0	0.3	0.0	0.3	-
27-Feb-18	-3.2	0.1	-6.3	71.5	2.3	9.3	82.7	333.5	88.9	96.5	0.2	0.0	0.2	-
28-Feb-18	-6.0	-4.3	-9.8	89.6	2.1	10.1	-	-	88.6	106.5	19.6	0.0	19.6	-
1-Mar-18	-7.6	-4.8	-11.0	89.6	3.3	10.6	55.8	288.9	89.1	144.5	16.2	0.0	16.2	-
2-Mar-18	-10.3	-8.8	-11.8	76.5	2.2	9.5	61.2	262.2	89.9	141.0	0.8	0.0	0.8	-
3-Mar-18	-11.7	-9.6	-14.9	73.1	1.6	7.2	92.3	496.4	90.4	133.9	0.0	0.0	0.0	-
4-Mar-18	-13.0	-6.8	-19.7	73.7	1.0	3.5	138.6	534.3	90.5	128.8	0.0	0.0	0.0	-
5-Mar-18	-9.6	-4.4	-14.5	78.2	0.9	3.5	119.7	494.6	90.7	124.3	0.0	0.0	0.0	-
6-Mar-18	-8.2	-2.2	-13.8	72.9	1.1	3.2	118.9	457.7	90.8	120.6	0.0	0.0	0.0	-
7-Mar-18	-9.1	-2.1	-14.5	79.4	1.0	3.2	142.6	541.8	90.2	117.7	0.0	0.0	0.0	-
8-Mar-18	-7.5	-3.1	-12.1	82.8	1.0	4.1	88.2	378.6	88.8	115.9	0.8	0.0	0.8	-
9-Mar-18	-4.6	2.4	-11.8	72.0	1.2	5.0	93.0	376.5	89.3	114.7	0.0	0.0	0.0	-
10-Mar-18	-1.2	4.7	-5.5	71.3	1.3	6.7	112.3	537.7	90.1	112.2	0.0	0.0	0.0	-
11-Mar-18	-1.2	6.1	-7.9	73.1	0.7	2.5	122.5	437.0	90.5	109.9	0.0	0.0	0.0	-
12-Mar-18	0.6	7.4	-4.0	69.7	0.9	3.2	128.7	556.0	90.3	108.7	0.0	0.0	0.0	-
13-Mar-18	1.7	7.7	-3.8	65.1	1.6	9.4	131.5	474.8	89.5	107.2	0.0	0.0	0.0	-
14-Mar-18	2.1	6.3	-0.7	71.3	1.1	4.7	85.8	381.8	89.1	105.2	0.5	0.5	0.0	-
15-Mar-18	1.1	5.4	-3.7	67.9	1.5	5.0	142.0	603.7	89.6	103.1	0.0	0.0	0.0	-
16-Mar-18	0.1	4.1	-4.4	74.8	1.1	4.0	120.0	460.7	89.8	102.2	0.0	0.0	0.0	-
17-Mar-18	1.7	4.3	-1.4	77.3	1.1	5.2	68.8	226.2	89.8	101.4	0.1	0.1	0.0	-
18-Mar-18	1.9	8.3	-4.3	60.8	1.5	7.6	171.0	609.0	90.3	100.1	0.0	0.0	0.0	-
19-Mar-18	2.0	5.6	-0.7	64.9	2.5	10.0	119.6	561.3	90.2	98.9	0.1	0.1	0.0	-
20-Mar-18	0.2	5.2	-2.4	73.9	1.5	8.2	115.7	410.6	89.5	97.4	0.8	0.1	0.7	-
21-Mar-18	-0.7	4.3	-4.6	78.5	2.2	8.8	138.9	652.7	89.0	97.3	2.8	0.0	2.8	-
22-Mar-18	-3.5	-0.1	-5.6	95.7	3.0	14.9	20.7	78.4	88.5	125.5	23.6	0.0	23.6	-
23-Mar-18	-4.2	0.5	-7.0	87.7	0.9	4.0	51.6	231.6	89.0	130.5	1.1	0.0	1.1	-
24-Mar-18	-2.5	1.7	-5.5	78.7	1.7	7.4	129.9	501.9	88.9	126.1	0.2	0.0	0.2	-
25-Mar-18	-2.9	-0.4	-4.9	91.4	0.9	8.2	32.7	112.9	88.9	128.6	4.9	0.0	4.9	-
26-Mar-18	-0.8	2.3	-3.5	93.7	1.1	6.7	61.6	271.4	88.9	129.4	4.9	0.0	4.9	-

Notes:

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Appendix 2-A. Tenas Deposit Meteorological Station Daily Data, January 1, 2017 to December 9, 2019

Date	Mean Air Temperature (°C)	Maximum Air Temperature (°C)	Minimum Air Temperature (°C)	Mean Relative Humidity (%)	Mean Wind Speed (m/s)	Maximum Wind Speed (m/s)	Mean Solar Radiation (W/m ²)	1-Hour Maximum Solar Radiation (W/m ²)	Mean Barometric Pressure at Station Elevation (kPa)	Mean Snow Depth (cm)	Total Precipitation (mm)	Total Rainfall (mm)	Total Snow-Water-Equivalent (mm)	Total Evaporation (mm)
27-Mar-18	0.3	2.8	-2.5	72.7	3.3	10.9	150.8	562.8	89.9	127.0	0.4	0.1	0.3	-
28-Mar-18	-1.0	3.3	-3.8	62.6	2.8	8.9	172.7	540.9	90.8	124.9	0.0	0.0	0.0	-
29-Mar-18	-3.5	-1.3	-6.5	86.2	1.0	3.9	45.4	257.9	90.0	130.3	19.2	0.0	19.2	-
30-Mar-18	-5.1	-3.3	-7.3	84.9	1.8	7.9	23.7	82.7	90.7	148.5	4.5	0.0	4.5	-
31-Mar-18	-7.0	-3.6	-11.1	79.0	0.8	4.7	21.8	78.8	90.7	143.6	0.0	0.0	0.0	-
1-Apr-18	-6.5	-0.3	-11.5	64.6	1.3	5.9	96.9	511.2	89.9	140.3	0.1	0.0	0.1	-
2-Apr-18	-7.2	-1.2	-13.9	63.7	1.2	6.7	154.8	571.9	89.7	137.4	0.0	0.0	0.0	-
3-Apr-18	-7.2	-3.0	-10.9	88.1	1.3	6.6	39.2	157.2	89.4	137.7	4.2	0.0	4.2	-
4-Apr-18	-6.8	-2.8	-12.7	74.0	2.4	9.5	142.1	500.8	90.3	136.8	0.0	0.0	0.0	-
5-Apr-18	-7.9	-6.6	-10.9	67.1	3.5	9.6	87.2	326.1	90.3	135.2	3.3	0.0	3.3	-
6-Apr-18	-7.0	-3.9	-10.1	83.4	2.0	8.5	103.2	380.5	89.7	136.0	1.1	0.0	1.1	-
7-Apr-18	-2.5	1.5	-6.3	82.6	1.3	4.9	63.9	199.0	88.7	134.9	0.0	0.0	0.0	-
8-Apr-18	2.0	8.1	-3.7	73.4	0.9	4.6	127.2	436.3	89.5	131.2	0.0	0.0	0.0	-
9-Apr-18	4.0	9.7	-0.1	71.3	1.1	7.4	137.3	528.0	90.1	125.6	0.0	0.0	0.0	-
10-Apr-18	3.0	6.3	-1.2	73.0	2.0	8.1	89.1	388.8	88.8	121.2	2.7	2.7	0.0	-
11-Apr-18	1.4	6.2	-3.6	72.5	2.2	8.8	156.6	641.4	88.7	118.2	0.2	0.1	0.1	-
12-Apr-18	1.1	6.3	-3.0	61.4	1.6	6.9	233.4	840.0	89.1	115.1	0.0	0.0	0.0	-
13-Apr-18	0.1	4.7	-3.1	76.6	1.7	8.7	103.1	361.7	89.0	113.6	1.4	0.0	1.3	-
14-Apr-18	1.0	5.1	-3.3	69.4	1.5	7.2	161.4	700.7	89.7	113.0	0.0	0.0	0.0	-
15-Apr-18	0.1	7.2	-6.1	71.0	1.4	9.3	244.9	782.0	89.9	111.4	0.0	0.0	0.0	-
16-Apr-18	0.9	4.3	-2.2	58.5	1.7	6.6	132.7	457.6	89.4	110.2	0.0	0.0	0.0	-
17-Apr-18	0.6	4.8	-3.2	61.9	2.0	9.2	169.0	741.3	89.7	109.5	0.6	0.2	0.4	-
18-Apr-18	1.6	5.5	-2.5	68.6	1.5	7.7	116.7	329.6	90.4	108.4	0.0	0.0	0.0	-
19-Apr-18	2.9	7.0	-0.2	60.0	2.2	10.6	175.4	782.9	90.0	105.8	0.0	0.0	0.0	-
20-Apr-18	3.0	7.7	-1.3	69.0	1.7	10.5	109.5	616.4	89.7	103.2	0.2	0.2	0.0	-
21-Apr-18	1.3	4.8	-2.0	74.7	2.4	10.6	182.0	726.6	90.1	101.7	0.0	0.0	0.0	-
22-Apr-18	2.0	6.6	-3.1	56.3	1.3	4.7	171.2	610.2	91.1	100.2	0.0	0.0	0.0	-
23-Apr-18	4.1	10.4	-1.7	51.8	1.0	5.8	146.6	613.3	91.0	98.3	0.0	0.0	0.0	-
24-Apr-18	5.8	10.5	1.4	50.4	1.8	8.9	219.8	763.2	90.9	95.5	0.0	0.0	0.0	-
25-Apr-18	6.5	14.8	-1.9	55.4	1.1	4.2	270.8	782.8	91.0	91.5	0.0	0.0	0.0	-
26-Apr-18	10.5	19.8	1.8	44.7	1.2	4.5	270.2	765.9	90.5	87.0	0.0	0.0	0.0	-
27-Apr-18	11.0	19.3	3.3	42.3	1.5	6.7	271.1	790.0	89.8	81.8	0.0	0.0	0.0	-
28-Apr-18	6.7	9.7	-2.3	41.8	2.5	9.6	277.9	857.0	89.6	74.6	0.0	0.0	0.0	-
29-Apr-18	4.4	12.6	-4.2	41.0	1.6	5.8	288.1	813.0	90.1	71.0	0.0	0.0	0.0	-
30-Apr-18	5.5	10.4	-0.1	47.7	2.7	9.7	215.6	639.6	90.2	67.6	0.0	0.0	0.0	-
1-May-18	6.7	14.9	-0.8	59.5	2.0	8.2	254.8	780.8	90.4	63.6	0.0	0.0	0.0	-
2-May-18	7.9	12.4	3.9	53.7	3.0	11.0	285.7	804.0	90.2	57.4	0.0	0.0	0.0	-
3-May-18	5.7	8.6	3.0	74.3	1.2	5.9	111.9	410.7	90.2	52.4	0.3	0.3	0.0	-
4-May-18	6.5	11.3	3.2	70.2	2.0	7.3	166.3	503.4	90.6	47.7	0.0	0.0	0.0	-
5-May-18	8.6	15.2	2.5	62.6	1.1	4.1	233.2	749.1	90.9	42.0	0.0	0.0	0.0	-
6-May-18	11.0	19.6	2.6	52.6	1.2	4.2	297.9	814.0	90.6	36.3	0.0	0.0	0.0	-
7-May-18	11.4	17.7	6.0	54.1	1.7	7.4	233.7	770.0	90.6	28.7	0.0	0.0	0.0	-
8-May-18	12.3	18.8	4.0	55.3	1.6	8.3	276.2	728.4	90.3	18.4	0.0	0.0	0.0	-
9-May-18	7.2	13.2	2.0	84.0	1.3	6.4	87.8	410.3	89.7	10.7	9.1	9.1	0.0	-
10-May-18	7.3	14.2	0.6	70.8	1.8	7.5	259.8	811.0	90.3	4.8	0.0	0.0	0.0	-

Notes:

Dashes (-) indicate that not enough data were available or were erroneous.

Underlined values indicate data that were gap-filled.

Appendix 2-A. Tenas Deposit Meteorological Station Daily Data, January 1, 2017 to December 9, 2019

Date	Mean Air Temperature (°C)	Maximum Air Temperature (°C)	Minimum Air Temperature (°C)	Mean Relative Humidity (%)	Mean Wind Speed (m/s)	Maximum Wind Speed (m/s)	Mean Solar Radiation (W/m ²)	1-Hour Maximum Solar Radiation (W/m ²)	Mean Barometric Pressure at Station Elevation (kPa)	Mean Snow Depth (cm)	Total Precipitation (mm)	Total Rainfall (mm)	Total Snow-Water-Equivalent (mm)	Total Evaporation (mm)
11-May-18	10.0	15.9	2.5	58.7	2.0	6.2	275.9	780.1	91.1	0.1	0.0	0.0	0.0	-
12-May-18	11.5	18.1	5.4	58.4	1.8	7.8	302.3	815.0	91.0	0.0	0.0	0.0	0.0	-
13-May-18	12.5	20.9	4.4	55.3	1.3	5.0	278.8	810.0	90.6	0.0	0.0	0.0	0.0	-
14-May-18	13.5	20.1	6.0	43.7	1.8	9.2	288.1	759.7	90.1	0.0	0.0	0.0	0.0	-
15-May-18	10.4	19.1	2.7	39.9	1.5	5.4	293.4	830.0	90.0	0.0	0.0	0.0	0.0	-
16-May-18	12.4	20.6	5.1	38.1	1.6	6.1	302.6	840.0	90.2	0.0	0.0	0.0	0.0	-
17-May-18	13.9	22.1	4.7	39.7	1.8	9.6	261.5	826.0	90.6	0.0	0.0	0.0	0.0	-
18-May-18	14.9	22.0	6.2	35.3	1.7	6.3	319.0	844.0	90.5	0.0	0.0	0.0	0.0	-
19-May-18	15.2	23.7	8.8	47.1	1.6	9.7	240.4	809.0	90.0	0.0	2.1	2.1	0.0	-
20-May-18	10.5	16.2	6.1	75.6	1.8	9.4	187.6	761.5	89.9	0.0	1.3	1.3	0.0	-
21-May-18	9.1	14.6	2.9	63.1	1.8	7.3	153.6	565.4	90.1	0.0	0.0	0.0	0.0	-
22-May-18	10.5	16.7	6.4	68.0	1.3	8.6	139.9	747.8	90.0	0.0	0.0	0.0	0.0	-
23-May-18	13.6	22.4	4.3	61.6	1.8	8.9	293.1	785.1	89.7	0.0	0.0	0.0	0.0	-
24-May-18	10.3	16.0	4.0	52.4	2.5	9.2	243.6	757.6	89.9	0.0	0.0	0.0	0.0	-
25-May-18	5.8	11.8	0.8	60.7	1.7	7.6	156.2	402.4	89.9	0.0	0.0	0.0	0.0	-
26-May-18	4.5	10.9	-0.5	73.7	1.5	8.1	151.0	774.9	89.9	0.0	0.5	0.5	0.0	-
27-May-18	7.7	14.2	1.7	70.5	2.0	9.8	225.0	742.9	89.9	0.0	0.3	0.3	0.0	-
28-May-18	5.4	10.3	0.7	63.0	2.7	9.4	289.5	836.0	90.4	0.0	0.1	0.1	0.0	-
29-May-18	4.7	11.4	-1.1	62.9	1.4	6.1	214.4	675.2	90.4	0.0	0.0	0.0	0.0	-
30-May-18	5.2	12.5	-0.1	67.0	1.2	5.7	211.6	667.9	90.0	0.0	0.0	0.0	0.0	-
31-May-18	5.7	11.1	-0.8	75.9	1.4	9.1	188.1	594.6	89.7	0.0	0.7	0.7	0.0	-
1-Jun-18	5.2	12.0	-0.1	79.2	1.3	8.4	142.5	537.6	89.9	0.0	1.2	1.2	0.0	-
2-Jun-18	7.9	14.2	2.1	53.3	1.7	7.1	223.4	844.0	90.5	0.0	0.0	0.0	0.0	-
3-Jun-18	4.5	8.3	1.5	86.6	1.2	5.5	121.7	382.2	90.0	0.0	9.0	9.0	0.0	-
4-Jun-18	4.9	10.4	-0.8	69.2	2.0	8.3	221.1	678.9	89.8	0.0	0.0	0.0	0.0	-
5-Jun-18	5.1	10.6	-1.0	74.2	1.6	7.7	200.2	660.9	89.5	0.0	0.7	0.7	0.0	-
6-Jun-18	7.0	12.0	2.2	74.6	1.4	9.3	181.9	504.5	89.5	0.0	0.7	0.7	0.0	-
7-Jun-18	7.3	12.0	3.8	82.8	1.1	6.7	133.8	327.1	89.5	0.0	2.0	2.0	0.0	-
8-Jun-18	5.5	9.9	2.7	87.6	1.2	5.1	139.1	426.0	89.7	0.0	9.6	9.6	0.0	-
9-Jun-18	6.5	12.7	2.9	74.4	1.9	8.9	210.3	607.9	89.6	0.0	0.1	0.1	0.0	-
10-Jun-18	6.9	13.4	1.5	61.0	2.7	9.0	298.6	873.0	89.8	0.0	0.0	0.0	0.0	-
11-Jun-18	6.7	12.5	2.3	60.4	3.2	11.2	235.2	883.0	90.3	0.0	0.0	0.0	0.0	-
12-Jun-18	8.9	14.9	1.5	59.9	1.8	7.6	249.6	695.6	90.0	0.0	0.0	0.0	0.0	-
13-Jun-18	10.3	16.5	3.8	63.6	2.1	10.1	250.2	637.4	89.5	0.0	0.0	0.0	0.0	-
14-Jun-18	9.8	14.9	5.8	65.0	2.8	9.5	250.0	746.9	90.0	0.0	0.0	0.0	0.0	-
15-Jun-18	10.7	18.0	4.4	52.0	1.9	6.1	238.0	699.1	90.4	0.0	0.0	0.0	0.0	-
16-Jun-18	16.4	24.6	6.4	37.8	1.9	7.9	335.7	875.0	90.8	0.0	0.0	0.0	0.0	-
17-Jun-18	19.1	27.2	10.9	42.5	1.7	5.8	327.1	842.0	90.6	0.0	0.0	0.0	0.0	-
18-Jun-18	20.6	28.2	11.4	43.8	1.6	6.0	333.9	820.0	90.7	0.0	0.0	0.0	0.0	-
19-Jun-18	22.6	30.1	14.4	36.7	1.5	5.4	279.9	719.3	90.6	0.0	0.0	0.0	0.0	-
20-Jun-18	18.7	27.2	12.2	64.2	1.3	8.0	175.7	680.9	90.3	0.0	10.0	10.0	0.0	-
21-Jun-18	17.4	24.5	10.6	62.5	2.2	10.0	286.0	748.2	90.2	0.0	1.3	1.3	0.0	-
22-Jun-18	15.0	20.6	9.1	56.2	2.5	10.8	309.5	746.9	90.3	0.0	0.0	0.0	0.0	-
23-Jun-18	13.6	19.5	7.5	53.8	2.3	8.6	322.5	837.0	90.4	0.0	0.0	0.0	0.0	-
24-Jun-18	10.0	16.3	6.1	72.7	1.5	7.6	186.7	719.4	90.0	0.0	5.4	5.4	0.0	-

Notes:

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Underlined values indicate data that were gap-filled.

Appendix 2-A. Tenas Deposit Meteorological Station Daily Data, January 1, 2017 to December 9, 2019

Date	Mean Air Temperature (°C)	Maximum Air Temperature (°C)	Minimum Air Temperature (°C)	Mean Relative Humidity (%)	Mean Wind Speed (m/s)	Maximum Wind Speed (m/s)	Mean Solar Radiation (W/m ²)	1-Hour Maximum Solar Radiation (W/m ²)	Mean Barometric Pressure at Station Elevation (kPa)	Mean Snow Depth (cm)	Total Precipitation (mm)	Total Rainfall (mm)	Total Snow-Water-Equivalent (mm)	Total Evaporation (mm)
25-Jun-18	9.0	13.4	5.7	67.6	3.6	11.9	274.9	775.2	89.7	0.0	1.2	1.2	0.0	-
26-Jun-18	9.3	13.6	5.4	53.1	4.3	13.2	351.3	883.0	90.1	0.0	0.0	0.0	0.0	-
27-Jun-18	9.0	14.6	3.1	57.0	2.6	7.9	250.9	700.9	90.2	0.0	0.0	0.0	0.0	-
28-Jun-18	10.1	15.1	4.8	64.5	1.7	6.6	180.2	448.8	90.0	0.0	0.0	0.0	0.0	-
29-Jun-18	11.6	16.9	7.5	70.5	1.8	8.7	178.2	503.2	90.1	0.0	0.1	0.1	0.0	-
30-Jun-18	10.0	14.9	6.5	70.1	2.4	8.9	240.0	821.0	90.1	0.0	1.3	1.3	0.0	-
1-Jul-18	9.2	14.2	6.3	61.7	2.8	8.5	257.3	853.0	90.4	0.0	0.0	0.0	0.0	-
2-Jul-18	12.3	19.8	5.0	64.7	1.8	7.2	285.0	861.0	90.8	0.0	3.9	3.9	0.0	-
3-Jul-18	12.0	17.6	7.6	74.7	1.4	7.0	205.7	780.4	90.9	0.0	2.9	2.9	0.0	-
4-Jul-18	14.5	22.1	7.9	64.3	1.5	6.2	229.7	682.4	90.9	0.0	0.1	0.1	0.0	-
5-Jul-18	13.5	18.7	7.9	75.1	1.2	6.9	161.7	537.5	90.5	0.0	7.6	7.6	0.0	-
6-Jul-18	13.5	18.3	8.5	66.6	2.4	9.7	219.7	705.7	90.2	0.0	0.1	0.1	0.0	-
7-Jul-18	13.5	19.7	10.0	64.7	2.5	9.7	232.6	754.4	90.4	0.0	0.1	0.1	0.0	-
8-Jul-18	13.4	18.5	8.3	65.0	1.3	5.2	186.2	490.4	90.6	0.0	0.0	0.0	0.0	-
9-Jul-18	14.9	21.9	6.3	56.8	1.6	7.2	269.5	825.0	90.5	0.0	0.0	0.0	0.0	-
10-Jul-18	13.9	19.0	10.4	60.9	2.8	10.3	270.9	956.0	90.8	0.0	0.0	0.0	0.0	-
11-Jul-18	12.7	18.0	8.0	68.4	2.2	9.0	192.1	678.7	90.9	0.0	0.0	0.0	0.0	-
12-Jul-18	12.6	17.5	8.3	59.9	2.1	9.1	241.7	635.8	90.8	0.0	0.0	0.0	0.0	-
13-Jul-18	11.9	18.1	5.2	54.9	1.6	6.6	245.9	686.8	90.8	0.0	0.0	0.0	0.0	-
14-Jul-18	15.5	23.6	6.3	44.7	1.9	7.6	308.7	830.0	91.0	0.0	0.0	0.0	0.0	-
15-Jul-18	15.8	23.5	9.6	44.9	1.8	8.6	225.3	769.7	90.6	0.0	0.0	0.0	0.0	-
16-Jul-18	17.5	23.8	10.1	52.5	2.1	10.4	261.8	909.0	90.5	0.0	0.0	0.0	0.0	-
17-Jul-18	16.6	21.7	11.8	62.9	1.6	7.3	202.6	685.1	90.4	0.0	0.6	0.6	0.0	-
18-Jul-18	14.0	19.7	9.9	57.3	2.3	8.4	254.7	848.0	90.5	0.0	0.1	0.1	0.0	-
19-Jul-18	9.8	13.9	7.4	78.7	1.1	5.4	141.9	786.9	90.5	0.0	10.0	10.0	0.0	-
20-Jul-18	9.1	11.5	6.7	95.6	1.0	4.3	48.5	137.3	90.6	0.0	19.0	19.0	0.0	-
21-Jul-18	15.0	24.0	6.8	74.5	1.2	5.8	279.6	825.0	90.9	0.0	0.4	0.4	0.0	-
22-Jul-18	16.3	21.5	9.8	65.2	1.9	8.4	247.6	689.3	91.2	0.0	0.0	0.0	0.0	-
23-Jul-18	14.1	21.2	5.4	59.5	1.7	7.5	301.6	794.6	91.3	0.0	0.0	0.0	0.0	-
24-Jul-18	16.4	23.1	8.3	47.5	1.3	5.8	273.6	760.5	91.1	0.0	0.0	0.0	0.0	-
25-Jul-18	18.1	25.5	10.2	43.2	1.2	5.5	268.5	746.4	91.1	0.0	0.0	0.0	0.0	-
26-Jul-18	19.5	27.0	12.0	44.0	1.4	4.3	281.3	775.9	91.1	0.0	0.0	0.0	0.0	-
27-Jul-18	21.4	29.0	13.4	39.0	1.5	4.9	284.9	776.2	90.7	0.0	0.0	0.0	0.0	-
28-Jul-18	23.5	30.8	15.2	36.9	1.6	5.9	287.9	780.7	90.6	0.0	0.0	0.0	0.0	-
29-Jul-18	23.7	31.8	15.8	37.6	1.7	8.5	292.7	787.9	90.7	0.0	0.0	0.0	0.0	-
30-Jul-18	23.9	30.9	15.1	37.5	1.7	7.0	291.2	791.9	90.6	0.0	0.0	0.0	0.0	-
31-Jul-18	21.4	28.5	13.5	47.9	1.5	6.9	259.0	747.1	90.3	0.0	5.7	5.7	0.0	-
1-Aug-18	19.7	27.5	13.7	46.0	1.8	9.5	252.2	770.2	90.0	0.0	0.0	0.0	0.0	-
2-Aug-18	15.7	19.3	11.9	59.4	2.8	9.4	197.2	627.1	89.9	0.0	0.0	0.0	0.0	-
3-Aug-18	14.2	18.7	10.4	67.3	1.7	6.9	141.6	522.6	90.1	0.0	0.0	0.0	0.0	-
4-Aug-18	15.6	22.2	10.0	62.5	1.1	4.6	231.8	731.6	90.4	0.0	0.0	0.0	0.0	-
5-Aug-18	18.5	27.0	9.4	50.1	1.5	7.1	261.7	783.0	90.6	0.0	0.0	0.0	0.0	-
6-Aug-18	19.3	25.6	12.1	43.2	2.7	10.4	227.5	782.8	90.6	0.0	0.0	0.0	0.0	-
7-Aug-18	19.8	26.6	13.0	37.7	2.6	9.1	285.8	787.8	90.5	0.0	0.0	0.0	0.0	-
8-Aug-18	19.4	27.0	11.7	47.3	1.8	7.3	234.1	810.0	90.1	0.0	0.0	0.0	0.0	-

Notes:

Dashes (-) indicate that not enough data were available or were erroneous.

Underlined values indicate data that were gap-filled.

Appendix 2-A. Tenas Deposit Meteorological Station Daily Data, January 1, 2017 to December 9, 2019

Date	Mean Air Temperature (°C)	Maximum Air Temperature (°C)	Minimum Air Temperature (°C)	Mean Relative Humidity (%)	Mean Wind Speed (m/s)	Maximum Wind Speed (m/s)	Mean Solar Radiation (W/m ²)	1-Hour Maximum Solar Radiation (W/m ²)	Mean Barometric Pressure at Station Elevation (kPa)	Mean Snow Depth (cm)	Total Precipitation (mm)	Total Rainfall (mm)	Total Snow-Water-Equivalent (mm)	Total Evaporation (mm)
9-Aug-18	17.8	22.6	13.2	50.8	2.5	11.8	185.3	566.4	90.1	0.0	0.0	0.0	0.0	-
10-Aug-18	16.0	21.6	9.6	48.3	1.9	8.7	254.2	758.9	90.3	0.0	0.0	0.0	0.0	-
11-Aug-18	14.9	22.7	7.4	42.1	1.2	4.6	237.1	690.8	90.4	0.0	0.0	0.0	0.0	-
12-Aug-18	17.1	24.9	8.6	44.6	1.8	7.8	268.3	774.4	90.6	0.0	0.0	0.0	0.0	-
13-Aug-18	17.7	26.2	9.4	49.7	2.0	9.7	212.1	778.5	90.7	0.0	0.0	0.0	0.0	-
14-Aug-18	16.2	21.7	10.5	49.5	2.4	8.5	107.7	451.3	90.1	0.0	0.0	0.0	0.0	-
15-Aug-18	14.0	21.9	6.5	49.7	1.4	5.6	245.8	753.6	90.3	0.0	0.0	0.0	0.0	-
16-Aug-18	15.0	23.8	6.7	35.0	1.9	8.6	248.8	744.9	90.4	0.0	0.0	0.0	0.0	-
17-Aug-18	14.0	19.6	8.0	44.9	2.6	10.4	268.1	755.2	90.9	0.0	0.0	0.0	0.0	-
18-Aug-18	14.0	21.9	5.6	50.9	1.5	4.4	259.9	749.8	91.3	0.0	0.0	0.0	0.0	-
19-Aug-18	15.7	23.1	7.6	44.7	1.4	5.6	253.7	744.1	91.2	0.0	0.0	0.0	0.0	-
20-Aug-18	17.3	25.9	9.6	34.2	1.1	4.5	246.3	722.2	91.1	0.0	0.0	0.0	0.0	-
21-Aug-18	19.9	29.3	11.3	29.4	1.7	9.8	246.5	705.2	90.6	0.0	0.0	0.0	0.0	-
22-Aug-18	16.9	22.2	11.0	43.5	2.8	9.8	206.7	763.4	90.0	0.0	0.0	0.0	0.0	-
23-Aug-18	11.6	16.6	6.5	58.3	2.3	7.6	128.0	511.7	90.1	0.0	0.0	0.0	0.0	-
24-Aug-18	11.1	18.5	4.9	64.2	2.0	8.5	195.4	757.6	90.2	0.0	0.7	0.7	0.0	-
25-Aug-18	11.5	16.8	7.5	70.2	2.2	9.2	134.5	457.0	90.1	0.0	0.3	0.3	0.0	-
26-Aug-18	11.4	18.7	7.7	61.4	1.6	6.8	137.2	566.6	90.3	0.0	0.0	0.0	0.0	-
27-Aug-18	14.4	20.4	7.0	57.1	2.2	10.1	157.6	517.0	90.6	0.0	0.0	0.0	0.0	-
28-Aug-18	13.6	17.6	9.2	65.7	2.2	8.5	108.7	365.3	90.1	0.0	0.0	0.0	0.0	-
29-Aug-18	11.0	17.0	7.6	64.0	1.9	7.6	98.4	491.6	89.7	0.0	0.1	0.1	0.0	-
30-Aug-18	11.6	16.5	7.6	59.9	2.5	9.3	148.7	487.8	89.9	0.0	0.2	0.2	0.0	-
31-Aug-18	9.7	14.3	6.2	65.5	2.5	10.6	90.6	387.6	89.9	0.0	0.6	0.6	0.0	-
1-Sep-18	8.5	14.0	4.1	63.8	2.1	10.3	187.8	738.1	90.3	0.0	0.0	0.0	0.0	-
2-Sep-18	7.7	12.0	4.2	78.0	1.9	8.9	108.7	441.7	90.0	0.0	0.5	0.5	0.0	-
3-Sep-18	8.2	15.0	2.9	67.3	1.2	4.5	160.3	501.4	90.7	0.0	0.0	0.0	0.0	-
4-Sep-18	9.4	17.1	2.0	58.4	1.0	4.9	184.1	658.3	90.8	0.0	0.0	0.0	0.0	-
5-Sep-18	10.4	15.9	5.5	61.7	1.2	4.3	129.3	495.1	90.7	0.0	0.0	0.0	0.0	-
6-Sep-18	11.0	18.5	5.4	71.2	1.0	6.9	147.2	552.7	90.4	0.0	1.0	1.0	0.0	-
7-Sep-18	9.9	14.9	6.6	87.5	1.1	7.6	101.3	358.5	89.9	0.0	9.7	9.7	0.0	-
8-Sep-18	8.3	11.9	3.1	89.5	0.8	3.9	88.5	273.2	89.9	0.0	0.0	0.0	0.0	-
9-Sep-18	6.8	9.4	4.9	94.5	2.2	8.5	28.9	143.8	89.6	0.0	6.1	6.1	0.0	-
10-Sep-18	7.0	10.0	5.2	98.6	1.1	4.7	39.7	126.9	89.5	0.0	1.1	1.1	0.0	-
11-Sep-18	8.5	13.8	5.1	86.7	1.0	5.3	120.8	483.2	89.9	0.0	1.1	1.1	0.0	-
12-Sep-18	3.4	6.5	-1.2	91.5	1.2	5.5	85.1	333.3	90.1	0.0	2.8	2.8	0.0	-
13-Sep-18	1.2	7.6	-3.5	71.1	1.1	4.5	171.3	593.0	90.3	0.0	0.0	0.0	0.0	-
14-Sep-18	0.0	3.7	-2.7	81.5	1.7	9.0	63.2	220.0	90.2	0.0	2.6	0.0	2.6	-
15-Sep-18	-0.6	1.0	-1.8	96.7	1.5	5.9	M	M	90.1	6.0	15.7	0.0	15.7	-
16-Sep-18	0.7	2.3	-0.3	96.5	M	3.5	59.2	263.6	90.1	7.8	2.0	0.7	1.3	-
17-Sep-18	1.9	5.7	-1.0	98.2	0.7	2.3	57.9	272.5	90.5	3.9	0.1	0.0	0.0	-
18-Sep-18	3.1	9.7	-1.8	85.5	1.0	5.3	146.3	615.3	90.6	1.1	0.1	0.1	0.0	-
19-Sep-18	5.2	8.3	2.8	83.1	0.6	2.4	63.0	220.1	90.4	0.0	0.1	0.1	0.0	-
20-Sep-18	5.2	9.6	1.4	87.0	1.2	8.2	89.2	383.5	90.4	0.0	0.4	0.4	0.0	-
21-Sep-18	3.5	8.8	-1.8	71.2	1.4	5.6	167.0	611.5	90.1	0.0	0.1	0.1	0.0	-
22-Sep-18	3.4	11.5	-3.7	60.5	1.3	4.8	179.4	617.5	90.0	0.0	0.0	0.0	0.0	-

Notes:

Dashes (-) indicate that not enough data were available or were erroneous.

Underlined values indicate data that were gap-filled.

Appendix 2-A. Tenas Deposit Meteorological Station Daily Data, January 1, 2017 to December 9, 2019

Date	Mean Air Temperature (°C)	Maximum Air Temperature (°C)	Minimum Air Temperature (°C)	Mean Relative Humidity (%)	Mean Wind Speed (m/s)	Maximum Wind Speed (m/s)	Mean Solar Radiation (W/m ²)	1-Hour Maximum Solar Radiation (W/m ²)	Mean Barometric Pressure at Station Elevation (kPa)	Mean Snow Depth (cm)	Total Precipitation (mm)	Total Rainfall (mm)	Total Snow-Water-Equivalent (mm)	Total Evaporation (mm)
23-Sep-18	7.3	10.9	2.2	64.9	1.9	7.8	75.7	305.0	90.2	0.0	0.2	0.2	0.0	-
24-Sep-18	9.8	14.6	6.6	65.8	2.4	9.1	138.5	593.8	90.9	0.0	0.0	0.0	0.0	-
25-Sep-18	10.2	15.9	6.6	64.2	2.2	7.8	136.0	585.8	91.1	0.0	0.0	0.0	0.0	-
26-Sep-18	9.0	11.6	7.6	85.4	1.3	6.3	55.2	223.8	91.0	0.0	0.5	0.5	0.0	-
27-Sep-18	7.8	10.8	4.0	98.0	1.0	4.9	66.6	306.8	91.1	0.0	6.1	6.1	0.0	-
28-Sep-18	6.1	12.0	2.0	85.0	1.0	4.9	114.4	560.2	90.6	0.0	0.0	0.0	0.0	-
29-Sep-18	3.0	7.0	-2.6	50.1	3.2	9.8	142.5	555.8	90.8	0.0	0.0	0.0	0.0	-
30-Sep-18	-0.4	5.0	-5.2	55.4	1.9	7.6	155.8	567.8	90.2	0.0	0.0	0.0	0.0	-
1-Oct-18	-1.4	5.1	-6.3	63.9	2.2	9.1	127.4	561.8	90.1	0.0	0.3	0.0	0.3	-
2-Oct-18	-1.8	4.5	-5.7	45.3	1.4	5.7	154.8	564.8	90.3	0.0	0.1	0.0	0.1	-
3-Oct-18	-1.3	4.7	-5.5	46.2	0.7	2.6	97.3	324.4	90.0	0.0	0.2	0.0	0.2	-
4-Oct-18	0.4	7.9	-4.9	50.1	0.9	3.9	139.2	548.9	89.9	0.0	0.3	0.1	0.2	-
5-Oct-18	3.7	9.8	-2.6	55.7	1.1	5.7	141.9	530.3	90.1	0.0	0.5	0.5	0.0	-
6-Oct-18	5.4	9.4	2.7	74.6	1.0	5.7	55.1	248.9	90.3	0.0	2.9	2.9	0.0	-
7-Oct-18	4.2	5.3	3.1	99.9	0.6	3.2	22.5	85.4	90.3	0.0	7.5	7.5	0.0	-
8-Oct-18	3.0	3.9	2.0	99.7	0.6	3.1	25.5	115.0	90.1	0.0	15.3	15.3	0.0	-
9-Oct-18	2.4	4.8	1.1	98.8	0.6	3.5	43.9	166.4	90.6	0.0	0.8	0.8	0.0	-
10-Oct-18	1.3	4.7	-1.3	92.5	0.6	3.1	55.4	206.7	90.6	0.0	0.0	0.0	0.0	-
11-Oct-18	4.2	9.7	-0.6	90.9	1.3	12.3	68.6	397.0	89.8	0.0	2.8	2.8	0.0	-
12-Oct-18	4.3	8.1	-1.0	68.3	3.0	14.7	42.3	174.8	90.5	0.0	0.2	0.2	0.0	-
13-Oct-18	1.8	7.0	-2.6	79.5	0.8	2.8	95.6	362.8	91.3	0.0	0.2	0.2	0.0	-
14-Oct-18	4.7	10.6	-1.1	61.2	0.9	4.9	52.1	192.2	91.1	0.0	0.2	0.2	0.0	-
15-Oct-18	6.1	10.6	2.7	48.8	0.7	3.8	59.6	237.8	91.2	0.0	0.0	0.0	0.0	-
16-Oct-18	8.0	14.5	2.0	46.1	0.6	2.7	92.1	417.2	91.0	0.0	0.0	0.0	0.0	-
17-Oct-18	9.0	15.5	4.0	55.4	1.2	9.0	94.2	524.1	90.4	0.0	0.4	0.4	0.0	-
18-Oct-18	4.7	7.7	2.1	89.1	0.9	4.8	72.8	371.4	90.8	0.0	0.7	0.7	0.0	-
19-Oct-18	6.7	13.3	2.7	81.5	1.4	9.3	80.0	465.7	90.5	0.0	0.5	0.5	0.0	-
20-Oct-18	4.9	9.0	-0.3	65.8	1.9	8.1	85.3	457.4	90.8	0.0	0.0	0.0	0.0	-
21-Oct-18	2.1	7.9	-2.6	79.8	0.8	2.5	87.6	408.9	90.5	0.0	0.1	0.1	0.0	-
22-Oct-18	3.0	9.3	-1.3	76.2	0.9	2.8	84.3	419.4	89.9	0.0	0.0	0.0	0.0	-
23-Oct-18	4.0	10.4	-1.3	70.5	1.0	3.3	83.7	427.5	89.4	0.0	0.1	0.1	0.0	-
24-Oct-18	5.3	9.2	1.1	71.6	1.0	6.6	75.9	406.7	89.4	0.0	0.1	0.1	0.0	-
25-Oct-18	2.9	7.5	-2.2	81.2	1.4	9.4	84.1	447.9	89.4	0.0	1.2	1.2	0.0	-
26-Oct-18	0.4	3.5	-2.2	91.6	1.3	8.3	25.0	155.2	89.1	0.0	3.5	0.8	2.8	-
27-Oct-18	1.3	4.5	-2.7	82.0	1.4	6.7	69.6	353.2	89.8	0.0	0.1	0.0	0.0	-
28-Oct-18	0.7	3.5	-0.5	98.7	M	5.2	21.2	154.4	88.9	1.3	6.2	2.2	3.9	-
29-Oct-18	1.9	5.4	-0.7	92.2	1.0	4.4	46.9	234.5	89.6	0.2	0.3	0.2	0.0	-
30-Oct-18	1.8	4.3	-1.0	91.6	0.9	5.6	31.6	149.2	90.0	0.0	6.1	5.4	0.6	-
31-Oct-18	0.2	3.3	-2.6	92.0	M	8.0	52.3	350.6	89.7	4.4	3.6	0.4	3.2	-
1-Nov-18	-1.1	0.0	-2.1	98.7	M	M	M	M	89.4	11.1	13.0	0.0	13.0	-
2-Nov-18	1.9	6.2	-2.2	91.8	1.3	7.0	43.9	293.7	89.4	11.7	0.2	0.2	0.0	-
3-Nov-18	2.2	3.6	0.5	98.8	1.0	4.6	15.6	65.6	88.9	6.2	5.5	5.5	0.0	-
4-Nov-18	2.6	5.9	0.1	88.8	1.5	9.5	41.6	241.1	88.9	3.2	0.4	0.4	0.0	-
5-Nov-18	0.1	1.8	-1.8	99.7	0.5	2.6	21.8	100.8	89.6	2.9	3.6	0.2	3.4	-
6-Nov-18	-2.1	-0.8	-6.3	94.6	0.8	3.3	7.7	40.0	90.9	4.3	0.9	0.0	0.9	-

Notes:

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Underlined values indicate data that were gap-filled.

Appendix 2-A. Tenas Deposit Meteorological Station Daily Data, January 1, 2017 to December 9, 2019

Date	Mean Air Temperature (°C)	Maximum Air Temperature (°C)	Minimum Air Temperature (°C)	Mean Relative Humidity (%)	Mean Wind Speed (m/s)	Maximum Wind Speed (m/s)	Mean Solar Radiation (W/m²)	1-Hour Maximum Solar Radiation (W/m²)	Mean Barometric Pressure at Station Elevation (kPa)	Mean Snow Depth (cm)	Total Precipitation (mm)	Total Rainfall (mm)	Total Snow-Water-Equivalent (mm)	Total Evaporation (mm)
7-Nov-18	-6.0	-3.9	-9.1	94.9	0.8	3.2	17.5	132.4	91.4	4.3	0.0	0.0	0.0	-
8-Nov-18	-3.6	-1.0	-5.9	96.9	0.6	4.0	11.4	52.1	91.0	4.0	0.1	0.0	0.1	-
9-Nov-18	0.6	2.7	-2.0	85.5	1.9	8.3	35.4	234.8	90.5	4.0	1.3	0.4	0.9	-
10-Nov-18	-1.0	1.5	-3.5	91.2	0.9	4.0	46.6	261.3	91.2	3.4	0.0	0.0	0.0	-
11-Nov-18	-2.0	-0.8	-3.2	97.2	0.5	2.0	20.6	123.2	91.5	3.0	0.0	0.0	0.0	-
12-Nov-18	-3.0	-1.5	-4.4	98.9	0.4	1.6	22.2	97.3	91.1	3.5	0.0	0.0	0.0	-
13-Nov-18	-0.1	4.5	-5.1	85.9	2.0	10.9	27.6	146.6	89.8	4.5	0.1	0.0	0.1	-
14-Nov-18	0.7	3.1	-1.3	92.7	1.0	6.3	27.1	189.7	89.8	4.8	2.5	0.9	1.6	-
15-Nov-18	-0.5	1.6	-2.5	99.3	M	3.7	M	M	90.2	12.8	11.6	0.0	11.6	-
16-Nov-18	-2.7	-1.0	-6.5	98.3	0.6	2.7	M	M	91.3	15.8	0.3	0.0	0.3	-
17-Nov-18	-3.1	1.6	-6.6	96.9	0.7	4.7	M	M	90.8	13.5	0.0	0.0	0.0	-
18-Nov-18	0.6	4.0	-1.5	98.3	0.7	3.8	10.5	80.7	90.5	12.1	0.1	0.0	0.0	-
19-Nov-18	-1.9	-0.9	-2.8	100.0	0.4	2.2	14.5	72.5	90.2	11.0	0.2	0.0	0.2	-
20-Nov-18	-1.2	0.7	-2.9	99.7	0.7	2.8	26.5	162.6	89.4	10.7	0.0	0.0	0.0	-
21-Nov-18	-0.3	2.5	-1.9	94.1	1.4	10.5	21.1	165.9	88.4	10.8	0.1	0.0	0.1	-
22-Nov-18	-3.1	-1.1	-5.4	93.6	0.8	3.9	25.8	129.9	88.5	10.5	0.1	0.0	0.1	-
23-Nov-18	-2.0	-0.3	-4.1	97.8	0.6	2.3	7.9	36.0	88.7	12.7	1.4	0.0	1.4	-
24-Nov-18	-1.2	0.7	-4.1	95.1	0.7	3.5	9.1	47.6	89.6	12.9	0.7	0.0	0.7	-
25-Nov-18	-0.7	1.1	-2.2	99.2	0.7	4.0	5.3	31.1	89.5	14.0	1.6	0.0	1.6	-
26-Nov-18	0.3	1.9	-1.0	99.8	0.9	2.9	8.5	63.2	88.5	15.0	5.5	0.9	4.6	-
27-Nov-18	0.5	2.2	-0.8	99.8	0.6	5.0	8.4	36.8	88.0	13.7	1.9	0.5	1.4	-
28-Nov-18	0.1	2.6	-2.1	99.2	0.6	2.2	21.9	116.2	88.6	13.6	0.0	0.0	0.0	-
29-Nov-18	-2.1	-0.4	-3.9	98.4	0.7	3.2	16.6	91.4	89.0	13.5	0.3	0.0	0.3	-
30-Nov-18	-2.7	-1.4	-3.8	96.4	0.4	1.8	8.9	46.4	89.3	13.7	0.0	0.0	0.0	-
1-Dec-18	-4.2	-3.5	-7.1	95.8	0.8	2.8	7.0	38.3	90.0	13.6	0.0	0.0	0.0	-
2-Dec-18	-6.5	-4.9	-8.6	88.8	0.8	3.1	9.8	55.8	90.7	13.6	0.0	0.0	0.0	-
3-Dec-18	-8.9	-7.8	-11.3	90.7	0.7	3.2	15.0	106.3	91.1	13.6	0.0	0.0	0.0	-
4-Dec-18	-11.0	-7.2	-12.7	91.8	0.7	2.3	9.3	72.3	91.0	13.3	0.0	0.0	0.0	-
5-Dec-18	-12.3	-10.4	-16.1	91.3	0.5	1.9	13.4	75.2	90.9	13.3	0.0	0.0	0.0	-
6-Dec-18	-10.4	-9.6	-11.3	91.4	0.6	2.4	7.6	56.8	90.5	13.4	0.0	0.0	0.0	-
7-Dec-18	-11.1	-10.1	-12.0	89.2	0.6	3.6	9.2	53.8	90.1	13.7	0.0	0.0	0.0	-
8-Dec-18	-10.5	-8.4	-12.5	89.9	0.6	3.2	10.5	64.1	90.3	13.8	0.0	0.0	0.0	-
9-Dec-18	-5.9	-0.9	-10.0	92.0	1.0	5.9	10.0	58.9	89.4	14.1	0.7	0.0	0.7	-
10-Dec-18	-2.1	0.2	-4.9	79.1	1.4	6.6	10.0	56.3	89.3	14.1	0.2	0.0	0.2	-
11-Dec-18	-1.6	0.6	-3.2	86.5	2.7	12.3	3.7	31.8	87.7	17.7	3.0	0.0	3.0	-
12-Dec-18	-2.8	-0.5	-4.4	83.9	1.7	9.0	5.4	35.2	88.4	19.5	3.4	0.0	3.4	-
13-Dec-18	-3.1	-1.5	-5.8	83.3	2.2	11.3	M	M	88.6	27.4	5.4	0.0	5.4	-
14-Dec-18	-5.6	-4.8	-7.0	95.3	1.3	5.5	M	M	87.7	36.8	22.4	0.0	22.4	-
15-Dec-18	-6.9	-4.1	-10.7	92.7	2.1	11.5	M	M	88.9	41.2	7.5	0.0	7.5	-
16-Dec-18	-3.6	-1.3	-5.0	96.1	1.1	4.0	M	M	88.3	47.1	3.4	0.0	3.4	-
17-Dec-18	-2.6	-0.6	-5.3	97.3	1.5	8.1	M	M	88.1	45.6	3.4	0.0	3.4	-
18-Dec-18	-2.8	0.5	-4.6	96.5	1.0	5.2	M	M	87.9	48.0	0.1	0.0	0.1	-
19-Dec-18	-3.0	-0.8	-5.4	92.6	0.9	4.8	M	M	89.4	45.4	0.7	0.0	0.7	-
20-Dec-18	-5.1	-3.7	-7.4	92.6	1.7	10.0	M	M	88.4	51.8	13.6	0.0	13.6	-
21-Dec-18	-9.1	-5.7	-12.5	85.8	1.0	7.0	M	M	89.8	54.3	0.0	0.0	0.0	-

Notes:

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Appendix 2-A. Tensas Deposit Meteorological Station Daily Data, January 1, 2017 to December 9, 2019

Date	Mean Air Temperature (°C)	Maximum Air Temperature (°C)	Minimum Air Temperature (°C)	Mean Relative Humidity (%)	Mean Wind Speed (m/s)	Maximum Wind Speed (m/s)	Mean Solar Radiation (W/m ²)	1-Hour Maximum Solar Radiation (W/m ²)	Mean Barometric Pressure at Station Elevation (kPa)	Mean Snow Depth (cm)	Total Precipitation (mm)	Total Rainfall (mm)	Total Snow-Water-Equivalent (mm)	Total Evaporation (mm)
22-Dec-18	-9.9	-8.4	-12.3	91.7	1.0	4.4	M	M	89.6	52.7	4.9	0.0	4.9	-
23-Dec-18	-7.1	-5.3	-9.4	94.5	0.9	5.3	M	M	88.9	57.0	3.9	0.0	3.9	-
24-Dec-18	-4.9	-0.3	-8.6	89.8	1.3	5.1	M	M	89.8	55.1	0.0	0.0	0.0	-
25-Dec-18	-7.2	-5.0	-9.6	92.0	0.8	3.4	M	M	90.2	53.7	0.0	0.0	0.0	-
26-Dec-18	-7.6	-4.9	-10.2	93.2	0.6	2.2	M	M	89.7	54.2	2.2	0.0	2.2	-
27-Dec-18	-6.1	-2.6	-10.6	93.9	0.6	2.5	M	M	90.4	52.4	0.4	0.0	0.4	-
28-Dec-18	-2.0	0.3	-3.8	98.5	M	M	M	M	89.5	57.4	18.3	0.0	18.3	-
29-Dec-18	-2.1	0.3	-5.0	94.2	M	12.1	M	M	88.5	74.5	19.7	0.0	19.7	-
30-Dec-18	-6.9	-3.7	-11.1	88.3	1.4	6.9	M	M	90.7	71.2	0.0	0.0	0.0	-
31-Dec-18	-5.2	-0.6	-9.0	91.5	0.8	3.5	M	M	90.7	68.1	0.0	0.0	0.0	-
1-Jan-19	1.1	4.5	-1.6	93.8	1.7	11.3	12.5	99.3	89.7	64.96	3.7	2.0	1.7	-
2-Jan-19	-0.1	3.4	-6.7	94.8	1.9	13.4	12.2	50.8	88.8	58.97	3.7	0.0	3.7	-
3-Jan-19	-6.1	-4.5	-7.6	96.4	0.6	2.2	6.4	31.9	88.5	56.30	1.3	0.0	1.3	-
4-Jan-19	-6.3	-5.2	-8.1	95.8	0.4	1.7	5.7	37.6	88.6	56.68	0.7	0.0	0.7	-
5-Jan-19	-5.8	-3.6	-7.6	96.2	-	-	4.5	30.5	88.3	59.74	6.6	0.0	6.6	-
6-Jan-19	-6.6	-5.7	-8.1	95.6	-	-	-	0.0	87.5	67.41	7.3	0.0	7.3	-
7-Jan-19	-11.9	-7.7	-14.6	88.1	1.0	4.5	-	0.0	89.6	68.85	0.0	0.0	0.0	-
8-Jan-19	-12.1	-10.4	-14.7	89.8	1.0	5.6	-	0.0	90.1	67.34	1.9	0.0	1.9	-
9-Jan-19	-9.7	-7.6	-12.0	91.6	0.6	2.2	-	0.0	88.9	72.77	7.9	0.0	7.9	-
10-Jan-19	-5.2	-1.0	-10.1	95.2	0.8	3.1	-	0.0	89.0	75.78	3.2	0.0	3.2	-
11-Jan-19	0.0	1.5	-1.7	99.3	0.9	3.3	-	0.0	89.1	73.52	2.1	0.0	2.1	-
12-Jan-19	0.6	1.8	-0.1	99.9	0.5	2.2	-	0.0	89.8	70.32	6.7	2.0	4.8	-
13-Jan-19	0.1	1.4	-0.6	100.0	0.7	2.9	10.5	48.6	90.5	66.90	0.1	0.0	0.1	-
14-Jan-19	-0.2	2.0	-2.2	99.9	0.5	2.1	22.8	112.7	90.4	65.46	0.0	0.0	0.0	-
15-Jan-19	-3.2	-1.7	-4.5	99.0	0.6	3.0	7.1	33.7	89.8	65.12	0.1	0.0	0.1	-
16-Jan-19	-5.1	-4.0	-6.1	93.8	1.8	7.4	6.2	41.2	89.6	64.82	0.0	0.0	0.0	-
17-Jan-19	-7.7	-5.7	-10.4	87.4	1.8	9.1	8.6	49.1	89.1	64.69	0.0	0.0	0.0	-
18-Jan-19	-8.8	-6.6	-10.6	93.0	0.5	3.6	14.9	100.9	89.1	65.28	1.0	0.0	1.0	-
19-Jan-19	-3.7	0.3	-8.4	91.2	1.4	7.3	10.8	70.0	88.4	67.67	2.3	0.0	2.3	-
20-Jan-19	-1.3	1.4	-4.5	78.9	1.9	7.8	26.7	188.1	89.6	68.23	0.0	0.0	0.0	-
21-Jan-19	-3.7	0.0	-6.6	78.0	1.4	5.6	41.3	275.1	90.0	67.39	1.6	0.0	1.6	-
22-Jan-19	-3.0	-0.2	-5.2	97.4	0.7	2.7	24.7	153.1	89.6	70.63	2.0	0.0	2.0	-
23-Jan-19	-2.7	-1.1	-5.7	98.8	0.5	3.8	17.0	90.9	90.8	69.57	0.3	0.0	0.3	-
24-Jan-19	-2.6	1.1	-5.7	94.8	1.0	4.9	14.6	89.0	90.9	68.76	0.0	0.0	0.0	-
25-Jan-19	1.2	3.9	-1.7	91.4	1.0	6.3	24.3	141.6	90.8	68.28	0.1	0.0	0.0	-
26-Jan-19	3.2	6.2	-0.6	82.1	2.4	12.8	43.6	261.5	90.6	65.55	1.6	1.6	0.0	-
27-Jan-19	-2.2	1.0	-6.9	81.5	1.3	6.8	36.4	182.4	91.5	63.22	0.0	0.0	0.0	-
28-Jan-19	-6.1	-2.6	-10.1	84.8	0.6	2.4	27.9	150.9	91.3	63.02	0.0	0.0	0.0	-
29-Jan-19	-7.8	-5.5	-11.0	87.6	0.4	3.0	28.0	160.8	90.4	62.81	0.2	0.0	0.2	-
30-Jan-19	-1.7	1.8	-6.5	88.4	0.7	2.5	28.2	131.7	89.6	62.91	0.2	0.0	0.2	-
31-Jan-19	-0.5	0.9	-1.9	99.2	0.4	2.0	5.9	23.9	88.7	65.56	6.0	0.0	6.0	-
1-Feb-19	-10.2	-0.3	-17.7	91.7	1.5	7.3	9.7	52.6	88.2	72.77	5.1	0.0	5.1	-
2-Feb-19	-22.6	-17.7	-26.5	71.4	2.7	8.3	17.7	99.9	89.6	75.29	0.5	0.0	0.5	-
3-Feb-19	-22.5	-18.8	-26.2	62.5	2.1	6.5	28.6	168.2	90.1	73.92	0.0	0.0	0.0	-
4-Feb-19	-19.8	-14.6	-24.5	74.9	0.6	2.3	29.7	162.8	89.8	72.83	0.0	0.0	0.0	-

Notes:

Dashes (-) indicate that not enough data were available or were erroneous.

Underlined values indicate data that were gap-filled.

Appendix 2-A. Tensas Deposit Meteorological Station Daily Data, January 1, 2017 to December 9, 2019

Date	Mean Air Temperature (°C)	Maximum Air Temperature (°C)	Minimum Air Temperature (°C)	Mean Relative Humidity (%)	Mean Wind Speed (m/s)	Maximum Wind Speed (m/s)	Mean Solar Radiation (W/m ²)	1-Hour Maximum Solar Radiation (W/m ²)	Mean Barometric Pressure at Station Elevation (kPa)	Mean Snow Depth (cm)	Total Precipitation (mm)	Total Rainfall (mm)	Total Snow-Water-Equivalent (mm)	Total Evaporation (mm)
5-Feb-19	-18.1	-12.7	-23.1	81.6	0.6	2.0	31.2	176.8	90.0	71.99	0.0	0.0	0.0	-
6-Feb-19	-13.8	-11.4	-17.7	87.5	0.4	1.8	14.6	92.4	90.4	72.19	1.0	0.0	1.0	-
7-Feb-19	-11.1	-6.2	-13.5	90.1	0.6	3.6	13.0	63.1	90.6	73.22	1.1	0.0	1.1	-
8-Feb-19	-14.4	-11.4	-18.4	77.1	2.3	8.9	17.3	82.1	91.2	73.74	0.1	0.0	0.1	-
9-Feb-19	-17.1	-12.4	-22.9	60.5	1.1	6.0	35.9	203.2	91.0	73.41	0.0	0.0	0.0	-
10-Feb-19	-11.9	-8.2	-16.6	74.1	1.6	7.1	14.8	67.9	89.7	73.62	0.6	0.0	0.6	-
11-Feb-19	-11.9	-9.9	-14.1	64.2	2.2	7.3	18.8	137.0	89.7	73.36	0.0	0.0	0.0	-
12-Feb-19	-15.7	-10.9	-20.0	67.9	1.2	5.8	46.5	238.9	89.6	72.93	0.0	0.0	0.0	-
13-Feb-19	-16.8	-12.2	-21.6	74.3	0.6	2.8	46.3	256.0	88.8	72.65	0.0	0.0	0.0	-
14-Feb-19	-12.6	-9.5	-16.8	68.5	2.5	9.7	21.8	107.7	88.7	72.64	0.0	0.0	0.0	-
15-Feb-19	-13.4	-11.3	-17.6	74.6	1.9	7.7	24.0	109.9	88.9	72.54	0.1	0.0	0.1	-
16-Feb-19	-13.8	-11.6	-15.3	80.9	1.2	5.3	31.3	154.3	89.9	74.14	1.2	0.0	1.2	-
17-Feb-19	-14.1	-10.3	-17.1	68.8	1.1	4.9	76.1	420.9	91.2	74.00	0.0	0.0	0.0	-
18-Feb-19	-11.0	-3.3	-18.0	75.2	0.6	5.0	47.2	266.4	90.6	73.63	0.0	0.0	0.0	-
19-Feb-19	-3.0	2.7	-6.1	74.7	1.6	7.0	76.3	457.2	89.5	73.24	0.0	0.0	0.0	-
20-Feb-19	-6.2	-1.4	-10.2	85.1	1.2	3.3	64.9	370.6	90.1	72.81	0.0	0.0	0.0	-
21-Feb-19	-7.4	-4.3	-11.6	84.7	0.8	3.9	47.2	225.5	89.6	72.85	1.0	0.0	1.0	-
22-Feb-19	-6.2	-4.1	-9.5	92.8	1.3	8.9	9.6	39.4	89.0	76.62	7.3	0.0	7.3	-
23-Feb-19	-12.8	-9.5	-17.2	76.0	2.5	9.2	22.3	152.3	90.7	82.59	0.6	0.0	0.6	-
24-Feb-19	-15.6	-10.1	-20.1	73.3	0.9	3.5	32.4	152.0	90.8	80.75	0.0	0.0	0.0	-
25-Feb-19	-14.2	-8.2	-20.6	66.9	1.3	5.9	39.8	183.8	90.7	79.92	0.0	0.0	0.0	-
26-Feb-19	-9.9	-1.5	-15.7	62.5	0.9	2.7	78.6	387.6	91.0	79.28	0.0	0.0	0.0	-
27-Feb-19	-6.1	0.0	-13.6	58.6	1.7	9.2	128.2	591.6	90.6	78.74	0.0	0.0	0.0	-
28-Feb-19	-4.5	1.2	-9.5	59.7	0.9	3.2	117.3	471.3	90.4	78.42	0.0	0.0	0.0	-
1-Mar-19	-9.4	-3.8	-14.8	72.5	2.1	7.9	54.9	216.9	90.7	78.51	0.3	0.0	0.3	-
2-Mar-19	-16.0	-11.9	-20.7	43.1	1.9	7.8	134.7	531.6	91.5	79.46	0.0	0.0	0.0	-
3-Mar-19	-13.8	-7.8	-20.0	39.5	1.6	5.8	137.5	536.1	91.4	79.18	0.0	0.0	0.0	-
4-Mar-19	-10.8	-3.9	-17.1	45.6	1.1	4.8	139.8	539.0	91.2	79.00	0.0	0.0	0.0	-
5-Mar-19	-9.1	-2.9	-15.6	45.2	1.3	6.1	142.4	545.8	90.5	78.88	0.0	0.0	0.0	-
6-Mar-19	-6.9	-3.3	-10.3	45.7	1.6	7.1	90.9	466.5	89.3	79.04	0.0	0.0	0.0	-
7-Mar-19	-5.5	1.0	-11.4	56.5	1.2	5.5	125.0	524.4	89.3	78.64	0.0	0.0	0.0	-
8-Mar-19	-6.3	-0.5	-12.1	61.5	1.1	3.4	151.2	560.1	89.6	78.34	0.0	0.0	0.0	-
9-Mar-19	-6.8	-0.6	-12.5	68.4	0.9	3.8	153.8	569.9	90.0	78.29	0.0	0.0	0.0	-
10-Mar-19	-5.0	-1.0	-10.9	74.8	1.6	9.4	59.6	237.4	89.6	78.27	0.8	0.0	0.8	-
11-Mar-19	-2.3	0.5	-6.2	89.5	1.3	8.0	20.3	91.0	88.6	81.75	6.3	0.0	6.3	-
12-Mar-19	-3.1	1.9	-7.1	72.4	1.9	6.6	102.2	435.9	89.5	82.79	0.0	0.0	0.0	-
13-Mar-19	-2.5	2.6	-8.3	68.2	1.2	5.1	120.1	470.7	90.2	82.15	0.0	0.0	0.0	-
14-Mar-19	-1.4	3.4	-5.5	72.8	1.9	9.4	125.5	592.3	90.2	81.71	0.6	0.0	0.6	-
15-Mar-19	-2.1	2.3	-4.7	75.0	1.0	5.4	76.1	335.5	90.8	80.64	0.0	0.0	0.0	-
16-Mar-19	-0.7	4.4	-4.5	84.8	0.7	2.9	71.5	283.8	90.7	80.94	0.2	0.0	0.2	-
17-Mar-19	2.5	9.1	-3.2	77.2	1.0	4.6	148.4	607.5	91.1	79.80	0.0	0.0	0.0	-
18-Mar-19	4.3	11.9	-2.1	65.0	0.8	3.9	160.4	573.1	91.0	78.62	0.0	0.0	0.0	-
19-Mar-19	5.7	13.8	-0.9	50.5	0.9	3.6	178.6	622.1	90.6	76.93	0.0	0.0	0.0	-
20-Mar-19	6.1	13.4	-0.8	44.1	0.9	4.1	184.1	630.0	90.3	74.80	0.0	0.0	0.0	-
21-Mar-19	7.6	16.5	-0.1	39.4	1.3	6.3	182.8	626.2	90.0	72.45	0.0	0.0	0.0	-

Notes:

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Appendix 2-A. Tenas Deposit Meteorological Station Daily Data, January 1, 2017 to December 9, 2019

Date	Mean Air Temperature (°C)	Maximum Air Temperature (°C)	Minimum Air Temperature (°C)	Mean Relative Humidity (%)	Mean Wind Speed (m/s)	Maximum Wind Speed (m/s)	Mean Solar Radiation (W/m ²)	1-Hour Maximum Solar Radiation (W/m ²)	Mean Barometric Pressure at Station Elevation (kPa)	Mean Snow Depth (cm)	Total Precipitation (mm)	Total Rainfall (mm)	Total Snow-Water-Equivalent (mm)	Total Evaporation (mm)
22-Mar-19	6.0	12.4	1.6	53.1	1.1	7.2	83.1	296.0	89.5	69.94	0.0	0.0	0.0	-
23-Mar-19	3.5	8.4	-1.9	61.1	1.5	7.8	115.3	503.8	90.4	66.67	0.0	0.0	0.0	-
24-Mar-19	1.9	8.0	-3.9	59.2	0.9	3.4	145.5	544.4	90.8	65.00	0.0	0.0	0.0	-
25-Mar-19	3.5	8.9	-1.1	52.3	1.2	4.3	187.8	641.1	90.1	64.24	0.0	0.0	0.0	-
26-Mar-19	2.9	9.4	-3.4	54.4	1.1	4.4	167.4	666.6	89.8	63.29	0.0	0.0	0.0	-
27-Mar-19	3.2	9.0	-2.3	54.9	1.6	7.3	182.0	642.8	90.5	61.81	0.0	0.0	0.0	-
28-Mar-19	3.5	11.1	-3.3	43.1	1.3	5.2	200.7	672.1	90.7	60.45	0.0	0.0	0.0	-
29-Mar-19	4.4	11.0	-2.4	45.6	1.3	5.2	205.1	678.4	91.1	59.24	0.0	0.0	0.0	-
30-Mar-19	3.7	9.5	-2.3	50.4	1.5	6.8	198.3	684.5	91.2	57.64	0.0	0.0	0.0	-
31-Mar-19	3.3	9.9	-2.5	49.3	1.3	4.6	210.9	690.0	91.1	56.32	0.0	0.0	0.0	-
1-Apr-19	4.1	10.8	-2.2	47.0	1.1	4.6	210.3	686.8	90.8	54.71	0.0	0.0	0.0	-
2-Apr-19	5.1	12.1	-2.4	39.2	1.2	5.3	212.1	687.5	89.8	52.92	0.0	0.0	0.0	-
3-Apr-19	4.5	10.4	-2.4	43.7	1.8	9.7	205.1	700.1	89.0	50.87	0.0	0.0	0.0	-
4-Apr-19	2.4	5.7	0.6	65.7	1.1	7.4	76.0	296.9	89.4	48.87	0.0	0.0	0.0	-
5-Apr-19	3.7	8.1	-1.1	75.7	1.7	11.8	133.7	530.6	88.5	47.61	2.1	2.1	0.0	-
6-Apr-19	2.6	6.8	-1.9	73.4	1.4	8.1	136.5	477.0	88.3	45.91	0.0	0.0	0.0	-
7-Apr-19	2.5	8.4	-2.3	62.8	1.6	10.4	153.6	709.0	89.1	43.78	0.0	0.0	0.0	-
8-Apr-19	2.6	9.0	-2.9	56.9	1.3	5.6	181.8	643.3	90.0	41.62	0.0	0.0	0.0	-
9-Apr-19	2.4	7.8	-2.1	63.9	1.6	7.8	128.5	437.2	90.2	40.28	0.0	0.0	0.0	-
10-Apr-19	1.1	5.4	-3.5	64.2	2.2	8.5	202.6	706.1	90.2	39.54	0.0	0.0	0.0	-
11-Apr-19	0.9	8.8	-5.6	57.6	1.2	7.0	240.1	750.8	90.1	38.54	0.0	0.0	0.0	-
12-Apr-19	2.9	8.8	-2.0	52.4	1.8	8.3	208.1	789.4	89.7	36.33	0.0	0.0	0.0	-
13-Apr-19	0.1	4.1	-1.9	92.1	1.0	5.6	96.1	442.3	88.5	35.53	3.3	0.2	3.1	-
14-Apr-19	0.9	6.1	-3.4	71.7	1.9	7.5	151.5	588.5	88.9	35.17	0.0	0.0	0.0	-
15-Apr-19	0.7	8.4	-6.2	60.1	1.4	5.5	177.3	571.5	89.1	34.70	0.1	0.0	0.1	-
16-Apr-19	2.1	7.4	-1.8	73.0	1.3	10.7	134.1	647.4	89.0	33.32	0.4	0.4	0.0	-
17-Apr-19	2.1	6.8	-1.4	81.1	1.4	8.2	123.2	463.0	89.8	31.15	0.0	0.0	0.0	-
18-Apr-19	3.4	8.6	-1.4	63.7	2.6	9.9	207.4	800.0	89.8	29.33	0.0	0.0	0.0	-
19-Apr-19	1.3	5.7	-2.8	59.7	2.6	11.5	208.8	762.3	89.9	27.98	0.0	0.0	0.0	-
20-Apr-19	2.6	9.8	-3.8	45.2	1.5	5.2	254.3	767.1	90.3	26.64	0.0	0.0	0.0	-
21-Apr-19	3.6	8.0	0.4	61.0	1.3	8.1	104.8	394.7	90.0	24.53	2.2	2.2	0.0	-
22-Apr-19	3.7	9.2	0.1	79.7	2.4	13.1	218.3	734.4	89.4	21.47	1.7	1.7	0.0	-
23-Apr-19	0.9	6.8	-3.8	64.5	2.3	10.3	191.5	736.0	90.3	18.26	0.5	0.2	0.3	-
24-Apr-19	-0.6	4.2	-5.2	62.8	1.7	7.2	184.4	671.8	90.9	17.98	0.0	0.0	0.0	-
25-Apr-19	0.3	7.0	-4.5	60.2	1.1	4.5	181.5	594.0	90.8	17.27	0.0	0.0	0.0	-
26-Apr-19	-0.5	4.2	-2.6	82.7	1.4	7.0	100.0	497.1	90.1	17.07	2.4	0.0	2.4	-
27-Apr-19	1.4	8.1	-2.8	69.9	1.3	5.2	228.7	782.5	90.8	17.09	0.8	0.5	0.2	-
28-Apr-19	2.9	9.1	-3.6	51.1	1.4	6.4	250.5	824.0	91.2	14.60	0.0	0.0	0.0	-
29-Apr-19	5.0	11.3	-2.5	34.2	1.6	6.2	273.0	866.0	91.0	12.37	0.0	0.0	0.0	-
30-Apr-19	6.4	12.7	-1.3	32.4	2.0	9.0	269.0	780.9	90.5	9.68	0.0	0.0	0.0	-
1-May-19	7.5	11.2	3.2	37.3	2.6	10.3	190.9	511.0	89.8	6.42	0.0	0.0	0.0	-
2-May-19	6.7	10.8	3.6	55.9	3.2	11.2	276.0	814.0	89.8	1.81	0.0	0.0	0.0	-
3-May-19	6.2	10.9	1.9	65.7	3.0	10.2	197.8	663.9	90.2	0.00	0.0	0.0	0.0	-
4-May-19	6.9	12.4	1.2	54.5	2.4	9.1	287.0	843.0	90.1	0.00	0.0	0.0	0.0	-
5-May-19	6.9	12.6	1.7	52.9	2.3	8.7	265.6	805.0	90.1	0.00	0.0	0.0	0.0	-

Notes:

Dashes (-) indicate that not enough data were available or were erroneous.

Underlined values indicate data that were gap-filled.

Appendix 2-A. Tenas Deposit Meteorological Station Daily Data, January 1, 2017 to December 9, 2019

Date	Mean Air Temperature (°C)	Maximum Air Temperature (°C)	Minimum Air Temperature (°C)	Mean Relative Humidity (%)	Mean Wind Speed (m/s)	Maximum Wind Speed (m/s)	Mean Solar Radiation (W/m ²)	1-Hour Maximum Solar Radiation (W/m ²)	Mean Barometric Pressure at Station Elevation (kPa)	Mean Snow Depth (cm)	Total Precipitation (mm)	Total Rainfall (mm)	Total Snow-Water-Equivalent (mm)	Total Evaporation (mm)
6-May-19	7.1	14.1	1.5	55.8	1.9	7.6	199.4	598.8	90.3	0.00	0.0	0.0	0.0	-
7-May-19	7.3	11.9	2.7	69.4	1.6	6.8	148.5	433.9	90.8	0.00	0.0	0.0	0.0	-
8-May-19	10.6	18.2	2.4	60.2	1.4	5.8	283.8	805.0	91.2	0.00	0.0	0.0	0.0	-
9-May-19	13.7	22.0	4.8	51.5	1.5	7.3	291.8	792.9	90.7	0.00	0.0	0.0	0.0	-
10-May-19	15.6	24.1	6.6	39.7	1.8	7.2	301.7	794.2	90.2	0.00	0.0	0.0	0.0	-
11-May-19	11.8	17.1	2.3	39.7	2.5	9.4	287.5	831.0	89.8	0.00	0.0	0.0	0.0	-
12-May-19	7.6	15.2	-1.4	43.8	1.5	5.2	301.1	848.0	89.9	0.00	0.0	0.0	0.0	-
13-May-19	10.1	17.7	1.7	34.2	1.5	6.8	276.4	790.9	89.8	0.00	0.0	0.0	0.0	-
14-May-19	6.0	9.5	3.8	76.1	1.2	7.1	92.7	241.8	89.6	0.00	9.8	9.8	0.0	-
15-May-19	7.2	13.1	0.6	73.4	1.8	7.4	210.2	535.6	89.8	0.00	0.1	0.1	0.0	-
16-May-19	7.4	10.7	4.5	76.8	2.0	6.8	108.6	405.9	89.2	0.00	1.0	1.0	0.0	-
17-May-19	6.0	8.4	0.8	97.0	1.1	5.9	54.6	146.0	89.2	0.00	3.1	3.1	0.0	-
18-May-19	7.0	14.3	0.2	76.6	1.2	6.2	194.7	646.1	89.7	0.00	0.0	0.0	0.0	-
19-May-19	10.9	17.6	3.4	66.0	1.3	6.7	190.2	663.0	89.6	0.00	0.5	0.5	0.0	-
20-May-19	9.2	17.3	5.3	89.2	1.3	9.7	132.0	623.1	89.3	0.00	5.2	5.2	0.0	-
21-May-19	9.8	18.5	2.6	71.8	1.3	5.8	236.4	842.0	89.8	0.00	0.1	0.1	0.0	-
22-May-19	13.0	20.4	5.0	51.3	1.4	7.7	257.9	853.0	90.5	0.00	0.0	0.0	0.0	-
23-May-19	11.2	17.5	6.7	63.5	1.6	7.3	176.6	618.4	90.3	0.00	0.1	0.1	0.0	-
24-May-19	8.2	12.6	5.4	86.5	1.0	5.6	109.6	419.9	90.1	0.00	2.4	2.4	0.0	-
25-May-19	11.4	20.1	4.5	70.9	1.4	7.4	283.5	804.0	90.4	0.00	4.1	4.1	0.0	-
26-May-19	15.9	22.9	7.5	44.7	1.4	5.9	300.6	817.0	90.4	0.00	0.0	0.0	0.0	-
27-May-19	17.6	25.6	9.3	36.2	1.8	8.2	305.1	802.0	90.3	0.00	0.0	0.0	0.0	-
28-May-19	17.5	24.2	9.6	35.8	2.1	9.0	328.9	847.0	90.3	0.00	0.0	0.0	0.0	-
29-May-19	16.5	23.1	8.5	47.3	2.0	8.3	328.4	879.0	90.3	0.00	0.0	0.0	0.0	-
30-May-19	16.8	25.2	7.8	48.0	1.6	7.3	266.6	763.7	90.3	0.00	0.0	0.0	0.0	-
31-May-19	15.6	23.1	9.8	55.9	2.0	7.9	259.6	755.2	90.3	0.00	0.0	0.0	0.0	-
1-Jun-19	10.4	14.6	4.4	63.6	2.6	11.4	253.0	864.0	90.1	0.00	1.0	1.0	0.0	-
2-Jun-19	5.7	10.5	0.4	71.8	1.5	7.1	143.4	396.1	89.8	0.00	0.2	0.2	0.0	-
3-Jun-19	6.9	13.1	0.9	71.3	2.0	8.7	244.3	679.1	89.8	0.00	0.3	0.3	0.0	-
4-Jun-19	6.2	11.7	1.9	72.3	1.7	6.7	172.7	482.8	90.2	0.00	2.4	2.4	0.0	-
5-Jun-19	6.0	12.4	-1.3	74.1	1.4	6.7	241.2	712.1	89.8	0.00	3.3	3.3	0.0	-
6-Jun-19	4.4	7.2	1.9	97.3	0.8	3.4	89.7	265.9	89.7	0.00	26.1	26.1	0.0	-
7-Jun-19	7.5	14.9	2.9	82.8	1.3	6.7	265.7	881.0	90.3	0.00	1.9	1.9	0.0	-
8-Jun-19	9.1	14.7	3.9	63.7	2.8	9.9	287.3	838.0	90.8	0.00	0.0	0.0	0.0	-
9-Jun-19	7.7	12.6	2.0	70.7	1.4	6.6	155.8	406.6	91.0	0.00	0.0	0.0	0.0	-
10-Jun-19	8.8	13.2	5.6	84.6	1.0	4.6	123.7	379.7	90.9	0.00	2.6	2.6	0.0	-
11-Jun-19	13.3	20.1	7.8	70.9	1.6	7.2	192.0	710.6	91.0	0.00	0.0	0.0	0.0	-
12-Jun-19	13.0	18.8	8.1	72.8	1.3	7.8	153.9	469.3	90.4	0.00	1.3	1.3	0.0	-
13-Jun-19	12.7	19.3	5.8	66.3	1.9	8.6	294.8	761.6	90.0	0.00	0.0	0.0	0.0	-
14-Jun-19	13.9	21.9	5.8	58.1	1.7	6.6	310.9	847.0	90.3	0.00	0.0	0.0	0.0	-
15-Jun-19	14.8	22.3	6.0	58.4	1.5	6.1	279.6	775.2	90.3	0.00	0.0	0.0	0.0	-
16-Jun-19	13.3	19.5	8.3	75.6	1.3	5.1	165.5	618.7	90.3	0.00	2.9	2.9	0.0	-
17-Jun-19	11.8	19.2	7.0	73.5	1.9	9.1	203.8	779.7	90.0	0.00	0.4	0.4	0.0	-
18-Jun-19	7.5	11.6	4.0	72.1	2.7	8.4	209.8	724.9	90.4	0.00	0.3	0.3	0.0	-
19-Jun-19	7.5	13.1	2.9	66.5	2.5	10.4	218.0	685.2	90.4	0.00	0.1	0.1	0.0	-

Notes:

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Appendix 2-A. Tenas Deposit Meteorological Station Daily Data, January 1, 2017 to December 9, 2019

Date	Mean Air Temperature (°C)	Maximum Air Temperature (°C)	Minimum Air Temperature (°C)	Mean Relative Humidity (%)	Mean Wind Speed (m/s)	Maximum Wind Speed (m/s)	Mean Solar Radiation (W/m ²)	1-Hour Maximum Solar Radiation (W/m ²)	Mean Barometric Pressure at Station Elevation (kPa)	Mean Snow Depth (cm)	Total Precipitation (mm)	Total Rainfall (mm)	Total Snow-Water-Equivalent (mm)	Total Evaporation (mm)
20-Jun-19	9.9	16.1	5.0	67.8	1.0	4.1	188.9	683.4	90.8	0.00	0.0	0.0	0.0	-
21-Jun-19	12.0	16.6	5.2	64.5	1.0	4.7	141.3	352.4	90.7	0.00	0.0	0.0	0.0	-
22-Jun-19	11.6	16.7	6.3	60.7	2.9	10.6	213.3	669.3	90.4	0.00	0.0	0.0	0.0	-
23-Jun-19	10.3	15.8	5.9	62.4	2.5	7.5	279.6	750.5	90.3	0.00	0.0	0.0	0.0	-
24-Jun-19	11.1	17.4	4.8	61.1	1.8	7.1	265.2	765.5	90.1	0.00	0.0	0.0	0.0	-
25-Jun-19	12.7	18.5	6.6	66.0	1.4	6.2	242.0	727.8	90.1	0.00	0.0	0.0	0.0	-
26-Jun-19	15.4	23.3	8.0	61.0	1.3	11.8	289.7	788.8	90.2	0.00	2.9	2.9	0.0	-
27-Jun-19	16.0	21.6	10.4	55.9	2.2	8.9	242.5	818.0	90.3	0.00	0.0	0.0	0.0	-
28-Jun-19	14.9	22.0	10.8	63.2	1.2	5.4	181.9	725.6	90.4	0.00	0.0	0.0	0.0	-
29-Jun-19	15.0	22.6	10.1	77.9	1.9	8.2	227.4	760.6	90.6	0.00	9.0	9.0	0.0	-
30-Jun-19	17.3	24.8	8.1	69.5	1.9	8.1	308.5	788.9	90.7	0.00	2.0	2.0	0.0	-
1-Jul-19	18.8	25.9	13.9	63.5	1.5	8.1	276.7	729.0	90.3	0.00	0.0	0.0	0.0	-
2-Jul-19	18.6	25.6	11.2	65.7	1.6	7.4	306.1	821.0	90.3	0.00	0.3	0.3	0.0	-
3-Jul-19	16.5	21.5	11.4	75.8	1.5	6.1	184.5	623.0	90.1	0.00	5.3	5.3	0.0	-
4-Jul-19	12.0	18.3	8.1	91.1	1.1	6.4	155.1	570.7	90.6	0.00	7.8	7.8	0.0	-
5-Jul-19	13.0	19.2	5.8	69.7	1.4	7.0	233.5	620.8	90.9	0.00	0.1	0.1	0.0	-
6-Jul-19	17.3	25.4	7.4	51.8	1.4	5.8	314.0	833.0	90.5	0.00	0.2	0.2	0.0	-
7-Jul-19	17.2	25.1	11.8	63.3	1.6	7.9	257.9	838.0	90.1	0.00	2.4	2.4	0.0	-
8-Jul-19	13.8	20.1	8.6	82.3	1.3	8.8	154.6	472.7	90.1	0.00	12.6	12.6	0.0	-
9-Jul-19	13.3	20.0	8.2	89.6	0.9	4.0	179.6	555.5	90.2	0.00	1.9	1.9	0.0	-
10-Jul-19	13.4	18.6	9.4	85.0	1.1	4.8	137.9	609.9	90.0	0.00	0.1	0.1	0.0	-
11-Jul-19	14.0	18.5	10.9	74.9	1.8	7.8	160.6	541.7	90.4	0.00	0.5	0.5	0.0	-
12-Jul-19	13.6	18.1	9.1	71.4	1.5	5.9	160.1	424.4	90.3	0.00	0.0	0.0	0.0	-
13-Jul-19	13.3	19.1	8.8	76.2	1.2	4.8	178.2	709.6	90.2	0.00	1.8	1.8	0.0	-
14-Jul-19	13.3	18.1	9.8	71.9	1.5	5.9	162.4	492.6	90.3	0.00	1.2	1.2	0.0	-
15-Jul-19	13.8	19.5	9.2	66.6	1.4	7.5	196.1	660.4	90.4	0.00	0.0	0.0	0.0	-
16-Jul-19	13.0	17.1	7.6	69.5	1.2	5.2	165.2	556.9	89.9	0.00	0.9	0.9	0.0	-
17-Jul-19	9.8	12.5	7.2	90.9	1.5	8.6	122.2	383.8	88.9	0.00	6.2	6.2	0.0	-
18-Jul-19	9.4	11.9	7.1	74.9	2.5	8.9	109.5	363.8	89.7	0.00	0.0	0.0	0.0	-
19-Jul-19	9.4	11.4	7.0	88.8	1.3	7.1	70.3	190.5	90.4	0.00	1.5	1.5	0.0	0.3
20-Jul-19	11.2	16.3	8.0	85.0	0.8	3.4	123.1	294.3	90.7	0.00	0.2	0.2	0.0	0.8
21-Jul-19	11.7	17.6	6.6	85.9	1.1	5.2	163.4	675.2	90.5	0.00	0.9	0.9	0.0	1.4
22-Jul-19	12.1	21.9	5.2	83.2	1.6	12.7	277.8	792.4	90.5	0.00	10.3	10.3	0.0	4.5
23-Jul-19	12.3	19.8	8.1	86.7	1.3	5.7	181.0	646.4	90.4	0.00	15.7	15.7	0.0	2.7
24-Jul-19	11.5	16.1	5.9	63.5	2.5	10.3	301.3	818.0	90.5	0.00	0.0	0.0	0.0	3.9
25-Jul-19	11.9	16.5	7.7	76.9	1.0	6.3	140.3	555.5	90.3	0.00	0.2	0.2	0.0	1.4
26-Jul-19	11.5	15.0	9.6	93.8	1.1	6.2	93.5	361.8	90.0	0.00	5.7	5.7	0.0	1.2
27-Jul-19	12.5	17.5	9.0	73.5	2.5	10.2	190.0	647.7	90.5	0.00	0.1	0.1	0.0	2.6
28-Jul-19	12.7	17.2	7.9	65.3	2.1	8.9	233.2	793.0	90.8	0.00	0.0	0.0	0.0	3.5
29-Jul-19	11.0	16.7	5.5	70.5	1.4	4.5	191.3	706.3	90.3	0.00	0.0	0.0	0.0	2.0
30-Jul-19	9.1	10.9	6.7	92.8	0.7	2.9	72.9	175.3	90.0	0.00	5.2	5.2	0.0	0.9
31-Jul-19	8.9	15.5	3.8	86.6	1.0	6.9	159.1	435.0	90.3	0.00	1.6	1.6	0.0	1.3
1-Aug-19	10.0	16.7	3.8	76.8	1.2	4.5	226.4	780.6	90.3	0.00	0.0	0.0	0.0	1.9
2-Aug-19	13.7	20.9	5.2	60.5	1.4	6.2	238.2	618.1	90.3	0.00	0.0	0.0	0.0	3.2
3-Aug-19	15.5	21.2	8.8	64.7	1.4	8.0	214.7	732.6	90.8	0.00	0.0	0.0	0.0	2.7

Notes:

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Appendix 2-A. Tenas Deposit Meteorological Station Daily Data, January 1, 2017 to December 9, 2019

Date	Mean Air Temperature (°C)	Maximum Air Temperature (°C)	Minimum Air Temperature (°C)	Mean Relative Humidity (%)	Mean Wind Speed (m/s)	Maximum Wind Speed (m/s)	Mean Solar Radiation (W/m ²)	1-Hour Maximum Solar Radiation (W/m ²)	Mean Barometric Pressure at Station Elevation (kPa)	Mean Snow Depth (cm)	Total Precipitation (mm)	Total Rainfall (mm)	Total Snow-Water-Equivalent (mm)	Total Evaporation (mm)
4-Aug-19	17.9	26.6	9.0	59.9	1.4	5.7	264.0	755.7	90.7	0.00	0.0	0.0	0.0	3.6
5-Aug-19	20.2	28.4	12.3	53.6	1.7	7.9	275.6	720.6	90.5	0.00	0.0	0.0	0.0	4.8
6-Aug-19	19.9	27.0	11.5	52.0	1.6	6.2	266.6	737.6	90.3	0.00	0.0	0.0	0.0	4.2
7-Aug-19	19.2	26.8	11.5	52.6	1.5	7.0	266.3	743.1	90.0	0.00	0.0	0.0	0.0	4.2
8-Aug-19	17.8	24.7	10.4	59.4	1.5	7.5	247.7	714.7	90.0	0.00	0.0	0.0	0.0	3.9
9-Aug-19	12.1	14.7	10.2	84.7	1.6	7.1	84.6	269.9	90.4	0.00	0.4	0.4	0.0	1.8
10-Aug-19	13.3	18.1	9.7	75.6	0.8	3.1	125.1	380.4	90.2	0.00	0.0	0.0	0.0	1.3
11-Aug-19	12.2	17.0	9.0	90.7	1.1	4.6	120.5	766.0	90.3	0.00	7.5	7.5	0.0	1.6
12-Aug-19	12.1	18.0	8.3	84.2	1.0	4.9	154.0	662.3	90.6	0.00	0.0	0.0	0.0	1.3
13-Aug-19	14.4	21.6	6.7	69.1	1.3	5.2	222.2	733.8	90.8	0.00	0.0	0.0	0.0	2.3
14-Aug-19	17.2	23.0	11.3	55.4	2.2	7.7	243.6	711.0	90.8	0.00	0.0	0.0	0.0	4.2
15-Aug-19	14.4	17.7	12.2	59.9	2.9	10.2	113.0	370.3	90.7	0.00	0.0	0.0	0.0	2.7
16-Aug-19	14.5	20.9	7.3	61.6	1.5	8.2	224.6	659.6	90.6	0.00	0.0	0.0	0.0	3.2
17-Aug-19	12.1	14.2	9.2	74.6	1.7	7.4	60.8	255.1	89.6	0.00	0.5	0.5	0.0	1.3
18-Aug-19	10.6	17.8	5.7	77.0	1.8	10.5	180.9	801.0	89.1	0.00	1.8	1.8	0.0	1.7
19-Aug-19	7.2	13.1	1.7	69.8	1.6	6.9	179.9	625.2	89.9	0.00	3.5	3.5	0.0	1.8
20-Aug-19	9.5	14.4	4.0	94.1	1.0	4.8	76.2	388.6	89.5	0.00	0.2	0.2	0.0	0.0
21-Aug-19	10.4	15.2	6.4	75.0	2.4	12.3	223.2	830.0	89.4	0.00	2.4	2.4	0.0	2.8
22-Aug-19	8.7	13.0	4.8	78.2	1.3	6.5	126.1	417.4	90.1	0.00	1.4	1.4	0.0	1.0
23-Aug-19	9.6	15.2	5.9	81.9	1.5	8.7	114.9	373.1	89.4	0.00	0.0	0.0	0.0	1.0
24-Aug-19	10.1	13.9	7.2	80.4	1.7	7.5	71.0	259.6	89.7	0.00	0.1	0.1	0.0	0.9
25-Aug-19	9.6	14.9	5.1	65.5	2.6	8.6	230.5	720.4	90.7	0.00	0.0	0.0	0.0	2.5
26-Aug-19	8.5	13.3	3.0	79.7	1.1	4.9	106.5	349.6	90.9	0.00	2.4	2.4	0.0	1.1
27-Aug-19	11.2	17.0	4.8	75.4	1.7	10.5	211.9	724.8	90.4	0.00	0.7	0.7	0.0	2.2
28-Aug-19	9.3	17.1	2.3	71.5	1.3	5.2	217.1	680.0	90.5	0.00	0.0	0.0	0.0	2.1
29-Aug-19	11.7	19.6	4.9	61.6	1.3	6.3	212.7	658.0	90.4	0.00	0.0	0.0	0.0	2.3
30-Aug-19	12.6	19.4	6.8	55.5	1.3	6.3	169.3	578.6	90.4	0.00	0.0	0.0	0.0	1.9
31-Aug-19	14.2	21.8	6.1	49.6	1.3	8.5	222.7	682.3	90.3	0.00	0.0	0.0	0.0	2.7
1-Sep-19	14.9	23.1	8.9	54.3	1.4	7.6	170.9	609.1	90.3	0.00	0.0	0.0	0.0	2.3
2-Sep-19	15.7	23.2	8.7	59.7	1.6	6.0	215.6	681.9	90.6	0.00	0.0	0.0	0.0	2.9
3-Sep-19	13.2	17.2	8.8	75.8	1.1	3.9	121.6	403.4	90.3	0.00	0.0	0.0	0.0	1.1
4-Sep-19	11.8	18.1	5.1	73.3	1.8	8.9	167.6	706.5	90.4	0.00	1.9	1.9	0.0	2.9
5-Sep-19	11.2	18.9	4.2	70.8	1.1	4.6	175.9	692.1	90.7	0.00	0.0	0.0	0.0	1.4
6-Sep-19	13.2	17.8	9.0	74.7	0.7	3.0	107.9	441.3	90.5	0.00	0.1	0.1	0.0	0.8
7-Sep-19	11.8	15.5	8.7	89.6	1.0	3.7	80.6	317.5	90.5	0.00	10.0	10.0	0.0	1.2
8-Sep-19	9.3	10.9	7.7	97.9	1.4	5.2	38.5	138.6	90.2	0.00	14.2	14.2	0.0	0.4
9-Sep-19	8.2	10.0	6.9	84.0	1.3	5.6	44.5	148.6	90.2	0.00	0.0	0.0	0.0	0.3
10-Sep-19	8.8	11.4	6.6	89.1	0.9	3.5	77.5	315.0	90.3	0.00	0.1	0.1	0.0	0.4
11-Sep-19	9.5	13.5	6.6	94.2	0.8	4.4	81.5	264.9	90.3	0.00	8.3	8.3	0.0	0.9
12-Sep-19	9.0	12.7	5.5	97.4	0.8	4.1	67.1	295.9	89.9	0.00	5.2	5.2	0.0	0.3
13-Sep-19	9.0	12.5	6.3	91.5	1.0	7.0	73.6	216.6	89.5	0.00	0.7	0.7	0.0	0.2
14-Sep-19	6.8	13.4	1.3	84.9	1.3	6.8	118.7	534.2	89.2	0.00	0.0	0.0	0.0	0.8
15-Sep-19	5.2	13.1	0.0	85.8	1.0	4.6	161.9	634.1	89.3	0.00	0.0	0.0	0.0	1.0
16-Sep-19	6.1	12.8	1.1	84.1	0.9	6.2	111.1	440.8	89.2	0.00	0.0	0.0	0.0	0.8
17-Sep-19	7.2	12.8	2.7	85.7	1.1	4.8	76.4	263.9	89.3	0.00	0.0	0.0	0.0	0.6

Notes:

Dashes (-) indicate that not enough data were available or were erroneous.

Underlined values indicate data that were gap-filled.

Appendix 2-A. Tenas Deposit Meteorological Station Daily Data, January 1, 2017 to December 9, 2019

Date	Mean Air Temperature (°C)	Maximum Air Temperature (°C)	Minimum Air Temperature (°C)	Mean Relative Humidity (%)	Mean Wind Speed (m/s)	Maximum Wind Speed (m/s)	Mean Solar Radiation (W/m ²)	1-Hour Maximum Solar Radiation (W/m ²)	Mean Barometric Pressure at Station Elevation (kPa)	Mean Snow Depth (cm)	Total Precipitation (mm)	Total Rainfall (mm)	Total Snow-Water-Equivalent (mm)	Total Evaporation (mm)
18-Sep-19	9.9	16.9	2.5	71.2	1.3	5.9	164.8	604.2	90.1	0.00	0.0	0.0	0.0	1.3
19-Sep-19	10.3	14.0	7.3	73.2	2.1	10.7	84.1	296.7	90.0	0.00	0.0	0.0	0.0	1.5
20-Sep-19	9.2	13.1	5.9	79.4	1.0	6.2	87.0	304.7	90.2	0.00	0.2	0.2	0.0	0.6
21-Sep-19	11.8	17.5	7.0	73.4	1.7	8.7	136.5	634.5	89.4	0.00	1.1	1.1	0.0	0.8
22-Sep-19	7.4	11.3	2.4	74.2	2.2	11.1	143.2	588.5	89.6	0.00	0.7	0.7	0.0	1.3
23-Sep-19	5.2	8.9	2.6	85.7	1.1	6.9	59.8	222.8	89.4	0.00	1.7	1.7	0.0	0.3
24-Sep-19	7.4	12.0	4.4	76.1	1.9	9.1	78.6	480.0	90.0	0.00	0.0	0.0	0.0	0.3
25-Sep-19	5.7	8.3	2.2	85.2	1.7	8.1	41.5	197.1	90.1	0.00	1.3	1.3	0.0	0.2
26-Sep-19	3.2	8.0	-1.0	80.0	2.0	7.3	95.4	395.3	89.9	0.00	0.4	0.4	0.0	0.3
27-Sep-19	1.2	6.1	-2.3	94.5	1.3	10.0	50.0	211.9	90.7	0.00	1.4	0.8	0.6	-
28-Sep-19	0.7	6.1	-4.8	72.0	1.5	6.7	135.7	546.4	91.0	0.00	0.0	0.0	0.0	-
29-Sep-19	0.9	6.6	-2.7	53.5	1.5	5.7	152.1	553.0	90.8	0.00	0.0	0.0	0.0	-
30-Sep-19	3.0	10.4	-3.2	54.5	1.0	3.0	136.2	525.4	90.3	0.00	0.0	0.0	0.0	-
1-Oct-19	5.5	9.5	1.7	69.1	0.6	2.9	69.0	333.4	90.2	0.00	0.2	0.2	0.0	-
2-Oct-19	4.0	5.3	2.5	98.5	0.5	2.1	33.2	119.3	90.0	0.00	6.5	6.5	0.0	-
3-Oct-19	4.1	5.6	3.3	99.1	0.4	2.2	44.7	205.7	89.7	0.00	9.3	9.3	0.0	-
4-Oct-19	4.4	7.4	2.6	87.6	1.6	6.9	77.3	319.6	89.9	0.00	0.1	0.1	0.0	-
5-Oct-19	4.2	8.7	0.2	69.7	2.2	9.9	130.6	495.3	90.7	0.00	0.0	0.0	0.0	-
6-Oct-19	6.4	12.3	1.3	68.3	2.1	9.7	106.3	540.0	90.0	0.00	0.2	0.2	0.0	-
7-Oct-19	1.3	7.3	-2.9	91.2	2.1	9.6	86.6	394.8	89.1	0.00	11.7	7.7	4.0	-
8-Oct-19	-3.6	0.4	-8.2	84.6	1.4	7.8	72.8	378.8	90.7	0.00	0.5	0.0	0.5	-
9-Oct-19	-4.2	2.0	-9.5	81.3	0.9	3.0	107.8	431.2	91.2	0.00	0.0	0.0	0.0	-
10-Oct-19	-1.3	4.8	-5.3	85.9	0.8	3.1	109.3	409.7	91.1	0.00	0.0	0.0	0.0	-
11-Oct-19	1.1	5.1	-3.3	85.8	0.8	3.7	50.8	341.3	90.1	0.00	0.2	0.1	0.1	-
12-Oct-19	1.7	6.5	-2.9	87.8	1.1	4.2	77.3	363.1	90.1	0.00	0.0	0.0	0.0	-
13-Oct-19	-0.6	4.3	-4.2	89.2	1.0	4.7	85.9	446.0	89.9	0.00	1.0	0.0	1.0	-
14-Oct-19	-2.1	0.7	-5.1	95.8	0.7	2.5	27.9	154.9	90.0	0.00	3.3	0.0	3.3	-
15-Oct-19	0.8	3.0	-0.6	99.5	0.9	2.7	24.1	115.2	88.8	0.00	3.4	1.3	2.0	-
16-Oct-19	2.6	5.1	0.2	98.9	1.1	4.6	25.5	125.8	88.2	0.00	2.4	2.4	0.0	-
17-Oct-19	2.5	8.6	-0.4	88.3	1.2	6.7	79.2	349.9	87.7	0.00	0.0	0.0	0.0	-
18-Oct-19	1.2	4.6	-2.2	84.3	1.5	6.6	54.8	332.9	88.4	0.00	0.0	0.0	0.0	-
19-Oct-19	-1.2	2.4	-3.9	93.9	0.6	2.4	48.8	450.5	89.1	0.00	0.5	0.0	0.5	-
20-Oct-19	-0.4	1.3	-1.8	99.2	0.6	2.3	29.8	220.6	89.2	0.00	2.5	0.0	2.5	-
21-Oct-19	0.7	2.6	-0.2	100.0	0.7	3.4	20.3	95.6	89.3	0.00	5.4	1.8	3.6	-
22-Oct-19	2.4	5.4	-1.2	83.4	2.4	11.8	69.5	360.0	90.3	0.00	1.0	1.0	0.0	-
23-Oct-19	1.0	3.8	-1.9	96.8	0.8	4.0	22.0	114.3	91.0	0.00	1.5	0.8	0.7	-
24-Oct-19	3.7	7.4	-0.9	87.9	2.0	10.4	13.8	67.8	89.9	2.87	36.7	36.7	0.0	-
25-Oct-19	0.3	2.5	-0.7	93.5	2.0	7.2	28.9	196.2	90.2	29.28	6.0	1.0	5.0	-
26-Oct-19	-2.9	0.9	-5.6	96.5	0.8	3.5	53.5	314.2	92.0	26.63	0.2	0.0	0.2	-
27-Oct-19	-4.3	-0.2	-8.0	95.5	0.7	2.6	58.1	324.1	91.5	24.94	0.3	0.0	0.3	-
28-Oct-19	-2.2	2.3	-5.4	93.5	0.7	2.6	66.7	347.5	91.3	21.94	0.0	0.0	0.0	-
29-Oct-19	-3.3	1.2	-7.7	89.0	0.7	3.5	60.6	333.9	91.1	19.33	0.2	0.0	0.2	-
30-Oct-19	0.8	4.9	-2.5	90.0	0.8	5.8	37.5	210.4	90.9	16.75	0.0	0.0	0.0	-
31-Oct-19	-1.0	2.0	-2.7	97.9	0.7	2.2	38.8	222.2	91.1	13.78	0.1	0.0	0.1	-
1-Nov-19	2.8	8.3	-1.9	91.3	1.2	7.0	38.9	265.1	91.0	11.46	0.1	0.1	0.0	-

Notes:

Dashes (-) indicate that not enough data were available or were erroneous.

Underlined values indicate data that were gap-filled.

Appendix 2-A. Tenas Deposit Meteorological Station Daily Data, January 1, 2017 to December 9, 2019

Date	Mean Air Temperature (°C)	Maximum Air Temperature (°C)	Minimum Air Temperature (°C)	Mean Relative Humidity (%)	Mean Wind Speed (m/s)	Maximum Wind Speed (m/s)	Mean Solar Radiation (W/m ²)	1-Hour Maximum Solar Radiation (W/m ²)	Mean Barometric Pressure at Station Elevation (kPa)	Mean Snow Depth (cm)	Total Precipitation (mm)	Total Rainfall (mm)	Total Snow-Water-Equivalent (mm)	Total Evaporation (mm)
2-Nov-19	5.6	8.9	1.8	80.0	2.2	8.0	61.5	291.7	90.7	7.51	0.0	0.0	0.0	-
3-Nov-19	3.7	5.5	2.2	96.9	0.7	3.7	20.9	90.1	90.5	5.15	2.9	2.9	0.0	-
4-Nov-19	6.2	9.1	2.6	77.2	2.8	10.2	54.6	283.7	90.4	2.43	0.0	0.0	0.0	-
5-Nov-19	2.2	6.6	-3.3	86.5	1.3	7.0	30.2	156.9	90.9	0.05	2.3	2.3	0.0	-
6-Nov-19	-3.8	-3.2	-4.4	96.9	0.5	2.7	9.2	41.3	91.1	0.23	0.0	0.0	0.0	-
7-Nov-19	-0.7	5.2	-3.6	99.5	0.5	5.5	8.3	41.5	90.1	0.14	20.1	0.0	20.1	-
8-Nov-19	4.0	5.6	2.5	98.3	1.0	6.2	17.6	79.7	89.8	0.05	2.3	2.3	0.0	-
9-Nov-19	1.6	7.8	-7.4	95.0	1.3	8.3	31.2	181.9	90.2	0.58	1.3	1.0	0.3	-
10-Nov-19	-7.7	-6.3	-9.7	89.4	1.0	5.3	30.0	155.8	91.5	0.00	0.3	0.0	0.3	-
11-Nov-19	-7.9	-6.5	-9.0	95.1	0.6	2.0	11.4	47.8	90.5	0.96	1.6	0.0	1.6	-
12-Nov-19	-2.4	3.4	-8.4	97.7	0.8	5.2	26.1	142.5	89.7	1.14	0.2	0.0	0.2	-
13-Nov-19	1.9	3.8	0.6	94.6	0.9	4.3	19.5	120.9	90.1	0.58	0.0	0.0	0.0	-
14-Nov-19	2.2	5.1	0.3	92.6	1.0	3.7	38.6	202.7	89.3	0.34	0.0	0.0	0.0	-
15-Nov-19	2.1	5.6	-0.8	90.6	1.1	5.7	41.1	202.3	89.5	0.00	0.5	0.5	0.0	-
16-Nov-19	1.3	2.9	0.0	96.8	0.9	4.0	11.3	62.2	89.1	0.00	9.8	6.2	3.7	-
17-Nov-19	3.8	6.7	0.2	88.0	2.3	10.7	19.7	90.1	89.0	0.00	2.5	2.5	0.0	-
18-Nov-19	-0.8	1.7	-4.5	92.7	0.9	4.9	15.7	72.3	89.9	0.00	0.0	0.0	0.0	-
19-Nov-19	-3.1	-1.3	-4.5	98.8	0.8	2.9	18.9	105.4	90.3	0.00	0.0	0.0	0.0	-
20-Nov-19	-2.1	1.2	-3.8	97.1	0.5	2.2	23.2	191.6	90.5	0.05	0.1	0.0	0.1	-
21-Nov-19	-1.0	2.4	-2.9	92.3	0.7	4.0	14.4	86.9	89.6	0.91	0.0	0.0	0.0	-
22-Nov-19	2.6	4.4	-0.1	87.9	2.3	12.8	14.8	72.0	89.4	0.02	9.0	9.0	0.0	-
23-Nov-19	0.6	2.9	-0.7	95.2	-	13.2	1.9	8.0	89.1	8.07	17.8	4.9	12.9	-
24-Nov-19	-1.8	0.4	-5.5	88.3	1.9	7.4	8.4	69.3	89.8	18.78	0.5	0.0	0.5	-
25-Nov-19	-4.4	-2.2	-7.0	88.5	1.1	5.1	9.2	55.0	90.1	14.76	0.0	0.0	0.0	-
26-Nov-19	-6.5	-5.1	-10.8	92.3	1.8	7.4	6.0	38.8	90.2	13.46	1.6	0.0	1.6	-
27-Nov-19	-12.1	-9.4	-16.3	75.0	1.6	7.9	9.1	74.1	90.9	13.57	0.0	0.0	0.0	-
28-Nov-19	-14.1	-9.8	-16.8	87.7	0.5	1.8	13.7	113.9	90.1	11.70	0.0	0.0	0.0	-
29-Nov-19	-13.9	-10.8	-15.7	89.4	0.5	2.2	9.2	68.4	89.8	11.84	0.0	0.0	0.0	-
30-Nov-19	-13.8	-10.3	-15.2	89.0	0.6	2.1	13.0	113.7	90.1	12.96	0.0	0.0	0.0	-
1-Dec-19	-10.2	-7.7	-15.3	92.2	0.3	2.1	4.2	21.9	89.6	15.27	0.0	0.0	0.0	-
2-Dec-19	-2.3	1.3	-8.0	92.2	1.4	7.8	13.6	99.6	89.1	12.79	0.7	0.0	0.7	-
3-Dec-19	-2.4	-0.1	-8.0	92.6	1.2	9.0	13.3	88.3	89.3	12.15	1.7	0.0	1.7	-
4-Dec-19	-7.6	-3.6	-9.9	86.4	1.3	4.3	12.8	99.3	89.7	13.00	0.0	0.0	0.0	-
5-Dec-19	-8.8	-5.4	-13.0	88.3	0.7	3.8	8.4	45.6	90.1	13.54	0.0	0.0	0.0	-
6-Dec-19	-10.4	-7.6	-13.2	92.3	0.5	2.0	9.3	55.8	89.6	14.00	0.0	0.0	0.0	-
7-Dec-19	-11.6	-9.3	-15.9	92.9	0.5	2.6	17.1	140.6	89.6	14.20	0.0	0.0	0.0	-
8-Dec-19	-11.3	-6.7	-16.3	91.9	0.3	2.2	10.7	58.6	90.3	13.98	0.0	0.0	0.0	-
9-Dec-19	-7.0	-3.8	-8.9	95.3	0.3	2.0	10.5	56.6	90.5	13.07	0.0	0.0	0.0	-

Notes:

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Appendix 3-A Dustfall Laboratory Analysis Results



ERM Consultants Canada Ltd.
ATTN: Daniel Casanova
1500-1111 West Hastings Street
Vancouver BC V6E 2J3

Date Received: 20-OCT-17
Report Date: 31-OCT-17 11:41 (MT)
Version: FINAL

Client Phone: 604-689-9460

Certificate of Analysis

Lab Work Order #: L2010563
Project P.O. #: NOT SUBMITTED
Job Reference: 0403488-0007
C of C Numbers: 17-677666
Legal Site Desc:

Amber Springer, B.Sc
Account Manager

[This report shall not be reproduced except in full without the written authority of the Laboratory.]

ADDRESS: 8081 Lougheed Hwy, Suite 100, Burnaby, BC V5A 1W9 Canada | Phone: +1 604 253 4188 | Fax: +1 604 253 6700
ALS CANADA LTD Part of the ALS Group An ALS Limited Company

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID Description Sampled Date Sampled Time Client ID		L2010563-1 DUSTFALL 18-OCT-17 16:15 DF-RAIL	L2010563-2 DUSTFALL 18-OCT-17 15:10 DF-KERR	L2010563-3 DUSTFALL 18-OCT-17 10:15 DF-TELKWA	L2010563-4 DUSTFALL 16-OCT-17 12:26 DF-TENAS DEP	
Grouping	Analyte					
DUSTFALL						
Particulates	Total Dustfall (mg/dm2.day)	<0.21	1.71	0.80	0.47	
	Total Insoluble Dustfall (mg/dm2.day)	<0.21	0.24	0.53	<0.18	
	Total Soluble Dustfall (mg/dm2.day)	<0.21	1.47	0.26	0.37	
Anions and Nutrients	Ammonia, Total (as N) (mg/dm2.day)	<0.0020	0.0033	<0.0013	0.0031	
	Chloride (Cl) (mg/dm2.day)	<0.35	<0.26	<0.22	<0.25	
	Nitrate (as N) (mg/dm2.day)	<0.0022 ^{DLB}	<0.00093 ^{DLB}	<0.0014 ^{DLB}	<0.00088 ^{DLB}	
	Sulfate (SO4) (mg/dm2.day)	<0.025	0.032 ^{DLB}	<0.016	<0.018 ^{DLB}	
Metals	Aluminum (Al)-Total (mg/dm2.day)	0.00172	<0.00096 ^{DLB}	0.00203	<0.00082 ^{DLB}	
	Antimony (Sb)-Total (mg/dm2.day)	<0.0000046	<0.0000036	<0.0000029	<0.0000031	
	Arsenic (As)-Total (mg/dm2.day)	<0.0000046	<0.0000036	<0.0000029	<0.0000031	
	Barium (Ba)-Total (mg/dm2.day)	0.0000399	0.0000255	0.0000687	0.0000196	
	Beryllium (Be)-Total (mg/dm2.day)	<0.000023	<0.000018	<0.000014	<0.000015	
	Bismuth (Bi)-Total (mg/dm2.day)	<0.000023	<0.000018	<0.000014	<0.000015	
	Boron (B)-Total (mg/dm2.day)	<0.00046	<0.00036	<0.00029	<0.00031	
	Cadmium (Cd)-Total (mg/dm2.day)	<0.0000023	<0.0000018	<0.0000014	<0.0000015	
	Calcium (Ca)-Total (mg/dm2.day)	<0.0092 ^{DLB}	<0.0085 ^{DLB}	0.0140	<0.0098 ^{DLB}	
	Chromium (Cr)-Total (mg/dm2.day)	<0.000023	<0.000018	<0.000014	<0.000015	
	Cobalt (Co)-Total (mg/dm2.day)	<0.0000046	<0.0000036	<0.0000029	<0.0000031	
	Copper (Cu)-Total (mg/dm2.day)	0.0017 ^{DLB}	0.00221	<0.00060 ^{DLB}	0.00272	
	Iron (Fe)-Total (mg/dm2.day)	0.0021	<0.0011	0.00183	<0.00092	
	Lead (Pb)-Total (mg/dm2.day)	0.0000057	0.0000064	0.0000029	0.0000078	
	Lithium (Li)-Total (mg/dm2.day)	<0.00023	<0.00018	<0.00014	<0.00015	
	Magnesium (Mg)-Total (mg/dm2.day)	0.00191	0.00220	0.00274	0.00105	
	Manganese (Mn)-Total (mg/dm2.day)	0.000132	0.0000987	0.000208	0.0000929	
	Mercury (Hg)-Total (mg/dm2.day)	<0.0000023	<0.0000018	<0.0000014	<0.0000015	
	Molybdenum (Mo)-Total (mg/dm2.day)	<0.0000023	<0.0000018	<0.0000014	<0.0000015	
	Nickel (Ni)-Total (mg/dm2.day)	<0.000023	<0.000018	<0.000014	0.000023	
	Phosphorus (P)-Total (mg/dm2.day)	0.0032	0.0118	0.0081	0.0040	
	Potassium (K)-Total (mg/dm2.day)	0.0043	0.0208	0.0187	0.0107	
	Selenium (Se)-Total (mg/dm2.day)	<0.000046	<0.000036	<0.000029	<0.000031	
	Silicon (Si)-Total (mg/dm2.day)	0.0029	<0.0018	0.0042	<0.0015	
	Silver (Ag)-Total (mg/dm2.day)	<0.00000046	<0.00000036	<0.00000029	<0.00000031	
	Sodium (Na)-Total (mg/dm2.day)	<0.0046 ^{DLB}	<0.0071 ^{DLB}	<0.0086 ^{DLB}	<0.0061 ^{DLB}	
	Strontium (Sr)-Total (mg/dm2.day)	0.0000171	0.0000201	0.0000551	0.0000131	
	Thallium (Tl)-Total (mg/dm2.day)	<0.0000046	<0.0000036	<0.0000029	<0.0000031	
	Tin (Sn)-Total (mg/dm2.day)	<0.0000046	<0.0000036	<0.0000029	<0.0000031	
	Titanium (Ti)-Total (mg/dm2.day)	<0.00046	<0.00036	<0.00029	<0.00031	

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

		Sample ID	L2010563-1	L2010563-2	L2010563-3	L2010563-4	
		Description	DUSTFALL	DUSTFALL	DUSTFALL	DUSTFALL	
		Sampled Date	18-OCT-17	18-OCT-17	18-OCT-17	16-OCT-17	
		Sampled Time	16:15	15:10	10:15	12:26	
		Client ID	DF-RAIL	DF-KERR	DF-TELKWA	DF-TENAS DEP	
Grouping	Analyte						
DUSTFALL							
Metals	Uranium (U)-Total (mg/dm2.day)	<0.00000046	<0.00000036	<0.00000029	0.00000074		
	Vanadium (V)-Total (mg/dm2.day)	<0.000046 ^{DLB}	<0.000036 ^{DLB}	<0.000029 ^{DLB}	<0.000031 ^{DLB}		
	Zinc (Zn)-Total (mg/dm2.day)	<0.00028	<0.00032	<0.00026	<0.00037		

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

Reference Information

QC Samples with Qualifiers & Comments:

QC Type Description	Parameter	Qualifier	Applies to Sample Number(s)
Method Blank	Manganese (Mn)-Total	B	L2010563-1, -2, -3, -4
Method Blank	Aluminum (Al)-Total	MB-LOR	L2010563-1, -2, -3, -4
Method Blank	Calcium (Ca)-Total	MB-LOR	L2010563-1, -2, -3, -4
Method Blank	Copper (Cu)-Total	MB-LOR	L2010563-1, -2, -3, -4
Method Blank	Sodium (Na)-Total	MB-LOR	L2010563-1, -2, -3, -4
Method Blank	Zinc (Zn)-Total	MB-LOR	L2010563-1, -2, -3, -4

Qualifiers for Individual Parameters Listed:

Qualifier	Description
B	Method Blank exceeds ALS DQO. Associated sample results which are < Limit of Reporting or > 5 times blank level are considered reliable.
DLB	Detection Limit Raised. Analyte detected at comparable level in Method Blank.
MB-LOR	Method Blank exceeds ALS DQO. Limits of Reporting have been adjusted for samples with positive hits below 5x blank level.

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
CL-IC-VA	Dustfall	Dustfall Chloride by Ion Chromatography	BC LAB MAN. - PART. - SOLUBLE - ANIONS
The Dustfall analysis is carried out in accordance with the B.C. Laboratory Manual method 'Particulate - Total' and 'Particulate - Soluble - Anions and Cations by Ion Chromatography'. The chloride analysis is specifically carried out using procedures adapted from APHA Method 4110 "Determination of Anions by Ion Chromatography" and EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography".			
DUSTFALLS-COM-DM2-VA	Dustfall	Combined Dustfalls-Total, soluble, insol	BCMOE PARTICULATE
This analysis is carried out using procedures modified from British Columbia Environmental Manual "Particulate." Particulates or Dustfall are determined gravimetrically. Total Insoluble Dustfall is determined by filtering a sample through a 0.45 um membrane filter and drying the filter at 104 degrees celsius. Total Soluble Dustfall is determined by evaporating the filtrate to dryness at 104 degrees celsius. The Total Dustfall is the sum of Insoluble Dustfall and the Soluble Dustfall.			
HG-DUST(DM2-CVAFS-VA	Dustfall	Total Mercury in Dustfalls by CVAFS	EPA 245.7
This analysis is carried out using procedures adapted from "Standard Methods for the Examination of Water and Wastewater" published by the American Public Health Association, and with procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846 published by the United States Environmental Protection Agency (EPA). Instrumental analysis is by cold vapour atomic fluorescence spectrophotometry or atomic absorption spectrophotometry (EPA Method 245.7).			
MET-DUST(DM2)-MS-VA	Dustfall	Total Metals in Dustfalls by ICPMS	EPA 6020A
This analysis is carried out using procedures adapted from "Standard Methods for the Examination of Water and Wastewater" published by the American Public Health Association, and with procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846 published by the United States Environmental Protection Agency (EPA). Instrumental analysis is by inductively coupled plasma - mass spectrometry (EPA Method 6020A).			
NH3-F-VA	Dustfall	Dustfall Ammonia by Fluorescence	BC LAB MAN. - PART. - SOLUBLE - ANIONS
The Dustfall analysis is carried out in accordance with the B.C. Laboratory Manual method 'Particulate - Total' and 'Particulate - Soluble - Anions and Cations by Ion Chromatography'. The ammonia analysis is specifically carried out using procedures modified from J. Environ. Monit., 2005, 7, 37 - 42, The Royal Society of Chemistry, "Flow-injection analysis with fluorescence detection for the determination of trace levels of ammonium in seawater", Roslyn J. Waston et al.			
Results are reported in units of nitrogen weight. To convert to units by weight of ammonium, multiply by 1.29.			
NO3-IC-VA	Dustfall	Dustfall Nitrate by Ion Chromatography	BC LAB MAN. - PART. - SOLUBLE - ANIONS
The Dustfall analysis is carried out in accordance with the B.C. Laboratory Manual method 'Particulate - Total' and 'Particulate - Soluble - Anions and Cations by Ion Chromatography'. The nitrate analysis is specifically carried out using procedures adapted from APHA Method 4110 "Determination of Anions by Ion Chromatography" and EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography".			
Results are reported in units of nitrogen weight. To convert to units by weight of nitrate, multiply by 4.43.			
SO4-IC-VA	Dustfall	Dustfall Sulfate by Ion Chromatography	BC LAB MAN. - PART. - SOLUBLE - ANIONS
The Dustfall analysis is carried out in accordance with the B.C. Laboratory Manual method 'Particulate - Total' and 'Particulate - Soluble - Anions and Cations by Ion Chromatography'. The sulfate analysis is specifically carried out using procedures adapted from APHA Method 4110 "Determination of Anions by Ion Chromatography" and EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography".			

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

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
----------------------------	---------------------

Reference Information

VA

ALS ENVIRONMENTAL - VANCOUVER, BRITISH COLUMBIA, CANADA

Chain of Custody Numbers:

17-677666

GLOSSARY OF REPORT TERMS

Surrogate - A compound that is similar in behaviour to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.

mg/kg - milligrams per kilogram based on dry weight of sample.

mg/kg wwt - milligrams per kilogram based on wet weight of sample.

mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight of sample.

mg/L - milligrams per litre.

< - Less than.

D.L. - The reported Detection Limit, also known as the Limit of Reporting (LOR).

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.

Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.



ALS Environmental

www.alsglobal.com

Chain of Custody (COC) / Analytical Request Form

Canada Toll Free: 1 800 668 9878



L2010563-COFC

COC Number: 17 - 677666

Page 1 of 1

Report To Contact and company name below will appear on the final report		Report Format / Distribution		Select Service Level Below - Contact your AM to confirm all E&P TATs (surcharges may apply)																																																																		
Company:	ERM	Select Report Format:	☒ PDF ☒ EXCEL ☐ EDD (DIGITAL)	Regular [R] ☒ Standard TAT if received by 3 pm - business days - no surcharges apply																																																																		
Contact:	Daniel Casanova	Quality Control (QC) Report with Report	☒ YES ☐ NO	4 day [P4-20%] ☐ 1 Business day [E-100%] ☐																																																																		
Phone:	250-877-7878	☐ Compare Results to Criteria on Report - provide details below if box checked		3 day [P3-25%] ☐ Same Day, Weekend or Statutory holiday [E2-200%] ☐																																																																		
Company address below will appear on the final report		Select Distribution:	☒ EMAIL ☐ MAIL ☐ FAX	2 day [P2-50%] ☐ (Laboratory opening fees may apply) ☐																																																																		
Street:	3790 Alfred Ave	Email 1 or Fax:	daniel.casanova@erm.com	Date and Time Required for all E&P TATs: dd-mm-yy hh:mm																																																																		
City/Province:	Smithers BC	Email 2:	andres.souk@erm.com	For tests that can not be performed according to the service level selected, you will be contacted.																																																																		
Postal Code:	V0J 2N0	Email 3:		Analysis Request																																																																		
Invoice To:	Same as Report To ☒ YES ☐ NO	Invoice Distribution		Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below																																																																		
Copy of Invoice with Report:	☒ YES ☐ NO	Select Invoice Distribution:	☒ EMAIL ☐ MAIL ☐ FAX																																																																			
Company:		Email 1 or Fax:	daniel.casanova@erm.com																																																																			
Contact:		Email 2:	Korina.houghton@erm.com																																																																			
Project Information		Oil and Gas Required Fields (client use)																																																																				
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ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)		end Date (dd-mm-yy)	end Time (hh:mm)	Sample Type																																																																	
	DF - Rail	Start: Oct 4 15:30	18-Oct-17	16:15	Dwt full																																																																	
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Drinking Water (DW) Samples (client use)		Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)																																																																				
Are samples taken from a Regulated DW System?																																																																						
☐ YES ☐ NO																																																																						
Are samples for human consumption/ use?																																																																						
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SHIPMENT RELEASE (client use)		INITIAL SHIPMENT RECEPTION (lab use only)																																																																				
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Daniel Casanova	Oct. 18 '17			Christa	Oct 20 2017																																																																	
REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION		WHITE - LABORATORY COPY YELLOW - CLIENT COPY																																																																				

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.

1. If any water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC form.

JULY 2017 FRONT



ERM Consultants Canada Ltd.
ATTN: Daniel Casanova
1500-1111 West Hastings Street
Vancouver BC V6E 2J3

Date Received: 29-NOV-17
Report Date: 18-DEC-17 14:17 (MT)
Version: FINAL

Client Phone: 604-689-9460

Certificate of Analysis

Lab Work Order #: L2028727
Project P.O. #: NOT SUBMITTED
Job Reference: 0403488-0007
C of C Numbers: 15-587287
Legal Site Desc:

Amber Springer, B.Sc
Account Manager

[This report shall not be reproduced except in full without the written authority of the Laboratory.]

ADDRESS: 8081 Lougheed Hwy, Suite 100, Burnaby, BC V5A 1W9 Canada | Phone: +1 604 253 4188 | Fax: +1 604 253 6700
ALS CANADA LTD Part of the ALS Group An ALS Limited Company

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID Description Sampled Date Sampled Time Client ID		L2028727-1 DUSTFALL 22-NOV-17 12:49 DF-RAIL START: OCT 18 16:15	L2028727-2 DUSTFALL 22-NOV-17 11:47 DF-KERR START: OCT 18 15:10	L2028727-3 DUSTFALL 22-NOV-17 10:35 DF-TELKWA START: OCT 18 10:15		
Grouping	Analyte					
DUSTFALL						
Particulates	Total Dustfall (mg/dm2.day)	0.16	0.40	0.28		
	Total Insoluble Dustfall (mg/dm2.day)	<0.10	0.10	0.11		
	Total Soluble Dustfall (mg/dm2.day)	0.13	0.30	0.17		
Anions and Nutrients	Ammonia, Total (as N) (mg/dm2.day)	<0.0018	0.0026	<0.0019		
	Chloride (Cl) (mg/dm2.day)	<0.31	<0.34	<0.34		
	Nitrate (as N) (mg/dm2.day)	<0.0031 ^{DLB}	<0.0017 ^{DLB}	<0.0019 ^{DLB}		
	Sulfate (SO4) (mg/dm2.day)	<0.022	<0.024	<0.024		
Metals	Aluminum (Al)-Total (mg/dm2.day)	0.00363	0.00144	0.00342		
	Antimony (Sb)-Total (mg/dm2.day)	<0.0000096 ^{DLB}	<0.0000048	<0.0000048		
	Arsenic (As)-Total (mg/dm2.day)	<0.0000048	<0.0000048	<0.0000048		
	Barium (Ba)-Total (mg/dm2.day)	0.0000905	0.000231	0.0000673		
	Beryllium (Be)-Total (mg/dm2.day)	<0.000024	<0.000024	<0.000024		
	Bismuth (Bi)-Total (mg/dm2.day)	<0.000024	<0.000024	<0.000024		
	Boron (B)-Total (mg/dm2.day)	<0.00048	<0.00048	<0.00048		
	Cadmium (Cd)-Total (mg/dm2.day)	<0.0000024	<0.0000024	<0.0000024		
	Calcium (Ca)-Total (mg/dm2.day)	<0.0067 ^{DLB}	0.0141	<0.0058 ^{DLB}		
	Chromium (Cr)-Total (mg/dm2.day)	<0.000024	<0.000024	<0.000024		
	Cobalt (Co)-Total (mg/dm2.day)	<0.0000048	<0.0000048	<0.0000048		
	Copper (Cu)-Total (mg/dm2.day)	0.00119	0.000298	0.00111		
	Iron (Fe)-Total (mg/dm2.day)	0.0047	<0.0014	0.0031		
	Lead (Pb)-Total (mg/dm2.day)	0.0000144	0.0000031	0.0000039		
	Lithium (Li)-Total (mg/dm2.day)	<0.00024	<0.00024	<0.00024		
	Magnesium (Mg)-Total (mg/dm2.day)	0.00173	0.00195	0.00179		
	Manganese (Mn)-Total (mg/dm2.day)	0.000213	0.00102	0.000199		
	Mercury (Hg)-Total (mg/dm2.day)	<0.0000024	<0.0000024	<0.0000024		
	Molybdenum (Mo)-Total (mg/dm2.day)	<0.0000024	<0.0000024	<0.0000024		
	Nickel (Ni)-Total (mg/dm2.day)	<0.000024	<0.000024	<0.000024		
	Phosphorus (P)-Total (mg/dm2.day)	<0.0024	<0.0024	0.0055		
	Potassium (K)-Total (mg/dm2.day)	<0.0024	0.0043	0.0075		
	Selenium (Se)-Total (mg/dm2.day)	<0.000048	<0.000048	<0.000048		
	Silicon (Si)-Total (mg/dm2.day)	0.0060	0.0027	0.0062		
	Silver (Ag)-Total (mg/dm2.day)	<0.00000048	<0.00000048	<0.00000048		
	Sodium (Na)-Total (mg/dm2.day)	0.0036	<0.0024	0.0040		
	Strontium (Sr)-Total (mg/dm2.day)	0.0000205	0.0000803	0.0000304		
	Thallium (Tl)-Total (mg/dm2.day)	<0.0000048	<0.0000048	<0.0000048		
	Tin (Sn)-Total (mg/dm2.day)	<0.0000048	<0.0000048	<0.0000048		
	Titanium (Ti)-Total (mg/dm2.day)	<0.00048	<0.00048	<0.00048		

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID Description Sampled Date Sampled Time Client ID		L2028727-1 DUSTFALL 22-NOV-17 12:49 DF-RAIL START: OCT 18 16:15	L2028727-2 DUSTFALL 22-NOV-17 11:47 DF-KERR START: OCT 18 15:10	L2028727-3 DUSTFALL 22-NOV-17 10:35 DF-TELKWA START: OCT 18 10:15		
Grouping	Analyte					
DUSTFALL						
Metals	Uranium (U)-Total (mg/dm2.day)	<0.00000048	<0.00000048	<0.00000048		
	Vanadium (V)-Total (mg/dm2.day)	<0.000048	<0.000048	<0.000048		
	Zinc (Zn)-Total (mg/dm2.day)	0.00040	0.00027	0.00022		

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

Reference Information

QC Samples with Qualifiers & Comments:

QC Type Description	Parameter	Qualifier	Applies to Sample Number(s)
Method Blank	Antimony (Sb)-Total	MB-LOR	L2028727-1, -2, -3
Method Blank	Calcium (Ca)-Total	MB-LOR	L2028727-1, -2, -3

Qualifiers for Individual Parameters Listed:

Qualifier	Description
DLB	Detection Limit Raised. Analyte detected at comparable level in Method Blank.
MB-LOR	Method Blank exceeds ALS DQO. Limits of Reporting have been adjusted for samples with positive hits below 5x blank level.

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
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CL-IC-VA Dustfall Dustfall Chloride by Ion Chromatography BC LAB MAN. - PART. - SOLUBLE - ANIONS

The Dustfall analysis is carried out in accordance with the B.C. Laboratory Manual method 'Particulate - Total' and 'Particulate - Soluble - Anions and Cations by Ion Chromatography'. The chloride analysis is specifically carried out using procedures adapted from APHA Method 4110 "Determination of Anions by Ion Chromatography" and EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography".

DUSTFALLS-COM-DM2-VA Dustfall Combined Dustfalls-Total, soluble, insol BCMOE PARTICULATE

This analysis is carried out using procedures modified from British Columbia Environmental Manual "Particulate." Particulates or Dustfall are determined gravimetrically. Total Insoluble Dustfall is determined by filtering a sample through a 0.45 um membrane filter and drying the filter at 104 degrees celsius. Total Soluble Dustfall is determined by evaporating the filtrate to dryness at 104 degrees celsius. The Total Dustfall is the sum of Insoluble Dustfall and the Soluble Dustfall.

HG-DUST(DM2-CVAFS-VA Dustfall Total Mercury in Dustfalls by CVAFS EPA 245.7

This analysis is carried out using procedures adapted from "Standard Methods for the Examination of Water and Wastewater" published by the American Public Health Association, and with procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846 published by the United States Environmental Protection Agency (EPA). Instrumental analysis is by cold vapour atomic fluorescence spectrophotometry or atomic absorption spectrophotometry (EPA Method 245.7).

MET-DUST(DM2)-MS-VA Dustfall Total Metals in Dustfalls by ICPMS EPA 6020A

This analysis is carried out using procedures adapted from "Standard Methods for the Examination of Water and Wastewater" published by the American Public Health Association, and with procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846 published by the United States Environmental Protection Agency (EPA). Instrumental analysis is by inductively coupled plasma - mass spectrometry (EPA Method 6020A).

NH3-F-VA Dustfall Dustfall Ammonia by Fluorescence BC LAB MAN. - PART. - SOLUBLE - ANIONS

The Dustfall analysis is carried out in accordance with the B.C. Laboratory Manual method 'Particulate - Total' and 'Particulate - Soluble - Anions and Cations by Ion Chromatography'. The ammonia analysis is specifically carried out using procedures modified from J. Environ. Monit., 2005, 7, 37 - 42, The Royal Society of Chemistry, "Flow-injection analysis with fluorescence detection for the determination of trace levels of ammonium in seawater", Roslyn J. Waston et al.

Results are reported in units of nitrogen weight. To convert to units by weight of ammonium, multiply by 1.29.

NO3-IC-VA Dustfall Dustfall Nitrate by Ion Chromatography BC LAB MAN. - PART. - SOLUBLE - ANIONS

The Dustfall analysis is carried out in accordance with the B.C. Laboratory Manual method 'Particulate - Total' and 'Particulate - Soluble - Anions and Cations by Ion Chromatography'. The nitrate analysis is specifically carried out using procedures adapted from APHA Method 4110 "Determination of Anions by Ion Chromatography" and EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography".

Results are reported in units of nitrogen weight. To convert to units by weight of nitrate, multiply by 4.43.

SO4-IC-VA Dustfall Dustfall Sulfate by Ion Chromatography BC LAB MAN. - PART. - SOLUBLE - ANIONS

The Dustfall analysis is carried out in accordance with the B.C. Laboratory Manual method 'Particulate - Total' and 'Particulate - Soluble - Anions and Cations by Ion Chromatography'. The sulfate analysis is specifically carried out using procedures adapted from APHA Method 4110 "Determination of Anions by Ion Chromatography" and EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography".

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

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
VA	ALS ENVIRONMENTAL - VANCOUVER, BRITISH COLUMBIA, CANADA

Chain of Custody Numbers:

15-587287

Reference Information

GLOSSARY OF REPORT TERMS

Surrogate - A compound that is similar in behaviour to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.

mg/kg - milligrams per kilogram based on dry weight of sample.

mg/kg ww - milligrams per kilogram based on wet weight of sample.

mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight of sample.

mg/L - milligrams per litre.

< - Less than.

D.L. - The reported Detection Limit, also known as the Limit of Reporting (LOR).

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.

Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.

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[illegible]

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

WHITE - LABORATORY COPY YELLOW - CLIENT COPY

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.

1. If any water samples are taken from a **Regulated Drinking Water (DW) System**, please submit using an **Authorized DW COC form**.

OCTOBER 2015 FRO



ERM Consultants Canada Ltd.
ATTN: Daniel Casanova
1500-1111 West Hastings Street
Vancouver BC V6E 2J3

Date Received: 30-NOV-17
Report Date: 13-DEC-17 11:03 (MT)
Version: FINAL

Client Phone: 604-689-9460

Certificate of Analysis

Lab Work Order #: L2029324
Project P.O. #: NOT SUBMITTED
Job Reference: 0403488-0007
C of C Numbers: 10-385511
Legal Site Desc:

Amber Springer, B.Sc
Account Manager

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ADDRESS: 8081 Lougheed Hwy, Suite 100, Burnaby, BC V5A 1W9 Canada | Phone: +1 604 253 4188 | Fax: +1 604 253 6700
ALS CANADA LTD Part of the ALS Group An ALS Limited Company

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID Description Sampled Date Sampled Time Client ID		L2029324-1 Dustfall 28-NOV-17 12:45 DF-TENAS DEP/START OCT 16 12:25				
Grouping	Analyte					
DUSTFALL						
Particulates	Total Dustfall (mg/dm2.day)	0.32				
	Total Insoluble Dustfall (mg/dm2.day)	<0.10				
	Total Soluble Dustfall (mg/dm2.day)	0.32				
Anions and Nutrients	Ammonia, Total (as N) (mg/dm2.day)	<0.0020				
	Chloride (Cl) (mg/dm2.day)	<0.36				
	Nitrate (as N) (mg/dm2.day)	0.00187				
	Sulfate (SO4) (mg/dm2.day)	<0.025				
Metals	Aluminum (Al)-Total (mg/dm2.day)	0.00063				
	Antimony (Sb)-Total (mg/dm2.day)	<0.0000051				
	Arsenic (As)-Total (mg/dm2.day)	<0.0000051				
	Barium (Ba)-Total (mg/dm2.day)	0.0000145				
	Beryllium (Be)-Total (mg/dm2.day)	<0.000025				
	Bismuth (Bi)-Total (mg/dm2.day)	<0.000025				
	Boron (B)-Total (mg/dm2.day)	<0.00051				
	Cadmium (Cd)-Total (mg/dm2.day)	<0.0000025				
	Calcium (Ca)-Total (mg/dm2.day)	<0.0030 ^{DLB}				
	Chromium (Cr)-Total (mg/dm2.day)	<0.000025				
	Cobalt (Co)-Total (mg/dm2.day)	<0.0000051				
	Copper (Cu)-Total (mg/dm2.day)	0.000119				
	Iron (Fe)-Total (mg/dm2.day)	<0.0015				
	Lead (Pb)-Total (mg/dm2.day)	<0.0000025				
	Lithium (Li)-Total (mg/dm2.day)	<0.00025				
	Magnesium (Mg)-Total (mg/dm2.day)	0.00034				
	Manganese (Mn)-Total (mg/dm2.day)	0.0000508				
	Mercury (Hg)-Total (mg/dm2.day)	<0.0000025				
	Molybdenum (Mo)-Total (mg/dm2.day)	<0.0000025				
	Nickel (Ni)-Total (mg/dm2.day)	<0.000025				
	Phosphorus (P)-Total (mg/dm2.day)	<0.0025				
	Potassium (K)-Total (mg/dm2.day)	<0.0025				
	Selenium (Se)-Total (mg/dm2.day)	<0.000051				
	Silicon (Si)-Total (mg/dm2.day)	<0.0025				
	Silver (Ag)-Total (mg/dm2.day)	<0.00000051				
	Sodium (Na)-Total (mg/dm2.day)	<0.0025				
	Strontium (Sr)-Total (mg/dm2.day)	0.0000066				
	Thallium (Tl)-Total (mg/dm2.day)	<0.0000051				
	Tin (Sn)-Total (mg/dm2.day)	<0.0000051				
	Titanium (Ti)-Total (mg/dm2.day)	<0.00051				

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID Description Sampled Date Sampled Time Client ID		L2029324-1 Dustfall 28-NOV-17 12:45 DF-TENAS DEP/START OCT 16 12:25				
Grouping	Analyte					
DUSTFALL						
Metals	Uranium (U)-Total (mg/dm2.day)	<0.00000051				
	Vanadium (V)-Total (mg/dm2.day)	<0.000051				
	Zinc (Zn)-Total (mg/dm2.day)	<0.00015				

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

Reference Information

QC Samples with Qualifiers & Comments:

QC Type Description	Parameter	Qualifier	Applies to Sample Number(s)
Method Blank	Calcium (Ca)-Total	MB-LOR	L2029324-1

Qualifiers for Individual Parameters Listed:

Qualifier	Description
DLB	Detection Limit Raised. Analyte detected at comparable level in Method Blank.
MB-LOR	Method Blank exceeds ALS DQO. Limits of Reporting have been adjusted for samples with positive hits below 5x blank level.

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
CL-IC-VA	Dustfall	Dustfall Chloride by Ion Chromatography	BC LAB MAN. - PART. - SOLUBLE - ANIONS
The Dustfall analysis is carried out in accordance with the B.C. Laboratory Manual method 'Particulate - Total' and 'Particulate - Soluble - Anions and Cations by Ion Chromatography'. The chloride analysis is specifically carried out using procedures adapted from APHA Method 4110 "Determination of Anions by Ion Chromatography" and EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography".			
DUSTFALLS-COM-DM2-VA	Dustfall	Combined Dustfalls-Total, soluble, insol	BCMOE PARTICULATE
This analysis is carried out using procedures modified from British Columbia Environmental Manual "Particulate." Particulates or Dustfall are determined gravimetrically. Total Insoluble Dustfall is determined by filtering a sample through a 0.45 um membrane filter and drying the filter at 104 degrees celsius. Total Soluble Dustfall is determined by evaporating the filtrate to dryness at 104 degrees celsius. The Total Dustfall is the sum of Insoluble Dustfall and the Soluble Dustfall.			

HG-DUST(DM2-CVAFS-VA)	Dustfall	Total Mercury in Dustfalls by CVAFS	EPA 245.7
This analysis is carried out using procedures adapted from "Standard Methods for the Examination of Water and Wastewater" published by the American Public Health Association, and with procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846 published by the United States Environmental Protection Agency (EPA). Instrumental analysis is by cold vapour atomic fluorescence spectrophotometry or atomic absorption spectrophotometry (EPA Method 245.7).			

MET-DUST(DM2)-MS-VA	Dustfall	Total Metals in Dustfalls by ICPMS	EPA 6020A
This analysis is carried out using procedures adapted from "Standard Methods for the Examination of Water and Wastewater" published by the American Public Health Association, and with procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846 published by the United States Environmental Protection Agency (EPA). Instrumental analysis is by inductively coupled plasma - mass spectrometry (EPA Method 6020A).			

NH3-F-VA	Dustfall	Dustfall Ammonia by Fluorescence	BC LAB MAN. - PART. - SOLUBLE - ANIONS
The Dustfall analysis is carried out in accordance with the B.C. Laboratory Manual method 'Particulate - Total' and 'Particulate - Soluble - Anions and Cations by Ion Chromatography'. The ammonia analysis is specifically carried out using procedures modified from J. Environ. Monit., 2005, 7, 37 - 42, The Royal Society of Chemistry, "Flow-injection analysis with fluorescence detection for the determination of trace levels of ammonium in seawater", Roslyn J. Waston et al.			

Results are reported in units of nitrogen weight. To convert to units by weight of ammonium, multiply by 1.29.

NO3-IC-VA	Dustfall	Dustfall Nitrate by Ion Chromatography	BC LAB MAN. - PART. - SOLUBLE - ANIONS
The Dustfall analysis is carried out in accordance with the B.C. Laboratory Manual method 'Particulate - Total' and 'Particulate - Soluble - Anions and Cations by Ion Chromatography'. The nitrate analysis is specifically carried out using procedures adapted from APHA Method 4110 "Determination of Anions by Ion Chromatography" and EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography".			

Results are reported in units of nitrogen weight. To convert to units by weight of nitrate, multiply by 4.43.

SO4-IC-VA	Dustfall	Dustfall Sulfate by Ion Chromatography	BC LAB MAN. - PART. - SOLUBLE - ANIONS
The Dustfall analysis is carried out in accordance with the B.C. Laboratory Manual method 'Particulate - Total' and 'Particulate - Soluble - Anions and Cations by Ion Chromatography'. The sulfate analysis is specifically carried out using procedures adapted from APHA Method 4110 "Determination of Anions by Ion Chromatography" and EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography".			

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

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
VA	ALS ENVIRONMENTAL - VANCOUVER, BRITISH COLUMBIA, CANADA

Chain of Custody Numbers:

10-385511

Reference Information

GLOSSARY OF REPORT TERMS

Surrogate - A compound that is similar in behaviour to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.

mg/kg - milligrams per kilogram based on dry weight of sample.

mg/kg ww - milligrams per kilogram based on wet weight of sample.

mg/kg lw - milligrams per kilogram based on lipid-adjusted weight of sample.

mg/L - milligrams per litre.

< - Less than.

D.L. - The reported Detection Limit, also known as the Limit of Reporting (LOR).

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.

Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.



Chain of Custody / Analytical Request Form
Canada Toll Free: 1 800 668 9878
www.alsglobal.com

Page 1 of 1

Report To			Report Format / Distribution			Service Request:(Rush subject to availability - Contact ALS to confirm TAT)												
Company: <i>ERM</i>			Standard: ☒ Other (specify):			☒ Regular (Standard Turnaround Times - Business Days)												
Contact: <i>Don Casanova</i>			Select: PDF ☒ Excel ☒ Digital ☐ Fax			Priority(2-4 Business Days)-50% surcharge - Contact ALS to confirm TAT												
Address: <i>3790 Alfred Ave.</i>			Email 1: <i>daniel.casanova@erm.com</i>			Emergency (1-2 Business Days)-100% Surcharge - Contact ALS to confirm TAT												
<i>Smithers BC, V0J 2N0</i>			Email 2: <i>andres.soux@erm.com</i>			Same Day or Weekend Emergency - Contact ALS to confirm TAT												
Phone: Fax:			Korina.houghton@erm.com			Analysis Request												
Invoice To Same as Report ? (circle) ☒ Yes or No (if No, provide details)			Client / Project Information			(Indicate Filtered or Preserved, F/P)												
Copy of Invoice with Report? (circle) ☒ Yes or No			Job #: <i>0403488-0007</i>															
Company:			PO / AFE:															
Contact:			LSD:															
Address:			Quote #:															
Phone: Fax:			ALS Contact: <i>A. Springer</i>			Sampler: <i>C. Hall</i>												
Lab Work Order # (lab use only)																		
Sample #	Sample Identification (This description will appear on the report)		Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Total Particulates	Soluble Particulates	Insoluble Particulates	Sulfate	Nitrate	NH3, NH4	Cl	Total Metals	Mg+	Ca+	K+	Number of Containers	
	<i>DF-Texas Dep Start Oct 16 12:25</i>		<i>28-11-17</i>	<i>12:45</i>	<i>Dustfall</i>	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	<i>2</i>	
Special Instructions / Regulation with water or land use (CCME- Freshwater Aquatic Life/BC CSR-Commercial/AB Tier 1-Natural/ETC) / Hazardous Details																		
<i>Bottles had alcohol or algicide from ALS</i>																		
Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY.																		
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SHIPMENT RELEASE (client use)			SHIPMENT RECEPTION (lab use only)			SHIPMENT VERIFICATION (lab use only)												
Released by:	Date:	Time:	Received by:	Date:	Time:	Temperature:	Verified by:	Date:	Time:	Observations: Yes / No ? If Yes add SIF								
<i>C. Hall</i>	<i>Nov 29/17</i>		<i>Code</i>	<i>Nov 30</i>	<i>1130</i>	<i>-1.6 °C</i>												

GENF 18.01 Front



ERM Consultants Canada Ltd.
ATTN: Daniel Casanova
1500-1111 West Hastings Street
Vancouver BC V6E 2J3

Date Received: 19-JAN-18
Report Date: 01-FEB-18 12:34 (MT)
Version: FINAL

Client Phone: 604-689-9460

Certificate of Analysis

Lab Work Order #: L2047191
Project P.O. #: NOT SUBMITTED
Job Reference: 0403488-0007
C of C Numbers: 15-604375
Legal Site Desc:

Amber Springer, B.Sc
Account Manager

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ADDRESS: 8081 Lougheed Hwy, Suite 100, Burnaby, BC V5A 1W9 Canada | Phone: +1 604 253 4188 | Fax: +1 604 253 6700
ALS CANADA LTD Part of the ALS Group An ALS Limited Company

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID Description Sampled Date Sampled Time Client ID		L2047191-1 Dustfall 17-JAN-18 12:06 DF-RAIL	L2047191-2 Dustfall 17-JAN-18 12:58 DF-KERR	L2047191-3 Dustfall 17-JAN-18 13:18 DF-TELKWA	L2047191-4 Dustfall 17-JAN-18 10:11 DF-TENAS DEP	
Grouping	Analyte					
DUSTFALL						
Particulates	Total Dustfall (mg/dm2.day)	<0.10	0.11	<0.10	<0.10	
	Total Insoluble Dustfall (mg/dm2.day)	<0.10	<0.10	<0.10	<0.10	
	Total Soluble Dustfall (mg/dm2.day)	<0.10	<0.10	<0.10	<0.10	
Anions and Nutrients	Ammonia, Total (as N) (mg/dm2.day)	0.00361	0.00405	0.00593	0.00432	
	Chloride (Cl) (mg/dm2.day)	<0.12	<0.15	<0.12	<0.13	
	Nitrate (as N) (mg/dm2.day)	0.00073	0.00051 ^{DLB}	0.00104	0.00038 ^{DLB}	
	Sulfate (SO4) (mg/dm2.day)	<0.0086	<0.010	<0.0086	<0.0093	
Metals	Aluminum (Al)-Total (mg/dm2.day)	<0.00027 ^{DLB}	<0.00026 ^{DLB}	0.000390	<0.00010 ^{DLB}	
	Antimony (Sb)-Total (mg/dm2.day)	<0.0000036 ^{DLB}	<0.0000022	<0.0000035 ^{DLB}	<0.0000017	
	Arsenic (As)-Total (mg/dm2.day)	<0.0000018	<0.0000022	<0.0000017	<0.0000017	
	Barium (Ba)-Total (mg/dm2.day)	0.00000789	0.0000048	0.0000139	0.00000178	
	Beryllium (Be)-Total (mg/dm2.day)	<0.0000090	<0.000011	<0.0000087	<0.0000083	
	Bismuth (Bi)-Total (mg/dm2.day)	<0.0000090	<0.000011	<0.0000087	<0.0000083	
	Boron (B)-Total (mg/dm2.day)	<0.00018	<0.00022	<0.00017	<0.00017	
	Cadmium (Cd)-Total (mg/dm2.day)	<0.00000090	<0.0000011	<0.0000087	<0.00000083	
	Calcium (Ca)-Total (mg/dm2.day)	<0.0032 ^{DLB}	<0.0026 ^{DLB}	0.00361	<0.0023 ^{DLB}	
	Chromium (Cr)-Total (mg/dm2.day)	<0.0000090	<0.000011	<0.0000087	<0.0000083	
	Cobalt (Co)-Total (mg/dm2.day)	<0.0000018	<0.0000022	<0.0000017	<0.0000017	
	Copper (Cu)-Total (mg/dm2.day)	<0.0000090	<0.000011	<0.000017 ^{DLB}	<0.0000083	
	Iron (Fe)-Total (mg/dm2.day)	<0.00054	<0.00065	0.00084	<0.00050	
	Lead (Pb)-Total (mg/dm2.day)	0.00000123	<0.0000011	0.00000201	<0.00000083	
	Lithium (Li)-Total (mg/dm2.day)	<0.000090	<0.00011	<0.000087	<0.000083	
	Magnesium (Mg)-Total (mg/dm2.day)	0.000178	0.00018	0.000266	0.000093	
	Manganese (Mn)-Total (mg/dm2.day)	<0.000020 ^{DLB}	<0.000017 ^{DLB}	0.000043 ^{DLB}	<0.0000083 ^{DLB}	
	Mercury (Hg)-Total (mg/dm2.day)	<0.00000090	<0.0000011	<0.0000087	<0.00000083	
	Molybdenum (Mo)-Total (mg/dm2.day)	0.00000229	<0.0000011	<0.0000087	<0.00000083	
	Nickel (Ni)-Total (mg/dm2.day)	<0.0000090	<0.000011	0.0000116	<0.0000083	
	Phosphorus (P)-Total (mg/dm2.day)	<0.00090	<0.0011	<0.00087	<0.00083	
	Potassium (K)-Total (mg/dm2.day)	<0.00090	<0.0011	<0.00087	<0.00083	
	Selenium (Se)-Total (mg/dm2.day)	<0.000018	<0.000022	<0.000017	<0.000017	
	Silicon (Si)-Total (mg/dm2.day)	<0.00090	<0.0011	<0.00087	<0.00083	
	Silver (Ag)-Total (mg/dm2.day)	<0.00000018	<0.00000022	<0.00000017	<0.00000017	
	Sodium (Na)-Total (mg/dm2.day)	0.00148	0.0013	0.00329	0.00137	
	Strontium (Sr)-Total (mg/dm2.day)	0.0000052	0.0000050	0.0000080	0.0000024	
	Thallium (Tl)-Total (mg/dm2.day)	<0.0000018	<0.0000022	<0.0000017	<0.0000017	
	Tin (Sn)-Total (mg/dm2.day)	<0.0000018	<0.0000022	<0.0000017	<0.0000017	
	Titanium (Ti)-Total (mg/dm2.day)	<0.00018	<0.00022	<0.00017	<0.00017	

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

		Sample ID	L2047191-1	L2047191-2	L2047191-3	L2047191-4	
		Description	Dustfall	Dustfall	Dustfall	Dustfall	
		Sampled Date	17-JAN-18	17-JAN-18	17-JAN-18	17-JAN-18	
		Sampled Time	12:06	12:58	13:18	10:11	
		Client ID	DF-RAIL	DF-KERR	DF-TELKWA	DF-TENAS DEP	
Grouping	Analyte						
DUSTFALL							
Metals	Uranium (U)-Total (mg/dm2.day)	<0.00000018	<0.00000022	<0.00000017	<0.00000017		
	Vanadium (V)-Total (mg/dm2.day)	<0.000018	<0.000022	<0.000017	<0.000017		
	Zinc (Zn)-Total (mg/dm2.day)	<0.000054	<0.000065	0.000073	<0.000050		

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

Reference Information

QC Samples with Qualifiers & Comments:

QC Type Description	Parameter	Qualifier	Applies to Sample Number(s)
Method Blank	Aluminum (Al)-Total	MB-LOR	L2047191-1, -2, -3, -4
Method Blank	Antimony (Sb)-Total	MB-LOR	L2047191-1, -2, -3, -4
Method Blank	Calcium (Ca)-Total	MB-LOR	L2047191-1, -2, -3, -4
Method Blank	Copper (Cu)-Total	MB-LOR	L2047191-1, -2, -3, -4
Method Blank	Manganese (Mn)-Total	MB-LOR	L2047191-1, -2, -3, -4

Qualifiers for Individual Parameters Listed:

Qualifier	Description
DLB	Detection Limit Raised. Analyte detected at comparable level in Method Blank.
MB-LOR	Method Blank exceeds ALS DQO. Limits of Reporting have been adjusted for samples with positive hits below 5x blank level.

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
CL-IC-VA	Dustfall	Dustfall Chloride by Ion Chromatography	BC LAB MAN. - PART. - SOLUBLE - ANIONS
The Dustfall analysis is carried out in accordance with the B.C. Laboratory Manual method 'Particulate - Total' and 'Particulate - Soluble - Anions and Cations by Ion Chromatography'. The chloride analysis is specifically carried out using procedures adapted from APHA Method 4110 "Determination of Anions by Ion Chromatography" and EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography".			
DUSTFALLS-COM-DM2-VA	Dustfall	Combined Dustfalls-Total, soluble, insol	BCMOE PARTICULATE
This analysis is carried out using procedures modified from British Columbia Environmental Manual "Particulate." Particulates or Dustfall are determined gravimetrically. Total Insoluble Dustfall is determined by filtering a sample through a 0.45 um membrane filter and drying the filter at 104 degrees celsius. Total Soluble Dustfall is determined by evaporating the filtrate to dryness at 104 degrees celsius. The Total Dustfall is the sum of Insoluble Dustfall and the Soluble Dustfall.			
HG-DUST(DM2-CVAFS-VA	Dustfall	Total Mercury in Dustfalls by CVAFS	EPA 245.7
This analysis is carried out using procedures adapted from "Standard Methods for the Examination of Water and Wastewater" published by the American Public Health Association, and with procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846 published by the United States Environmental Protection Agency (EPA). Instrumental analysis is by cold vapour atomic fluorescence spectrophotometry or atomic absorption spectrophotometry (EPA Method 245.7).			
MET-DUST(DM2)-MS-VA	Dustfall	Total Metals in Dustfalls by ICPMS	EPA 6020A
This analysis is carried out using procedures adapted from "Standard Methods for the Examination of Water and Wastewater" published by the American Public Health Association, and with procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846 published by the United States Environmental Protection Agency (EPA). Instrumental analysis is by inductively coupled plasma - mass spectrometry (EPA Method 6020A).			
NH3-F-VA	Dustfall	Dustfall Ammonia by Fluorescence	BC LAB MAN. - PART. - SOLUBLE - ANIONS
The Dustfall analysis is carried out in accordance with the B.C. Laboratory Manual method 'Particulate - Total' and 'Particulate - Soluble - Anions and Cations by Ion Chromatography'. The ammonia analysis is specifically carried out using procedures modified from J. Environ. Monit., 2005, 7, 37 - 42, The Royal Society of Chemistry, "Flow-injection analysis with fluorescence detection for the determination of trace levels of ammonium in seawater", Roslyn J. Waston et al.			
Results are reported in units of nitrogen weight. To convert to units by weight of ammonium, multiply by 1.29.			
NO3-IC-VA	Dustfall	Dustfall Nitrate by Ion Chromatography	BC LAB MAN. - PART. - SOLUBLE - ANIONS
The Dustfall analysis is carried out in accordance with the B.C. Laboratory Manual method 'Particulate - Total' and 'Particulate - Soluble - Anions and Cations by Ion Chromatography'. The nitrate analysis is specifically carried out using procedures adapted from APHA Method 4110 "Determination of Anions by Ion Chromatography" and EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography".			
Results are reported in units of nitrogen weight. To convert to units by weight of nitrate, multiply by 4.43.			
SO4-IC-VA	Dustfall	Dustfall Sulfate by Ion Chromatography	BC LAB MAN. - PART. - SOLUBLE - ANIONS
The Dustfall analysis is carried out in accordance with the B.C. Laboratory Manual method 'Particulate - Total' and 'Particulate - Soluble - Anions and Cations by Ion Chromatography'. The sulfate analysis is specifically carried out using procedures adapted from APHA Method 4110 "Determination of Anions by Ion Chromatography" and EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography".			

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

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
VA	ALS ENVIRONMENTAL - VANCOUVER, BRITISH COLUMBIA, CANADA

Chain of Custody Numbers:

Reference Information

15-604375

GLOSSARY OF REPORT TERMS

Surrogate - A compound that is similar in behaviour to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.

mg/kg - milligrams per kilogram based on dry weight of sample.

mg/kg ww - milligrams per kilogram based on wet weight of sample.

mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight of sample.

mg/L - milligrams per litre.

< - Less than.

D.L. - The reported Detection Limit, also known as the Limit of Reporting (LOR).

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.

Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.

OCTOBER 2015 ERON



ERM Consultants Canada Ltd.
ATTN: Daniel Casanova
1500-1111 West Hastings Street
Vancouver BC V6E 2J3

Date Received: 18-DEC-17
Report Date: 08-JAN-18 13:56 (MT)
Version: FINAL

Client Phone: 604-689-9460

Certificate of Analysis

Lab Work Order #: L2036519
Project P.O. #: NOT SUBMITTED
Job Reference: 0403488-0007
C of C Numbers: 15-603878
Legal Site Desc:

Amber Springer, B.Sc
Account Manager

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ALS CANADA LTD Part of the ALS Group An ALS Limited Company

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID Description Sampled Date Sampled Time Client ID		L2036519-1 Dustfall 15-DEC-17 09:43 DF-RAIL	L2036519-2 Dustfall 15-DEC-17 11:22 DF-KERR	L2036519-3 Dustfall 15-DEC-17 11:44 DF-TELKWA	L2036519-4 Dustfall 14-DEC-17 09:50 DF-TENAS DEP'	
Grouping	Analyte					
DUSTFALL						
Particulates	Total Dustfall (mg/dm2.day)	<0.13	0.19	0.27	<0.13	
	Total Insoluble Dustfall (mg/dm2.day)	<0.13	<0.13	<0.13	<0.13	
	Total Soluble Dustfall (mg/dm2.day)	<0.13	0.15	0.24	<0.13	
Anions and Nutrients	Ammonia, Total (as N) (mg/dm2.day)	<0.0013	<0.0015	0.0014	<0.00090	
	Chloride (Cl) (mg/dm2.day)	<0.23	<0.26	<0.21	<0.16	
	Nitrate (as N) (mg/dm2.day)	<0.0010 ^{DLB}	<0.00075 ^{DLB}	<0.0012 ^{DLB}	<0.00045 ^{DLB}	
	Sulfate (SO4) (mg/dm2.day)	<0.017	<0.019	<0.015 ^{DLB}	<0.011 ^{DLB}	
Metals	Aluminum (Al)-Total (mg/dm2.day)	0.000692	0.00391	<0.00092 ^{DLB}	<0.00094 ^{DLB}	
	Antimony (Sb)-Total (mg/dm2.day)	<0.0000032	<0.0000038	<0.0000031	<0.0000031 ^{DLB}	
	Arsenic (As)-Total (mg/dm2.day)	<0.0000032	<0.0000076 ^{DLB}	<0.0000031	<0.0000063 ^{DLB}	
	Barium (Ba)-Total (mg/dm2.day)	0.0000107	0.0000226	0.0000176	0.0000104	
	Beryllium (Be)-Total (mg/dm2.day)	<0.000016	<0.000019	<0.000015	<0.000016	
	Bismuth (Bi)-Total (mg/dm2.day)	<0.000016	<0.000019	<0.000015	<0.000016	
	Boron (B)-Total (mg/dm2.day)	<0.00032	<0.00038	<0.00031	<0.00031	
	Cadmium (Cd)-Total (mg/dm2.day)	<0.0000016	<0.0000019	<0.0000015	<0.0000016 ^{DLB}	
	Calcium (Ca)-Total (mg/dm2.day)	<0.0064 ^{DLB}	<0.0076 ^{DLB}	<0.0031 ^{DLB}	<0.0016 ^{DLB}	
	Chromium (Cr)-Total (mg/dm2.day)	<0.000016	<0.000019	<0.000015	<0.000016	
	Cobalt (Co)-Total (mg/dm2.day)	<0.0000032	<0.0000038	<0.0000031	<0.0000031 ^{DLB}	
	Copper (Cu)-Total (mg/dm2.day)	<0.00022 ^{DLB}	<0.0015 ^{DLB}	<0.000062 ^{DLB}	<0.00063 ^{DLB}	
	Iron (Fe)-Total (mg/dm2.day)	<0.00096	0.0045	<0.00092	0.00221	
	Lead (Pb)-Total (mg/dm2.day)	<0.0000022 ^{DLB}	<0.0000030 ^{DLB}	<0.0000015	<0.0000028 ^{DLB}	
	Lithium (Li)-Total (mg/dm2.day)	<0.00016	<0.00019	<0.00015	<0.00016	
	Magnesium (Mg)-Total (mg/dm2.day)	0.00070	0.00341	0.00023	0.00037	
	Manganese (Mn)-Total (mg/dm2.day)	<0.000064 ^{DLB}	0.0000716	0.0000395	0.0000493	
	Mercury (Hg)-Total (mg/dm2.day)	<0.0000016	<0.0000019	<0.0000015	<0.0000016	
	Molybdenum (Mo)-Total (mg/dm2.day)	<0.0000016	<0.0000019	<0.0000015	<0.0000016	
	Nickel (Ni)-Total (mg/dm2.day)	<0.000016	<0.000019	<0.000015	<0.000016	
	Phosphorus (P)-Total (mg/dm2.day)	<0.0016	<0.0019	<0.0015	<0.0016	
	Potassium (K)-Total (mg/dm2.day)	<0.0016	<0.0019	<0.0015	<0.0016	
	Selenium (Se)-Total (mg/dm2.day)	<0.000032	<0.000038	<0.000031	<0.000031	
	Silicon (Si)-Total (mg/dm2.day)	<0.0016	0.0074	<0.0015	<0.0016	
	Silver (Ag)-Total (mg/dm2.day)	<0.00000032	<0.00000038	<0.00000031	<0.00000031 ^{DLB}	
	Sodium (Na)-Total (mg/dm2.day)	<0.0064 ^{DLB}	<0.0038 ^{DLB}	<0.0092 ^{DLB}	<0.0063 ^{DLB}	
	Strontium (Sr)-Total (mg/dm2.day)	0.0000067	0.0000140	0.0000039	0.0000045	
	Thallium (Tl)-Total (mg/dm2.day)	<0.0000032	<0.0000038	<0.0000031	<0.0000031	
	Tin (Sn)-Total (mg/dm2.day)	<0.0000032	<0.0000038	<0.0000031	<0.0000031	
	Titanium (Ti)-Total (mg/dm2.day)	<0.00032	<0.00038	<0.00031	<0.00031	

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

		Sample ID	L2036519-1	L2036519-2	L2036519-3	L2036519-4	
		Description	Dustfall	Dustfall	Dustfall	Dustfall	
		Sampled Date	15-DEC-17	15-DEC-17	15-DEC-17	14-DEC-17	
		Sampled Time	09:43	11:22	11:44	09:50	
		Client ID	DF-RAIL	DF-KERR	DF-TELKWA	DF-TENAS DEP'	
Grouping	Analyte						
DUSTFALL							
Metals	Uranium (U)-Total (mg/dm2.day)	<0.00000032	<0.00000038	<0.00000031	0.00000033		
	Vanadium (V)-Total (mg/dm2.day)	<0.000032 ^{DLB}	<0.000038 ^{DLB}	<0.000031 ^{DLB}	<0.000031 ^{DLB}		
	Zinc (Zn)-Total (mg/dm2.day)	<0.00019	<0.00023	<0.00018	<0.00019		

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

Reference Information

QC Samples with Qualifiers & Comments:

QC Type Description	Parameter	Qualifier	Applies to Sample Number(s)
Method Blank	Barium (Ba)-Total	B	L2036519-1, -2, -3, -4
Duplicate	Barium (Ba)-Total	DUP-H	L2036519-1, -2, -3, -4
Method Blank	Aluminum (Al)-Total	MB-LOR	L2036519-1, -2, -3, -4
Method Blank	Arsenic (As)-Total	MB-LOR	L2036519-1, -2, -3, -4
Method Blank	Calcium (Ca)-Total	MB-LOR	L2036519-1, -2, -3, -4
Method Blank	Copper (Cu)-Total	MB-LOR	L2036519-1, -2, -3, -4
Method Blank	Lead (Pb)-Total	MB-LOR	L2036519-1, -2, -3, -4
Method Blank	Manganese (Mn)-Total	MB-LOR	L2036519-1, -2, -3, -4
Method Blank	Sodium (Na)-Total	MB-LOR	L2036519-1, -2, -3, -4
Method Blank	Zinc (Zn)-Total	MB-LOR	L2036519-1, -2, -3, -4

Qualifiers for Individual Parameters Listed:

Qualifier	Description
B	Method Blank exceeds ALS DQO. Associated sample results which are < Limit of Reporting or > 5 times blank level are considered reliable.
DLB	Detection Limit Raised. Analyte detected at comparable level in Method Blank.
DUP-H	Duplicate results outside ALS DQO, due to sample heterogeneity.
MB-LOR	Method Blank exceeds ALS DQO. Limits of Reporting have been adjusted for samples with positive hits below 5x blank level.

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
CL-IC-VA	Dustfall	Dustfall Chloride by Ion Chromatography	BC LAB MAN. - PART. - SOLUBLE - ANIONS
The Dustfall analysis is carried out in accordance with the B.C. Laboratory Manual method 'Particulate - Total' and 'Particulate - Soluble - Anions and Cations by Ion Chromatography'. The chloride analysis is specifically carried out using procedures adapted from APHA Method 4110 "Determination of Anions by Ion Chromatography" and EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography".			
DUSTFALLS-COM-DM2-VA	Dustfall	Combined Dustfalls-Total, soluble, insol	BCMOE PARTICULATE
This analysis is carried out using procedures modified from British Columbia Environmental Manual "Particulate." Particulates or Dustfall are determined gravimetrically. Total Insoluble Dustfall is determined by filtering a sample through a 0.45 um membrane filter and drying the filter at 104 degrees celsius. Total Soluble Dustfall is determined by evaporating the filtrate to dryness at 104 degrees celsius. The Total Dustfall is the sum of Insoluble Dustfall and the Soluble Dustfall.			
HG-DUST(DM2-CVAFS-VA	Dustfall	Total Mercury in Dustfalls by CVAFS	EPA 245.7
This analysis is carried out using procedures adapted from "Standard Methods for the Examination of Water and Wastewater" published by the American Public Health Association, and with procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846 published by the United States Environmental Protection Agency (EPA). Instrumental analysis is by cold vapour atomic fluorescence spectrophotometry or atomic absorption spectrophotometry (EPA Method 245.7).			
MET-DUST(DM2-MS-VA	Dustfall	Total Metals in Dustfalls by ICPMS	EPA 6020A
This analysis is carried out using procedures adapted from "Standard Methods for the Examination of Water and Wastewater" published by the American Public Health Association, and with procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846 published by the United States Environmental Protection Agency (EPA). Instrumental analysis is by inductively coupled plasma - mass spectrometry (EPA Method 6020A).			
NH3-F-VA	Dustfall	Dustfall Ammonia by Fluorescence	BC LAB MAN. - PART. - SOLUBLE - ANIONS
The Dustfall analysis is carried out in accordance with the B.C. Laboratory Manual method 'Particulate - Total' and 'Particulate - Soluble - Anions and Cations by Ion Chromatography'. The ammonia analysis is specifically carried out using procedures modified from J. Environ. Monit., 2005, 7, 37 - 42, The Royal Society of Chemistry, "Flow-injection analysis with fluorescence detection for the determination of trace levels of ammonium in seawater", Roslyn J. Waston et al.			
Results are reported in units of nitrogen weight. To convert to units by weight of ammonium, multiply by 1.29.			
NO3-IC-VA	Dustfall	Dustfall Nitrate by Ion Chromatography	BC LAB MAN. - PART. - SOLUBLE - ANIONS
The Dustfall analysis is carried out in accordance with the B.C. Laboratory Manual method 'Particulate - Total' and 'Particulate - Soluble - Anions and Cations by Ion Chromatography'. The nitrate analysis is specifically carried out using procedures adapted from APHA Method 4110 "Determination of Anions by Ion Chromatography" and EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography".			
Results are reported in units of nitrogen weight. To convert to units by weight of nitrate, multiply by 4.43.			
SO4-IC-VA	Dustfall	Dustfall Sulfate by Ion Chromatography	BC LAB MAN. - PART. - SOLUBLE - ANIONS
The Dustfall analysis is carried out in accordance with the B.C. Laboratory Manual method 'Particulate - Total' and 'Particulate - Soluble - Anions and Cations by Ion Chromatography'. The sulfate analysis is specifically carried out using procedures adapted from APHA Method 4110 "Determination of Anions by Ion Chromatography" and EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography".			

Reference Information

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

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
VA	ALS ENVIRONMENTAL - VANCOUVER, BRITISH COLUMBIA, CANADA

Chain of Custody Numbers:

15-603878

GLOSSARY OF REPORT TERMS

Surrogate - A compound that is similar in behaviour to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.

mg/kg - milligrams per kilogram based on dry weight of sample.

mg/kg ww - milligrams per kilogram based on wet weight of sample.

mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight of sample.

mg/L - milligrams per litre.

< - Less than.

D.L. - The reported Detection Limit, also known as the Limit of Reporting (LOR).

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.

Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.





ERM Consultants Canada Ltd.
ATTN: Daniel Casanova
1500-1111 West Hastings Street
Vancouver BC V6E 2J3

Date Received: 22-FEB-18
Report Date: 08-MAR-18 11:27 (MT)
Version: FINAL

Client Phone: 604-689-9460

Certificate of Analysis

Lab Work Order #: L2059708
Project P.O. #: NOT SUBMITTED
Job Reference: 0403488-0007
C of C Numbers: 17-677145
Legal Site Desc:

Amber Springer, B.Sc
Account Manager

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ALS CANADA LTD Part of the ALS Group An ALS Limited Company

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID Description Sampled Date Sampled Time Client ID		L2059708-1 Dustfall 19-FEB-18 12:58 DF-RAIL	L2059708-2 Dustfall 19-FEB-18 14:00 DF-KERR	L2059708-3 Dustfall 19-FEB-18 14:24 DF-TELKWA	L2059708-4 Dustfall 19-FEB-18 21:52 DF-TENAS DEP	
Grouping	Analyte					
DUSTFALL						
Particulates	Total Dustfall (mg/dm2.day)	<0.10	0.19	0.20	<0.10	
	Total Insoluble Dustfall (mg/dm2.day)	<0.10	<0.10	0.12	<0.10	
	Total Soluble Dustfall (mg/dm2.day)	<0.10	0.16	<0.10	<0.10	
Anions and Nutrients	Ammonia, Total (as N) (mg/dm2.day)	<0.0016	<0.0016	0.0029	<0.0016	
	Chloride (Cl) (mg/dm2.day)	<0.28	<0.27	<0.26	<0.27	
	Nitrate (as N) (mg/dm2.day)	0.00128	0.00116	0.00180	0.00078	
	Sulfate (SO4) (mg/dm2.day)	<0.020	<0.020	<0.018	<0.020	
Metals	Aluminum (Al)-Total (mg/dm2.day)	0.00089	<0.00069 ^{DLB}	0.00126	<0.00061 ^{DLB}	
	Antimony (Sb)-Total (mg/dm2.day)	<0.0000038	<0.000011 ^{DLB}	<0.000010 ^{DLB}	<0.000012 ^{DLB}	
	Arsenic (As)-Total (mg/dm2.day)	0.0000152	<0.0000076 ^{DLM}	<0.000014 ^{DLM}	<0.0000041	
	Barium (Ba)-Total (mg/dm2.day)	<0.000015 ^{DLB}	<0.0000095 ^{DLB}	<0.000019 ^{DLB}	<0.000012 ^{DLB}	
	Beryllium (Be)-Total (mg/dm2.day)	<0.000019	<0.000019	<0.000017	<0.000020	
	Bismuth (Bi)-Total (mg/dm2.day)	<0.000019	<0.000019	<0.000017	<0.000020	
	Boron (B)-Total (mg/dm2.day)	<0.00038	<0.00038	<0.00034	<0.00041	
	Cadmium (Cd)-Total (mg/dm2.day)	<0.0000019	<0.0000019 ^{DLB}	<0.0000017	<0.0000020 ^{DLB}	
	Calcium (Ca)-Total (mg/dm2.day)	<0.0030 ^{DLB}	<0.0069 ^{DLB}	0.0183	<0.0033	
	Chromium (Cr)-Total (mg/dm2.day)	<0.000019	<0.000019	<0.000017	<0.000020	
	Cobalt (Co)-Total (mg/dm2.day)	<0.0000038	<0.0000038	<0.0000034	<0.0000041 ^{DLB}	
	Copper (Cu)-Total (mg/dm2.day)	0.00274	0.00225	0.00075 ^{DLB}	<0.0011 ^{DLB}	
	Iron (Fe)-Total (mg/dm2.day)	<0.0011 ^{DLB}	<0.0011	0.0017	<0.0012	
	Lead (Pb)-Total (mg/dm2.day)	<0.0000038 ^{DLB}	0.0000028	0.0000024	<0.0000020	
	Lithium (Li)-Total (mg/dm2.day)	<0.00019	<0.00019	<0.00017	<0.00020	
	Magnesium (Mg)-Total (mg/dm2.day)	0.00097	0.00182	0.00428	0.00058	
	Manganese (Mn)-Total (mg/dm2.day)	0.0000330	0.0000339	0.0000745	<0.000025 ^{DLB}	
	Mercury (Hg)-Total (mg/dm2.day)	<0.0000019	<0.0000019	<0.0000017	<0.0000020	
	Molybdenum (Mo)-Total (mg/dm2.day)	<0.0000019	<0.0000019	<0.0000017	<0.0000020	
	Nickel (Ni)-Total (mg/dm2.day)	<0.000019	<0.000019	<0.000017	<0.000020	
	Phosphorus (P)-Total (mg/dm2.day)	<0.0019	<0.0019	<0.0017	<0.0020	
	Potassium (K)-Total (mg/dm2.day)	<0.0019	<0.0019	0.0020	<0.0020	
	Selenium (Se)-Total (mg/dm2.day)	<0.000038	<0.000038	<0.000034	<0.000041	
	Silicon (Si)-Total (mg/dm2.day)	<0.0019	0.0020	0.0055	<0.0020	
	Silver (Ag)-Total (mg/dm2.day)	<0.00000038	<0.00000038	<0.00000034	<0.00000041	
	Sodium (Na)-Total (mg/dm2.day)	<0.0019	0.0027	0.0215	<0.0020	
	Strontium (Sr)-Total (mg/dm2.day)	0.0000193	0.0000743	0.000259	0.0000188	
	Thallium (Tl)-Total (mg/dm2.day)	<0.0000038	<0.0000038	<0.0000034	<0.0000041	
	Tin (Sn)-Total (mg/dm2.day)	<0.0000038	<0.0000038	<0.0000034	<0.0000041	
	Titanium (Ti)-Total (mg/dm2.day)	<0.00038	<0.00038	<0.00034	<0.00041	

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

		Sample ID	L2059708-1	L2059708-2	L2059708-3	L2059708-4	
		Description	Dustfall	Dustfall	Dustfall	Dustfall	
		Sampled Date	19-FEB-18	19-FEB-18	19-FEB-18	19-FEB-18	
		Sampled Time	12:58	14:00	14:24	21:52	
		Client ID	DF-RAIL	DF-KERR	DF-TELKWA	DF-TENAS DEP	
Grouping	Analyte						
DUSTFALL							
Metals	Uranium (U)-Total (mg/dm2.day)		0.00000054	0.00000126	0.00000160	0.00000056	
	Vanadium (V)-Total (mg/dm2.day)		<0.000038	<0.000038	<0.000034	<0.000041	
	Zinc (Zn)-Total (mg/dm2.day)		<0.00023 ^{DLB}	<0.00034 ^{DLB}	<0.00021 ^{DLB}	<0.00025 ^{DLB}	

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

Reference Information

QC Samples with Qualifiers & Comments:

QC Type Description	Parameter	Qualifier	Applies to Sample Number(s)
Duplicate	Sodium (Na)-Total	DUP-H	L2059708-1
Duplicate	Strontium (Sr)-Total	DUP-H	L2059708-1
Duplicate	Calcium (Ca)-Total	DUP-H,J	L2059708-1
Duplicate	Magnesium (Mg)-Total	DUP-H,J	L2059708-1
Method Blank	Aluminum (Al)-Total	MB-LOR	L2059708-2, -3, -4
Method Blank	Antimony (Sb)-Total	MB-LOR	L2059708-2, -3, -4
Method Blank	Barium (Ba)-Total	MB-LOR	L2059708-2, -3, -4
Method Blank	Calcium (Ca)-Total	MB-LOR	L2059708-2, -3, -4
Method Blank	Copper (Cu)-Total	MB-LOR	L2059708-2, -3, -4
Method Blank	Manganese (Mn)-Total	MB-LOR	L2059708-2, -3, -4
Method Blank	Zinc (Zn)-Total	MB-LOR	L2059708-2, -3, -4

Qualifiers for Individual Parameters Listed:

Qualifier	Description
DLB	Detection Limit Raised. Analyte detected at comparable level in Method Blank.
DLM	Detection Limit Adjusted due to sample matrix effects (e.g. chemical interference, colour, turbidity).
DUP-H	Duplicate results outside ALS DQO, due to sample heterogeneity.
DUP-H,J	Duplicate results outside ALS DQO, due to sample heterogeneity. Duplicate results and limits are expressed in terms of absolute difference.
MB-LOR	Method Blank exceeds ALS DQO. Limits of Reporting have been adjusted for samples with positive hits below 5x blank level.

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
CL-IC-VA	Dustfall	Dustfall Chloride by Ion Chromatography	BC LAB MAN. - PART. - SOLUBLE - ANIONS
The Dustfall analysis is carried out in accordance with the B.C. Laboratory Manual method 'Particulate - Total' and 'Particulate - Soluble - Anions and Cations by Ion Chromatography'. The chloride analysis is specifically carried out using procedures adapted from APHA Method 4110 "Determination of Anions by Ion Chromatography" and EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography".			
DUSTFALLS-COM-DM2-VA	Dustfall	Combined Dustfalls-Total, soluble, insol	BCMOE PARTICULATE
This analysis is carried out using procedures modified from British Columbia Environmental Manual "Particulate." Particulates or Dustfall are determined gravimetrically. Total Insoluble Dustfall is determined by filtering a sample through a 0.45 um membrane filter and drying the filter at 104 degrees celsius. Total Soluble Dustfall is determined by evaporating the filtrate to dryness at 104 degrees celsius. The Total Dustfall is the sum of Insoluble Dustfall and the Soluble Dustfall.			
HG-DUST(DM2-CVAFS-VA	Dustfall	Total Mercury in Dustfalls by CVAFS	EPA 245.7
This analysis is carried out using procedures adapted from "Standard Methods for the Examination of Water and Wastewater" published by the American Public Health Association, and with procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846 published by the United States Environmental Protection Agency (EPA). Instrumental analysis is by cold vapour atomic fluorescence spectrophotometry or atomic absorption spectrophotometry (EPA Method 245.7).			
MET-DUST(DM2-MS-VA	Dustfall	Total Metals in Dustfalls by ICPMS	EPA 6020A
This analysis is carried out using procedures adapted from "Standard Methods for the Examination of Water and Wastewater" published by the American Public Health Association, and with procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846 published by the United States Environmental Protection Agency (EPA). Instrumental analysis is by inductively coupled plasma - mass spectrometry (EPA Method 6020A).			
NH3-F-VA	Dustfall	Dustfall Ammonia by Fluorescence	BC LAB MAN. - PART. - SOLUBLE - ANIONS
The Dustfall analysis is carried out in accordance with the B.C. Laboratory Manual method 'Particulate - Total' and 'Particulate - Soluble - Anions and Cations by Ion Chromatography'. The ammonia analysis is specifically carried out using procedures modified from J. Environ. Monit., 2005, 7, 37 - 42, The Royal Society of Chemistry, "Flow-injection analysis with fluorescence detection for the determination of trace levels of ammonium in seawater", Roslyn J. Waston et al.			
Results are reported in units of nitrogen weight. To convert to units by weight of ammonium, multiply by 1.29.			
NO3-IC-VA	Dustfall	Dustfall Nitrate by Ion Chromatography	BC LAB MAN. - PART. - SOLUBLE - ANIONS
The Dustfall analysis is carried out in accordance with the B.C. Laboratory Manual method 'Particulate - Total' and 'Particulate - Soluble - Anions and Cations by Ion Chromatography'. The nitrate analysis is specifically carried out using procedures adapted from APHA Method 4110 "Determination of Anions by Ion Chromatography" and EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography".			
Results are reported in units of nitrogen weight. To convert to units by weight of nitrate, multiply by 4.43.			
SO4-IC-VA	Dustfall	Dustfall Sulfate by Ion Chromatography	BC LAB MAN. - PART. - SOLUBLE - ANIONS

Reference Information

The Dustfall analysis is carried out in accordance with the B.C. Laboratory Manual method 'Particulate - Total' and 'Particulate - Soluble - Anions and Cations by Ion Chromatography'. The sulfate analysis is specifically carried out using procedures adapted from APHA Method 4110 "Determination of Anions by Ion Chromatography" and EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography".

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

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
----------------------------	---------------------

VA	ALS ENVIRONMENTAL - VANCOUVER, BRITISH COLUMBIA, CANADA
----	---

Chain of Custody Numbers:

17-677145

GLOSSARY OF REPORT TERMS

Surrogate - A compound that is similar in behaviour to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.

mg/kg - milligrams per kilogram based on dry weight of sample.

mg/kg ww - milligrams per kilogram based on wet weight of sample.

mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight of sample.

mg/L - milligrams per litre.

< - Less than.

D.L. - The reported Detection Limit, also known as the Limit of Reporting (LOR).

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.

Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.



Chain of Custody (COC) / Analytical Request Form

Canada Toll Free: 1 800 668 9878



COC Number: 17-677145

Page 2 of 2

L2059708-COFC

[illegible]

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JULY 2017 FROM

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1. If any water samples are taken from a **Regulated Drinking Water (DW) System**, please submit using an **Authorized DW COC form**.



Chain of Custody (COC) / Analytical Request Form

Canada Toll Free: 1 800 668 9878



COC Number: 17-677145

Page 1 of 1

L2059708-COFC

[illegible]

JULY 2017 EPOCH



ERM Consultants Canada Ltd.
ATTN: Daniel Casanova
1500-1111 West Hastings Street
Vancouver BC V6E 2J3

Date Received: 24-MAR-18
Report Date: 05-APR-18 11:29 (MT)
Version: FINAL

Client Phone: 604-689-9460

Certificate of Analysis

Lab Work Order #: L2071980
Project P.O. #: NOT SUBMITTED
Job Reference: 0403488-0007
C of C Numbers: 17-664733
Legal Site Desc:

Amber Springer, B.Sc
Account Manager

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ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID Description Sampled Date Sampled Time Client ID		L2071980-1 Dustfall 22-MAR-18 12:50 DF-RAIL	L2071980-2 Dustfall 22-MAR-18 14:22 DF-KERR	L2071980-3 Dustfall 22-MAR-18 13:58 DF-TELKWA	L2071980-4 Dustfall 22-MAR-18 10:15 DF-TENAS DEP	
Grouping	Analyte					
DUSTFALL						
Particulates	Fixed Dustfall (mg/dm2.day)	<0.10	<0.10	0.24	<0.10	
	Volatile Dustfall (mg/dm2.day)	<0.10	0.19	<0.10	<0.10	
	Total Dustfall (mg/dm2.day)	0.11	0.25	0.28	0.11	
	Fixed Insoluble Dustfall (mg/dm2.day)	<0.10	<0.10	0.20	<0.10	
	Volatile Insoluble Dustfall (mg/dm2.day)	<0.10	<0.10	<0.10	<0.10	
	Total Insoluble Dustfall (mg/dm2.day)	<0.10	<0.10	0.23	<0.10	
	Fixed Soluble Dustfall (mg/dm2.day)	<0.10	<0.10	<0.10	<0.10	
	Volatile Soluble Dustfall (mg/dm2.day)	<0.10	0.18	<0.10	<0.10	
	Total Soluble Dustfall (mg/dm2.day)	<0.10	0.21	<0.10	<0.10	

Reference Information

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
DUSTFALLS-ALL-DM2-VA	Dustfall	Dustfalls-Total, Soluble, Insoluble +FV	BC LAB MANUAL - PARTICULATE
This analysis is carried out using procedures modified from British Columbia Environmental Manual "Particulate." Particulates or "Dustfalls" are determined gravimetrically. Total Insoluble and Soluble Dustfalls are determined by filtering a sample through a 0.45 um membrane filter and drying the filter and filtrate at 104 C, followed by ignition at 550 C. The remaining residue after 550 C represents the fixed portion and the weight lost on ignition represents the volatile portion. The sum of all fixed and volatile portions on both Insoluble and Soluble portions represents Total Dustfalls.			

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

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
VA	ALS ENVIRONMENTAL - VANCOUVER, BRITISH COLUMBIA, CANADA

Chain of Custody Numbers:

17-664733

GLOSSARY OF REPORT TERMS

Surrogate - A compound that is similar in behaviour to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.

mg/kg - milligrams per kilogram based on dry weight of sample.

mg/kg ww - milligrams per kilogram based on wet weight of sample.

mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight of sample.

mg/L - milligrams per litre.

< - Less than.

D.L. - The reported Detection Limit, also known as the Limit of Reporting (LOR).

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.

Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.



Chain of Custody (COC) / Analytical Request Form

Canada Toll Free: 1 800 668 9878



L2071980-COFC

COC Number: 17 - 664733

Page 1 of 1

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Report To Contact and company name below will appear on the final report		Report Format / Distribution		Regular [R] ☒ Standard TAT if received by 3 pm - business days - no surcharges apply		
Company:	ERM	Select Report Format:	☒ PDF ☒ EXCEL ☐ EDD (DIGITAL)	Emergency [E] ☐ Standard TAT if received by 3 pm - business days - no surcharges apply		
Contact:	Daniel Casanova	Quality Control (QC) Report with Report	☒ YES ☐ NO	1 Business day [E-100%] ☐		
Phone:	226-822-8998	☐ Compare Results to Criteria on Report - provide details below if box checked		Same Day, Weekend or Statutory holiday [E2-200%] ☐		
Company address below will appear on the final report		Select Distribution:	☒ EMAIL ☐ MAIL ☐ FAX	(Laboratory opening fees may apply)		
Street:	3790 Alfred Ave	Email 1 or Fax:	daniel.casanova@erm.com	Date and Time Required for all E&P TATs:		
City/Province:	Smithers BC	Email 2:	andrea.sau@erm.com	For tests that can not be performed according to the service level selected, you will be contacted.		
Postal Code:	V0J 2M0	Email 3:		Analysis Request		
Invoice To:	Same as Report To ☒ YES ☐ NO	Invoice Distribution		Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below		
	Copy of Invoice with Report ☒ YES ☐ NO	Select Invoice Distribution:	☒ EMAIL ☐ MAIL ☐ FAX			
Company:		Email 1 or Fax:	daniel.casanova@erm.com			
Contact:		Email 2:	corinne.houghton@erm.com			
Project Information		Oil and Gas Required Fields (client use)				
ALS Account # / Quote #:		AFE/Cost Center:	PO#			
Job #:	0403488-0007	Major/Minor Code:	Routing Code:			
PO / AFE:		Requisitioner:				
LSD:		Location:				
ALS Lab Work Order # (lab use only):		ALS Contact:	A. Springer	Sampler:	D. Casanova	
ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)		End Date (dd-mm-yy)	End Time (hh:mm)	Sample Type	
	DF-Rail	Start: Feb 19	12:58	22-Mar-18	12:50	Dustfall
	DF-Kern	"	14:00	"	14:22	"
	DF-Tekma	"	14:25	"	13:58	"
	DF-TexasDep	"	9:52	"	10:15	"
Drinking Water (DW) Samples¹ (client use)						
Are samples taken from a Regulated DW System?		Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)				
☐ YES ☐ NO						
Are samples for human consumption/ use?						
☐ YES ☐ NO						
SHIPMENT RELEASE (client use)						
Released by:	Date:	Time:	Received by:	Date:	Time:	
Daniel Casanova	3/23/2018	6:40				
INITIAL SHIPMENT RECEPTION (lab use only)						
FINAL SHIPMENT RECEPTION (lab use only)						
Received by: <i>lucy</i> Date: <i>Mar 24</i> Time: <i>11:30AM</i>						

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

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1. If any water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC form.

JULY 2017 FRONT



ERM Consultants Canada Ltd.
ATTN: Daniel Casanova
1500-1111 West Hastings Street
Vancouver BC V6E 2J3

Date Received: 24-APR-18
Report Date: 03-MAY-18 11:52 (MT)
Version: FINAL

Client Phone: 604-689-9460

Certificate of Analysis

Lab Work Order #: L2084100
Project P.O. #: NOT SUBMITTED
Job Reference: 0403488-0007
C of C Numbers: 17-685767
Legal Site Desc:

Amber Springer, B.Sc
Account Manager

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ALS CANADA LTD Part of the ALS Group An ALS Limited Company

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID Description Sampled Date Sampled Time Client ID		L2084100-1 Dustfall 23-APR-18 10:45 DF-RAIL	L2084100-2 Dustfall 23-APR-18 09:45 DF-KERR	L2084100-3 Dustfall 23-APR-18 10:05 DF-TELKWA		
Grouping	Analyte					
DUSTFALL						
Particulates	Fixed Dustfall (mg/dm2.day)	<0.10	0.39	<0.10		
	Volatile Dustfall (mg/dm2.day)	<0.10	<0.10	<0.10		
	Total Dustfall (mg/dm2.day)	0.13	0.47	0.16		
	Fixed Insoluble Dustfall (mg/dm2.day)	<0.10	0.37	<0.10		
	Volatile Insoluble Dustfall (mg/dm2.day)	<0.10	<0.10	<0.10		
	Total Insoluble Dustfall (mg/dm2.day)	<0.10	0.42	0.12		
	Fixed Soluble Dustfall (mg/dm2.day)	<0.10	<0.10	<0.10		
	Volatile Soluble Dustfall (mg/dm2.day)	<0.10	<0.10	<0.10		
	Total Soluble Dustfall (mg/dm2.day)	<0.10	<0.10	<0.10		

Reference Information

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
DUSTFALLS-ALL-DM2-VA	Dustfall	Dustfalls-Total, Soluble, Insoluble +FV	BC LAB MANUAL - PARTICULATE
This analysis is carried out using procedures modified from British Columbia Environmental Manual "Particulate." Particulates or "Dustfalls" are determined gravimetrically. Total Insoluble and Soluble Dustfalls are determined by filtering a sample through a 0.45 um membrane filter and drying the filter and filtrate at 104 C, followed by ignition at 550 C. The remaining residue after 550 C represents the fixed portion and the weight lost on ignition represents the volatile portion. The sum of all fixed and volatile portions on both Insoluble and Soluble portions represents Total Dustfalls.			

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

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
VA	ALS ENVIRONMENTAL - VANCOUVER, BRITISH COLUMBIA, CANADA

Chain of Custody Numbers:

17-685767

GLOSSARY OF REPORT TERMS

Surrogate - A compound that is similar in behaviour to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.

mg/kg - milligrams per kilogram based on dry weight of sample.

mg/kg ww - milligrams per kilogram based on wet weight of sample.

mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight of sample.

mg/L - milligrams per litre.

< - Less than.

D.L. - The reported Detection Limit, also known as the Limit of Reporting (LOR).

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.

Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.



Report To Contact and company name below will appear on the final report		Report Format / Distribution		Select Service Level Below - Contact your AM to confirm all E&P TATs (surcharges may apply)																																					
Company: ERM		Select Report Format: ☒ PDF ☒ EXCEL ☐ EDD (DIGITAL)		Regular [R] ☒ Standard TAT if received by 3 pm - business days - no surcharges apply																																					
Contact: Daniel Casanova		Quality Control (QC) Report with Report ☒ YES ☐ NO		PRIORITY (Business Days) 4 day [P4-20%] ☐ 3 day [P3-25%] ☐ 2 day [P2-50%] ☐ EMERGENCY 1 Business day [E-100%] ☐ Same Day, Weekend or Statutory holiday [E2-200%] (Laboratory opening fees may apply) ☐																																					
Phone: 250-877-8498		☐ Compare Results to Criteria on Report - provide details below if box checked Select Distribution: ☒ EMAIL ☐ MAIL ☐ FAX																																							
Company address below will appear on the final report		Email 1 or Fax: daniel.casanova@erm.com		Date and Time Required for all E&P TATs:																																					
Street: 3790 Alfred Ave		Email 2: quines.soux@erm.com		For tests that can not be performed according to the service level selected, you will be contacted.																																					
City/Province: Smithers BC		Email 3:		Analysis Request																																					
Postal Code: V0J 2N0				Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below																																					
Invoice To: Same as Report To ☒ YES ☐ NO		Invoice Distribution		<table border="1" style="width:100%; border-collapse: collapse;"> <tr> <td>Total Particulate Matter</td><td>Fixed</td><td>Variable</td><td>Total Inorg. Dustfall</td><td>Fixed</td><td>Variable</td><td>Total Soluble Dustfall</td><td>Fixed</td><td>Variable</td> </tr> <tr> <td></td><td>Dustfall</td><td>Dustfall</td><td></td><td>Dustfall</td><td>Dustfall</td><td></td><td>Dustfall</td><td>Dustfall</td> </tr> <tr> <td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td> </tr> <tr> <td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td> </tr> </table>		Total Particulate Matter	Fixed	Variable	Total Inorg. Dustfall	Fixed	Variable	Total Soluble Dustfall	Fixed	Variable		Dustfall	Dustfall		Dustfall	Dustfall		Dustfall	Dustfall																		
Total Particulate Matter	Fixed	Variable	Total Inorg. Dustfall			Fixed	Variable	Total Soluble Dustfall	Fixed	Variable																															
	Dustfall	Dustfall				Dustfall	Dustfall		Dustfall	Dustfall																															
Copy of Invoice with Report ☒ YES ☐ NO		Select Invoice Distribution: ☒ EMAIL ☐ MAIL ☐ FAX																																							
Company:		Email 1 or Fax: daniel.casanova@erm.com																																							
Contact:		Email 2: Korina.haystone@erm.com																																							
Project Information		Oil and Gas Required Fields (client use)																																							
ALS Account # / Quote #: 0403488-COFC		AFE/Cost Center:		PO#																																					
Job #: 0403488-COFC		Major/Minor Code:		Routing Code:																																					
PO / AFE:		Requisitioner:																																							
LSD:		Location:																																							
ALS Lab Work Order # (lab use only):		ALS Contact: A. Springer		Sampler: D. Casanova																																					
ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	End Date (dd-mm-yy)	End Time (hh:mm)	Sample Type																																					
	DF-Rail	22-Mar-18	12:50	Dustfall																																					
	DF-Kerr	22-Mar-18	14:22																																						
	DF-Tekwa	22-Mar-18	13:58																																						
	DF-Terra																																								
Drinking Water (DW) Samples¹ (client use)		Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)		SAMPLE CONDITION AS RECEIVED (lab use only)																																					
Are samples taken from a Regulated DW System? ☐ YES ☐ NO		Only 3 stations, 1 pair of unused sample bottles returned in cooler		Frozen ☐ SIF Observations Yes ☐ No ☐ Ice Packs ☐ Ice Cubes ☐ Custody seal intact Yes ☐ No ☐ Cooling Initiated ☐																																					
Are samples for human consumption/ use? ☐ YES ☐ NO				INITIAL COOLER TEMPERATURES °C FINAL COOLER TEMPERATURES °C 9																																					
SHIPMENT RELEASE (client use)		INITIAL SHIPMENT RECEPTION (lab use only)		FINAL SHIPMENT RECEPTION (lab use only)																																					
Released by: Daniel Casanova		Received by:		Received by: JC																																					
Date: April 23 '18		Date:		Date: 4/24/18																																					
Time:		Time:		Time: 12pm																																					

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1. If any water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC form.



ERM Consultants Canada Ltd.
ATTN: Daniel Casanova
1500-1111 West Hastings Street
Vancouver BC V6E 2J3

Date Received: 25-MAY-18
Report Date: 01-JUN-18 12:59 (MT)
Version: FINAL

Client Phone: 604-689-9460

Certificate of Analysis

Lab Work Order #: L2100748
Project P.O. #: NOT SUBMITTED
Job Reference: 0403488-0007
C of C Numbers: 17-686238
Legal Site Desc:

Amber Springer, B.Sc
Account Manager

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ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID Description Sampled Date Sampled Time Client ID		L2100748-1 Dustfall 23-MAY-18 17:00 DF-RAIL	L2100748-2 Dustfall 23-MAY-18 14:05 DF-KERR	L2100748-3 Dustfall 23-MAY-18 15:30 DF-TELKWA		
Grouping	Analyte					
DUSTFALL						
Particulates	Fixed Dustfall (mg/dm2.day)	0.40	0.36	0.63		
	Volatile Dustfall (mg/dm2.day)	2.13	0.83	0.74		
	Total Dustfall (mg/dm2.day)	2.54	1.18	1.37		
	Fixed Insoluble Dustfall (mg/dm2.day)	<0.10	0.30	0.47		
	Volatile Insoluble Dustfall (mg/dm2.day)	0.80	0.70	0.55		
	Total Insoluble Dustfall (mg/dm2.day)	0.88	1.00	1.02		
	Fixed Soluble Dustfall (mg/dm2.day)	0.32	<0.10	0.16		
	Volatile Soluble Dustfall (mg/dm2.day)	1.34	0.13	0.19		
	Total Soluble Dustfall (mg/dm2.day)	1.66	0.19	0.35		

Reference Information

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
DUSTFALLS-ALL-DM2-VA	Dustfall	Dustfalls-Total, Soluble, Insoluble +FV	BC LAB MANUAL - PARTICULATE
This analysis is carried out using procedures modified from British Columbia Environmental Manual "Particulate." Particulates or "Dustfalls" are determined gravimetrically. Total Insoluble and Soluble Dustfalls are determined by filtering a sample through a 0.45 um membrane filter and drying the filter and filtrate at 104 C, followed by ignition at 550 C. The remaining residue after 550 C represents the fixed portion and the weight lost on ignition represents the volatile portion. The sum of all fixed and volatile portions on both Insoluble and Soluble portions represents Total Dustfalls.			

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

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
VA	ALS ENVIRONMENTAL - VANCOUVER, BRITISH COLUMBIA, CANADA

Chain of Custody Numbers:

17-686238

GLOSSARY OF REPORT TERMS

Surrogate - A compound that is similar in behaviour to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.

mg/kg - milligrams per kilogram based on dry weight of sample.

mg/kg ww - milligrams per kilogram based on wet weight of sample.

mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight of sample.

mg/L - milligrams per litre.

< - Less than.

D.L. - The reported Detection Limit, also known as the Limit of Reporting (LOR).

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

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Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.



Page 1 of 1

JULY 2017 FROM

1. If any water samples are taken from a **Regulated Drinking Water (DW) System**, please submit using an **Authorized DW COC form**.



ERM Consultants Canada Ltd.
ATTN: Daniel Casanova
1500-1111 West Hastings Street
Vancouver BC V6E 2J3

Date Received: 21-JUN-18
Report Date: 03-JUL-18 15:56 (MT)
Version: FINAL

Client Phone: 604-689-9460

Certificate of Analysis

Lab Work Order #: L2116738
Project P.O. #: NOT SUBMITTED
Job Reference: 0403488-0103
C of C Numbers: 17-668043
Legal Site Desc:

Amber Springer, B.Sc
Account Manager

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ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID Description Sampled Date Sampled Time Client ID		L2116738-1 Dustfall 18-JUN-18 14:35 DF-RAIL (23/05/18- 18/06/18)	L2116738-2 Dustfall 18-JUN-18 13:45 DF- KERR(23/05/18- 18/06/18)	L2116738-3 Dustfall 18-JUN-18 14:00 DF- TELKWA(23/05/18- 18/06/18)		
Grouping	Analyte					
DUSTFALL						
Particulates	Fixed Dustfall (mg/dm2.day)	<0.12	0.38	0.34		
	Volatile Dustfall (mg/dm2.day)	1.42	1.57	0.97		
	Total Dustfall (mg/dm2.day)	1.53	1.95	1.31		
	Fixed Insoluble Dustfall (mg/dm2.day)	<0.12	0.26	0.27		
	Volatile Insoluble Dustfall (mg/dm2.day)	1.07	0.75	0.74		
	Total Insoluble Dustfall (mg/dm2.day)	1.13	1.01	1.01		
	Fixed Soluble Dustfall (mg/dm2.day)	<0.12	0.12	<0.12		
	Volatile Soluble Dustfall (mg/dm2.day)	0.35	0.82	0.23		
	Total Soluble Dustfall (mg/dm2.day)	0.40	0.94	0.30		

Reference Information

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
DUSTFALLS-ALL-DM2-VA	Dustfall	Dustfalls-Total, Soluble, Insoluble +FV	BC LAB MANUAL - PARTICULATE
This analysis is carried out using procedures modified from British Columbia Environmental Manual "Particulate." Particulates or "Dustfalls" are determined gravimetrically. Total Insoluble and Soluble Dustfalls are determined by filtering a sample through a 0.45 um membrane filter and drying the filter and filtrate at 104 C, followed by ignition at 550 C. The remaining residue after 550 C represents the fixed portion and the weight lost on ignition represents the volatile portion. The sum of all fixed and volatile portions on both Insoluble and Soluble portions represents Total Dustfalls.			

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

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
VA	ALS ENVIRONMENTAL - VANCOUVER, BRITISH COLUMBIA, CANADA

Chain of Custody Numbers:

17-668043

GLOSSARY OF REPORT TERMS

Surrogate - A compound that is similar in behaviour to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.

mg/kg - milligrams per kilogram based on dry weight of sample.

mg/kg ww - milligrams per kilogram based on wet weight of sample.

mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight of sample.

mg/L - milligrams per litre.

< - Less than.

D.L. - The reported Detection Limit, also known as the Limit of Reporting (LOR).

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.

Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.



L2116738-COFC

COC Number: 17 - 668043

Page 1 of 1

Report To Contact and company name below will appear on the final report			Report Format / Distribution			Select Service Level Below - Contact your AM to confirm all E&P TATs (surcharges may apply)																																																			
Company: ERM			Select Report Format: ☒ PDF ☒ EXCEL ☐ EDD (DIGITAL)			Regular [R] ☒ Standard TAT if received by 3 pm - business days - no surcharges apply																																																			
Contact: Daniel Casanova			Quality Control (QC) Report with Report ☐ YES ☐ NO			PRIORITY (Business Days) 4 day [P4-20%] ☐ 3 day [P3-25%] ☐ 2 day [P2-50%] ☐		EMERGENCY 1 Business day [E-100%] ☐ Same Day, Weekend or Statutory holiday [E2-200% (Laboratory opening fees may apply)] ☐																																																	
Phone: 250-877-8998			☐ Compare Results to Criteria on Report - provide details below if box checked																																																						
Company address below will appear on the final report			Select Distribution: ☒ EMAIL ☐ MAIL ☐ FAX																																																						
Street: 3790 Alfred Ave			Email 1 or Fax: daniel.casanova@erm.com			Date and Time Required for all E&P TATs: dd-mm-yy hh:mm																																																			
City/Province: Surrey BC			Email 2: address.sout@erm.com			For tests that can not be performed according to the service level selected, you will be contacted.																																																			
Postal Code: V03 2N0			Email 3:			Analysis Request																																																			
Invoice To: Same as Report To ☒ YES ☐ NO			Invoice Distribution			Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below																																																			
Copy of Invoice with Report ☒ YES ☐ NO			Select Invoice Distribution: ☒ EMAIL ☐ MAIL ☐ FAX																																																						
Company:			Email 1 or Fax: daniel.casanova@erm.com			<table border="1" style="width:100%; border-collapse: collapse;"> <tr> <th>Total</th> <th>Fixed</th> <th>Volatile</th> <th>Total Insol.</th> <th>Fixed Insol.</th> <th>Volatile Insol.</th> <th>Total Soluble</th> <th>Fixed Soluble</th> <th>Volatile Soluble</th> <th colspan="2">SAMPLES ON HOLD</th> <th rowspan="4">Sample is hazardous (please provide further details)</th> <th rowspan="4">NUMBER OF CONTAINERS</th> </tr> <tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> </table>						Total	Fixed	Volatile	Total Insol.	Fixed Insol.	Volatile Insol.	Total Soluble	Fixed Soluble	Volatile Soluble	SAMPLES ON HOLD		Sample is hazardous (please provide further details)	NUMBER OF CONTAINERS																																	
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Contact:			Email 2: Korina.haughton@erm.com																																																						
Project Information			Oil and Gas Required Fields (client use)																																																						
ALS Account # / Quote #:			AFE/Cost Center:			PO#:																																																			
Job #: 0403488-0103			Major/Minor Code:			Routing Code:																																																			
PO / AFE:			Requisitioner:																																																						
LSD:			Location:																																																						
ALS Lab Work Order # (lab use only):			ALS Contact: A. Springer			Sampler: D. Casanova																																																			
ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)		Est Date (dd-mm-yy)	Est Time (hh:mm)	Sample Type																																																				
DF-Rail	Start: 23-May-18		17:00	18-June-18	14:35	Dustfall																																																			
DF-Kern	" 23-May-18		14:05		13:45																																																				
DF-Telkwa	" 23-May-18		15:30		14:00																																																				



ERM Consultants Canada Ltd.
ATTN: Daniel Casanova
1500-1111 West Hastings Street
Vancouver BC V6E 2J3

Date Received: 21-JUL-18
Report Date: 01-AUG-18 12:50 (MT)
Version: FINAL

Client Phone: 604-689-9460

Certificate of Analysis

Lab Work Order #: L2133610
Project P.O. #: NOT SUBMITTED
Job Reference: 0403488-0103
C of C Numbers: 17-692196
Legal Site Desc:

Amber Springer, B.Sc
Account Manager

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ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID Description Sampled Date Sampled Time Client ID		L2133610-1 dustfall 20-JUL-18 11:12 DF-RAIL	L2133610-2 dustfall 20-JUL-18 10:08 DF-KERR	L2133610-3 dustfall 20-JUL-18 10:31 DF-TELKWA		
Grouping	Analyte					
DUSTFALL						
Particulates	Fixed Dustfall (mg/dm2.day)	<0.10	0.65	0.30		
	Volatile Dustfall (mg/dm2.day)	0.39	1.55	0.60		
	Total Dustfall (mg/dm2.day)	0.45	2.20	0.91		
	Fixed Insoluble Dustfall (mg/dm2.day)	<0.10	0.18	0.16		
	Volatile Insoluble Dustfall (mg/dm2.day)	0.39	0.79	0.19		
	Total Insoluble Dustfall (mg/dm2.day)	0.42	0.97	0.35		
	Fixed Soluble Dustfall (mg/dm2.day)	<0.10	0.47	0.14		
	Volatile Soluble Dustfall (mg/dm2.day)	<0.10	0.75	0.42		
	Total Soluble Dustfall (mg/dm2.day)	<0.10	1.22	0.56		

Reference Information

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
DUSTFALLS-ALL-DM2-VA	Dustfall	Dustfalls-Total, Soluble, Insoluble +FV	BC LAB MANUAL - PARTICULATE
This analysis is carried out using procedures modified from British Columbia Environmental Manual "Particulate." Particulates or "Dustfalls" are determined gravimetrically. Total Insoluble and Soluble Dustfalls are determined by filtering a sample through a 0.45 um membrane filter and drying the filter and filtrate at 104 C, followed by ignition at 550 C. The remaining residue after 550 C represents the fixed portion and the weight lost on ignition represents the volatile portion. The sum of all fixed and volatile portions on both Insoluble and Soluble portions represents Total Dustfalls.			

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

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
VA	ALS ENVIRONMENTAL - VANCOUVER, BRITISH COLUMBIA, CANADA

Chain of Custody Numbers:

17-692196

GLOSSARY OF REPORT TERMS

Surrogate - A compound that is similar in behaviour to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.

mg/kg - milligrams per kilogram based on dry weight of sample.

mg/kg ww - milligrams per kilogram based on wet weight of sample.

mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight of sample.

mg/L - milligrams per litre.

< - Less than.

D.L. - The reported Detection Limit, also known as the Limit of Reporting (LOR).

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.

Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.



L2133610-COFC

COC Number: 17 - 692196

Page 1 of 1

Report To Contact and company name below will appear on the final report:			Report Format / Distribution			Select Service Level Below - Contact your AM to confirm all E&P TATs (surcharges may apply)																																																																														
Company: ERM			Select Report Format: ☒ PDF ☒ EXCEL ☐ EDD (DIGITAL)			Regular [R] ☒ Standard TAT if received by 3 pm - business days - no surcharges apply																																																																														
Contact: Daniel Casanova			Quality Control (QC) Report with Report ☐ YES ☐ NO			PRIORITY (Business Days) 4 day [P4-20%] ☐ 3 day [P3-25%] ☐ 2 day [P2-50%] ☐				EMERGENCY 1 Business day [E-100%] ☐ Same Day, Weekend or Statutory holiday [E2-200%] (Laboratory opening fees may apply) ☐																																																																										
Phone: 250-877-8948			☐ Compare Results to Criteria on Report - provide details below if box checked																																																																																	
Company address below will appear on the final report			Select Distribution: ☒ EMAIL ☐ MAIL ☐ FAX																																																																																	
Street: 3790 Alfred Ave			Email 1 or Fax: daniel.casanova@erm.com			Date and Time Required for all E&P TATs: dd-mm-yy hh:mm																																																																														
City/Province: Smiths BC			Email 2: andrea.souza@erm.com			For tests that can not be performed according to the service level selected, you will be contacted.																																																																														
Postal Code: V0T 2N0			Email 3:			Analysis Request																																																																														
Invoice To: Same as Report To ☒ YES ☐ NO			Invoice Distribution			Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below <table border="1" style="width:100%; border-collapse: collapse;"> <tr> <th>Total</th> <th>Fixed</th> <th>Volatile</th> <th>Total Insol.</th> <th>Fixed Insol.</th> <th>Volatile Insol.</th> <th>Total Soluble</th> <th>Fixed Soluble</th> <th>Volatile Soluble</th> <th colspan="4">SAMPLES ON HOLD</th> <th rowspan="5">Sample is hazardous (please provide further details)</th> <th rowspan="5">NUMBER OF CONTAINERS</th> </tr> <tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> </table>												Total	Fixed	Volatile	Total Insol.	Fixed Insol.	Volatile Insol.	Total Soluble	Fixed Soluble	Volatile Soluble	SAMPLES ON HOLD				Sample is hazardous (please provide further details)	NUMBER OF CONTAINERS																																																				
Total	Fixed	Volatile	Total Insol.	Fixed Insol.	Volatile Insol.													Total Soluble	Fixed Soluble	Volatile Soluble	SAMPLES ON HOLD				Sample is hazardous (please provide further details)	NUMBER OF CONTAINERS																																																										
Copy of Invoice with Report ☒ YES ☐ NO			Select Invoice Distribution: ☒ EMAIL ☐ MAIL ☐ FAX																																																																																	
Company:			Email 1 or Fax: daniel.casanova@erm.com																																																																																	
Contact:			Email 2: robert.houghton@erm.com																																																																																	
Project Information			Oil and Gas Required Fields (client use)																																																																																	
ALS Account # / Quote #:			AFECost Center:			PO#																																																																														
Job #: 0403488-0103			Major/Minor Code:			Routing Code:																																																																														
PO / AFE:			Requisitioner:																																																																																	
LSD:			Location:																																																																																	
ALS Lab Work Order # (lab use only):			ALS Contact: A. Springer			Sampler: D. Casanova																																																																														
ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)				Date (dd-mm-yy)	Time (hh:mm)	Sample Type																																																																													
	DF-Rail Start: June 18 14:35				20-July-18	11:12	Dustfall																																																																													
	DF-Kerr " June 18 13:45				"	10:08	"																																																																													
	DF-Telkwa " June 18 14:00				"	10:31	"																																																																													



ERM Consultants Canada Ltd.
ATTN: Daniel Casanova
1500-1111 West Hastings Street
Vancouver BC V6E 2J3

Date Received: 23-AUG-18
Report Date: 04-SEP-18 14:10 (MT)
Version: FINAL

Client Phone: 604-689-9460

Certificate of Analysis

Lab Work Order #: L2152032
Project P.O. #: NOT SUBMITTED
Job Reference: 0403488-0103
C of C Numbers: 17-698624
Legal Site Desc:

Amber Springer, B.Sc
Account Manager

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ALS ENVIRONMENTAL ANALYTICAL REPORT

		Sample ID Description Sampled Date Sampled Time Client ID	L2152032-1 22-AUG-18 08:38 DF-RAIL	L2152032-2 22-AUG-18 12:27 DF-KERR	L2152032-3 22-AUG-18 09:18 DF-TELKWA		
Grouping	Analyte						
DUSTFALL							
Particulates	Fixed Dustfall (mg/dm2.day)	0.10	0.72	0.36			
	Volatile Dustfall (mg/dm2.day)	0.22	1.32	0.77			
	Total Dustfall (mg/dm2.day)	0.33	2.04	1.12			
	Fixed Insoluble Dustfall (mg/dm2.day)	<0.10	0.52	0.29			
	Volatile Insoluble Dustfall (mg/dm2.day)	0.18	0.86	0.15			
	Total Insoluble Dustfall (mg/dm2.day)	0.24	1.38	0.43			
	Fixed Soluble Dustfall (mg/dm2.day)	<0.10	0.21	<0.10			
	Volatile Soluble Dustfall (mg/dm2.day)	<0.10	0.46	0.62			
	Total Soluble Dustfall (mg/dm2.day)	<0.10	0.66	0.69			

Reference Information

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
DUSTFALLS-ALL-DM2-VA	Dustfall	Dustfalls-Total, Soluble, Insoluble +FV	BC LAB MANUAL - PARTICULATE
This analysis is carried out using procedures modified from British Columbia Environmental Manual "Particulate." Particulates or "Dustfalls" are determined gravimetrically. Total Insoluble and Soluble Dustfalls are determined by filtering a sample through a 0.45 um membrane filter and drying the filter and filtrate at 104 C, followed by ignition at 550 C. The remaining residue after 550 C represents the fixed portion and the weight lost on ignition represents the volatile portion. The sum of all fixed and volatile portions on both Insoluble and Soluble portions represents Total Dustfalls.			

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

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
VA	ALS ENVIRONMENTAL - VANCOUVER, BRITISH COLUMBIA, CANADA

Chain of Custody Numbers:

17-698624

GLOSSARY OF REPORT TERMS

Surrogate - A compound that is similar in behaviour to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.

mg/kg - milligrams per kilogram based on dry weight of sample.

mg/kg ww - milligrams per kilogram based on wet weight of sample.

mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight of sample.

mg/L - milligrams per litre.

< - Less than.

D.L. - The reported Detection Limit, also known as the Limit of Reporting (LOR).

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.

Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.



Page | of |

JULY 2017 EDITION



ERM Consultants Canada Ltd.
ATTN: Daniel Casanova
1500-1111 West Hastings Street
Vancouver BC V6E 2J3

Date Received: 03-OCT-18
Report Date: 15-OCT-18 11:51 (MT)
Version: FINAL

Client Phone: 604-689-9460

Certificate of Analysis

Lab Work Order #: L2175313
Project P.O. #: NOT SUBMITTED
Job Reference: 0403488-0103
C of C Numbers: 17-717923
Legal Site Desc:

Amber Springer, B.Sc
Account Manager

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ALS CANADA LTD Part of the ALS Group An ALS Limited Company

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID Description Sampled Date Sampled Time Client ID		L2175313-1 dustfall 02-OCT-18 12:55 DF-RAIL	L2175313-2 dustfall 02-OCT-18 11:35 DF-KERR	L2175313-3 dustfall 02-OCT-18 12:15 DF-TELKWA		
Grouping	Analyte					
DUSTFALL						
Particulates	Fixed Dustfall (mg/dm2.day)	0.29	0.79	0.33		
	Volatile Dustfall (mg/dm2.day)	1.88	3.64	0.83		
	Total Dustfall (mg/dm2.day)	2.17	4.43	1.16		
	Fixed Insoluble Dustfall (mg/dm2.day)	0.11	0.34	0.21		
	Volatile Insoluble Dustfall (mg/dm2.day)	1.18	1.58	0.55		
	Total Insoluble Dustfall (mg/dm2.day)	1.29	1.92	0.76		
	Fixed Soluble Dustfall (mg/dm2.day)	0.17	0.45	0.12		
	Volatile Soluble Dustfall (mg/dm2.day)	0.70	2.06	0.28		
	Total Soluble Dustfall (mg/dm2.day)	0.87	2.51	0.40		

Reference Information

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
DUSTFALLS-ALL-DM2-VA	Dustfall	Dustfalls-Total, Soluble, Insoluble +FV	BC LAB MANUAL - PARTICULATE
This analysis is carried out using procedures modified from British Columbia Environmental Manual "Particulate." Particulates or "Dustfalls" are determined gravimetrically. Total Insoluble and Soluble Dustfalls are determined by filtering a sample through a 0.45 um membrane filter and drying the filter and filtrate at 104 C, followed by ignition at 550 C. The remaining residue after 550 C represents the fixed portion and the weight lost on ignition represents the volatile portion. The sum of all fixed and volatile portions on both Insoluble and Soluble portions represents Total Dustfalls.			

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

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
VA	ALS ENVIRONMENTAL - VANCOUVER, BRITISH COLUMBIA, CANADA

Chain of Custody Numbers:

17-717923

GLOSSARY OF REPORT TERMS

Surrogate - A compound that is similar in behaviour to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.

mg/kg - milligrams per kilogram based on dry weight of sample.

mg/kg ww - milligrams per kilogram based on wet weight of sample.

mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight of sample.

mg/L - milligrams per litre.

< - Less than.

D.L. - The reported Detection Limit, also known as the Limit of Reporting (LOR).

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

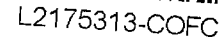
Test results reported relate only to the samples as received by the laboratory.

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Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.



Canada Toll Free: 1 800 668 9878



Page 1 of 1

1. If any water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC form.



ERM Consultants Canada Ltd.
ATTN: Daniel Casanova
1500-1111 West Hastings Street
Vancouver BC V6E 2J3

Date Received: 07-NOV-18
Report Date: 16-NOV-18 15:00 (MT)
Version: FINAL

Client Phone: 604-689-9460

Certificate of Analysis

Lab Work Order #: L2193450
Project P.O. #: NOT SUBMITTED
Job Reference: 0403488-0103-0001
C of C Numbers: 17-720624
Legal Site Desc:

Amber Springer, B.Sc
Account Manager

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ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID Description Sampled Date Sampled Time Client ID		L2193450-1 Dustfall 05-NOV-18 09:55 DF-RAIL	L2193450-2 Dustfall 05-NOV-18 12:00 DF-KERR	L2193450-3 Dustfall 05-NOV-18 11:36 DF-TELKWA		
Grouping	Analyte					
DUSTFALL						
Particulates	Fixed Dustfall (mg/dm2.day)	0.12	0.23	0.18		
	Volatile Dustfall (mg/dm2.day)	0.34	0.59	<0.10		
	Total Dustfall (mg/dm2.day)	0.46	0.83	0.27		
	Fixed Insoluble Dustfall (mg/dm2.day)	<0.10	<0.10	0.15		
	Volatile Insoluble Dustfall (mg/dm2.day)	0.21	0.46	<0.10		
	Total Insoluble Dustfall (mg/dm2.day)	0.25	0.53	0.20		
	Fixed Soluble Dustfall (mg/dm2.day)	<0.10	0.17	<0.10		
	Volatile Soluble Dustfall (mg/dm2.day)	0.13	0.13	<0.10		
	Total Soluble Dustfall (mg/dm2.day)	0.22	0.30	<0.10		

Reference Information

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
DUSTFALLS-ALL-DM2-VA	Dustfall	Dustfalls-Total, Soluble, Insoluble +FV	BC LAB MANUAL - PARTICULATE
This analysis is carried out using procedures modified from British Columbia Environmental Manual "Particulate." Particulates or "Dustfalls" are determined gravimetrically. Total Insoluble and Soluble Dustfalls are determined by filtering a sample through a 0.45 um membrane filter and drying the filter and filtrate at 104 C, followed by ignition at 550 C. The remaining residue after 550 C represents the fixed portion and the weight lost on ignition represents the volatile portion. The sum of all fixed and volatile portions on both Insoluble and Soluble portions represents Total Dustfalls.			

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

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
VA	ALS ENVIRONMENTAL - VANCOUVER, BRITISH COLUMBIA, CANADA

Chain of Custody Numbers:

17-720624

GLOSSARY OF REPORT TERMS

Surrogate - A compound that is similar in behaviour to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.

mg/kg - milligrams per kilogram based on dry weight of sample.

mg/kg ww - milligrams per kilogram based on wet weight of sample.

mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight of sample.

mg/L - milligrams per litre.

< - Less than.

D.L. - The reported Detection Limit, also known as the Limit of Reporting (LOR).

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.

Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.



Chain of Custody (COC) / Analytic
Request Form



L2193450-COFC

COC Number: 17 - 720624

Page 1 of 1

Canada Toll Free: 1 800 668 9878

www.alsglobal.com

Report To		Report Format / Distribution		Select Service Level Below - Contact your AM to confirm all E&P TATs (surcharges may apply)																																					
Contact and company name below will appear on the final report																																									
Company:	ERM	Select Report Format:	☒ PDF ☒ EXCEL ☐ EDD (DIGITAL)	Regular [R] ☒ Standard TAT if received by 3 pm - business days - no surcharges apply																																					
Contact:	Daniel Casanova	Quality Control (QC) Report with Report	☐ YES ☐ NO	4 day [P4-20%] ☐ 1 Business day [E-100%] ☐																																					
Phone:	250-877-8448	☐ Compare Results to Criteria on Report - provide details below if box checked		3 day [P3-25%] ☐ Same Day, Weekend or Statutory holiday [E2-200%] ☐																																					
Company address below will appear on the final report		Select Distribution:	☒ EMAIL ☐ MAIL ☐ FAX	2 day [P2-50%] ☐ (Laboratory opening fees may apply)]																																					
Street:	3790 Alfred Ave	Email 1 or Fax:	daniel.casanova@erm.com	Date and Time Required for all E&P TATs:																																					
City/Province:	Smithers BC	Email 2:	andres.souza@erm.com	CO-MUNIC. REPORT																																					
Postal Code:	V0J 2N0	Email 3:		For tests that can not be performed according to the service level selected, you will be contacted.																																					
Invoice To:	Same as Report To ☒ YES ☐ NO	Invoice Distribution		Analysis Request																																					
Copy of Invoice with Report:	☒ YES ☐ NO	Select Invoice Distribution:	☒ EMAIL ☐ MAIL ☐ FAX	Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below																																					
Company:		Email 1 or Fax:	Korina Houghton @ erm.com	<table border="1"><thead><tr><th>Total</th><th>Fixed</th><th>Volatiles</th><th>Total</th><th>Fixed</th><th>Volatiles</th><th>Total</th><th>Fixed</th><th>Volatiles</th></tr></thead><tbody><tr><td>↓</td><td>↓</td><td>↓</td><td>↓</td><td>↓</td><td>↓</td><td>↓</td><td>↓</td><td>↓</td></tr><tr><td>↓</td><td>↓</td><td>↓</td><td>↓</td><td>↓</td><td>↓</td><td>↓</td><td>↓</td><td>↓</td></tr><tr><td>↓</td><td>↓</td><td>↓</td><td>↓</td><td>↓</td><td>↓</td><td>↓</td><td>↓</td><td>↓</td></tr></tbody></table>		Total	Fixed	Volatiles	Total	Fixed	Volatiles	Total	Fixed	Volatiles	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓
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Contact:		Email 2:	daniel.casanova@erm.com																																						
Project Information		Oil and Gas Required Fields (client use)																																							
ALS Account # / Quote #:		AFE/Cost Center:	PO#																																						
Job #:	0403488 - 0103-0001	Major/Minor Code:	Routing Code:																																						
PO / AFE:		Requisitioner:																																							
LSD:		Location:																																							
ALS Lab Work Order # (lab use only):		ALS Contact:	Amber Springer	Sampler:																																					
				D. Casanova																																					
				T. Bakri																																					
ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Start date	End Date (dd-mmm-yy)	End Time (hh:mm)	Sample Type																																				
	DF-Rail	Oct 2	12:55	5-Nov-18	9:55																																				
	DF-kerr	Oct 2	11:35	5-Nov-18	12:00																																				
	DF-Tekwa	Oct 2	12:15	5-Nov-18	11:36																																				
Drinking Water (DW) Samples (client use)		Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)		SAMPLE CONDITION AS RECEIVED (lab use only)																																					
Are samples taken from a Regulated DW System?				Frozen ☐ SIF Observations Yes ☐ No ☐																																					
Are samples for human consumption/ use?				Ice Packs ☐ Ice Cubes ☐ Custody seal intact Yes ☐ No ☐																																					
				Cooling Initiated ☐																																					
				INITIAL COOLER TEMPERATURES °C																																					
				FINAL COOLER TEMPERATURES °C																																					
				13																																					
SHIPMENT RELEASE (client use)		INITIAL SHIPMENT RECEPTION (lab use only)		FINAL SHIPMENT RECEPTION (lab use only)																																					
Released by:	Date:	Time:	Received by:	Date:	Time:																																				
Daniel Casanova	Nov 5 2018	15:00		11/7/18	10:20 AM																																				

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

WHITE - LABORATORY COPY YELLOW - CLIENT COPY

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.

1. If any water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC form.

JULY 2017 FRONT

Appendix 3-B *PM-Kerr Partisol Audit, Calibration and
Maintenance Documentation*

Oct 30 2018

Thermo Scientific™ Partisol™ 2025i

Sequential Air Samplers

Instrument PM and verification sheet

2025i-D

Techs: Dan Casanova
Tulnat Bakri

Instrument serial number	20201W202171808
Instrument location	Kerr Farm, PM-Kerr

Factory Testing Station Installation Oct 29-30 2018

Recommended preventative maintenance intervals				
Activity	PM Interval	Last activity date	Current activity date	Next activity date
Clean PM10 Inlet:	Monthly	N/A	N/A, first use	Dec 2018
Clean VSCC Inlet:	Monthly			
Clean WINS impactor well:	Every five sampling days			
Replace in-line filter:	Every six months			May 2019
Clean filter cassettes/magazines:	Inspect regularly, clean as required			Dec 2018
Replace V-seals:	Annually			Nov 2019
Clean rain hood:	Every month			Dec 2018
Clean air screen/replace as necessary:	Every month			Dec 2018
Rebuild vacuum pump:	Inspect every 6 months, rebuild annually at a minimum			May 2019

Virtual Inspector Monthly

Recommended instrument verification interval (unless regional requirements dictate otherwise)				
Equipment required:	A NIST-traceable (or equivalent) transfer standard for temperature calibrated for $\pm 0.5^\circ\text{C}$ precision			
	A NIST-traceable (or equivalent) transfer standard for pressure calibrated for ± 5 mm Hg precision			
	A NIST-traceable (or equivalent) transfer standard for relative humidity calibrated for $\pm 2.5\%$ precision			
	A NIST-traceable (or equivalent) flow transfer standard capable of measuring flow range of 0.9–19 lpm is required (depending on the flow transfer standard used, a flow inlet adapter may be required)			
Activity	Verification frequency	Last audit date	Current audit date	Next calibration date
Ambient temperature:	Audit monthly/Calibrate quarterly	N/A	Oct 30 2018	Dec 2018 audit
Filter temperature:	Audit monthly/Calibrate quarterly			
Filter compartment temperature:	Audit monthly/Calibrate annually			
Electronics compartment temperature:	Audit monthly/Calibration annually			
Ambient pressure:	Audit monthly/Calibrate quarterly			
Filter pressure:	Audit monthly/Calibrate quarterly			
Ambient RH:	Audit monthly/Calibrate annually		did not do	
Flow check:	Audit monthly/Calibrate quarterly		Oct 30 2018	
External leak check:	Every five days of inlet usage			
Internal leak check:	Monthly			

will do monthly

Factory Testing

No reference RH instrument to do RH audit.

For more information, please consult your technical support representative.

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Oct 30 2018

Thermo Scientific™ Partisol™ 2025i

Sequential Air Sampler

2025i-D

Maintenance and troubleshooting guide

client: Telkwa Coal

Operator	ERM, Dan Casanova, Talarat Bakri
Site location	Kerr Farm, PM - Kerr
Instrument serial number	202 DIW 202171808
Shelter temperature	4°C
Software version	did not record, purchased new in mid 2018

Date	Oct. 30	2018
Time	11 am	

using ref. instrument

		Unit displayed value	Calibration date	Audit date	Measured results	Calibration offset/intercept	Calibration Span
Instrument diagnostics	Ambient temperature °C	3.4 °C	factory date	Oct. 30	4.8 °C	factory set	
	Ambient pressure mmHg	704 mmHg		Oct. 30	703.0 mmHg		
	Filter temperature °C	5.7 5.8		Oct 30	4.5 4.6		
	Filter pressure mmHg	N/A		N/A	N/A		
	Filter compartment temperature °C	didn't check		N/A	N/A		
	Electronics compartment temperature °C	didn't check		N/A	N/A		
	Ambient RH %	didn't record		didn't do	N/A		
	Flow LPM	14.99 1.67		Oct 30	14.93 1.724		
	Maximum pump pressure	didn't check atm					
	Internal leak check	delta 9 mm Hg					
	External leak check	delta 13 mm Hg					

Filter ①/②

Flow 1/Flow 2

Status code		Comments/notes
Code	Description	
	None	used BGI tetraCal as reference
		station first installed today
		No RH ref. instrument available, RH audit not done, value looked reasonable
		Time set to local PDT time, upcoming time change on Nov 4. Set to PDT/PST time zone.

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Texas Partiso 1 Test_{1/2}10/29

- put in 4 filter
- set first to Blank
- set start to 16:00
- set repeat and duration to 6h

what happened

- at 15:55 we pressed start
- machine shuttled 2 filters back to back before 16:00
- then started sampling at 16:00

1st to get rid of the one stuck with sub load blank

- 2nd for running blank and loading new for actual 16:00 sample

- at 16:00 it did not shuttle
→ OK, expected.

- marked as expected
Blank, 4, 10, 4, 10

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• Data logging: Default

Site ID Texas PM-ken

Date/time: current
Timezone PDT

Return to Home

[illegible]

Partisol / Carb Audit

Oct. 30 2018

	Partisol	tetraCal
Temp ambient	3.4 °C	4.8 °C OK

Filter		
Filter temp.	5.7 °C	4.5 °C OK
Filter 2 temp.	5.8 °C	4.6 °C OK

Pressure Ambient	704 mmHg	703.0 mmHg OK
------------------	----------	---------------

RH can't do as tetraCal doesn't have RH sensor

External Leak Check Delta P = 13 mmHg
PASS ✓

	Partisol	tetraCal
Flow (15 LPM)	14.99	14.93
5% = 0.7495		OK ✓

Flow 2 (1.67 LPM)	1.67	1.724
5% = 0.0835		

$\Delta = 0.054$
OK ✓

Internal Leak check

Delta P = 9 mm Hg

PA-ST OK

Instrument Setup

• Default Sample Setup

Method Desc

Flow 15.00

Flow2 1.67

Filter A

Filter B

Separator No

• Default Sample Time

Start 0:00

Duration 24h

Repeat 72 h

For 3-day
sampling

• System Setup

- Av Temp 99

- STD Temp 25

- Avg Press 999

- STD Press 760

- Report Volume: Actual

Filter Fun Auto

Auto Run off

Flow enr mode: EHR

Nov. 5 Tens Partisid check

- checked stn. to see if it handled time Δ okay
- on arrival time was correct (changed to PST automatically)
- all ^{future} samples were 23:00 to 23:00

• what we did! - changed sample setup times to be back on 0:00 $\rightarrow$ 0:30 sampling

- this ~~caused~~ STOP mode which needed

caused ~~2~~ 1 filter pair to be skipped b/c new Run mode causes ~~for~~ filter Δ at start and at end

- $\therefore$ Filter Cassette ID 65078
Filter Cassette ID 2 66742
are skipped

- next samples will be 65080 ~~ID~~
@ Nov 5 0:00 66745 ~~ID 2~~
7

- data $\downarrow$
- Blanks occurred as expected,

Nov
Oct 26 2018

Thermo Scientific™ Partisol™ 2025i

Sequential Air Samplers

Instrument PM and verification sheet

2025i-D

Techs: Dan Casanova
Tulant Bukvi

Instrument serial number	202DIW202171808
Instrument location	Kerr Farm, PM-Kerr

Recommended preventative maintenance intervals				
Activity	PM interval	Last activity date	Current activity date	Next activity date
Clean PM10 inlet:	Monthly	NA, first use	Nov 26 checked	Dec 2018
Clean VSCC inlet: virtual imp	Monthly		Nov 26 cleaned	Dec 2018
Clean WINS impactor well:	Every five sampling days			
Replace in-line filter:	Every six months		Nov 26 inspected	May 2019 replace
Clean filter cassettes/magazines:	Inspect regularly, clean as required		Nov 26 inspected	Dec 2018
Replace V-seals:	Annually		Nov 26 inspected	Nov 2019 replace
Clean rain hood:	Every month		Nov 26 were clean	Dec 2018
Clean air screen/replace as necessary:	Every month		Nov 26 were clean	Dec 2018
Rebuild vacuum pump:	Inspect every 6 months, rebuild annually at a minimum		N/A	May 2019 inspect

Recommended instrument verification interval (unless regional requirements dictate otherwise)				
Equipment required:	A NIST-traceable (or equivalent) transfer standard for temperature calibrated for $\pm 0.5^{\circ}\text{C}$ precision			
	A NIST-traceable (or equivalent) transfer standard for pressure calibrated for ± 5 mm Hg precision			
	A NIST-traceable (or equivalent) transfer standard for relative humidity calibrated for $\pm 2.5\%$ precision			
	A NIST-traceable (or equivalent) flow transfer standard capable of measuring flow range of 0.9–19 lpm is required (depending on the flow transfer standard used, a flow inlet adapter may be required)			
Activity	Verification frequency	Last audit date	Current audit date	Next calibration date
Ambient temperature:	Audit monthly/Calibrate quarterly	Oct 30 2018	Nov 26 2018	late Dec 2018
Filter temperature:	Audit monthly/Calibrate quarterly			
Filter compartment temperature:	Audit monthly/Calibrate annually			
Electronics compartment temperature:	Audit monthly/Calibration annually			
Ambient pressure:	Audit monthly/Calibrate quarterly			
Filter pressure:	Audit monthly/Calibrate quarterly			
Ambient RH:	Audit monthly/Calibrate annually	did not do	did not do	
Flow check:	Audit monthly/Calibrate quarterly	Oct 30 2018	Nov 26 2018	
External leak check:	Every five days of inlet usage			
Internal leak check:	Monthly			

RH ref. instrument ordered for future RH audits

For more information, please consult your technical support representative.

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Nov 26 2018

Thermo Scientific™ Partisol™ 2025i

Sequential Air Sampler

2025i-D

Maintenance and troubleshooting guide

client: Telkwa Coal

Operator	ERM: Dan Casanova, Tuluat Bakir
Site location	Kerr Farm, PM-Kerr
Instrument serial number	202DTW202171808
Shelter temperature	did not record
Software version	did not record

Date	Nov 26	2018
Time	13:00	

wing ref.

		Unit displayed value	Calibration date	Audit date	Measured results	Calibration offset/intercept	Calibration Span
Instrument diagnostics	Ambient temperature	2.9 °C	factory date	Nov 26	3.6 °C	no change	
	Ambient pressure	691 mmHg			689.0 mmHg		
	Filter temperature	5.0 / 5.9			4.0 / 4.4		
	Filter pressure	N/A		N/A	N/A		
	Filter compartment temperature	didn't check		N/A	N/A		
	Electronics compartment temperature	didn't check		N/A	N/A		
	Ambient RH	didn't check		N/A	not available		
	Flow 4PM	15.00 / 1.67		Nov 26	15.00 / 1.75		no change
	Maximum pump pressure	N/A atm					
	Internal leak check	ΔP=10 mm Hg					
	External leak check	ΔP=9 mm Hg					

Status code		Comments/notes
Code	Description	
	None on control	• used BGI tetraCyl for audit
	Filter file data status code	• RH ref instrument on order
	= 100000 on Nov 7 sample	• Cassette IDs 65078 and 66742
		skipped on purpose on Nov 5
		• Nov 7 sample started at 3:41 am
		for an unknown reason
		• Samples sent to ALS on COC
		17-717043

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Tenas Nov. 26

New Filter list prepared:

from ALs BR 228744
bottle:

Cassette ID	Filter ID	Position	Param.
066748	28	16 (bottom) 12	PM coarse
066751	29	15 11	"
066750	30	14 10	"
066746	22	13 9	"
065045	23	12 8	"
065046	24	11 7	"
066755	25	10 6	"
066739	26	9 5	"
066757	27	8 4	"
066741	17	7	"
066754	16	6	"
066758	18	5	"
066752	19	4	"
066753	20	3	"
066740	21	2	"

↑ moved to PM 2.5 mag.

Cassette ID	Filter ID	Position	PM
065061	1	16 (bottom)	PM2.5
065065	2	15	11
065063	3	14	10
066740	21	13	9
066753	20	12	8
066752	19	11	7
066758	18	10	6
066754	16	9	5
066741	17	8	4

moved old unsampled cassettes to top of new cassette

	A	BR20.12.78	A	
065086	23	7	3	11
065088	21	6	2	11
065090	22	5	1	11
065071	39	7	3	PM coarse
065072	38	6	2	11
065074	37	5	1	11

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 13000A, VA, USA • 800.440.8811

Partial Stn on arrival

- PM course, ^{top} ~~start~~ cassette = 065068
- PM_{2.5}, top " 065087
- status conditions = none

- cassettes in the sample position waiting:

cass 1 ID = 65089

cass 2 ID = 65070

- PM10 inlet checked and cleaned

- clean on arrival

- virtual impactor checked and clean

- clean on arrival

- upper/lower V seal inspected - no cracks

- in-line filter looked visually - clean clean

Audit

	Partial	Ref	
Temperature Ambient:	2.9 °C	3.6 °C	✓
Filter 1 Ambi Temp:	5.0 °C	4.0 °C	✓
Filter 2 Ambi Temp:	5.9 °C	4.4 °C	✓
ambient pressure:	691 mmtHg	689.0 mmtHg	✓
ambient RH →	not done		
External Leak check:	Pass	ΔP = 9 mmtHg	
Flow (try 1)	15.00 lpm	16.41 lpm	
Flow (try 2)	15.00	15.06 lpm	✓

0.08

re-zeroed the calibration for
try 2.

	Partisol	Ref
Flw 2	1.67	1.75 ✓

Internal Leak Check P/HSS ✓	
$\Delta P = 10 \text{ mmHg}$	

JLDARLING LLC
Tacoma, WA, USA - info@jldarling.com

Dec. 21 2018

Thermo Scientific™ Partisol™ 2025i

Sequential Air Samplers

Instrument PM and verification sheet

2025i-D

field crew: Dan Casanova
Mike Stead

Instrument serial number	202DIW202171808
Instrument location	PM-Kerr, Texas Project

Recommended preventative maintenance intervals				
Activity	PM interval	Last activity date	Current activity date	Next activity date
Clean PM10 inlet:	Monthly	Nov 26	Dec 21, cleaned	Jan 2019
Clean VSCC inlet: <i>virtual imp.</i>	Monthly		cleaned	Jan 2019
Clean WINS Impactor well:	Every five sampling days			
Replace in-line filter:	Every six months		inspected	May 2019 replace
Clean filter cassettes/magazines:	Inspect regularly, clean as required		inspected	Jan 2019
Replace V-seals:	Annually		inspected	Nov 2018 replace
Clean rain hood:	Every month		clean	Jan 2019
Clean air screen/replace as necessary:	Every month		clean	Jan 2019
Rebuild vacuum pump:	Inspect every 6 months, rebuild annually at a minimum	N/A	N/A	May 2019 inspect

Recommended instrument verification interval (unless regional requirements dictate otherwise)				
Equipment required:	A NIST-traceable (or equivalent) transfer standard for temperature calibrated for $\pm 0.5^\circ\text{C}$ precision			
	A NIST-traceable (or equivalent) transfer standard for pressure calibrated for ± 5 mm Hg precision			
	A NIST-traceable (or equivalent) transfer standard for relative humidity calibrated for $\pm 2.5\%$ precision			
	A NIST-traceable (or equivalent) flow transfer standard capable of measuring flow range of 0.9–19 lpm is required (depending on the flow transfer standard used, a flow inlet adapter may be required)			
Activity	Verification frequency	Last audit date	Current audit date	Next calibration date
Ambient temperature:	Audit monthly/Calibrate quarterly	Nov 26 2018	Dec 21 2018	late Jan 2019
Filter temperature:	Audit monthly/Calibrate quarterly			
Filter compartment temperature:	Audit monthly/Calibrate annually			
Electronics compartment temperature:	Audit monthly/Calibration annually			
Ambient pressure:	Audit monthly/Calibrate quarterly			
Filter pressure:	Audit monthly/Calibrate quarterly			
Ambient RH:	Audit monthly/Calibrate annually	did not do		
Flow check:	Audit monthly/Calibrate quarterly	Nov 26 2018		
External leak check:	Every five days of inlet usage			
Internal leak check:	Monthly			

For more information, please consult your technical support representative.

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Dec 21 2018

Thermo Scientific™ Partisol™ 2025i

Sequential Air Sampler

Maintenance and troubleshooting guide

Operator	ERM, Texas Project
Site location	PM-1 Kerr
Instrument serial number	202 DIW 202171808
Shelter temperature	N/A
Software version	02.08.65.45H +

Date	Dec 21 '18
Time	10 am

Firmware: 11.57.160

Dan Cakernov

Mike Stead

Instrument diagnostics		Unit displayed value	Calibration date	Audit date	Measured results	Calibration offset/intercept	Calibration Span
	Ambient temperature °C	-7.9 °C	factory	Dec 21 '18	-7.4	N/A	
	Ambient pressure mmHg	704			702.1	N/A	
	Filter temperature °C	-5.3 °C			-5.6 °C	N/A	
	Filter pressure mmHg	704			704		
	Filter compartment temperature	-5.2 °C			-6.4	N/A	
	Electronics compartment temperature	4.7 °C			N/A	N/A	
	Ambient RH %	89.9	Dec 21		89.6	0.0	
	Flow LPM	15.0			14.81	N/A	N/A
	Maximum pump pressure	atm					
	Internal leak check	SP 8 mm Hg					
	External leak check	AP 9 mm Hg					

Status code		Comments/notes
Code	Description	
	None	-recalibrated RH sensor
		-data looked OK on arrival
		Sample shipped to ALS on
		COC 117-812134
		New filters came from ALS bottle order
		BR232330

Next filters for Dec 22 sample PM2.5: 65089
 Blank filters for Dec 23 coarse: 65070
 PM2.5: 65047
 Coarse: 65051

Removed: PM2.5, top: 66740
 bottom: 65090
 PM10, top: 66746
 bottom: 65074

For more information, please consult your technical support representative.

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Jan 22, 2019

Thermo Scientific™ Partisol™ 2025i

Sequential Air Samplers

Instrument PM and verification sheet

2025i-10

Field crew:
Talaat Bachari
Jill Zyla

Instrument serial number	202DIW202171808
Instrument location	PM-Kerr, Texas Project

Recommended preventative maintenance intervals				
Activity	PM interval	Last activity date	Current activity date	Next activity date
Clean PM10 inlet:	Monthly	Dec 21, 2018	Jan 22, 19, cleaned	Feb 2019
Clean VSCC Inlet: virtual inlet	Monthly		cleaned	Feb 2019
Clean WINS impactor wall:	Every five sampling days			
Replace in-line filter:	Every six months		inspected	May 2019
Clean filter cassettes/magazines:	Inspect regularly, clean as required		=	Feb 2019
Replace V-seals:	Annually		=	Nov 2019
Clean rain hood:	Every month		clean	Feb 2019
Clean air screen/replace as necessary:	Every month		clean	Feb 2019
Rebuild vacuum pump:	Inspect every 6 months, rebuild annually at a minimum	N/A	N/A	May 2019

Recommended instrument verification interval (unless regional requirements dictate otherwise)				
Equipment required:	A NIST-traceable (or equivalent) transfer standard for temperature calibrated for $\pm 0.5^\circ\text{C}$ precision			
	A NIST-traceable (or equivalent) transfer standard for pressure calibrated for ± 5 mm Hg precision			
	A NIST-traceable (or equivalent) transfer standard for relative humidity calibrated for $\pm 2.5\%$ precision			
	A NIST-traceable (or equivalent) flow transfer standard capable of measuring flow range of 0.9–19 lpm is required (depending on the flow transfer standard used, a flow inlet adapter may be required)			
Activity	Verification frequency	Last audit date	Current audit date	Next calibration date
Ambient temperature:	Audit monthly/Calibrate quarterly	Dec 21, 2018	Jan 22, 2019	Feb 2019
Filter temperature:	Audit monthly/Calibrate quarterly			
Filter compartment temperature:	Audit monthly/Calibrate annually			
Electronics compartment temperature:	Audit monthly/Calibration annually			
Ambient pressure:	Audit monthly/Calibrate quarterly			
Filter pressure:	Audit monthly/Calibrate quarterly			
Ambient RH:	Audit monthly/Calibrate annually			
Flow check:	Audit monthly/Calibrate quarterly			
External leak check:	Every five days of inlet usage			
Internal leak check:	Monthly			

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Jan 22 / 2019

Thermo Scientific™ Partisol™ 2025i

Sequential Air Sampler

Maintenance and troubleshooting guide

Operator	ERM, Texas Project
Site location	PM - Kerv
Instrument serial number	702 DIW 202171808
Shelter temperature	N/A
Software version	02.08.65.154

Date	Jan 22/2019
Time	1:30 pm

Talant & Jill

Instrument diagnostics		Unit displayed value	Calibration date	Audit date	Measured results	Calibration offset/intercept	Calibration Span
	Ambient temperature	1.6	Factory	Jan 22	1.4	N/A	
	Ambient pressure	700			701.1		
	Filter temperature	0.7 / 0.8			0.1 / -0.2		
	Filter pressure	N/A			N/A		
	Filter compartment temperature	did not check			N/A		
	Electronics compartment temperature	did not check			N/A		
	Ambient RH	90.1	Dec 21		88.5	✓	
	Flow	15.7 / 1.67	Factory		15.8 / 1.81		N/A
	Maximum pump pressure	did not check					
	Internal leak check	Δ 9 mm Hg					
	External leak check	Δ 14 mm Hg					

Status code		Comments/notes
Code	Description	
	N/A	data record instrument looked ok on arrival

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Feb. 28 2019

Thermo Scientific™ Partisol™ 2025i

Sequential Air Samplers

Instrument PM and verification sheet

2025i-D

Field crew: Dan Casanova
Tahar Bakri

Instrument serial number	202DIW202171808
Instrument location	PM-Kerry, Texas Project

Recommended preventative maintenance intervals				
Activity	PM interval	Last activity date	Current activity date	Next activity date
Clean PM10 inlet:	Monthly	Jan 22 '19	Feb 28 '19, cleaned	March 2019
Clean VSGG inlet:	Monthly		" "	
Clean WINS impactor well:	Every five sampling days		" "	
Replace in-line filter:	Every six months		" inspected	(inspect)
Clean filter cassettes/magazines:	Inspect regularly, clean as required		" "	
Replace V-seals:	Annually		" "	
Clean rain hood:	Every month		" cleaned	
Clean air screen/replace as necessary:	Every month		" cleaned	
Rebuild vacuum pump:	Inspect every 6 months, rebuild annually at a minimum	N/A	N/A	May 2019 inspect

Recommended instrument verification interval (unless regional requirements dictate otherwise)				
Equipment required:	A NIST-traceable (or equivalent) transfer standard for temperature calibrated for $\pm 0.5^{\circ}\text{C}$ precision			
	A NIST-traceable (or equivalent) transfer standard for pressure calibrated for ± 5 mm Hg precision			
	A NIST-traceable (or equivalent) transfer standard for relative humidity calibrated for $\pm 2.5\%$ precision			
	A NIST-traceable (or equivalent) flow transfer standard capable of measuring flow range of 0.9–19 lpm is required (depending on the flow transfer standard used, a flow inlet adapter may be required)			
Activity	Verification frequency	Last audit date	Current audit date	Next calibration date
Ambient temperature:	Audit monthly/Calibrate quarterly	Jan 22 '19	Feb. 28 '19	March '19
Filter temperature:	Audit monthly/Calibrate quarterly			
Filter compartment temperature:	Audit monthly/Calibrate annually			
Electronics compartment temperature:	Audit monthly/Calibration annually			
Ambient pressure:	Audit monthly/Calibrate quarterly			
Filter pressure:	Audit monthly/Calibrate quarterly		*	
Ambient RH:	Audit monthly/Calibrate annually			
Flow check:	Audit monthly/Calibrate quarterly			
External leak check:	Every five days of inlet usage			
Internal leak check:	Monthly			

* Filter 2 pressure malfunctioning and did not allow for recalibration

calibrations done

For more information, please consult your technical support representative.

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Feb 28 2019

Thermo Scientific™ Partisol™ 2025i

Sequential Air Sampler

Maintenance and troubleshooting guide

Operator	ERM, Tenas Project
Site location	PM - Kerr
Instrument serial number	202 DIW 202171808
Shelter temperature	N/A, not in shelter
Software version	02.08.85.454 +

Date	Feb 28	2019
Time	10 am	

		AS-found	Unit displayed value	Calibration date	Audit date	Reference	Measured results	Calibration offset/intercept	New values after calibrating	Calibration Span	Span targets
Instrument diagnostics	Ambient temperature °C	0.4	°C	Feb 28 '19	Feb 28 '19	11.57, 160	1.0	°C	did not rec'd		SP1 13.5
	Ambient pressure mmHg	707					705.9				SP2 15.0
	Filter temperature °C	0.9	1.3				1.3	2.1			SP3 16.5
	Filter pressure mmHg	707	748				706.2	706.2			
	Filter compartment temperature °C	3.4					2.4				SP1 1,503
	Electronics compartment temperature °C	N/A					N/A				SP2 1,670
	Ambient RH %	41.3					41.3				SP3 1,837
	Flow LPM	14.98	1.67				15.26	1.735	0.1	0.25	
	Maximum pump pressure		atm								
	Internal leak check	ΔP 3.7	mm Hg								
	External leak check	ΔP 14	mm Hg								

Status code		Comments/notes
Code	Description	
	None	• #s above are for as-found values, before calibration
	Comments Cont.	• All calibrations completed fine except for Filter 2 pressure that was malfunctioning and did not accept any cal change
	• CD Navg recommended	• Filter 2 pressure did not change when pump was running. Filter 2 did change as expected
	firmware update/reset to try to fix problem. will do ASAP	

* See fieldnote scans for detailed pre and post calibration values.

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Tenas Feb. 28 fieldwork PM-terr

magazines from ALS

Cassette ordering, From Bottle Order
BR236515

#2 PM25

#3 PM10

top. 064480

top. 016076

064478

15064

064477

064447

064475

064448

064482

064463

064481

064464

064473

064454

064472

064461

064470

064462

064471

064452

057308

064450

064469

064465

064466

064468

034137 Bottom

Bottom 064439

(16)

(14)

These will be transferred from the provided
ALS magazines to the labelled Tenz
Magazines

Partised on arrival:

~~Storage PM coarse had more filters than storage PM2.5~~

• supply had 2 filters on top each.

• Storage PM coarse piston was further down than PM2.5. Possibly piston was at bottom during last install instead of being pushed up to top.

Retrieved filters,

PM2.5	top =	66741
PMc	top =	65071

Left over filters from supply

mag

PM_{2.5}

PM₁₀

1 65086

1 65072

2 65088

2 65074

Set to blank for March 2

These were placed on
top of the new ones
from ALS

List of filters from exposed
mass

PM_{2.5}

PM₁₀

~~PM₁₀~~

top 66741

top 65071

66740

66746

66754

65046

66758

66755

66753

65045 → found flipped

66752

66739 upside down

66750

66750

66751

65061

65048

66748

65078

65065

65080

66744

65077

65067

65075 bottom

66747 bottom (18)

As-fused display units, before calibration

	Display	Ref.
• Ambient temp.	0.4 °C	1.0 °C
• Amb. press	707	705.9
• Filter temp. 1	0.9 °C	1.3 °C
• Filter press. 1	707	706.2
• Filter comp. temp.	3.4 °C	2.4 °C
• Electronic comp. temp.		
• Ambient RH	41.3 %	41.3 %
• Flow	see other page	
• Filter temp. 2	1.3 °C	2.1 °C
• Filter press. 2	748	706.2
• Flow 2	see other page	

After calibration

	Display	Ref.
• Ambient temp.	-1.1	-1.1
• Amb. press.	706	706
• Filter temp. 1	1.3 °C	1.3 °C
• Filter press. 1	706	706
• Filter comp. temp.	2.6 °C	2.6 °C
• Electronic comp. temp.		
• Ambient RH	41.3 %	41.3 %
• Flow 1	see other page	
• Filter temp. 2	2.1 °C	2.1 °C
① Filter press. 2	could not do	
• Flow 2	see other page	

★ getting "unable to calibrate" error
when trying to calibrate Filter 2
pressure

• External Leak check: Pass
• $\Delta P = 14$

• Internal Leak check: Pass
 $\Delta P = 37$

Flow audit before calibration

Flow	Partial	Ref.
Flow 1	15.0	15.06

Flow 2	1.67	1.76
--------	------	------

★ CD Mura said to try firmware
update to solve Flow 2 problem

Test to see if filter pressure drops
when pump 1 on, Filter 1 pressure
drops ~100 units

when pump 2 on, Filter 2 pressure does
not drop at all
→ problem

Flow 1 Calibration		
	Live	Ref
SP1	13.49	13.75
SP2	14.98	15.26
SP3	16.51	16.78

original slope	new slope
intercept	intercept

1.01
0.1

Flow 2 Calibration		
	Live	Ref
SP1	1.49	1.59
SP2	1.670	1.7375
SP3	1.840	1.893

original slope	new slope
intercept	intercept

1.00
-0.01
0.89
0.25

Flow audit after calibration

Flow	Display	Ref.
Flow 1	15.01	15.02
Flow 2	1.67	1.68

April 2 2019

Thermo Scientific™ Partisol™ 2025i

Sequential Air Samplers

Instrument PM and verification sheet

2025i-D

field crew: Dan Casanova
Sill Zyla

Instrument serial number	202D/W 202171808
Instrument location	PM-kerr stn.

Recommended preventative maintenance intervals

Activity	PM interval	Last activity date	Current activity date	Next activity date
Clean PM10 inlet:	Monthly	Feb. 28 '19	April 2 '19	May 2019
Clean VOC inlet:	Monthly			
Clean WINS impactor wall:	Every five sampling days			
Replace in-line filter:	Every six months	inspected	inspected	inspect
Clean filter cassettes/magazines:	Inspect regularly, clean as required	inspected		
Replace V-seals:	Annually	inspected		
Clean rain hood:	Every month	inspected		
Clean air screen/replace as necessary:	Every month	inspected		
Rebuild vacuum pump:	Inspect every 6 months, rebuild annually at a minimum	N/A	N/A	May 2019 inspect

Recommended instrument verification interval (unless regional requirements dictate otherwise)

Equipment required:	A NIST-traceable (or equivalent) transfer standard for temperature calibrated for $\pm 0.5^{\circ}\text{C}$ precision			
	A NIST-traceable (or equivalent) transfer standard for pressure calibrated for ± 5 mm Hg precision			
	A NIST-traceable (or equivalent) transfer standard for relative humidity calibrated for $\pm 2.5\%$ precision			
	A NIST-traceable (or equivalent) flow transfer standard capable of measuring flow range of 0.9–19 lpm is required (depending on the flow transfer standard used, a flow inlet adapter may be required)			
Activity	Verification frequency	Last audit date	Current audit date	Next calibration date
Ambient temperature:	Audit monthly/Calibrate quarterly	Feb. 28 '19	April 2 '19	May 2019
Filter temperature:	Audit monthly/Calibrate quarterly			
Filter compartment temperature:	Audit monthly/Calibrate annually			
Electronics compartment temperature:	Audit monthly/Calibration annually			
Ambient pressure:	Audit monthly/Calibrate quarterly			
Filter pressure:	Audit monthly/Calibrate quarterly			
Ambient RH:	Audit monthly/Calibrate annually			
Flow check:	Audit monthly/Calibrate quarterly			
External leak check:	Every five days of inlet usage			
Internal leak check:	Monthly			

calibrations
done too due
to machine
reset

For more information, please consult your technical support representative.

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April 2 2019

Thermo Scientific™ Partisol™ 2025i

Sequential Air Sampler

2025i-D

Maintenance and troubleshooting guide

Operator	ERM, Tenzai Project
Site location	PM - Kerr
Instrument serial number	202011W202171808
Shelter temperature	N/A, not in shelter
Software version	02.08.05.454 +, Firmware 11.57.160

Date	April 2	2019
Time	9 am	

Instrument diagnostics		Unit displayed value	Calibration date	Audit date	Measured results	Calibration offset/intercept	Calibration Span	
							Slope	
①/② ①/② ①/②	Ambient temperature	8.0	April 2	April 2	8.0	did not recal		
	Ambient pressure	700			700.0			
	Filter temperature	410.7/10.9			10.7/10.9			
	Filter pressure	700/748			700.0/700.0			
	Filter compartment temperature	10.4			10.4			
	Electronics compartment temperature							
	Ambient RH	38.7 %			37.0			
	Flow	15.0/1.67			15.0/1.67	-0.22/0.14	1.03	0.96
	Maximum pump pressure	atm						
	Internal leak check	17.81 PASS mm Hg						
	External leak check	11.67 PASS mm Hg						

Span Setpoints

SP1	13.5
SP2	15.0
SP3	16.5
SP1	1.503
SP2	1.670
SP3	1.837

Status code		Comments/notes
Code	Description	
	Shuttle (x) code	
	error state 13	• Filter 2 pressure was still erroneous and did not allow calibration after firmware flash.
	→ PM cassette 64461	• CD Now talked to Thermo and a new circuit board will be sent under warranty to try to fix problem.
	was found stuck between the piston that pushes samples down into mag. This was the March 25 sample	• Station recalibrated
	→ March 28 and 31 samples were skipped.	• Could not adjust RH lower to match w/ ref RH, machine would not accept a lower cal value.

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Texas Partisal April 2 2019

New Filters From Lab.

Magnifying from lab

#1 (fine) PM.25

#2

(Coarse)

top. 057306	Top 057307
034159 (blank)	041682 (blank)
04220	057299
034121	057296
RP 054603	015526
27306	041625
245405	041652
25074	034145
057313	034144
04235	015496
015261	057303
015279	009909
27408	17843
057309	24543
041680	17820
RP 090549	041674

Error Code on arrival

- flashing red light

code: Shuttle (x)

Filter advance error detail:

error state: 13

Lift 7 up sensor

one Coarse PM cassette was

stuck between the piston that

was pushed samples down into magazine.

- see pic

- Filter ID 64461
cassette

March 28 sample may have been
skipped due to the error

Sampled filters going to lab

#2 PM_{coars}

#1 PM_{fine}

064461 Top

Top 064472

064454

064473

064464

064481

064463

064482

064448

064475

064447

064477

15064

064478

016076

064480

065074

065088

065072

065086

(10)

(10)

Sample from lab # 41635

had a speck of contaminant on it.

- I removed the speck,

- I assume it was there
after the lab weighed it

~~CD Nova called about Co~~

• Firmware are updated

→ same problem w/ Filter 2 pressure

• CD Nova called and replacement
circuit board ordered.

• Needed to do a full calibration due
to firmware update

Calibration

	Ref.	Reading	Set to
Ambient Temp.			
Ambient Temp.	8.0	11.4	8.0
Ambient Pressure.	700.0	701	700
Filter 1 Pressure	700.0	701	700
Filter 2 Pressure	700.0	748	748
Filter Comp. Temp.	10.4	9.4	10.4
Filter 1 Temp.	10.7	10.7	10.7
Filter 2 Temp.	10.9	11.3	10.9
Ambient RH	37.0	43.0	38.7

could not get
lower

Filter 2 press, could not calibrate
→ known issue

Calibration (cont.)

Ref. Reading. Set To

Leak Check:

External: 11 mmtg PASS

Internal: 17 mmtg PASS

Flow Cal.

Qa

Fluctuates

	Setpoint	Ref.	Reading	Set To
Flow 1 Setpoints	13.5	13.70	13.50	13.70
	15.0	15.26	15.00	15.26
	16.5	16.81	16.50	16.81
New Slope: 1.03	New intercept: -0.22			

Flow 2 Setpoints 1.503
1.670
1.837

Fluctuates

Setpoint	Ref.	Reading	Set To
1.503	1.572	1.500	1.572
1.670	1.737	1.670	1.737
1.837	1.888	1.835	1.888

New Slope : 0.96

New Intercept: 0.14

2025iD (PMcoarse/PM2.5) Partisol Calibration Inspection

Instrument Serial Number	202 DIW202 171808	Filter check		As found	As left
Date	2-May-19	PMcoarse	Filter # at the top of supply magazine		15064
Time	9:00		Filter # at the top of receiving/sampled magazine	57307	empty
Partisol Sampler Date			Filter # of the blank cassette	41682	65074
Error Codes (Top Left Hand Corner)	N/A	PM2.5	Filter # at the top of supply magazine		64482
Mode (Top Right Hand Corner)	Wait		Filter # at the top of receiving/sampled magazine	57306	empty
Next sampling date	3-May-19		Filter # of the blank cassette	34159	64472

Description	As found	Calibration/ Audit Reference	Variance	Allowable variance	Adjusted to	Final variance	Comments
Ambient Air Temperature (°C)	15.2	15.9	0.70	+/- 2°C	15.9	0.00	
Ambient Pressure (mmHg)	698.0	698.0	0.00	+/- 10 mmHg	698	0.00	
Filter Pressure (mmHg)	699.0	698.0	1.00	+/- 10 mmHg	698	0.00	
Filter #2 Pressure (mmHg)	698.0	698.0	0.00	+/- 10 mmHg	698	0.00	
Filter Temp (°C)	16.8	16.9	0.10	+/- 2°C	16.9	0.00	
Filter Temp #2 (°C)	17.2	17.0	-0.20	+/- 2°C	17	0.00	
Filter Compartment Temperature (°C)	13.9	12.5	-1.40	+/- 2°C	12.5	0.00	
External Leak Check (deltaP, mmHg)	13.0	N/A	Pass	25 mmHg		Pass	
Internal Leak Check (deltaP, mmHg)	11.0	N/A	Pass	140 mmHg		Pass	
Ambient Relative Humidity (%)			#DIV/0!	+/- 1.5%		#DIV/0!	
Flow Final (audit-before calibration), lpm			#DIV/0!	+/- 5%		#DIV/0!	
Flow, point 1 Calibration, lpm	13.47	13.54	0.52%	+/- 5%	13.54	0.00%	
Flow, point 2 Calibration, lpm	14.90	15.07	1.14%	+/- 5%	15.07	0.00%	
Flow, point 3 Calibration, lpm	16.48	16.59	0.67%	+/- 5%	16.59	0.00%	
Flow Final (After Calibration), lpm			#DIV/0!	+/- 5%		#DIV/0!	
Flow #2 final (audit-before calibration), lpm			#DIV/0!	+/- 5%		#DIV/0!	
Flow #2, point 1 Calibration, lpm	1.50	1.56	4.34%	+/- 5%	1.562	0.00%	
Flow #2, point 2 Calibration, lpm	1.66	1.73	3.85%	+/- 5%	1.728	0.00%	
Flow #2, point 3 Calibration, lpm	1.83	1.88	3.12%	+/- 5%	1.882	0.00%	
Flow Final (After Calibration), lpm			#DIV/0!	+/- 5%		#DIV/0!	

Instrument Used	Description	S/N	Calibration Date
Flow	BGI tetraCal	162606	18-Jul-18
Pressure	BGI tetraCal	162606	18-Jul-18
Temperature	Visala HUMICAP	P4760193	
Relative Humidity	Visala HUMICAP	P4760193	

New Calibration Points	Slope	Intercept
Flow	1.03	-0.43
Flow #2	0.93	0.16

PM2.5: Fine, high flow, rear side, Filter, Flow
PMcoarse: Coarse, low flow, front side, Filter2, Flow2

Calibration/Audit Complete By
Daniel Casanova & Talaat Bakri

Comments/Observations:[illegible]

Texas Partisol May 199

800000

106000

4000

115000

110000

• data ↓

- Sample times OK

- no errors

- Sample volumes OK

- Some issues w/ "Valid Sample times"

- need to look into these in office,
maybe Δ values are too high?

New ALS Mag from ALS

#1 = PM_{2.5}

#2 = PM_c

#1

#2

New Sample Order for new Filters

PM_{2.5}

PM_c

Bottom

090549	13	13	041674
041680	12	12	17820
27408	11	11	24543
57309	10	10	17843
015279	9	9	009909
064477	8 ← filter flipped	8	064448
064478	7 ← "correctly"	7	064461
064485		6	064454
064480	6	5	064464
065086	5	4	064447
065088	4	3	064463
064475	3	2	065074
064472	2	1	15064
064482	<u>Top</u> 1		<u>Top</u>

(13)

(13)

JL DURLING LLC
Tacoma, WA, USA - Rmohr@jldurling.com

Sample order from sampled filters
for analysis. Moved from Texas
magazine to ALS magazines.

from	to	from	to
PM2.5 #1	PMc #2		
<u>Top</u> 015261	<u>Bottom</u> 057303		
04235	015496		
057313	034144		
25074	034145		
25405	041682		
27306	041635		
RP 054603	015526		
034121	057296		
04220	057299		
034159	041682		
Bottom 057306	Top 057307		
(11)	(11)		

upload csv file = DW07

We swapped one of the circuit boards
and now filter2 pressure calibrator
firm, using system default config.

Calibration

Parameter	Reference	Pre-Cal	Post-Cal
Amb. Temp	15.9 °C	15.2 °C	15.9 °C
Amb. Press	698.8 mmHg	698	698
Filter1 Press	698.0	699	698
Filter2 Press	698.0	698	698
Filter1 Temp	16.9	16.8	16.9
Filter2 Temp	17.0	17.2	17.0
Amb. RH	39.8	39.3	39.8
External Leak Check	ΔP 13	PASS	
Internal Leak check	ΔP 11	PASS	
Filter Comp. Temp.	12.5	13.9	12.5
Filter Flow	Setpoint	Pre	Ref.
	13.50	13.47-13.51	13.54
	15.00	14.9-15.01	15.07
	16.50	16.48-16.5	16.59
new slope: 1.03			
new intercept: -0.43			

- after uploading the new configuration file, Filter2 pressure had the same problem as before: value way off and not able to calibrate

- we swapped circuit boards, no change (bad press 2)
- we swapped again (so new one was in place) and no change (bad press 2)
- we tried uploading original (blank) config file and it seems to be working again
→ maybe problem is w/ config file ???

Had to enter in all settings again

- Serial set to 20217
- Volume set ~~to~~ to Actual

Filter2 Flow

Setpoint	Pre.	Ref
1.503	1.490-1.509	

- Filter2 Flow did could not be calibrated due to leak issue

~~2 May 2~~

-after removing ^{top} cover, we saw the cassette for filter 2 did not go into position properly (see pics), causing the problem.

Filter 2 Flow Cal.

Setpoint	Pre.	Ref.
1.503	1.497-1.506	1.562
1.670	1.664-1.677	1.728
1.837	1.825-1.843	1.882

New slope = 0.93

new intercept = 0.16

2025iD (PMcoarse/PM2.5) Partisol Calibration Inspection

Instrument Serial Number	202 DIW202 171808	Filter check		As found	As left
Date	5-Jun-19	PM2.5	Filter # at the top of supply magazine	magazine empty	57307
Time	crew arrived at 10:50am		Filter # at the top of receiving/sampled magazine	41680	magazine empty
Partisol Sampler Date			Filter # of the blank cassette	64472	57306
Error Codes (Top Left Hand Corner)	none on arrival	PMcoarse	Filter # at the top of supply magazine	magazine empty	16076
Mode (Top Right Hand Corner)	"sampling" mode on arrival; sample cancelled		Filter # at the top of receiving/sampled magazine	17820	magazine empty
Next sampling date	June 5 was cancelled; next set to June 8		Filter # of the blank cassette	65074	65072

Description	As found	Calibration/ Audit Reference	Variance	Allowable variance	Adjusted to	Final variance	Comments
Ambient Air Temperature (°C)	13.8	13.8	0.00	+/- 2°C	n/a	#VALUE!	no adjustment; audit only
Ambient Pressure (mmHg)	698	699.0	-1.00	+/- 10 mmHg	n/a	#VALUE!	no adjustment; audit only
Filter Pressure (mmHg)	698.0	699.0	-1.00	+/- 10 mmHg	n/a	#VALUE!	no adjustment; audit only
Filter #2 Pressure (mmHg)	699.0	699.0	0.00	+/- 10 mmHg	n/a	#VALUE!	no adjustment; audit only
Filter Temp (°C)	15.7	15.4	-0.30	+/- 2°C	n/a	#VALUE!	no adjustment; audit only
Filter Temp #2 (°C)	15.8	15.7	-0.10	+/- 2°C	n/a	#VALUE!	no adjustment; audit only
Filter Compartment Temperature (°C)	15.8	16.6	0.80	+/- 2°C	n/a	#VALUE!	no adjustment; audit only
External Leak Check (deltaP, mmHg)	6.0	n/a	Pass	25 mmHg	n/a	Fail	no adjustment; audit only
Internal Leak Check (deltaP, mmHg)	9.0	n/a	Pass	140 mmHg	n/a	Fail	no adjustment; audit only
Ambient Relative Humidity (%)	39.2	40.4	1.20	+/- 1.5%	n/a	#VALUE!	no adjustment; audit only
Flow Final (audit- as found before maintenance), lpm	15.00	15.10	0.70%	+/- 5%	n/a	0.70%	as found ranged from 14.98 - 15.01
Flow Final (audit- after maintenance but before calibration), lpm	15.00	15.05	0.33%	+/- 5%	n/a	0.33%	as found ranged from 14.98 - 15.02
Flow, point 1 Calibration, lpm	n/a	n/a	#VALUE!	+/- 5%	n/a	#VALUE!	no adjustment; audit only
Flow, point 2 Calibration, lpm	n/a	n/a	#VALUE!	+/- 5%	n/a	#VALUE!	no adjustment; audit only
Flow, point 3 Calibration, lpm	n/a	n/a	#VALUE!	+/- 5%	n/a	#VALUE!	no adjustment; audit only
Flow Final (After Calibration), lpm	n/a	n/a	#VALUE!	+/- 5%	n/a	#VALUE!	no adjustment; audit only
Flow Final (audit- as found before maintenance), lpm	1.67	1.673	0.18%	+/- 5%	n/a	0.18%	as found ranged from 1.67 - 1.68
Flow Final (audit- after maintenance but before calibration), lpm	1.67	1.654	-0.96%	+/- 5%	n/a	-0.96%	as found ranged from 1.66 - 1.68
Flow #2, point 1 Calibration, lpm	n/a	n/a	#VALUE!	+/- 5%	n/a	#VALUE!	no adjustment; audit only
Flow #2, point 2 Calibration, lpm	n/a	n/a	#VALUE!	+/- 5%	n/a	#VALUE!	no adjustment; audit only
Flow #2, point 3 Calibration, lpm	n/a	n/a	#VALUE!	+/- 5%	n/a	#VALUE!	no adjustment; audit only
Flow Final (After Calibration), lpm	n/a	n/a	#VALUE!	+/- 5%	n/a	#VALUE!	no adjustment; audit only

Instrument Used	Description	S/N	Calibration Date
Flow	BGI tetraCal	162606	18-Jul-18
Pressure	BGI tetraCal	162606	18-Jul-18
Temperature	Vaisala HM40 meter	P4760193	24-Nov-18
Relative Humidity	Vaisala HM40 meter	P4760193	24-Nov-18

New Calibration Points	Slope	Intercept
Flow	no change made	no change made
Flow #2	no change made	no change made

PM2.5: Fine, high flow, rear side, Filter, Flow
PMcoarse: Coarse, low flow, front side, Filter2, Flow2

Calibration/Audit Complete By

Daniel Casanova (ERM)
Cory Koenig (Telkwa Coal)

Comments/Observations:

Maintenance on June 5 occurred on a scheduled sampling day. The June 5th sample disks (cassette IDs 90549, 41674) were interrupted and samples were marked as void. Before leaving the station, the monitoring schedule was set to June 8 to resume the normal 3-day schedule. I did not set the Partisol into the "Advanced" mode to customize the sample schedule to make up for the missed June 5 sample (e.g., sample on June 6, June 8, June 11, June 14, etc.). This was because the "Advanced" mode was untested and I did not want to risk losing 1 month of data if it was not set up correctly.

Tiny bugs were found on cassette IDs 65088 and 24543. These bugs were not stuck to the filter paper and were easily removed with tweezers. There was no visible bug "residue" (e.g., blood) on the filter.

The outer camouflage cover on the Partisol door had come off and was re-attached.

June 5 2019

Thermo Scientific™ Partisol™ 2025i

Sequential Air Samplers

Instrument PM and verification sheet

2025iD

field crew: Dan Casanova
Cory Koenig
(TCL)

Instrument serial number	202DIW202171808
Instrument location	PM-Kern

Recommended preventative maintenance intervals

Activity	PM interval	Last activity date	Current activity date	Next activity date
Clean PM10 inlet:	Monthly	May 1 2019	June 5 '19	July '19
Clean VSCC inlet:	Monthly			
Clean WINS impactor well:	Every five sampling days			
Replace in-line filter:	Every six months	inspected	inspected	
Clean filter cassettes/magazines:	Inspect regularly, clean as required			
Replace V-seals:	Annually			
Clean rain hood:	Every month			
Clean air screen/replace as necessary:	Every month			
Rebuild vacuum pump:	Inspect every 6 months, rebuild annually at a minimum	N/A	N/A	N/A

Recommended instrument verification interval (unless regional requirements dictate otherwise)

Equipment required:	A NIST-traceable (or equivalent) transfer standard for temperature calibrated for $\pm 0.5^{\circ}\text{C}$ precision			
	A NIST-traceable (or equivalent) transfer standard for pressure calibrated for ± 5 mm Hg precision			
	A NIST-traceable (or equivalent) transfer standard for relative humidity calibrated for $\pm 2.5\%$ precision			
	A NIST-traceable (or equivalent) flow transfer standard capable of measuring flow range of 0.9–19 lpm is required (depending on the flow transfer standard used, a flow inlet adapter may be required)			
Activity	Verification frequency	Last audit date	Current audit date	Next calibration date
Ambient temperature:	Audit monthly/Calibrate quarterly	May 1 '19	June 5 '19	July '19
Filter temperature:	Audit monthly/Calibrate quarterly			
Filter compartment temperature:	Audit monthly/Calibrate annually			
Electronics compartment temperature:	Audit monthly/Calibration annually			
Ambient pressure:	Audit monthly/Calibrate quarterly			
Filter pressure:	Audit monthly/Calibrate quarterly			
Ambient RH:	Audit monthly/Calibrate annually			
Flow check:	Audit monthly/Calibrate quarterly			
External leak check:	Every five days of inlet usage			
Internal leak check:	Monthly			

• Calibration done in May
• audit only - all passed
• next calibration in August '19

For more information, please consult your technical support representative.

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Tenas Partisol June 2019

Samples from ALS

★ New order
when it's all

#1	from ALS	#2	top
057307	bottom	016076	
057306		065072	
034145		034121	
057303		015496	
034144		041682	
04220		27306	
057296		064473	
015526		25074	
057299		064465	
057313	RP	054603	
041652		064481	
25405		064452	
034159		064468	
041635		064439	
04235		057308	
015261 top	top from ALS	064470	bottom

(16)

→ sample ID mesh found
upside down from Lab. Cassette
was taken apart to fit it.

(16)

PM-Aern Stn. June 5 2019

• Arrival at 10:50 am

• Sample was running today, the sample was stopped and will be marked void

• will deploy to start on June 6 at midnight, and then will resume normal 3-day schedule

• No alarms on arrival

• Once I manually stopped the in-progress sample, it gave "sample period" and "stop mode" alarms

• Samples stopped on June 5:

PM_D ID: 90549

PM_C ID2: 41674

• Data b

- all looks OK

• Ambient pressure on arrival = 700 ~~mb~~ mmtb

~~Dean~~~~604-218-3616~~

Initial flow test before any
cleaning or taking apart

Flow 1 Lpm

Flow 2 Lpm

~~isdr~~
Part 3d 14.98-15.01

1.67 - 1.68

tetraCal Qa = 15.10

1.673

 $\Delta = 0.1$ $\Delta = 0.01$

Both are within the 5%
tolerance ✓

exposed samples bags set to ALS	
PM2.5	PM10
Top 041680	17820
Bottom 064482	15064

↑

* original ordering

bugs found on filter: 065088
24543

- bugs removed before lab analysis

~~Valid Samples IDs~~

in separate bags on top

- Void sample placed on top of the magazine when sent to lab and was labelled void.

090549

041674

- All components inspected and cleaned where needed

41.8	39.8	39.2
43.8	41.2	40.4

Partisol Audit 12:41pm start

	Partisol	Refarm
Amb. Temp. °C	13.8	13.8
Filter 1 Temp. °C	15.7	15.4
Filter 2 Temp. °C	15.8	15.7
Amb. Pres. mmHg	698	699.0
Amb. RH %	39.2	40.4

External Leak Check $\Delta P = 6$ mmHg
PASS

Flow 1 14.98-15.02 $Q_n = 15.05$
-15.06
 $\Delta = 0.05$ PASS

Flow 2 1.66-1.68 $Q_n = 1.654$
 $\Delta = 0.016$
PASS

Internal Leak Check: $\Delta P = 9$ mmHg PASS

F. Compartment Temp. ~~15.8°C~~
15.8°C 14.6°C

* Sample

* Partisol Programmed to start
on June 8

June 9 ← blank

June 11

June 14

;

;

- I did not want to set Partisol
into "Advanced" operating mode
(compared to "Basic" Mode) as it
is un-tested

- Advanced mode would allow sampling
of June 6 ← special sample to
make up for June 5 interruption
June 8 ← EPA Schedule
June 9 ← blank
June 11
June 14 } EPA Schedule
;

- therefore we will be missing one of
the sampling days on purpose but
I don't expect it to be a
problem since Partisol's up-time has
been very good so far.

2025iD (PMcoarse/PM2.5) Partisol Calibration Inspection; Tenas Project

Instrument Serial Number	202 DIW202 171808	Filter check		As found	As left
Date	4-Jul-19	PM2.5	Filter # at the top of supply magazine	not recorded	4235
Time	crew arrived at 9:30 am		Filter # at the top of receiving/sampled magazine	57313	empty
Partisol Sampler Date	4-Jul		Filter # of the blank cassette	57306	15261
Error Codes (Top Left Hand Corner)	none on arrival	PMcoarse	Filter # at the top of supply magazine	not recorded	64468
Mode (Top Right Hand Corner)	wait mode, on arrival		Filter # at the top of receiving/sampled magazine	54603	empty
Next sampling date	Set to July 5, on departure		Filter # of the blank cassette	65072	64452

Description	As found	Audit Reference	Variance	Allowable variance	Adjusted to	Final variance	Comments
Ambient Air Temperature (°C)	18.4	19.0	0.60	+/- 2°C	n/a	#VALUE!	no adjustment; audit only
Ambient Pressure (mmHg)	705	705.0	0.00	+/- 10 mmHg	n/a	#VALUE!	no adjustment; audit only
Filter Pressure (mmHg)	705.0	705.0	0.00	+/- 10 mmHg	n/a	#VALUE!	no adjustment; audit only
Filter #2 Pressure (mmHg)	706.0	705.0	1.00	+/- 10 mmHg	n/a	#VALUE!	no adjustment; audit only
Filter Temp (°C)	17.3	18.2	0.90	+/- 2°C	n/a	#VALUE!	no adjustment; audit only
Filter Temp #2 (°C)	17.4	18.1	0.70	+/- 2°C	n/a	#VALUE!	no adjustment; audit only
Filter Compartment Temperature (°C)	not checked	not checked	#VALUE!	+/- 2°C	n/a	#VALUE!	no adjustment; audit only
External Leak Check (deltaP, mmHg)	7.0	n/a	Pass	25 mmHg	n/a	Fail	no adjustment; audit only
Internal Leak Check (deltaP, mmHg)	10.0	n/a	Pass	140 mmHg	n/a	Fail	no adjustment; audit only
Ambient Relative Humidity (%)	63 - 69	65 - 72	#VALUE!	+/- 1.5%	n/a	#VALUE!	See comments below
Flow (audit- as found before maintenance), lpm	15.00	15.11	0.73%	+/- 5%	n/a	0.73%	no adjustment; audit only
Flow Final (audit- after maintenance but before calibration), lpm	15.00	15.16	1.07%	+/- 5%	n/a	1.07%	no adjustment; audit only
Flow, point 1 Calibration, lpm	n/a	n/a	#VALUE!	+/- 5%	n/a	#VALUE!	no adjustment; audit only
Flow, point 2 Calibration, lpm	n/a	n/a	#VALUE!	+/- 5%	n/a	#VALUE!	no adjustment; audit only
Flow, point 3 Calibration, lpm	n/a	n/a	#VALUE!	+/- 5%	n/a	#VALUE!	no adjustment; audit only
Flow Final (After Calibration), lpm	n/a	n/a	#VALUE!	+/- 5%	n/a	#VALUE!	no adjustment; audit only
Flow #2 Final (audit- as found before maintenance), lpm	1.67	1.690	1.20%	+/- 5%	n/a	1.20%	no adjustment; audit only
Flow #2 Final (audit- after maintenance but before calibration), lpm	1.67	1.714	2.63%	+/- 5%	n/a	2.63%	no adjustment; audit only
Flow #2, point 1 Calibration, lpm	n/a	n/a	#VALUE!	+/- 5%	n/a	#VALUE!	no adjustment; audit only
Flow #2, point 2 Calibration, lpm	n/a	n/a	#VALUE!	+/- 5%	n/a	#VALUE!	no adjustment; audit only
Flow #2, point 3 Calibration, lpm	n/a	n/a	#VALUE!	+/- 5%	n/a	#VALUE!	no adjustment; audit only
Flow Final (After Calibration), lpm	n/a	n/a	#VALUE!	+/- 5%	n/a	#VALUE!	no adjustment; audit only

Instrument Used	Description	S/N	Calibration Date
Flow	BGI tetraCal	162606	18-Jul-18
Pressure	BGI tetraCal	162606	18-Jul-18
Temperature	Vaisala HM40 meter	P4760193	24-Nov-18
Relative Humidity	Vaisala HM40 meter	P4760193	24-Nov-18

New Calibration Points	Slope	Intercept
Flow	n/a	n/a
Flow #2	n/a	n/a

PM2.5: Fine, high flow, rear side, Filter, Flow
PMcoarse: Coarse, low flow, front side, Filter2, Flow2

Calibration/Audit Complete By

Comments/Observations:

Minor dirt/dust/pollen inside the main compartment, wiped clean. There was cotton-like pollen attached to the main compartment air inlet fans, cleaned off. Minor dirt/dust inside PM10 inlet, cleaned out. Flow audit performed before any cleaning/servicing and it passed. The RH environment was heavily fluctuating (+/- 10% RH) and we could not stabilize an RH value from the Partisol and the reference instrument due to differences in response time. Estimated difference was about 5% RH, but it was not recalibrated because of the changing environment and RH is not used in the Flow calculation.

The BGI tetraCal was sent to CD Nova for recalibration on July 5, 2019.

July 4 2019

Thermo Scientific™ Partisol™ 2025i

Sequential Air Samplers

Instrument PM and verification sheet

2025iD

Field Crew: D. Casanova
K. Hart

Instrument serial number	202 DIW 202. 171808
Instrument location	PM-Kerr Texas Project

Recommended preventative maintenance intervals

Virtual impactor

Activity	PM interval	Last activity date	Current activity date	Next activity date
Clean PM10 inlet:	Monthly	June 5 '19	July 4 '19	August 2019
Clean VSCG Inlet:	Monthly			
Clean WINS impactor well:	Every five sampling days			
Replace in-line filter:	Every six months	inspect	inspected	inspect
Clean filter cassettes/magazines:	Inspect regularly, clean as required			
Replace V-seals:	Annually			
Clean rain hood:	Every month			
Clean air screen/replace as necessary:	Every month			
Rebuild vacuum pump:	Inspect every 6 months, rebuild annually at a minimum	May 1 '19	N/A	Oct '19 replace

Recommended instrument verification interval (unless regional requirements dictate otherwise)

Equipment required:

- A NIST-traceable (or equivalent) transfer standard for temperature calibrated for $\pm 0.5^\circ\text{C}$ precision
- A NIST-traceable (or equivalent) transfer standard for pressure calibrated for ± 5 mm Hg precision
- A NIST-traceable (or equivalent) transfer standard for relative humidity calibrated for $\pm 2.5\%$ precision
- A NIST-traceable (or equivalent) flow transfer standard capable of measuring flow range of 0.9–19 lpm is required (depending on the flow transfer standard used, a flow inlet adapter may be required)

Activity	Verification frequency	Last audit date	Current audit date	Next calibration date
Ambient temperature:	Audit monthly/Calibrate quarterly	June 5 '19	July 4 '19	August '19
Filter temperature:	Audit monthly/Calibrate quarterly			
Filter compartment temperature:	Audit monthly/Calibrate annually			
Electronics compartment temperature:	Audit monthly/Calibration annually			
Ambient pressure:	Audit monthly/Calibrate quarterly			
Filter pressure:	Audit monthly/Calibrate quarterly			
Ambient RH:	Audit monthly/Calibrate annually			
Flow check:	Audit monthly/Calibrate quarterly			
External leak check:	Every five days of inlet usage			
Internal leak check:	Monthly			

next calibration and audit in August 2019

For more information, please consult your technical support representative.

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Thermo
SCIENTIFIC
A Thermo Fisher Scientific Brand

Texas Partisol July 4 2019

8 New filters from lab.

#1 - Fine PM

ID

064475 bottom
064462 of supply
064469 mag

064477

064472

065088

RR 090549

27408

064478

17843

064447

064454

15064

041674

015261 ← blank

04235

011635 top
(supply)

#2 - Coarse PM

ID

064448 bottom
057309 of supply
064461 mag

041680

064464

065086

009909

17820

064463

064480

015279

065074

24543

064482

064452 ← blank

064468

~~064439~~ top
(supply?)

Exposed fillers from field

#1 - fine PM

↳ top filler ID: 057313

↳ total of 10 fillers

#2 - coarse PM

↳ top filler ID: RP 054603

↳ total of 10 fillers

• No errors on arrival

• data downloaded:

- looked fine from quick review

• Flow audit before cleaning

Flow	Partisol	tetraCal Qa
	14.98 - 15.01	15.11 - 15.12
$< 5\% \text{ difference} = \text{PASS}$ (0.75 lpm)		

Flow	1.66 - 1.68	1.690
5% diff = 0.084 $\rightarrow$ PASS		

• Cotton/seeds removed from air intake fans

• minor dirt/dust inside PM10 inlet
 $\rightarrow$ cleaned out

Audit

	Partial	Ref.	
Amb. Temp.	18.4 °C	19.0 °C	±2 °C PASS
#1 Temp.	17.3 °C	18.2 °C	±2 °C = PASS
#2 Temp.	17.4 °C	18.1 °C	±2 °C = PASS
Amb. Press.	705	705.0	
#1 Press.	705	705.0	
#2 Press.	706	705.0	
Amb. RH	63-69%	65-72%	

-fluctuating ambient RH environment
could not get both sensors to
stabilize. Did not recalibrate due to
unstable reference environment, and RH
not important to flow

External Leak check: PASS $\Delta P < 7 \text{ mmHg}$

	Partial	Qa
Flow 1	14.99-15.02	15.16-15.17
	$\Delta < 0.75 = \text{PASS}$	

Flow 2	1.67-1.68	1.714
	$\Delta < 0.084 = \text{PASS}$	

Internal Leak check: $\Delta P < 10$ PASS

2025iD (PMcoarse/PM2.5) Partisol Calibration Inspection; Tenas Project

Instrument Serial Number	202 DIW202 171808	Filter check		As found	As left
Date	1-Nov-19	PM2.5	Filter # at the top of supply magazine	empty	24543
Time	crew arrived at 12:30		Filter # at the top of receiving/sampled magazine	57313	empty
Partisol Sampler Date	2-Nov		Filter # of the blank cassette	not recorded	15261
Error Codes (Top Left Hand Corner)	none on arrival	PMcoarse	Filter # at the top of supply magazine	empty	27297
Mode (Top Right Hand Corner)	falg - empty supply magazine		Filter # at the top of receiving/sampled magazine	16076	empty
Next sampling date	Set to Nov 2, on departure		Filter # of the blank cassette	not recorded	24928

Description	As found	Audit Reference	Variance	Allowable variance	Adjusted to	Final variance	Comments
Ambient Air Temperature (°C)	5.7	6.4	0.70	+/- 2°C	n/a	#VALUE!	no adjustment; audit only
Ambient Pressure (mmHg)	709	709.0	0.00	+/- 10 mmHg	n/a	#VALUE!	no adjustment; audit only
Filter Pressure (mmHg)	709.0	709.0	0.00	+/- 10 mmHg	n/a	#VALUE!	no adjustment; audit only
Filter #2 Pressure (mmHg)	709.0	709.0	0.00	+/- 10 mmHg	n/a	#VALUE!	no adjustment; audit only
Filter Temp (°C)	7.5	6.3	-1.20	+/- 2°C	n/a	#VALUE!	no adjustment; audit only
Filter Temp #2 (°C)	7.5	6.3	-1.20	+/- 2°C	n/a	#VALUE!	no adjustment; audit only
Filter Compartment Temperature (°C)	not checked	not checked	#VALUE!	+/- 2°C	n/a	#VALUE!	no adjustment; audit only
External Leak Check (deltaP, mmHg)	8.0	n/a	Pass	25 mmHg	n/a	Fail	no adjustment; audit only
Internal Leak Check (deltaP, mmHg)	8.0	n/a	Pass	140 mmHg	n/a	Fail	no adjustment; audit only
Ambient Relative Humidity (%)	63.3	62.1	-1.21	+/- 1.5%	n/a	#VALUE!	See comments below
Flow (audit- as found before maintenance), lpm	15.00	15.10	0.67%	+/- 5%	n/a	0.67%	no adjustment; audit only
Flow Final (audit- after maintenance but before calibration), lpm	15.00	15.10	0.67%	+/- 5%	n/a	0.67%	no adjustment; audit only
Flow, point 1 Calibration, lpm	n/a	n/a	#VALUE!	+/- 5%	n/a	#VALUE!	no adjustment; audit only
Flow, point 2 Calibration, lpm	n/a	n/a	#VALUE!	+/- 5%	n/a	#VALUE!	no adjustment; audit only
Flow, point 3 Calibration, lpm	n/a	n/a	#VALUE!	+/- 5%	n/a	#VALUE!	no adjustment; audit only
Flow Final (After Calibration), lpm	n/a	n/a	#VALUE!	+/- 5%	n/a	#VALUE!	no adjustment; audit only
Flow #2 Final (audit- as found before maintenance), lpm	1.67	1.690	1.20%	+/- 5%	n/a	1.20%	no adjustment; audit only
Flow #2 Final (audit- after maintenance but before calibration), lpm	1.67	1.690	1.20%	+/- 5%	n/a	1.20%	no adjustment; audit only
Flow #2, point 1 Calibration, lpm	n/a	n/a	#VALUE!	+/- 5%	n/a	#VALUE!	no adjustment; audit only
Flow #2, point 2 Calibration, lpm	n/a	n/a	#VALUE!	+/- 5%	n/a	#VALUE!	no adjustment; audit only
Flow #2, point 3 Calibration, lpm	n/a	n/a	#VALUE!	+/- 5%	n/a	#VALUE!	no adjustment; audit only
Flow Final (After Calibration), lpm	n/a	n/a	#VALUE!	+/- 5%	n/a	#VALUE!	no adjustment; audit only

Instrument Used	Description	S/N	Calibration Date
Flow	BGI tetraCal	162606	1-Aug-19
Pressure	BGI tetraCal	162606	1-Aug-19
Temperature	Vaisala HM40 meter	P4760193	24-Nov-18
Relative Humidity	Vaisala HM40 meter	P4760193	24-Nov-18

New Calibration Points	Slope	Intercept
Flow	n/a	n/a
Flow #2	n/a	n/a

PM2.5: Fine, high flow, rear side, Filter, Flow
PMcoarse: Coarse, low flow, front side, Filter2, Flow2

Calibration/Audit Complete By

Comments/Observations:

Last sampling date was September 12; the machine was found with an error flag on arrival as the supply magazine was empty.

particular Nov 1, 2019

① Installed ②		Removed parts	
Bottom Rear	Front	Rear	Front
064462	064482 ^{bottom}	057313 ^{Top}	016076 ^{Top}
064469	064452		
064477	064463		
064472	17820		
065088	009909		
064447	064480		
064454	064468		
15064	064461		
041674	065086		
064478	065074		
17843	015279		
04235	057309		
RP 030549	041680		
027408	064464		
015261	24928		
24543	27297		

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Parameter	# calibrating instrument	pre-calib	post-calib
amb temp	6.4	5.7	
ambia pres	709	709	
Filter press	709	709	
Filter2 press	709	709	
Filter temp	6.3	7.5	
Filter2 temp	6.3	7.5	
Flow	15.1	15.0	
Flow2	1.69	1.67	
RH	63.4%	62.02	
Flowing			

download data

4 file: stopped at 100% and machine frozen with a flag of error
No filters

external leak check = 8 mm Hg
pass

external leak check = 8 mm Hg
pass

2025iD (PMcoarse/PM2.5) Partisol Calibration Inspection; Tenas Project

Instrument Serial Number	202 DIW202 171808	Filter check		As found	As left
Date	12-Dec-19	PM2.5	Filter # at the top of supply magazine	64467	64462
Time	crew arrived at 9:00		Filter # at the top of receiving/sampled magazine	64477	empty
Partisol Sampler Date	14-Dec		Filter # of the blank cassette	not recorded	25072
Error Codes (Top Left Hand Corner)	none on arrival	PMcoarse	Filter # at the top of supply magazine	64482	64482
Mode (Top Right Hand Corner)	N/A		Filter # at the top of receiving/sampled magazine	64463	empty
Next sampling date	Set to Dec 14, on departure		Filter # of the blank cassette	not recorded	15106

Description	As found	Audit Reference	Variance	Allowable variance	Adjusted to	Final variance	Comments
Ambient Air Temperature (°C)	-2.5	-3.5	-1.00	+/- 2°C	-3.5	0.00	no adjustment; audit only
Ambient Pressure (mmHg)	693	694.0	-1.00	+/- 10 mmHg	694	0.00	no adjustment; audit only
Filter Pressure (mmHg)	693.0	694.0	-1.00	+/- 10 mmHg	694	0.00	no adjustment; audit only
Filter #2 Pressure (mmHg)	691.0	694.0	-3.00	+/- 10 mmHg	694	0.00	no adjustment; audit only
Filter Temp (°C)	-1.6	-1.6	0.00	+/- 2°C	n/a	#VALUE!	no adjustment; audit only
Filter Temp #2 (°C)	-1.3	-1.6	-0.30	+/- 2°C	-1.6	0.00	no adjustment; audit only
Filter Compartment Temperature (°C)	-1.4	-1.6	-0.20	+/- 2°C	-1.6	0.00	no adjustment; audit only
External Leak Check (deltaP, mmHg)	10.0	n/a	Pass	25 mmHg	n/a	Fail	no adjustment; audit only
Internal Leak Check (deltaP, mmHg)	9.0	n/a	Pass	140 mmHg	n/a	Fail	no adjustment; audit only
Ambient Relative Humidity (%)	85.2	80.9	-4.30	+/- 1.5%	80.6	-0.37%	See comments below
Flow (audit- as found before maintenance), lpm	n/a	n/a	#VALUE!	+/- 5%	n/a	#VALUE!	no adjustment; audit only
Flow Final (audit- after maintenance but before calibration), lpm	n/a	n/a	#VALUE!	+/- 5%	n/a	#VALUE!	no adjustment; audit only
Flow, point 1 Calibration, lpm	13.49	13.49	0.00%	+/- 5%	n/a	#VALUE!	no adjustment; audit only
Flow, point 2 Calibration, lpm	15.00	15.00	0.00%	+/- 5%	n/a	#VALUE!	no adjustment; audit only
Flow, point 3 Calibration, lpm	16.50	16.52	0.12%	+/- 5%	16.5	-0.12%	no adjustment; audit only
Flow Final (After Calibration), lpm	n/a	n/a	#VALUE!	+/- 5%	n/a	#VALUE!	no adjustment; audit only
Flow #2 Final (audit- as found before maintenance), lpm	n/a	n/a	#VALUE!	+/- 5%	n/a	#VALUE!	no adjustment; audit only
Flow #2 Final (audit- after maintenance but before calibration), lpm	n/a	n/a	#VALUE!	+/- 5%	n/a	#VALUE!	no adjustment; audit only
Flow #2, point 1 Calibration, lpm	1.50	1.52	1.33%	+/- 5%	1.5	-1.32%	no adjustment; audit only
Flow #2, point 2 Calibration, lpm	1.66	1.67	0.60%	+/- 5%	1.66	-0.60%	no adjustment; audit only
Flow #2, point 3 Calibration, lpm	1.83	1.83	0.00%	+/- 5%	1.83	0.00%	no adjustment; audit only
Flow Final (After Calibration), lpm	n/a	n/a	#VALUE!	+/- 5%	n/a	#VALUE!	no adjustment; audit only

Instrument Used	Description	S/N	Calibration Date
Flow	BGI tetraCal	162606	1-Aug-19
Pressure	BGI tetraCal	162606	1-Aug-19
Temperature	Vaisala HM40 meter	P4760193	26-Nov-19
Relative Humidity	Vaisala HM40 meter	P4760193	26-Nov-19

New Calibration Points	Slope	Intercept
Flow	1.02	-0.25
Flow #2	0.94	0.1

PM2.5: Fine, high flow, rear side, Filter, Flow
PMcoarse: Coarse, low flow, front side, Filter2, Flow2

Calibration/Audit Complete By

Comments/Observations:

Last sampling date was September 12, the machine was found with an error flag on arrival as the suply magazine was empty.

Re-built the pump using the maintenance kit

March 10, 2020, dan casanova comment: real sample ID 64462 was accidentally entered in as 64467 in the Partisol memory. I manually edited the Feb 29 2020 data download record to use the correct sample ID.

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Installed		Removed	
rear PM2.5 bottom	Front PM10 bottom	rear PM2.5 top	Front PM10 top
041848	27308	064477	064463
041846	015113		
27573	24910		
27795	041843		
010326	27301		
27799	089020		
041842	24925		
27731	27442		
034136	041851		
041840	015127		
27810	041841		
016188	041857		
27798	107619		
24944	27478		
27584	25401		
25072	015106		
064462	064482		
From last sample period			
This is 064487 with partial list note wrong			

Dec 12, 1249

Calibration

Parameter	calib instrum	pre-calib	post-calib
ambi temp	-3.5	-2.5	-3.5
ambi press	694.0	693	694
Filter press	694.0	693.8	694
Filter 2 press	694.0	691	694
Filter temp	-1.6	-1.6	-
Filter 2 temp	-1.6	-1.63	-1.6
RH	80.9	85.2%	80.6
Fcomp temp	-1.4	-1.6	-1.6

Flow calib

Port	Flow 1			Flow 2		
	Qa	pre	post	Qa	pre	post
1	13.49	13.49	13.49	1.54	1.50	1.50
2	15.00	15.0	15.0	1.67	1.66	1.67
3	16.52	16.50	16.50	1.83	1.83	1.83

Flow 1

new slope = 1.02

intercept = -0.23

Flow 2

+0.94

+0.10

take photos of Johnny Mt
site from tower and heli

external link check: pass 10mm
internal S S ; pass 9mm
H9
H9

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Appendix 3-C *Daily PM₁₀ and PM_{2.5} Data from the PM-Kerr,
BC ENV-Smithers and BC-ENV Houston Stations,
November 1, 2018 to March 25, 2019*

APPENDIX 3-C. DAILY PM₁₀ AND PM_{2.5} DATA FROM THE PM-KERR, BC ENV-SMITHERS AND BC ENV-HOUSTON STATIONS, NOVEMBER 1, 2018 TO JANUARY 16, 2020

Table 3-C1. Daily PM₁₀ Results, November 1, 2018 to January 16, 2020

Date	PM-Kerr ^a	BC ENV-Houston ^b	BC ENV -Smithers ^{b,c}
1-Nov-2018	5.8	9.3	15.4
2-Nov-2018	-	5.8	11
3-Nov-2018	-	3.8	5.4
4-Nov-2018	1.2*	5.2	8.2
5-Nov-2018	-	5.8	9.2
6-Nov-2018	-	26.9	21.5
7-Nov-2018	12.5	21.7	21.9
8-Nov-2018	-	29.2	23.1
9-Nov-2018	-	13.5	20.1
10-Nov-2018	6.9	10.4	17.4
11-Nov-2018	-	8.8	12.5
12-Nov-2018	-	12.6	16.2
13-Nov-2018	5.7	20.7	17
14-Nov-2018	-	18.4	12
15-Nov-2018	-	3.8	4
16-Nov-2018	2.8	6.7	9.6
17-Nov-2018	-	14	15.3
18-Nov-2018	-	24.6	27.1
19-Nov-2018	1.2*	10.7	12.6
20-Nov-2018	-	20.7	21
21-Nov-2018	-	21.4	25.6
22-Nov-2018	3.2	10	28.9
23-Nov-2018	-	11.7	16.3
24-Nov-2018	-	6.2	8
25-Nov-2018	1.2*	4.4	5.1
26-Nov-2018	-	5.2	10.1
27-Nov-2018	-	7.1	10
28-Nov-2018	5.1	9	10.2
29-Nov-2018	-	7.2	8.7
30-Nov-2018	-	11.6	12.3
1-Dec-2018	7.4	12.1	10.3
2-Dec-2018	-	17.9	10.1
3-Dec-2018	-	29.2	16.6
4-Dec-2018	6.1	46.3	49.1
5-Dec-2018	-	23.7	16.8
6-Dec-2018	-	34.2	18.9

Date	PM-Kerr ^a	BC ENV-Houston ^b	BC ENV -Smithers ^{b,c}
7-Dec-2018	12.8	32.3	-
8-Dec-2018	-	23.6	-
9-Dec-2018	-	22.4	-
10-Dec-2018	1.2*	16.8	-
11-Dec-2018	-	4.3	-
12-Dec-2018	-	6.4	-
13-Dec-2018	1.2*	6.4	-
14-Dec-2018	-	6.4	-
15-Dec-2018	-	13.9	-
16-Dec-2018	2.5	5.2	-
17-Dec-2018	-	2.7	-
18-Dec-2018	-	5.6	-
19-Dec-2018	2.5	8.6	-
20-Dec-2018	-	5.8	-
21-Dec-2018	-	11.6	-
22-Dec-2018	1.2*	3.2	-
23-Dec-2018	-	9.2	-
24-Dec-2018	-	14.4	-
25-Dec-2018	1.2*	6.6	-
26-Dec-2018	-	9.7	-
27-Dec-2018	-	5.1	-
28-Dec-2018	1.2*	1.3	-
29-Dec-2018	-	1.8	-
30-Dec-2018	-	14.5	-
31-Dec-2018	1.2*	2.2	-
1-Jan-2019	-	3.4	-
2-Jan-2019	-	1.4	-
3-Jan-2019	2.6	1.2	-
4-Jan-2019	-	1.8	-
5-Jan-2019	-	2.3	-
6-Jan-2019	3.5	7.2	-
7-Jan-2019	-	21.9	-
8-Jan-2019	-	2.5	-
9-Jan-2019	1.2*	8.9	-
10-Jan-2019	-	7.6	-
11-Jan-2019	-	4.7	-
12-Jan-2019	1.2*	9.7	-
13-Jan-2019	-	8.7	-
14-Jan-2019	-	5.8	-
15-Jan-2019	3.1	3.9	-
16-Jan-2019	-	4.7	-
17-Jan-2019	-	3.8	-

APPENDIX 3-C. DAILY PM₁₀ AND PM_{2.5} DATA FROM THE PM-KERR, BC ENV-SMITHERS AND BC ENV-HOUSTON STATIONS,
NOVEMBER 1, 2018 TO JANUARY 16, 2020

Date	PM-Kerr ^a	BC ENV-Houston ^b	BC ENV -Smithers ^{b,c}
18-Jan-2019	1.6*	7	-
19-Jan-2019	-	6.4	-
20-Jan-2019	-	15.9	-
21-Jan-2019	1.6*	7.2	-
22-Jan-2019	-	7.2	-
23-Jan-2019	-	6.8	-
24-Jan-2019	M	6.5	-
25-Jan-2019	-	5.1	-
26-Jan-2019	-	2.4	13.1
27-Jan-2019	1.2*	15.2	12.4
28-Jan-2019	-	9.6	25.5
29-Jan-2019	-	9.6	19.4
30-Jan-2019	6	11.1	18.9
31-Jan-2019	-	8.2	29.5
1-Feb-2019	-	13.5	17.3
2-Feb-2019	1.2*	14.6	8.6
3-Feb-2019	-	14.6	-
4-Feb-2019	-	12.5	-
5-Feb-2019	1.2*	8.1	23
6-Feb-2019	-	5.7	12.5
7-Feb-2019	-	12.4	22.8
8-Feb-2019	1.2*	6.8	13.4
9-Feb-2019	-	-	29.3
10-Feb-2019	-	-	27.4
11-Feb-2019	1.2*	-	-
12-Feb-2019	-	-	-
13-Feb-2019	-	5	15.3
14-Feb-2019	1.2*	9.8	10.8
15-Feb-2019	-	16.1	13.2
16-Feb-2019	-	5.6	15.2
17-Feb-2019	1.2*	12.6	9.1
18-Feb-2019	-	15.5	15.3
19-Feb-2019	-	10.7	-
20-Feb-2019	1.6*	16.4	22
21-Feb-2019	-	3.3	9.4
22-Feb-2019	-	5.7	20.6
23-Feb-2019	1.6*	8.1	8.5
24-Feb-2019	-	10.9	26.9
25-Feb-2019	-	17.4	37.3
26-Feb-2019	1.6*	32.3	43.2
27-Feb-2019	-	19.8	31.9
28-Feb-2019	-	21.1	33.1

Date	PM-Kerr ^a	BC ENV-Houston ^b	BC ENV -Smithers ^{b,c}
1-Mar-2019	2.9	7.6	13.2
2-Mar-2019	-	17.3	19.1
3-Mar-2019	-	24.4	28.3
4-Mar-2019	1.2*	25.3	41.4
5-Mar-2019	-	16.6	36.1
6-Mar-2019	-	18.7	39.2
7-Mar-2019	4.2	23.4	42.4
8-Mar-2019	-	31.1	29.1
9-Mar-2019	-	25.2	27
10-Mar-2019	2.6	12.7	17
11-Mar-2019	-	4.2	12.4
12-Mar-2019	-	12.1	17.7
13-Mar-2019	1.2*	10.3	11
14-Mar-2019	-	9.6	10.2
15-Mar-2019	-	23.8	23
16-Mar-2019	1.2*	14	15.2
17-Mar-2019	-	19.4	31.1
18-Mar-2019	-	38.3	50.5
19-Mar-2019	6.4	83.2	93.4
20-Mar-2019	-	88.6	98.3
21-Mar-2019	-	76.3	92.4
22-Mar-2019	6.4	96.5	99.7
23-Mar-2019	-	35.7	46.8
24-Mar-2019	-	52.6	46.5
25-Mar-2019	2.5	68.5	77
26-Mar-2019	-	63.5	74.6
27-Mar-2019	-	71.8	75.9
28-Mar-2019	M	49.8	52
29-Mar-2019	-	56.9	86.9
30-Mar-2019	-	34.2	61.9
31-Mar-2019	M	28.4	50.5
1-Apr-2019	-	56.8	64.7
2-Apr-2019	-	35.6	56.3
3-Apr-2019	8.9	29	45.4
4-Apr-2019	-	21	35.6
5-Apr-2019	-	19.6	22.9
6-Apr-2019	1.6	3.9	4.8
7-Apr-2019	-	4.4	6.8
8-Apr-2019	-	16.5	21.4
9-Apr-2019	5.4	20.3	22
10-Apr-2019	-	14.9	21.2
11-Apr-2019	-	20.5	32.3

APPENDIX 3-C. DAILY PM₁₀ AND PM_{2.5} DATA FROM THE PM-KERR, BC ENV-SMITHERS AND BC ENV-HOUSTON STATIONS,
NOVEMBER 1, 2018 TO JANUARY 16, 2020

Date	PM-Kerr ^a	BC ENV-Houston ^b	BC ENV -Smithers ^{b,c}
12-Apr-2019	3.5	13.8	25.2
13-Apr-2019	-	3.7	11.8
14-Apr-2019	-	5.7	12.5
15-Apr-2019	5.8	10	-
16-Apr-2019	-	5.9	8
17-Apr-2019	-	9.6	3.9
18-Apr-2019	5.1	11.2	13
19-Apr-2019	-	10.9	10.3
20-Apr-2019	-	15.7	14.2
21-Apr-2019	6.7	10	9.6
22-Apr-2019	-	7.7	3.6
23-Apr-2019	-	14.7	7.8
24-Apr-2019	3.5	8.8	10.3
25-Apr-2019	-	13.5	16
26-Apr-2019	-	8.1	11.7
27-Apr-2019	5.3	4.8	12.2
28-Apr-2019	-	10	13.2
29-Apr-2019	-	14.2	19.8
30-Apr-2019	5.3	16.1	19.7
1-May-2019	-	24.3	22.2
2-May-2019	-	18.4	18.7
3-May-2019	1.2*	11.5	12.6
4-May-2019	-	8.8	8.5
5-May-2019	-	9.6	8.2
6-May-2019	6.5	24.4	18.7
7-May-2019	-	21.1	12.3
8-May-2019	-	16.7	14.2
9-May-2019	6.1	27.8	-
10-May-2019	-	21.5	23.4
11-May-2019	-	21.1	18.5
12-May-2019	10.3	9.7	9.4
13-May-2019	-	18.1	14.8
14-May-2019	-	11.1	16.2
15-May-2019	2.5	4	6.4
16-May-2019	-	5.8	8.2
17-May-2019	-	6.5	7.5
18-May-2019	1.2*	4.6	8.2
19-May-2019	-	6.4	7.3
20-May-2019	-	6	10.6
21-May-2019	7.6	12.5	16.4
22-May-2019	-	21.7	19.8
23-May-2019	-	26.4	16.3

Date	PM-Kerr ^a	BC ENV-Houston ^b	BC ENV -Smithers ^{b,c}
24-May-2019	4.7	4.2	9.4
25-May-2019	-	15.7	17.2
26-May-2019	-	24.7	28.3
27-May-2019	21	28.1	37.1
28-May-2019	-	27.3	35.2
29-May-2019	-	19	-
30-May-2019	9.2	24	-
31-May-2019	-	17.6	20.7
1-Jun-2019	-	11.4	12.1
2-Jun-2019	4.2	5	5.3
3-Jun-2019	-	7.7	7.5
4-Jun-2019	-	-	8.3
5-Jun-2019	M	-	9.4
6-Jun-2019	-	-	-
7-Jun-2019	-	-	7.2
8-Jun-2019	6.1	-	9.7
9-Jun-2019	-	-	5.1
10-Jun-2019	-	-	8.2
11-Jun-2019	5.6	-	11.5
12-Jun-2019	-	-	13.3
13-Jun-2019	-	-	14.8
14-Jun-2019	6.7	-	13.8
15-Jun-2019	-	-	15.5
16-Jun-2019	-	-	8.4
17-Jun-2019	6.8	-	13.6
18-Jun-2019	-	-	8.7
19-Jun-2019	-	-	10.4
20-Jun-2019	9.3	-	11.5
21-Jun-2019	-	-	26.9
22-Jun-2019	-	-	12.9
23-Jun-2019	7.6	-	9.5
24-Jun-2019	-	-	13
25-Jun-2019	-	-	19.3
26-Jun-2019	10.6	-	17.3
27-Jun-2019	-	-	18.3
28-Jun-2019	-	-	20.4
29-Jun-2019	10.6	-	13.7
30-Jun-2019	-	-	12.7
1-Jul-2019	-	-	18.4
2-Jul-2019	18.2	-	22.2
3-Jul-2019	-	-	24.5
4-Jul-2019	-	-	9.2

APPENDIX 3-C. DAILY PM₁₀ AND PM_{2.5} DATA FROM THE PM-KERR, BC ENV-SMITHERS AND BC ENV-HOUSTON STATIONS,
NOVEMBER 1, 2018 TO JANUARY 16, 2020

Date	PM-Kerr ^a	BC ENV-Houston ^b	BC ENV -Smithers ^{b,c}
5-Jul-2019	12.2	-	13.6
6-Jul-2019	-	-	13.6
7-Jul-2019	-	-	13.5
8-Jul-2019	13.1	-	18.1
9-Jul-2019	-	-	12.9
10-Jul-2019	-	-	21.4
11-Jul-2019	4.4	-	17.3
12-Jul-2019	-	-	11.7
13-Jul-2019	-	-	12.1
14-Jul-2019	6.7	-	10
15-Jul-2019	-	-	14.6
16-Jul-2019	-	-	25.3
17-Jul-2019	4	-	11.5
18-Jul-2019	-	-	14.9
19-Jul-2019	-	-	19.1
20-Jul-2019	8.2	-	20.5
21-Jul-2019	-	-	13.8
22-Jul-2019	-	-	17.6
23-Jul-2019	8.9	-	18.4
24-Jul-2019	-	-	9.8
25-Jul-2019	-	-	11.6
26-Jul-2019	7.8	-	9.3
27-Jul-2019	-	-	10.5
28-Jul-2019	-	-	7.8
29-Jul-2019	9.2	-	21.5
30-Jul-2019	-	-	27
31-Jul-2019	-	-	17.4
1-Aug-2019	10.3	-	14.3
2-Aug-2019	-	-	14.4
3-Aug-2019	-	-	15
4-Aug-2019	15.8	-	17.8
5-Aug-2019	-	-	15.1
6-Aug-2019	-	-	45.9
7-Aug-2019	14.7	-	27.2
8-Aug-2019	-	-	23.8
9-Aug-2019	-	-	8.8
10-Aug-2019	10	-	8
11-Aug-2019	-	-	11.8
12-Aug-2019	-	-	12.2
13-Aug-2019	9.4	-	18.9
14-Aug-2019	-	-	23.6
15-Aug-2019	-	-	20.6

Date	PM-Kerr ^a	BC ENV-Houston ^b	BC ENV -Smithers ^{b,c}
16-Aug-2019	1.6*	-	13.4
17-Aug-2019	-	-	10.4
18-Aug-2019	-	-	7.2
19-Aug-2019	1.6*	-	8.2
20-Aug-2019	-	-	7.1
21-Aug-2019	-	-	10.4
22-Aug-2019	3.7	-	-
23-Aug-2019	-	-	8.2
24-Aug-2019	-	-	9.7
25-Aug-2019	5.4	-	13.4
26-Aug-2019	-	-	21.6
27-Aug-2019	-	-	11.1
28-Aug-2019	7.6	-	16.6
29-Aug-2019	-	-	19.5
30-Aug-2019	-	-	20.6
31-Aug-2019	8.1	-	16.4
1-Sep-2019	-	-	-
2-Sep-2019	-	-	14.2
3-Sep-2019	5.4	-	19.9
4-Sep-2019	-	-	9.9
5-Sep-2019	-	-	15.3
6-Sep-2019	7.8	-	22.5
7-Sep-2019	-	-	10.5
8-Sep-2019	-	-	9
9-Sep-2019	7.2	-	-
10-Sep-2019	-	-	11.4
11-Sep-2019	-	-	11
12-Sep-2019	4.9	-	10.2
13-Sep-2019	-	-	7.3
14-Sep-2019	-	-	9.3
15-Sep-2019	M	-	9.2
16-Sep-2019	-	-	12.4
17-Sep-2019	-	13.9	17.1
18-Sep-2019	M	13.9	19.6
19-Sep-2019	-	13.4	20.9
20-Sep-2019	-	18.1	18.6
21-Sep-2019	M	4.2	7.1
22-Sep-2019	-	6.4	9.8
23-Sep-2019	-	5.8	8.2
24-Sep-2019	M	10.3	10.6
25-Sep-2019	-	7.8	8.3
26-Sep-2019	-	11.4	9.9

APPENDIX 3-C. DAILY PM₁₀ AND PM_{2.5} DATA FROM THE PM-KERR, BC ENV-SMITHERS AND BC ENV-HOUSTON STATIONS,
NOVEMBER 1, 2018 TO JANUARY 16, 2020

Date	PM-Kerr ^a	BC ENV-Houston ^b	BC ENV -Smithers ^{b,c}
27-Sep-2019	M	22.3	-
28-Sep-2019	-	10.5	-
29-Sep-2019	-	17.8	-
30-Sep-2019	M	25.3	-
1-Oct-2019	-	38.1	-
2-Oct-2019	-	6.2	9.8
3-Oct-2019	M	4	9.1
4-Oct-2019	-	11.3	15.9
5-Oct-2019	-	11.6	15.7
6-Oct-2019	M	2.5	9.5
7-Oct-2019	-	10	9.5
8-Oct-2019	-	12.4	14.6
9-Oct-2019	M	24.6	32
10-Oct-2019	-	31.7	32.8
11-Oct-2019	-	13.9	30.7
12-Oct-2019	M	22.7	24
13-Oct-2019	-	11.1	21.8
14-Oct-2019	-	9.5	14.5
15-Oct-2019	M	1.7	3.4
16-Oct-2019	-	5.9	7.9
17-Oct-2019	-	17.1	9.3
18-Oct-2019	M	20.3	31.1
19-Oct-2019	-	14.8	33.5
20-Oct-2019	-	3.1	10.3
21-Oct-2019	M	2.9	6.4
22-Oct-2019	-	14	17.6
23-Oct-2019	-	9.9	15.4
24-Oct-2019	M	2.8	10.5
25-Oct-2019	-	9	9
26-Oct-2019	-	19.9	37.2
27-Oct-2019	M	4.4	27.1
28-Oct-2019	-	25.6	12.6
29-Oct-2019	-	32.2	78.8
30-Oct-2019	M	68.7	65.1
31-Oct-2019	-	51.3	72
1-Nov-2019	-	23.8	49.7
2-Nov-2019	1.6*	29.2	42.5
3-Nov-2019	-	8.6	14.4
4-Nov-2019	-	17	27.3
5-Nov-2019	4.2	15.9	34.4
6-Nov-2019	-	11.6	6.6
7-Nov-2019	-	8.7	11.2

Date	PM-Kerr ^a	BC ENV-Houston ^b	BC ENV -Smithers ^{b,c}
8-Nov-2019	1.6*	4.6	14.8
9-Nov-2019	-	11.2	9.7
10-Nov-2019	-	4.9	5.6
11-Nov-2019	8.1	4.5	9.1
12-Nov-2019	-	5.1	13.9
13-Nov-2019	-	2.2	18.2
14-Nov-2019	1.6*	3.3	15.8
15-Nov-2019	-	12	14.7
16-Nov-2019	-	1	10
17-Nov-2019	1.6*	4	8.2
18-Nov-2019	-	37.1	50.8
19-Nov-2019	-	17.4	51
20-Nov-2019	1.6*	30.6	45.2
21-Nov-2019	-	23.6	33.2
22-Nov-2019	-	8	12.7
23-Nov-2019	1.6*	1.1	6.5
24-Nov-2019	-	6.1	9.5
25-Nov-2019	-	9.3	18.1
26-Nov-2019	5.3	2.8	15.8
27-Nov-2019	-	23.8	23.2
28-Nov-2019	-	21.6	20.1
29-Nov-2019	3.6	17.1	17.6
30-Nov-2019	-	23.2	19.6
1-Dec-2019	-	14.4	14.5
2-Dec-2019	1.6*	11.8	15.7
3-Dec-2019	-	6.3	12.8
4-Dec-2019	-	7.2	12.7
5-Dec-2019	3.3	5.3	12.4
6-Dec-2019	-	5.3	19.2
7-Dec-2019	-	5.4	13
8-Dec-2019	1.6*	12.6	10.3
9-Dec-2019	-	4.5	11.7
10-Dec-2019	-	6.1	11.8
11-Dec-2019	M	9.9	13.6
12-Dec-2019	-	14.4	15.5
13-Dec-2019	-	27.4	22.1
14-Dec-2019	1.6*	8.5	11.3
15-Dec-2019	-	8.4	7.7
16-Dec-2019	-	5.8	11.8
17-Dec-2019	1.6*	4.6	8.3
18-Dec-2019	-	5.6	10.1
19-Dec-2019	-	8.4	18.1

**APPENDIX 3-C. DAILY PM₁₀ AND PM_{2.5} DATA FROM THE PM-KERR, BC ENV-SMITHERS AND BC ENV-HOUSTON STATIONS,
NOVEMBER 1, 2018 TO JANUARY 16, 2020**

Date	PM-Kerr^a	BC ENV-Houston^b	BC ENV -Smithers^{b,c}
20-Dec-2019	3.6	10.3	18
21-Dec-2019	-	11.1	20.4
22-Dec-2019	-	3.4	17.6
23-Dec-2019	1.6*	2.4	4.4
24-Dec-2019	-	13.1	10.9
25-Dec-2019	-	8.8	13.3
26-Dec-2019	1.6*	3.2	5.2
27-Dec-2019	-	7	14.7
28-Dec-2019	-	3.1	7.8
29-Dec-2019	1.6*	4.5	14.1
30-Dec-2019	-	2.6	5.8
31-Dec-2019	-	8.8	10.8
1-Jan-2020	1.6*	6.8	12.4
2-Jan-2020	-	4.6	11.6
3-Jan-2020	-	2	12.5
4-Jan-2020	1.6*	7	9.7
5-Jan-2020	-	7.7	9.5
6-Jan-2020	-	15.8	23.4
7-Jan-2020	1.6*	4.8	25.5
8-Jan-2020	-	23.8	23.5
9-Jan-2020	-	8.5	23.2
10-Jan-2020	5.7	3.4	11.6
11-Jan-2020	-	7.2	8.6
12-Jan-2020	-	10.2	12.3
13-Jan-2020	3.9	-	-
14-Jan-2020	-	15.3	-
15-Jan-2020	-	15.8	-
16-Jan-2020	1.6*	17.8	13.2

Notes:

No data available from BC ENV-Telkwa station

Dash (-) = data not available

* Values below detection limit were considered to be half the detection limit for calculation purposes.

^a Partisol sampler at PM-Kerr is set up to sample once every 3 days in accordance with the NAPS schedule (ECCC 2018).

^b Data from BC ENV-Houston and BC ENV-Smithers stations are raw preliminary data and are subject to future review and revisions by the reporting agency.

^c BC ENV-Smithers station: November 1, 2018 – December 6, 2018 data from St. Joseph's station, and January 26, 2019 – January 16, 2020 data from Muheim Memorial station; data between those periods are not available.

Table 3-C2. Daily PM_{2.5} Results, November 1, 2018 to January 16, 2020

Date	PM-Kerr ^a	BC ENV-Houston ^b	BC ENV - Smithers ^{b,c}
1-Nov-2018	7.4	11.9	16.6
2-Nov-2018	-	7.4	11
3-Nov-2018	-	8.5	7.1
4-Nov-2018	1.2*	5.5	8.1
5-Nov-2018	-	9	6.9
6-Nov-2018	-	38.3	19.3
7-Nov-2018	9.3	20	16
8-Nov-2018	-	31.8	25.2
9-Nov-2018	-	18	24.5
10-Nov-2018	6.6	14.8	16.6
11-Nov-2018	-	13.2	11
12-Nov-2018	-	16.3	14.2
13-Nov-2018	6.3	23.2	13.3
14-Nov-2018	-	29.8	13.5
15-Nov-2018	-	7.5	2.9
16-Nov-2018	1.2*	11.3	9.6
17-Nov-2018	-	14.1	11.5
18-Nov-2018	-	28.6	21.8
19-Nov-2018	1.2*	12.3	9
20-Nov-2018	-	15.8	15.7
21-Nov-2018	-	23.8	19
22-Nov-2018	4.6	9.4	17.6
23-Nov-2018	-	16	17.7
24-Nov-2018	-	9.6	8.3
25-Nov-2018	1.2*	8.2	5.5
26-Nov-2018	-	8.2	10.7
27-Nov-2018	-	11.6	12.5
28-Nov-2018	3.2	16.4	10.6
29-Nov-2018	-	13.5	6.6
30-Nov-2018	-	15.6	11.1
1-Dec-2018	6.5	16.2	12.3
2-Dec-2018	-	10.7	9.4
3-Dec-2018	-	8	5.9
4-Dec-2018	1.2*	12	13.5
5-Dec-2018	-	5.6	4.9
6-Dec-2018	-	8.3	7.4
7-Dec-2018	11.1	15	-
8-Dec-2018	-	14.8	-
9-Dec-2018	-	18.9	-
10-Dec-2018	1.2*	8.9	-
11-Dec-2018	-	4.3	-

APPENDIX 3-C. DAILY PM₁₀ AND PM_{2.5} DATA FROM THE PM-KERR, BC ENV-SMITHERS AND BC ENV-HOUSTON STATIONS,
NOVEMBER 1, 2018 TO JANUARY 16, 2020

Date	PM-Kerr ^a	BC ENV-Houston ^b	BC ENV - Smithers ^{b,c}
12-Dec-2018	-	5.5	-
13-Dec-2018	1.2*	10.1	-
14-Dec-2018	-	12.5	-
15-Dec-2018	-	19.7	-
16-Dec-2018	1.2*	9.4	-
17-Dec-2018	-	7.7	-
18-Dec-2018	-	12.1	-
19-Dec-2018	1.2*	16.2	-
20-Dec-2018	-	8.1	-
21-Dec-2018	-	21.1	-
22-Dec-2018	1.2*	5.1	-
23-Dec-2018	-	14.4	-
24-Dec-2018	-	27.6	-
25-Dec-2018	1.2*	15.4	-
26-Dec-2018	-	12.8	-
27-Dec-2018	-	10.1	-
28-Dec-2018	1.2*	4.2	-
29-Dec-2018	-	2.1	-
30-Dec-2018	-	26.7	-
31-Dec-2018	2.3	8.1	-
1-Jan-2019	-	8.9	-
2-Jan-2019	-	3	-
3-Jan-2019	2.6	4.6	-
4-Jan-2019	-	5.7	-
5-Jan-2019	-	5.8	-
6-Jan-2019	4.0	14.1	-
7-Jan-2019	-	35.1	-
8-Jan-2019	-	4.1	-
9-Jan-2019	1.2*	10.3	-
10-Jan-2019	-	11.2	-
11-Jan-2019	-	8.2	-
12-Jan-2019	1.2*	15.4	-
13-Jan-2019	-	14.4	-
14-Jan-2019	-	11.9	-
15-Jan-2019	2.8	8.1	-
16-Jan-2019	-	8.4	-
17-Jan-2019	-	5.2	-
18-Jan-2019	2.8	8.2	-
19-Jan-2019	-	8.4	-
20-Jan-2019	-	27.5	-
21-Jan-2019	1.2*	13.3	-
22-Jan-2019	-	10	-

Date	PM-Kerr ^a	BC ENV-Houston ^b	BC ENV - Smithers ^{b,c}
23-Jan-2019	-	9.2	-
24-Jan-2019	M	14.2	-
25-Jan-2019	-	10.3	-
26-Jan-2019	-	5.3	-
27-Jan-2019	1.2*	27.6	-
28-Jan-2019	-	16.7	-
29-Jan-2019	-	8.2	-
30-Jan-2019	5.4	15.6	-
31-Jan-2019	-	13.6	-
1-Feb-2019	-	2.6	9.7
2-Feb-2019	1.2*	12.4	6.6
3-Feb-2019	-	25.7	18.9
4-Feb-2019	-	19	19.9
5-Feb-2019	2.3	17	21
6-Feb-2019	-	6.5	9.8
7-Feb-2019	-	22.2	20.9
8-Feb-2019	1.2*	15.9	10.3
9-Feb-2019	-	30.7	19.5
10-Feb-2019	-	22.6	24.6
11-Feb-2019	1.2*	27.9	30.3
12-Feb-2019	-	35.7	22.2
13-Feb-2019	-	8.4	11.7
14-Feb-2019	1.2*	16.2	9.7
15-Feb-2019	-	21.3	3.6
16-Feb-2019	-	5.7	12.7
17-Feb-2019	1.2*	22.9	7.4
18-Feb-2019	-	23.8	12.7
19-Feb-2019	-	13.5	19.8
20-Feb-2019	3.7	25.4	17.5
21-Feb-2019	-	4.7	6.9
22-Feb-2019	-	6.9	9.7
23-Feb-2019	1.2*	14.4	7.4
24-Feb-2019	-	18.4	20.4
25-Feb-2019	-	28.1	20.6
26-Feb-2019	1.2*	41.6	25.4
27-Feb-2019	-	28.8	19.4
28-Feb-2019	-	30.8	25.5
1-Mar-2019	1.2*	8	8.7
2-Mar-2019	-	20.1	11.1
3-Mar-2019	-	29.4	13.4
4-Mar-2019	1.2*	32.1	19.8
5-Mar-2019	-	25.3	18.9

APPENDIX 3-C. DAILY PM₁₀ AND PM_{2.5} DATA FROM THE PM-KERR, BC ENV-SMITHERS AND BC ENV-HOUSTON STATIONS,
NOVEMBER 1, 2018 TO JANUARY 16, 2020

Date	PM-Kerr ^a	BC ENV-Houston ^b	BC ENV - Smithers ^{b,c}
6-Mar-2019	-	20.4	21.7
7-Mar-2019	1.2*	23.7	19.9
8-Mar-2019	-	44.8	19.2
9-Mar-2019	-	34	17.5
10-Mar-2019	2.6	11	11.8
11-Mar-2019	-	8.1	12.9
12-Mar-2019	-	17.1	14.4
13-Mar-2019	1.2*	12.7	7.5
14-Mar-2019	-	6.3	5.3
15-Mar-2019	-	14.4	16.3
16-Mar-2019	1.2*	14.2	8.7
17-Mar-2019	-	16.4	11.5
18-Mar-2019	-	21.6	15.3
19-Mar-2019	3.4	26.1	24.1
20-Mar-2019	-	25.3	16.4
21-Mar-2019	-	24.5	18.1
22-Mar-2019	5.2	24.8	19.7
23-Mar-2019	-	15.3	13
24-Mar-2019	-	20	14.1
25-Mar-2019	1.2*	19.4	16.6
26-Mar-2019	-	14.9	15
27-Mar-2019	-	20	14.8
28-Mar-2019	M	15.4	8.1
29-Mar-2019	-	15.8	12.6
30-Mar-2019	-	14.1	13.8
31-Mar-2019	M	17.3	15.2
1-Apr-2019	-	19.4	13.1
2-Apr-2019	-	18.5	13.7
3-Apr-2019	5.7	6.4	9.7
4-Apr-2019	-	7	8.2
5-Apr-2019	-	6.9	8.4
6-Apr-2019	1.2*	3	3
7-Apr-2019	-	2.7	4.1
8-Apr-2019	-	7	6.2
9-Apr-2019	3.7	6.6	5.2
10-Apr-2019	-	4.5	3.8
11-Apr-2019	-	11.3	9.2
12-Apr-2019	1.2*	5.7	4.6
13-Apr-2019	-	5.3	13.4
14-Apr-2019	-	8.5	6.7
15-Apr-2019	4.3	7	-
16-Apr-2019	-	2.1	3.2

Date	PM-Kerra ^a	BC ENV-Houston ^b	BC ENV - Smithers ^{b,c}
17-Apr-2019	-	2.7	2.5
18-Apr-2019	3.1	2.9	2.9
19-Apr-2019	-	10.9	5
20-Apr-2019	-	13.4	9.3
21-Apr-2019	3.9	7.6	6.7
22-Apr-2019	-	2.2	2.3
23-Apr-2019	-	5.1	3.2
24-Apr-2019	1.2*	4.7	2.5
25-Apr-2019	-	14.4	6.2
26-Apr-2019	-	4.4	6.3
27-Apr-2019	2.9	4.1	3
28-Apr-2019	-	15.1	6.2
29-Apr-2019	-	9	5.3
30-Apr-2019	3.9	7.5	6.5
1-May-2019	-	6.7	4.5
2-May-2019	-	4.8	3.7
3-May-2019	1.2*	3.7	2.1
4-May-2019	-	4.8	3.8
5-May-2019	-	5.1	3.4
6-May-2019	2.5	7.2	5.4
7-May-2019	-	6	3.8
8-May-2019	-	3.5	2.6
9-May-2019	2.5	3.8	-
10-May-2019	-	6.3	5.6
11-May-2019	-	5.6	5.5
12-May-2019	3.1	9.2	6.2
13-May-2019	-	8.1	4.5
14-May-2019	-	-	6.6
15-May-2019	1.15	-	3.2
16-May-2019	-	-	2.9
17-May-2019	-	-	3.4
18-May-2019	1.2*	4.8	4.4
19-May-2019	-	3.3	4
20-May-2019	-	3.2	6.2
21-May-2019	4	7.1	4.6
22-May-2019	-	9.3	7.1
23-May-2019	-	6	6.6
24-May-2019	1.2*	1.9	2.1
25-May-2019	-	15.3	10.3
26-May-2019	-	20.3	19.5
27-May-2019	14.7	15.4	16.6
28-May-2019	-	14.2	14

APPENDIX 3-C. DAILY PM₁₀ AND PM_{2.5} DATA FROM THE PM-KERR, BC ENV-SMITHERS AND BC ENV-HOUSTON STATIONS,
NOVEMBER 1, 2018 TO JANUARY 16, 2020

Date	PM-Kerr ^a	BC ENV-Houston ^b	BC ENV - Smithers ^{b,c}
29-May-2019	-	7.1	-
30-May-2019	4.5	10.6	-
31-May-2019	-	6.9	3.5
1-Jun-2019	-	4.6	2.2
2-Jun-2019	1.15	4.5	2.7
3-Jun-2019	-	2.8	2.9
4-Jun-2019	-	4.2	1.8
5-Jun-2019	M	4.8	2.7
6-Jun-2019	-	2.8	-
7-Jun-2019	-	3	2.7
8-Jun-2019	3.5	4.2	3.4
9-Jun-2019	-	4.6	2.2
10-Jun-2019	-	3.6	1.9
11-Jun-2019	3.2	5.5	2.6
12-Jun-2019	-	10.1	3.5
13-Jun-2019	-	7.8	3
14-Jun-2019	2.5	10.3	2.9
15-Jun-2019	-	6.7	4.4
16-Jun-2019	-	4.2	2.8
17-Jun-2019	3.2	4.8	2.4
18-Jun-2019	-	4.1	2.1
19-Jun-2019	-	3.8	2.3
20-Jun-2019	3.4	5.4	2.6
21-Jun-2019	-	13.5	4.9
22-Jun-2019	-	15.6	4.6
23-Jun-2019	3.1	-	2.5
24-Jun-2019	-	-	2.7
25-Jun-2019	-	5.1	2.2
26-Jun-2019	5.1	8.9	3.6
27-Jun-2019	-	8.5	6.7
28-Jun-2019	-	10	5.1
29-Jun-2019	6.5	6.5	5.9
30-Jun-2019	-	8.8	6.6
1-Jul-2019	-	13	9.8
2-Jul-2019	12.5	11.9	-
3-Jul-2019	-	12.5	10
4-Jul-2019	-	5.2	2.8
5-Jul-2019	5.9	8.1	4.4
6-Jul-2019	-	7.4	3.9
7-Jul-2019	-	8.1	9.7
8-Jul-2019	9.1	7.7	7.6
9-Jul-2019	-	11.1	8.6

Date	PM-Kerr ^a	BC ENV-Houston ^b	BC ENV - Smithers ^{b,c}
10-Jul-2019	-	8.6	9.6
11-Jul-2019	1.2*	5.6	5.1
12-Jul-2019	-	6.5	3.2
13-Jul-2019	-	2.8	4.7
14-Jul-2019	3.1	2.5	3.2
15-Jul-2019	-	5.7	3.3
16-Jul-2019	-	4.8	4.3
17-Jul-2019	1.2*	0.9	1.8
18-Jul-2019	-	2.8	3.7
19-Jul-2019	-	4.1	2.8
20-Jul-2019	4	5.6	4.1
21-Jul-2019	-	4.6	3.2
22-Jul-2019	-	5.7	5.1
23-Jul-2019	3.5	5.8	4.2
24-Jul-2019	-	5.1	3.9
25-Jul-2019	-	2.8	3.4
26-Jul-2019	1.2*	1.5	2.7
27-Jul-2019	-	3	2.5
28-Jul-2019	-	3.9	3.8
29-Jul-2019	3.9	10.7	6.6
30-Jul-2019	-	11	8.3
31-Jul-2019	-	9.5	6.5
1-Aug-2019	4.8	8.3	5.2
2-Aug-2019	-	6.3	3.9
3-Aug-2019	-	8.2	4.9
4-Aug-2019	5.4	8.1	6.7
5-Aug-2019	-	8.8	11.1
6-Aug-2019	-	15.8	-
7-Aug-2019	7.1	13.7	-
8-Aug-2019	-	9.3	7.4
9-Aug-2019	-	2.6	2.4
10-Aug-2019	3.1	4.9	3.7
11-Aug-2019	-	3.1	4.9
12-Aug-2019	-	6.8	8.1
13-Aug-2019	3.5	7.3	11
14-Aug-2019	-	8.7	-
15-Aug-2019	-	8.8	7.1
16-Aug-2019	1.2*	6.5	3.4
17-Aug-2019	-	4.4	3.8
18-Aug-2019	-	2	1.7
19-Aug-2019	1.2*	5.6	3.2
20-Aug-2019	-	3.7	4.1

APPENDIX 3-C. DAILY PM₁₀ AND PM_{2.5} DATA FROM THE PM-KERR, BC ENV-SMITHERS AND BC ENV-HOUSTON STATIONS,
NOVEMBER 1, 2018 TO JANUARY 16, 2020

Date	PM-Kerr ^a	BC ENV-Houston ^b	BC ENV - Smithers ^{b,c}
21-Aug-2019	-	5.8	2.4
22-Aug-2019	1.2	8.8	4.8
23-Aug-2019	-	3.5	2.6
24-Aug-2019	-	0.8	1.7
25-Aug-2019	2.6	6.2	6.2
26-Aug-2019	-	6.7	8
27-Aug-2019	-	4.4	3.6
28-Aug-2019	3.4	7.6	6.5
29-Aug-2019	-	6.9	4.7
30-Aug-2019	-	5.8	6
31-Aug-2019	3.7	7.3	7.6
1-Sep-2019	-	7.6	-
2-Sep-2019	-	6.5	6.7
3-Sep-2019	2.3	6	4.6
4-Sep-2019	-	2.5	2.8
5-Sep-2019	-	3.9	3.4
6-Sep-2019	1.2*	4.6	4.4
7-Sep-2019	-	3.7	4.4
8-Sep-2019	-	1.4	1.6
9-Sep-2019	2.3	3.6	2
10-Sep-2019	-	4.6	2.7
11-Sep-2019	-	3.2	6.4
12-Sep-2019	1.2*	2.5	2.8
13-Sep-2019	-	1.3	2.4
14-Sep-2019	-	10.2	2
15-Sep-2019	M	12.9	4.5
16-Sep-2019	-	4.4	4.5
17-Sep-2019	-	8.5	5
18-Sep-2019	M	4.5	6.6
19-Sep-2019	-	6	3.9
20-Sep-2019	-	3.9	4.9
21-Sep-2019	M	2.6	2
22-Sep-2019	-	5	3.1
23-Sep-2019	-	1.4	3.9
24-Sep-2019	M	2.4	4.5
25-Sep-2019	-	2.5	3.9
26-Sep-2019	-	7.8	5.8
27-Sep-2019	M	25.5	7.5
28-Sep-2019	-	10.5	10.2
29-Sep-2019	-	24.6	15.2
30-Sep-2019	M	13.4	24.3

Date	PM-Kerr ^a	BC ENV-Houston ^b	BC ENV - Smithers ^{b,c}
1-Oct-2019	-	21.6	15.5
2-Oct-2019	-	7	7.8
3-Oct-2019	M	6.3	5.6
4-Oct-2019	-	10.8	4.7
5-Oct-2019	-	10.3	5.5
6-Oct-2019	M	1.9	6.3
7-Oct-2019	-	8.7	3.7
8-Oct-2019	-	14.1	7.8
9-Oct-2019	M	16.4	16.5
10-Oct-2019	-	29.3	11.6
11-Oct-2019	-	9.7	12.4
12-Oct-2019	M	28.5	14.4
13-Oct-2019	-	16.1	15
14-Oct-2019	-	14.7	10.7
15-Oct-2019	M	3.3	3.8
16-Oct-2019	-	9.7	8.5
17-Oct-2019	-	17.9	7.3
18-Oct-2019	M	13.4	10
19-Oct-2019	-	11.9	14.3
20-Oct-2019	-	6	7.8
21-Oct-2019	M	5.2	4.9
22-Oct-2019	-	8.6	4.9
23-Oct-2019	-	9.5	10
24-Oct-2019	M	2.9	9.8
25-Oct-2019	-	11.8	7.2
26-Oct-2019	-	16.9	11.9
27-Oct-2019	M	5.8	10.1
28-Oct-2019	-	13.1	7
29-Oct-2019	-	19.7	19
30-Oct-2019	M	27.6	14.1
31-Oct-2019	-	21.5	18.7
1-Nov-2019	-	12.1	15.3
2-Nov-2019	1.2*	13.9	14.3
3-Nov-2019	-	12	14.1
4-Nov-2019	-	14.9	7.9
5-Nov-2019	1.2*	13.5	7.3
6-Nov-2019	-	3.9	4.6
7-Nov-2019	-	10.6	12.3
8-Nov-2019	2.3	6.4	13.6
9-Nov-2019	-	3.6	5.6
10-Nov-2019	-	2.4	4.7
11-Nov-2019	6.2	8	6.4

APPENDIX 3-C. DAILY PM₁₀ AND PM_{2.5} DATA FROM THE PM-KERR, BC ENV-SMITHERS AND BC ENV-HOUSTON STATIONS,
NOVEMBER 1, 2018 TO JANUARY 16, 2020

Date	PM-Kerr ^a	BC ENV-Houston ^b	BC ENV - Smithers ^{b,c}
12-Nov-2019	-	8	13.3
13-Nov-2019	-	6.2	16.4
14-Nov-2019	1.2*	7.2	11.8
15-Nov-2019	-	18.5	9.2
16-Nov-2019	-	2.5	8.6
17-Nov-2019	1.2*	6.7	3.2
18-Nov-2019	-	17.2	11.3
19-Nov-2019	-	7	16.5
20-Nov-2019	1.2*	12.9	12.5
21-Nov-2019	-	13.3	11
22-Nov-2019	-	5.4	10.4
23-Nov-2019	1.2*	3.8	7.3
24-Nov-2019	-	9.8	7.4
25-Nov-2019	-	10.1	17.8
26-Nov-2019	4	4.5	11.5
27-Nov-2019	-	19.2	14.5
28-Nov-2019	-	10.4	14
29-Nov-2019	2.8	7.5	10.8
30-Nov-2019	-	21.9	15
1-Dec-2019	-	9.1	11.3
2-Dec-2019	1.2*	7.9	13.6
3-Dec-2019	-	9.9	10.9
4-Dec-2019	-	12.7	10.1
5-Dec-2019	2.5	8.8	15.7
6-Dec-2019	-	9.3	16
7-Dec-2019	-	7.5	9.5
8-Dec-2019	2.8	21.3	9.1
9-Dec-2019	-	7.3	10.6
10-Dec-2019	-	8.6	11.1
11-Dec-2019	M	11.4	11.3
12-Dec-2019	-	21.7	11.3
13-Dec-2019	-	32.5	19.7
14-Dec-2019	1.2*	9.9	7.8
15-Dec-2019	-	12.5	5.4
16-Dec-2019	-	6.8	8.7
17-Dec-2019	1.2*	8.2	7.7
18-Dec-2019	-	11	9.1
19-Dec-2019	-	14.5	-
20-Dec-2019	1.2*	16.1	11.2
21-Dec-2019	-	19.3	19
22-Dec-2019	-	4.4	14.6
23-Dec-2019	1.2*	4.9	3.5

Date	PM-Kerr ^a	BC ENV-Houston ^b	BC ENV - Smithers ^{b,c}
24-Dec-2019	-	24.2	11.6
25-Dec-2019	-	14	9.6
26-Dec-2019	1.2*	6.2	2.6
27-Dec-2019	-	11.5	11.7
28-Dec-2019	-	5.4	6.9
29-Dec-2019	1.2*	6.5	11.9
30-Dec-2019	-	6.1	6.3
31-Dec-2019	-	16.1	11.5
1-Jan-2020	1.2*	9.3	8.2
2-Jan-2020	-	5	7.6
3-Jan-2020	-	2.9	3.8
4-Jan-2020	1.2*	8.7	8.4
5-Jan-2020	-	10.6	6.4
6-Jan-2020	-	28.1	20.4
7-Jan-2020	1.2*	8	21.3
8-Jan-2020	-	33.2	20.1
9-Jan-2020	-	15.2	20.2
10-Jan-2020	4.2	3.5	9.2
11-Jan-2020	-	4.6	3.5
12-Jan-2020	-	22.9	10.5
13-Jan-2020	2.9	31.5	16.1
14-Jan-2020	-	-	10.2
15-Jan-2020	-	-	5.8
16-Jan-2020	2.3	20.9	8.8

Notes:

No data available from BC ENV-Telkwa station

Dash (-) = data not available

* Values below detection limit were considered to be half the detection limit for calculation purposes.

^a Partisol sampler at PM-Kerr is set up to sample once every 3 days in accordance with the NAPS schedule (ECCC 2018).

^b Data from BC ENV-Houston and BC ENV-Smithers stations are raw preliminary data and are subject to future review and revisions by the reporting agency.

^c BC ENV-Smithers station: November 1, 2018 – December 6, 2018 data from St. Joseph's station, and February 1, 2019 – January 16, 2020 data from Muheim Memorial station; ; data between those periods are not available.

Appendix 3-D** **Partisol Laboratory Analysis Results



ERM Consultants Canada Ltd.
ATTN: Daniel Casanova
1500-1111 West Hastings Street
Vancouver BC V6E 2J3

Date Received: 29-NOV-18
Report Date: 24-JAN-19 15:07 (MT)
Version: FINAL REV. 3

Client Phone: 604-689-9460

Certificate of Analysis

Lab Work Order #: L2203474
Project P.O. #: NOT SUBMITTED
Job Reference: 0403488-0103-0002
C of C Numbers: 17-717043
Legal Site Desc:

Comments: 18-DEC-2018 Air Volumes and the calculated parameters based on that data have been revised.
24-JAN-2019 Data for "Particulate - Coarse(ug)" has been added.

Amber Springer, B.Sc
Account Manager

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ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID Description Sampled Date Sampled Time Client ID		L2203474-1 Air Particulate 01-NOV-18 65075	L2203474-2 Air Particulate 02-NOV-18 65077	L2203474-3 Air Particulate 04-NOV-18 65076	L2203474-4 Air Particulate 07-NOV-18 03:41 65080	L2203474-5 Air Particulate 10-NOV-18 65079
Grouping	Analyte					
FILTER						
Particulates	Particulate - PM2.5 (ug)	160	<50	<50	170	143
	Particulate - PM2.5 (ug/m3)	7.4		<2.3	9.3	6.6
	Particulate-Fine (ug/m3)					
	Particulate-Coarse (ug)					
	Particulate-Coarse (ug/m3)					
	Particulate-PM10 (ug/m3)					
	Total particulate (mg)					

ALS ENVIRONMENTAL ANALYTICAL REPORT

		Sample ID	L2203474-6	L2203474-7	L2203474-8	L2203474-9	L2203474-10
		Description	Air Particulate	Air Particulate	Air Particulate	Air Particulate	Air Particulate
		Sampled Date	13-NOV-18	16-NOV-18	19-NOV-18	22-NOV-18	25-NOV-18
		Sampled Time					
		Client ID	65082	65081	65083	65085	65087
Grouping	Analyte						
FILTER							
Particulates	Particulate - PM2.5 (ug)		137	<50	<50	100	<50
	Particulate - PM2.5 (ug/m3)		6.3	<2.3	<2.3	4.6	<2.3
	Particulate-Fine (ug/m3)						
	Particulate-Coarse (ug)						
	Particulate-Coarse (ug/m3)						
	Particulate-PM10 (ug/m3)						
	Total particulate (mg)						

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID Description Sampled Date Sampled Time Client ID		L2203474-11 Air Particulate 01-NOV-18 66749	L2203474-12 Air Particulate 02-NOV-18 66747	L2203474-13 Air Particulate 04-NOV-18 66743	L2203474-14 Air Particulate 07-NOV-18 03:41 66745	L2203474-15 Air Particulate 10-NOV-18 66744
Grouping	Analyte					
FILTER						
Particulates	Particulate - PM2.5 (ug)					
	Particulate - PM2.5 (ug/m3)					
	Particulate-Fine (ug/m3)	7.4		<2.3	9.3	6.6
	Particulate-Coarse (ug)	<50		<50	83	<50
	Particulate-Coarse (ug/m3)	<-0.12		0.293	3.17	0.306
	Particulate-PM10 (ug/m3)	5.8		<2.3	12.5	6.9
	Total particulate (mg)		<0.060			

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID Description Sampled Date Sampled Time Client ID		L2203474-16 Air Particulate 13-NOV-18 65062	L2203474-17 Air Particulate 16-NOV-18 65066	L2203474-18 Air Particulate 19-NOV-18 65067	L2203474-19 Air Particulate 22-NOV-18 65069	L2203474-20 Air Particulate 25-NOV-18 65068
Grouping	Analyte					
FILTER						
Particulates	Particulate - PM2.5 (ug)					
	Particulate - PM2.5 (ug/m3)					
	Particulate-Fine (ug/m3)	6.3	<2.3	<2.3	4.6	<2.3
	Particulate-Coarse (ug)	<50	<50	<50	<50	<50
	Particulate-Coarse (ug/m3)	<0.089	0.925	0.432	<0.065	<0.017
	Particulate-PM10 (ug/m3)	5.7	2.8	<2.3	3.2	<2.3
	Total particulate (mg)					

		Sample ID Description Sampled Date Sampled Time Client ID	L2203474-1 Air Particulate 01-NOV-18 65075	L2203474-3 Air Particulate 04-NOV-18 65076	L2203474-4 Air Particulate 07-NOV-18 03:41 65080	L2203474-5 Air Particulate 10-NOV-18 65079	L2203474-6 Air Particulate 13-NOV-18 65082
Grouping	Analyte						
MISC.							
Field Tests	Air Volume, Client Supplied (L)		21600	21600	18300	21600	21600

	Sample ID Description Sampled Date Sampled Time Client ID	L2203474-7 Air Particulate 16-NOV-18 65081	L2203474-8 Air Particulate 19-NOV-18 65083	L2203474-9 Air Particulate 22-NOV-18 65085	L2203474-10 Air Particulate 25-NOV-18 65087	L2203474-11 Air Particulate 01-NOV-18 66749
Grouping	Analyte					
MISC.						
Field Tests	Air Volume, Client Supplied (L)	21600	21600	21600	21600	2400

		Sample ID Description Sampled Date Sampled Time Client ID	L2203474-13 Air Particulate 04-NOV-18 66743	L2203474-14 Air Particulate 07-NOV-18 03:41 66745	L2203474-15 Air Particulate 10-NOV-18 66744	L2203474-16 Air Particulate 13-NOV-18 65062	L2203474-17 Air Particulate 16-NOV-18 65066
Grouping	Analyte						
MISC.							
Field Tests	Air Volume, Client Supplied (L)		2410	2030	2410	2410	2410

		Sample ID Description Sampled Date Sampled Time Client ID	L2203474-18 Air Particulate 19-NOV-18 65067	L2203474-19 Air Particulate 22-NOV-18 65069	L2203474-20 Air Particulate 25-NOV-18 65068		
Grouping	Analyte						
MISC.							
Field Tests	Air Volume, Client Supplied (L)		2410	2410	2410		

Reference Information

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
AIR VOLUME-VA	Misc.	Air volume (L)	HYGIENE METHOD
PART-DICHOT-PM10-VA	Filter	Total Particulate (Dichot-PM10) by Grav.	BCMOE Method
Total Particulate Matter (PM10) Method analysis is carried out in accordance with the BCMOE Lab Manual, Section G Air Constituents - Inorganics, "Total Particulate - PM10/PM02 - 47mm - HiVol" method. ALS provides pre-weighed filters (Pallflex TX40 HI20-WW 47mm) and clients typically sample using a "Dichotomus Partisol sequential Air Sampler" equivalent sample (EQPS-0509-179, EQPS-0509-180, EQPS-0311-198) as per U.S. EPA Reference Method RFPS-0694-098, fitted with a PM10 inlet. The particulate matter is determined gravimetrically. Three formulas are required for the mass concentration (um/M3) computation of fine PM (PM-2.5) Course PM (PM-10 minus PM2.5) and PM-10.			
PART-PM2.5-VA	Filter	Total Particulate (PM2.5) by Gravimetric	BCMOE METHOD
Total Particulate Matter (PM2.5) Method analysis is carried out in accordance with the BCMOE Lab Manual, Section G Air Constituents - Inorganics, "Total Particulate - PM10/PM02 - 47mm - HiVol" method. ALS provides pre-weighed filters (Pallflex TX40 HI20-WW 47mm) and clients typically sample using a "Partisol Model 2000 Air Sampler" as per U.S. EPA Reference Method RFPS-0694-098, fitted with a PM2.5 inlet. The particulate matter is determined gravimetrically.			
PART-T-WCB-VA	Filter	Total Particulate (WCB) Gravimetric	WCB METHOD
These parameters are determined using procedures adapted from WCB method 1150 "Particulate (Total) in Air", NIOSH method 0500 "Particulates Not Otherwise Regulated, Total", and NIOSH method 0600 "Particulates Not Otherwise Regulated, Respirable". A membrane filter is desiccated and weighed before and after sample collection on a five-place analytical balance. The difference between the weights is reported either as total particulate or respirable dust, depending upon the sample collection technique used.			

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

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
VA	ALS ENVIRONMENTAL - VANCOUVER, BRITISH COLUMBIA, CANADA

Chain of Custody Numbers:

17-717043

GLOSSARY OF REPORT TERMS

Surrogate - A compound that is similar in behaviour to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.

mg/kg - milligrams per kilogram based on dry weight of sample.

mg/kg wwt - milligrams per kilogram based on wet weight of sample.

mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight of sample.

mg/L - milligrams per litre.

< - Less than.

D.L. - The reported Detection Limit, also known as the Limit of Reporting (LOR).

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.

Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.



www.alsglobal.com

Chain of Custody (COC) / Analytical
Request Form

Canada Toll Free: 1 800 668 9878



L2203474-COFC

COC Number: 17 - 717043

Page 1 of 2

Report To Contact and company name below will appear on the final report		Report Format / Distribution		Select Service Level Below - Contact your AM to confirm all E&P TATs (surcharges may apply)																																																
Company:	ERM	Select Report Format:	☒ PDF ☒ EXCEL ☐ EDD (DIGITAL)	Regular [R] ☒ Standard TAT if received by 3 pm - business days - no surcharges apply																																																
Contact:	Daniel Casanova	Quality Control (QC) Report with Report	☐ YES ☐ NO	1 Business day [E - 100%] ☐																																																
Phone:	250-877-7838	☐ Compare Results to Criteria on Report - provide details below if box checked		Same Day, Weekend or Statutory holiday [E2 - 200%] ☐ (Laboratory opening fees may apply)																																																
Company address below will appear on the final report		Select Distribution:	☒ EMAIL ☐ MAIL ☐ FAX																																																	
Street:	3790 Alfred Ave	Email 1 or Fax:	daniel.casanova@erm.com	Date and Time Required for all E&P TATs: dd-mmm-yy hh:mm																																																
City/Province:	Smithers, BC	Email 2:	talaat.bakri@erm.com	For tests that can not be performed according to the service level selected, you will be contacted.																																																
Postal Code:	V0J 2N0	Email 3:	andres.soux@erm.com																																																	
Invoice To	Same as Report To ☒ YES ☐ NO	Invoice Distribution		Analysis Request																																																
Copy of Invoice with Report	☐ YES ☒ NO	Select Invoice Distribution:	☒ EMAIL ☐ MAIL ☐ FAX	Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below																																																
Company:		Email 1 or Fax:	korina.houghton@erm.com	<table border="1"> <tr> <td rowspan="4">NUMBER OF CONTAINERS</td> <td rowspan="4">PM2.5 Mass</td> <td rowspan="4">PM2.5 Concentration</td> <td rowspan="4">PMcoarse Mass</td> <td rowspan="4">PMcoarse Concentration</td> <td rowspan="4">PM10 Mass</td> <td rowspan="4">PM10 Concentration</td> <td colspan="10"></td> </tr> <tr><td colspan="10"></td></tr> <tr><td colspan="10"></td></tr> <tr><td colspan="10"></td></tr> </table>		NUMBER OF CONTAINERS	PM2.5 Mass	PM2.5 Concentration	PMcoarse Mass	PMcoarse Concentration	PM10 Mass	PM10 Concentration																																								
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Contact:		Email 2:	daniel.casanova@erm.com																																																	
Project Information		Oil and Gas Required Fields (client use)																																																		
ALS Account # / Quote #:		AFECost Center:		PO#																																																
Job #:		Major/Minor Code:		Routing Code:																																																
PO / AFE:		Requisitioner:																																																		
LSD:		Location:																																																		
ALS Lab Work Order # (lab use only):		ALS Contact:	Amber Springer	Sampler:	Daniel Casanova																																															
ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type																																																
65075		1-Nov-18	0:00	Air Particulate	1 R R																																															
65077		2-Nov-18	0:00	Air Particulate	1 R R																																															
65076		4-Nov-18	0:00	Air Particulate	1 R R																																															
65080		7-Nov-18	3:41	Air Particulate	1 R R																																															
65079		10-Nov-18	0:00	Air Particulate	1 R R																																															
65082		13-Nov-18	0:00	Air Particulate	1 R R																																															
65081		16-Nov-18	0:00	Air Particulate	1 R R																																															
65083		19-Nov-18	0:00	Air Particulate	1 R R																																															
65085		22-Nov-18	0:00	Air Particulate	1 R R																																															
65087		25-Nov-18	0:00	Air Particulate	1 R R																																															
Drinking Water (DW) Samples¹ (client use)		Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)		SAMPLE CONDITION AS RECEIVED (lab use only)																																																
Are samples taken from a Regulated DW System? ☐ YES ☐ NO		Sample date/time represents start date/time. See attached information sheet for pre-weights of different bottle orders, and sampling volume. Refill all cassettes (including empty cassettes) with new pre-weighed filters and ship back.		Frozen ☐ SIF Observations Yes ☐ No ☐																																																
Are samples for human consumption/ use? ☐ YES ☐ NO				Ice Packs ☐ Ice Cubes ☐ Custody seal intact Yes ☐ No ☐																																																
				Cooling Initiated ☐																																																
				INITIAL COOLER TEMPERATURES °C																																																
				FINAL COOLER TEMPERATURES °C																																																
				10																																																
SHIPMENT RELEASE (client use)		INITIAL SHIPMENT RECEPTION (lab use only)		FINAL SHIPMENT RECEPTION (lab use only)																																																
Released by:	Date:	Received by:	Date:	Received by:	Date:																																															
Daniel Casanova	11/28/2018			AI JC	11/29/18																																															

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

WHITE - LABORATORY COPY

YELLOW - CLIENT COPY

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.

1. If any water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC form.

NOV 2018 FRONT



Canada Toll Free: 1 800 668 9878



L2203474-COFC

COC Number: 17 - 717043

Page 2 of 2

Report To		Contact and company name below will appear on the final report		Report Format / Distribution		Select Service Level Below - Contact your AM to confirm all E&P TATs (surcharges may apply)															
Company:		ERM		Select Report Format: ☒ PDF ☒ EXCEL ☐ EDD (DIGITAL)		Regular [R] ☒ Standard TAT if received by 3 pm - business days - no surcharges apply															
Contact:		Daniel Casanova		Quality Control (QC) Report with Report ☐ YES ☐ NO		PRIORITY (Business days) 4 day [P4-20%] ☐ 3 day [P3-25%] ☐ 2 day [P2-50%] ☐				EMERGENCY 1 Business day [E - 100%] Same Day, Weekend or Statutory holiday [E2 -200% (Laboratory opening fees may apply)] ☐											
Phone:		250-877-7838		☐ Compare Results to Criteria on Report - provide details below if box checked																	
Company address below will appear on the final report				Select Distribution: ☒ EMAIL ☐ MAIL ☐ FAX		Date and Time Required for all E&P TATs: dd-mmm-yy hh:mm															
Street:		3790 Alfred Ave		Email 1 or Fax daniel.casanova@erm.com		For tests that can not be performed according to the service level selected, you will be contacted.															
City/Province:		Smithers, BC		Email 2 talaat.bakri@erm.com		Analysis Request Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below															
Postal Code:		V0J 2N0		Email 3 andres.soux@erm.com																	
Invoice To		Same as Report To ☒ YES ☐ NO		Invoice Distribution		NUMBER OF CONTAINERS															
Copy of Invoice with Report ☐ YES ☒ NO		Select Invoice Distribution: ☒ EMAIL ☐ MAIL ☐ FAX																			
Company:				Email 1 or Fax korina.houghton@erm.com		SAMPLES ON HOLD															
Contact:				Email 2 daniel.casanova@erm.com																	
Project Information				Oil and Gas Required Fields (client use)		SUSPECTED HAZARD (see Special Instructions)															
ALS Account # / Quote #:		AFE/Cost Center:		PO#																	
Job #:		0403488-0103-0002		Major/Minor Code:		Routing Code:															
PO / AFE:				Requisitioner:																	
LSD:				Location:																	
ALS Lab Work Order # (lab use only):		ALS Contact: Amber Springer		Sampler: Daniel Casanova																	
ALS Sample # (lab use only)		Sample Identification and/or Coordinates (This description will appear on the report)		Date (dd-mmm-yy)		Time (hh:mm)		Sample Type													
66749				1-Nov-18		0:00		Air Particulate													
66747				2-Nov-18		0:00		Air Particulate													
66743				4-Nov-18		0:00		Air Particulate													
66745				7-Nov-18		3:41		Air Particulate													
66744				10-Nov-18		0:00		Air Particulate													
65062				13-Nov-18		0:00		Air Particulate													
65066				16-Nov-18		0:00		Air Particulate													
65067				19-Nov-18		0:00		Air Particulate													
65069				22-Nov-18		0:00		Air Particulate													
65068				25-Nov-18		0:00		Air Particulate													
Drinking Water (DW) Samples¹ (client use)				Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)				SAMPLE CONDITION AS RECEIVED (lab use only)													
Are samples taken from a Regulated DW System? ☐ YES ☐ NO				Sample date/time represents start date/time. See attached information sheet for pre-weights of different bottle orders, and sampling volume. Refill all cassettes (including empty cassettes) with new pre-weighed filters and ship back.				Frozen ☐ SIF Observations Yes ☐ No ☐													
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								Cooling Initiated ☐													
								INITIAL COOLER TEMPERATURES °C													
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SHIPMENT RELEASE (client use)				INITIAL SHIPMENT RECEPTION (lab use only)				FINAL SHIPMENT RECEPTION (lab use only)													
Released by:		Date:		Time:		Received by:		Date:		Time:		Received by:		Date:		Time:					
												TAL JC		11/29/18		955AM					

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

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1. If any water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC form.

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NOV 2018 FROM

Please scan to COC

NOTE: Filters came from 2 different bottle orders and FilterIDs may overlap.

Sampling order	CassetteID	FilterID (from ALS)	PM Type	Bottle Order Number	Start Date actual	Start Time e_act	Stop Date actual	Stop Time act	Total Sample time	Volume of air sampled (Actual Volume; m^3)	Blank Sample?
1	65075	35	2.5	BR221278	1-Nov-18	0:00	1-Nov-18	23:59	23:59	21.60	N
2	65077	34	2.5	BR221278	2-Nov-18	0:00	2-Nov-18	0:00	0:00	0.00	Y
3	65076	33	2.5	BR221278	4-Nov-18	0:00	4-Nov-18	23:00	24:00:00	21.60	N
4	65078	32	2.5	BR221278	sample skipped on purpose. Do not analyze filter.						
5	65080	31	2.5	BR221278	7-Nov-18	3:41	8-Nov-18	0:00	20:18	18.30	N
6	65079	30	2.5	BR221278	10-Nov-18	0:00	11-Nov-18	0:00	24:00:00	21.60	N
7	65082	29	2.5	BR221278	13-Nov-18	0:00	14-Nov-18	0:00	24:00:00	21.60	N
8	65081	28	2.5	BR221278	16-Nov-18	0:00	17-Nov-18	0:00	24:00:00	21.60	N
9	65083	27	2.5	BR221278	19-Nov-18	0:00	20-Nov-18	0:00	24:00:00	21.60	N
10	65085	26	2.5	BR221278	22-Nov-18	0:00	23-Nov-18	0:00	24:00:00	21.60	N
11	65087	25	2.5	BR221278	25-Nov-18	0:00	26-Nov-18	0:00	24:00:00	21.60	N
1	66749	5	coarse	BR228744	1-Nov-18	0:00	1-Nov-18	23:59	23:59	2.40	N
2	66747	4	coarse	BR228744	2-Nov-18	0:00	2-Nov-18	0:00	0:00	0.00	Y
3	66743	12	coarse	BR228744	4-Nov-18	0:00	4-Nov-18	23:00	24:00:00	2.41	N
4	66742	11	coarse	BR228744	sample skipped on purpose. Do not analyze filter.						
5	66745	9	coarse	BR228744	7-Nov-18	3:41	8-Nov-18	0:00	20:18	2.03	N
6	66744	10	coarse	BR228744	10-Nov-18	0:00	11-Nov-18	0:00	24:00:00	2.41	N
7	65062	8	coarse	BR228744	13-Nov-18	0:00	14-Nov-18	0:00	24:00:00	2.41	N
8	65066	7	coarse	BR228744	16-Nov-18	0:00	17-Nov-18	0:00	24:00:00	2.41	N
9	65067	15	coarse	BR228744	19-Nov-18	0:00	20-Nov-18	0:00	24:00:00	2.41	N
10	65069	14	coarse	BR228744	22-Nov-18	0:00	23-Nov-18	0:00	24:00:00	2.41	N
11	65068	13	coarse	BR228744	25-Nov-18	0:00	26-Nov-18	0:00	24:00:00	2.41	N

Pre-weight information from ALS

from ALS Bottle	FILTER ID	Pre-Weight Date	ALS Analyst	Weight 1 (mg)	Weight 2 (mg)	Weight 3 (mg)	Average of pre-weights (mg)
BR228744	1	21-Oct-18	SP	85.71	85.7	85.69	85.700000
BR228744	2	21-Oct-18	SP	84.83	84.82	84.82	84.823333
BR228744	3	21-Oct-18	SP	85.38	85.4	85.41	85.396667
BR228744	4	21-Oct-18	SP	85.34	85.34	85.34	85.340000
BR228744	5	21-Oct-18	SP	84.9	84.9	84.89	84.896667
BR228744	6	21-Oct-18	SP	85.02	85.02	85	85.013333
BR228744	7	21-Oct-18	SP	85.94	85.94	85.85	85.910000



L2203474-COFC

BR228744	8	21-Oct-18	SP	85.09	85.1	85.1	85.0966667
BR228744	9	21-Oct-18	SP	85.21	85.21	85.21	85.2100000
BR228744	10	21-Oct-18	SP	84.6	84.6	84.58	84.5933333
BR228744	11	22-Oct-18	CM	85.06	85.05	85.03	85.0466667
BR228744	12	22-Oct-18	CM	84.92	84.93	84.94	84.9300000
BR228744	13	22-Oct-18	CM	84.78	84.76	84.77	84.7700000
BR228744	14	22-Oct-18	CM	85.21	85.22	85.19	85.2066667
BR228744	15	22-Oct-18	CM	82.09	82.12	82.09	82.1000000
BR228744	16	22-Oct-18	CM	81.61	81.64	81.61	81.6200000
BR228744	17	22-Oct-18	CM	82.01	81.99	81.99	81.9966667
BR228744	18	22-Oct-18	CM	81.91	81.89	81.89	81.8966667
BR228744	19	22-Oct-18	CM	81.61	81.62	81.64	81.6233333
BR228744	20	22-Oct-18	CM	82.12	82.11	82.14	82.1233333
BR228744	21	22-Oct-18	CM	82.05	82.07	82.05	82.0566667
BR228744	22	22-Oct-18	CM	81.57	81.55	81.55	81.5566667
BR228744	23	22-Oct-18	CM	81.5	81.47	81.47	81.4800000
BR228744	24	22-Oct-18	CM	81.31	81.29	81.29	81.2966667
BR228744	25	22-Oct-18	CM	81.49	81.49	81.47	81.4833333
BR228744	26	22-Oct-18	CM	81.3	81.3	81.3	81.3000000
BR228744	27	22-Oct-18	CM	81.39	81.36	81.38	81.3766667
BR228744	28	22-Oct-18	CM	81.1	81.13	81.1	81.1100000
BR228744	29	22-Oct-18	CM	80.58	80.58	80.56	80.5733333
BR228744	30	22-Oct-18	CM	81.7	81.72	81.73	81.7166667
BR221278	#1	2-Aug-18	CM	83.69	83.67	83.69	83.6833333
BR221278	#2	2-Aug-18	NL	83.18	83.2	83.19	83.1900000
BR221278	#3	2-Aug-18	NL	83.98	83.99	84	83.9900000
BR221278	#4	2-Aug-18	NL	83.23	83.22	83.22	83.2233333
BR221278	#5	2-Aug-18	NL	83.76	83.77	83.75	83.7600000
BR221278	#6	2-Aug-18	NL	83.18	83.16	83.16	83.1666667
BR221278	#7	2-Aug-18	NL	82.75	82.73	82.76	82.7466667
BR221278	#8	2-Aug-18	NL	83.68	83.68	83.69	83.6833333
BR221278	#9	2-Aug-18	NL	82.62	82.63	82.61	82.6200000
BR221278	#10	2-Aug-18	NL	82.43	82.44	82.42	82.4300000
BR221278	#11	2-Aug-18	NL	83.95	83.95	83.94	83.9466667
BR221278	#12	2-Aug-18	NL	82.04	82.06	82.06	82.0533333
BR221278	#13	2-Aug-18	NL	82.48	82.48	82.48	82.4800000
BR221278	#14	2-Aug-18	NL	83.09	83.11	83.1	83.1000000
BR221278	#15	2-Aug-18	NL	82.23	82.23	82.22	82.2266667
BR221278	#16	2-Aug-18	NL	81.84	81.82	81.84	81.8333333
BR221278	#17	2-Aug-18	NL	81.49	81.48	81.5	81.4900000



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BR221278	#18	2-Aug-18	NL	82.24	82.24	82.22	82.2333333
BR221278	#19	2-Aug-18	NL	83.41	83.42	83.43	83.4200000
BR221278	#20	2-Aug-18	NL	83.73	83.72	83.73	83.7266667
BR221278	#21	2-Aug-18	NL	82.25	82.27	82.25	82.2566667
BR221278	#22	2-Aug-18	NL	81.79	81.77	81.78	81.7800000
BR221278	#23	2-Aug-18	NL	81.98	81.99	81.99	81.9866667
BR221278	#24	2-Aug-18	NL	81.86	81.85	81.84	81.8500000
BR221278	#25	2-Aug-18	NL	81.5	81.48	81.5	81.4933333
BR221278	#26	2-Aug-18	NL	81.76	81.75	81.75	81.7533333
BR221278	#27	2-Aug-18	NL	81.73	81.74	81.73	81.7333333
BR221278	#28	2-Aug-18	NL	81.2	81.21	81.19	81.2000000
BR221278	#29	2-Aug-18	NL	82.05	82.06	82.05	82.0533333
BR221278	#30	2-Aug-18	NL	83.88	83.89	83.9	83.8900000
BR221278	#31	2-Aug-18	NL	84.3	84.28	84.28	84.2866667
BR221278	#32	2-Aug-18	NL	83.69	83.68	83.69	83.6866667
BR221278	#33	2-Aug-18	NL	84.2	84.19	84.2	84.1966667
BR221278	#34	2-Aug-18	NL	82.59	82.58	82.58	82.5833333
BR221278	#35	2-Aug-18	NL	82.81	82.8	82.81	82.8066667
BR221278	#36	2-Aug-18	NL	83.18	83.19	83.18	83.1833333
BR221278	#37	2-Aug-18	NL	82.99	82.97	82.98	82.9800000
BR221278	#38	2-Aug-18	NL	82.19	82.21	82.2	82.2000000
BR221278	#39	2-Aug-18	NL	82.28	82.3	82.28	82.2866667
BR221278	#40	2-Aug-18	NL	82.16	82.18	82.18	82.1733333



L2203474-COFC



ERM Consultants Canada Ltd.
ATTN: Daniel Casanova
1500-1111 West Hastings Street
Vancouver BC V6E 2J3

Date Received: 02-JAN-19
Report Date: 24-JAN-19 15:05 (MT)
Version: FINAL

Client Phone: 604-689-9460

Certificate of Analysis

Lab Work Order #: L2215988
Project P.O. #: NOT SUBMITTED
Job Reference: 0403488-0103-0002
C of C Numbers: 17-812134
Legal Site Desc:

Comments:

Amber Springer, B.Sc
Account Manager

[This report shall not be reproduced except in full without the written authority of the Laboratory.]

ADDRESS: 8081 Lougheed Hwy, Suite 100, Burnaby, BC V5A 1W9 Canada | Phone: +1 604 253 4188 | Fax: +1 604 253 6700
ALS CANADA LTD Part of the ALS Group An ALS Limited Company

ALS ENVIRONMENTAL ANALYTICAL REPORT

		Sample ID Description Sampled Date Sampled Time Client ID	L2215988-1 Air Particulate 28-NOV-18 65090	L2215988-2 Air Particulate 29-NOV-18 65088	L2215988-3 Air Particulate 01-DEC-18 65086	L2215988-4 Air Particulate 04-DEC-18 66741	L2215988-5 Air Particulate 07-DEC-18 66754
Grouping	Analyte						
FILTER							
Particulates	Particulate - PM2.5 (ug)		70	<50	140	<50	240
	Particulate - PM2.5 (ug/m3)		3.2		6.5	<2.3	11.1
	Particulate-Fine (ug/m3)						
	Particulate-Coarse (ug)						
	Particulate-Coarse (ug/m3)						
	Particulate-PM10 (ug/m3)						
	Total particulate (mg)						

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID Description Sampled Date Sampled Time Client ID		L2215988-6 Air Particulate 10-DEC-18 66758	L2215988-7 Air Particulate 13-DEC-18 66752	L2215988-8 Air Particulate 16-DEC-18 66753	L2215988-9 Air Particulate 19-DEC-18 66740	L2215988-10 Air Particulate 28-NOV-18 65074
Grouping	Analyte					
FILTER						
Particulates	Particulate - PM2.5 (ug)	<50	<50	<50	<50	
	Particulate - PM2.5 (ug/m3)	<2.3	<2.3	<2.3	<2.3	
	Particulate-Fine (ug/m3)					3.2
	Particulate-Coarse (ug)					53
	Particulate-Coarse (ug/m3)					1.90
	Particulate-PM10 (ug/m3)					5.1
	Total particulate (mg)					

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID Description Sampled Date Sampled Time Client ID		L2215988-11 Air Particulate 29-NOV-18 65072	L2215988-12 Air Particulate 01-DEC-18 65071	L2215988-13 Air Particulate 04-DEC-18 66757	L2215988-14 Air Particulate 07-DEC-18 66739	L2215988-15 Air Particulate 10-DEC-18 66755
Grouping	Analyte					
FILTER						
Particulates	Particulate - PM2.5 (ug)					
	Particulate - PM2.5 (ug/m3)					
	Particulate-Fine (ug/m3)					
	Particulate-Coarse (ug)					
	Particulate-Coarse (ug/m3)					
	Particulate-PM10 (ug/m3)					
	Total particulate (mg)	40.0				

ALS ENVIRONMENTAL ANALYTICAL REPORT

		Sample ID Description Sampled Date Sampled Time Client ID	L2215988-16 Air Particulate 13-DEC-18 65046	L2215988-17 Air Particulate 16-DEC-18 65045	L2215988-18 Air Particulate 19-DEC-18 66746		
Grouping	Analyte						
FILTER							
Particulates	Particulate - PM2.5 (ug)						
	Particulate - PM2.5 (ug/m3)						
	Particulate-Fine (ug/m3)		<2.3	<2.3	<2.3		
	Particulate-Coarse (ug)		<50	<50	<50		
	Particulate-Coarse (ug/m3)		<0.024	1.26	1.42		
	Particulate-PM10 (ug/m3)		<2.3	2.5	2.5		
	Total particulate (mg)						

Sample ID Description Sampled Date Sampled Time Client ID		L2215988-1 Air Particulate 28-NOV-18 65090	L2215988-3 Air Particulate 01-DEC-18 65086	L2215988-4 Air Particulate 04-DEC-18 66741	L2215988-5 Air Particulate 07-DEC-18 66754	L2215988-6 Air Particulate 10-DEC-18 66758
Grouping	Analyte					
MISC.						
Field Tests	Air Volume, Client Supplied (L)	21600	21600	21600	21600	21600

		Sample ID	Description	Sampled Date	Sampled Time	Client ID
		L2215988-7	Air Particulate	13-DEC-18		66752
		L2215988-8	Air Particulate	16-DEC-18		66753
		L2215988-9	Air Particulate	19-DEC-18		66740
		L2215988-10	Air Particulate	28-NOV-18		65074
		L2215988-12	Air Particulate	01-DEC-18		65071
Grouping	Analyte					
MISC.						
Field Tests	Air Volume, Client Supplied (L)	21600	21600	21600	2400	2410

		Sample ID Description Sampled Date Sampled Time Client ID	L2215988-13 Air Particulate 04-DEC-18 66757	L2215988-14 Air Particulate 07-DEC-18 66739	L2215988-15 Air Particulate 10-DEC-18 66755	L2215988-16 Air Particulate 13-DEC-18 65046	L2215988-17 Air Particulate 16-DEC-18 65045
Grouping	Analyte						
MISC.							
Field Tests	Air Volume, Client Supplied (L)		2410	2410	2410	2410	2410

		Sample ID Description Sampled Date Sampled Time Client ID	L2215988-18 Air Particulate 19-DEC-18 66746				
Grouping	Analyte						
MISC.							
Field Tests	Air Volume, Client Supplied (L)	2410					

Reference Information

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
AIR VOLUME-VA	Misc.	Air volume (L)	HYGIENE METHOD
PART-DICHOT-PM10-VA	Filter	Total Particulate (Dichot-PM10) by Grav.	BCMOE Method
Total Particulate Matter (PM10) Method analysis is carried out in accordance with the BCMOE Lab Manual, Section G Air Constituents - Inorganics, "Total Particulate - PM10/PM02 - 47mm - HiVol" method. ALS provides pre-weighed filters (Pallflex TX40 HI20-WW 47mm) and clients typically sample using a "Dichotomus Partisol sequential Air Sampler" equivalent sample (EQPS-0509-179, EQPS-0509-180, EQPS-0311-198) as per U.S. EPA Reference Method RFPS-0694-098, fitted with a PM10 inlet. The particulate matter is determined gravimetrically. Three formulas are required for the mass concentration (um/M3) computation of fine PM (PM-2.5) Course PM (PM-10 minus PM2.5) and PM-10.			
PART-PM2.5-VA	Filter	Total Particulate (PM2.5) by Gravimetric	BCMOE METHOD
Total Particulate Matter (PM2.5) Method analysis is carried out in accordance with the BCMOE Lab Manual, Section G Air Constituents - Inorganics, "Total Particulate - PM10/PM02 - 47mm - HiVol" method. ALS provides pre-weighed filters (Pallflex TX40 HI20-WW 47mm) and clients typically sample using a "Partisol Model 2000 Air Sampler" as per U.S. EPA Reference Method RFPS-0694-098, fitted with a PM2.5 inlet. The particulate matter is determined gravimetrically.			
PART-T-WCB-VA	Filter	Total Particulate (WCB) Gravimetric	WCB METHOD
These parameters are determined using procedures adapted from WCB method 1150 "Particulate (Total) in Air", NIOSH method 0500 "Particulates Not Otherwise Regulated, Total", and NIOSH method 0600 "Particulates Not Otherwise Regulated, Respirable". A membrane filter is desiccated and weighed before and after sample collection on a five-place analytical balance. The difference between the weights is reported either as total particulate or respirable dust, depending upon the sample collection technique used.			

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

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
VA	ALS ENVIRONMENTAL - VANCOUVER, BRITISH COLUMBIA, CANADA

Chain of Custody Numbers:

17-812134

GLOSSARY OF REPORT TERMS

Surrogate - A compound that is similar in behaviour to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.

mg/kg - milligrams per kilogram based on dry weight of sample.

mg/kg wwt - milligrams per kilogram based on wet weight of sample.

mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight of sample.

mg/L - milligrams per litre.

< - Less than.

D.L. - The reported Detection Limit, also known as the Limit of Reporting (LOR).

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.

Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.



www.alsglobal.com

Chain of Custody (COC) / Analytical
Request Form

Canada Toll Free: 1 800 668 9878



L2215988-COFC

COC Number: 17-812134

Page 1 of

2

Report To Contact and company name below will appear on the final report		Report Format / Distribution		Select Service Level Below - Contact your AM to confirm all E&P TATs (surcharges may apply)																																																																																																								
Company:	ERM	Select Report Format:	☒ PDF ☒ EXCEL ☐ EDD (DIGITAL)	Regular [R] ☒ Standard TAT if received by 3 pm - business days - no surcharges apply																																																																																																								
Contact:	Daniel Casanova	Quality Control (QC) Report with Report	☐ YES ☐ NO	Emergency [E] ☐ 1 Business day [E - 100%]																																																																																																								
Phone:	250-877-7838	☐ Compare Results to Criteria on Report - provide details below if box checked		Same Day, Weekend or Statutory holiday [E2 - 200%] (Laboratory opening fees may apply) ☐																																																																																																								
Company address below will appear on the final report		Select Distribution:	☒ EMAIL ☐ MAIL ☐ FAX	Date and Time Required for all E&P TATs: dd-mmm-yy hh:mm																																																																																																								
Street:	3790 Alfred Ave	Email 1 or Fax:	daniel.casanova@erm.com	For tests that can not be performed according to the service level selected, you will be contacted.																																																																																																								
City/Province:	Smithers, BC	Email 2:	talaat.bakri@erm.com	Analysis Request																																																																																																								
Postal Code:	V0J 2N0	Email 3:	andres.soux@erm.com	Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below																																																																																																								
Invoice To	Same as Report To ☒ YES ☐ NO	Invoice Distribution		<table border="1"> <tr> <td rowspan="10">NUMBER OF CONTAINERS</td> <td colspan="10"></td> <td rowspan="10">SAMPLES ON HOLD</td> <td rowspan="10">SUSPECTED HAZARD (see Special Instructions)</td> </tr> <tr> <td>PM2.5 Mass</td> <td>PM2.5 Concentration</td> <td>PMcoarse Mass</td> <td>PMcoarse Concentration</td> <td>PM10 Mass</td> <td>PM10 Concentration</td> <td colspan="4"></td> </tr> <tr><td></td><td></td><td></td><td></td><td></td><td></td><td colspan="4"></td></tr> <tr><td></td><td></td><td></td><td></td><td></td><td></td><td colspan="4"></td></tr> <tr><td></td><td></td><td></td><td></td><td></td><td></td><td colspan="4"></td></tr> <tr><td></td><td></td><td></td><td></td><td></td><td></td><td colspan="4"></td></tr> <tr><td></td><td></td><td></td><td></td><td></td><td></td><td colspan="4"></td></tr> <tr><td></td><td></td><td></td><td></td><td></td><td></td><td colspan="4"></td></tr> <tr><td></td><td></td><td></td><td></td><td></td><td></td><td colspan="4"></td></tr> <tr><td></td><td></td><td></td><td></td><td></td><td></td><td colspan="4"></td></tr> </table>		NUMBER OF CONTAINERS											SAMPLES ON HOLD	SUSPECTED HAZARD (see Special Instructions)	PM2.5 Mass	PM2.5 Concentration	PMcoarse Mass	PMcoarse Concentration	PM10 Mass	PM10 Concentration																																																																																				
NUMBER OF CONTAINERS											SAMPLES ON HOLD	SUSPECTED HAZARD (see Special Instructions)																																																																																																
	PM2.5 Mass	PM2.5 Concentration	PMcoarse Mass				PMcoarse Concentration	PM10 Mass	PM10 Concentration																																																																																																			
Copy of Invoice with Report ☐ YES ☒ NO		Select Invoice Distribution: ☒ EMAIL ☐ MAIL ☐ FAX																																																																																																										
Company:		Email 1 or Fax: korina.houghton@erm.com																																																																																																										
Contact:		Email 2: daniel.casanova@erm.com																																																																																																										
Project Information		Oil and Gas Required Fields (client use)																																																																																																										
ALS Account # / Quote #:		AFE/Cost Center: PO#																																																																																																										
Job #: 0403488-0103-0002		Major/Minor Code: Routing Code:																																																																																																										
PO / AFE:		Requisitioner:																																																																																																										
LSD:		Location:																																																																																																										
ALS Lab Work Order # (lab use only):		ALS Contact: Amber Springer	Sampler: Daniel Casanova																																																																																																									
ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type																																																																																																								
	65090	28-Nov-18	0:00	Air Particulate	1	R R																																																																																																						
	65088	29-Nov-18	0:00	Air Particulate	1	R R																																																																																																						
	65086	1-Dec-18	0:00	Air Particulate	1	R R																																																																																																						
	66741	4-Dec-18	0:00	Air Particulate	1	R R																																																																																																						
	66754	7-Dec-18	0:00	Air Particulate	1	R R																																																																																																						
	66758	10-Dec-18	0:00	Air Particulate	1	R R																																																																																																						
	66752	13-Dec-18	0:00	Air Particulate	1	R R																																																																																																						
	66753	16-Dec-18	0:00	Air Particulate	1	R R																																																																																																						
	66740	19-Dec-18	0:00	Air Particulate	1	R R																																																																																																						
Drinking Water (DW) Samples¹ (client use)		Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)		SAMPLE CONDITION AS RECEIVED (lab use only)																																																																																																								
Are samples taken from a Regulated DW System? ☐ YES ☐ NO		Report PMcoarse mass Sample date/time represents start date/time. See attached information sheet for pre-weights of different bottle orders, and sampling volume. Refill all cassettes (including empty cassettes) with new pre-weighed filters and ship back.		Frozen ☐ SIF Observations Yes ☐ No ☐																																																																																																								
Are samples for human consumption/ use? ☐ YES ☐ NO				Ice Packs ☐ Ice Cubes ☐ Custody seal intact Yes ☐ No ☐																																																																																																								
				Cooling Initiated ☐																																																																																																								
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SHIPMENT RELEASE (client use)		INITIAL SHIPMENT RECEPTION (lab use only)		FINAL SHIPMENT RECEPTION (lab use only)																																																																																																								
Released by:	Date:	Time:	Received by:	Date:	Time:	Received by:																																																																																																						
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REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

WHITE - LABORATORY COPY YELLOW - CLIENT COPY

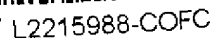
Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

1. If any water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC form.

NOV 2018 FROST



Canada Toll Free: 1 800 668 9878



COC Number: 17-812134

Page 2 of 2

[illegible]

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

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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.

1. If any water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC form.

NOV 2018 FROM

Scan to COA and COC

NOTE: Filters came from 2 different bottle orders and FilterIDs may overlap.

Sampling order	CassetteID	FilterID (from ALS)	PM Type	from ALS Bottle Order Number	Start_Date actual	Start_Time act	Stop_Date actual	Stop_Time act	Total Sample time	Volume of air sampled (Actual Volume; m ³)	Volume of air sampled (Actual Volume; Litres)	Blank Sample?
1	65090	22	PM2.5	BR221278	28-Nov-18	0:00	28-Nov-18	23:59	23:59	21.6	21600	No
2	65088	21	PM2.5	BR221278	29-Nov-18	0:00	29-Nov-18	0:00	0:00	0.0	0	Yes
3	65086	23	PM2.5	BR221278	1-Dec-18	0:00	2-Dec-18	0:00	24:00:00	21.6	21600	No
4	66741	17	PM2.5	BR228744	4-Dec-18	0:00	5-Dec-18	0:00	24:00:00	21.6	21600	No
5	66754	16	PM2.5	BR228744	7-Dec-18	0:00	8-Dec-18	0:00	24:00:00	21.6	21600	No
6	66758	18	PM2.5	BR228744	10-Dec-18	0:00	11-Dec-18	0:00	24:00:00	21.6	21600	No
7	66752	19	PM2.5	BR228744	13-Dec-18	0:00	14-Dec-18	0:00	24:00:00	21.6	21600	No
8	66753	20	PM2.5	BR228744	16-Dec-18	0:00	17-Dec-18	0:00	24:00:00	21.6	21600	No
9	66740	21	PM2.5	BR228744	19-Dec-18	0:00	20-Dec-18	0:00	24:00:00	21.6	21600	No
1	65074	37	PMcoarse	BR221278	28-Nov-18	0:00	28-Nov-18	23:59	23:59	2.4	2400	No
2	65072	38	PMcoarse	BR221278	29-Nov-18	0:00	29-Nov-18	0:00	0:00	0	0	Yes
3	65071	39	PMcoarse	BR221278	1-Dec-18	0:00	2-Dec-18	0:00	24:00:00	2.41	2410	No
4	66757	27	PMcoarse	BR228744	4-Dec-18	0:00	5-Dec-18	0:00	24:00:00	2.41	2410	No
5	66739	26	PMcoarse	BR228744	7-Dec-18	0:00	8-Dec-18	0:00	24:00:00	2.41	2410	No
6	66755	25	PMcoarse	BR228744	10-Dec-18	0:00	11-Dec-18	0:00	24:00:00	2.41	2410	No
7	65046	24	PMcoarse	BR228744	13-Dec-18	0:00	14-Dec-18	0:00	24:00:00	2.41	2410	No
8	65045	23	PMcoarse	BR228744	16-Dec-18	0:00	17-Dec-18	0:00	24:00:00	2.41	2410	No
9	66746	22	PMcoarse	BR228744	19-Dec-18	0:00	20-Dec-18	0:00	24:00:00	2.41	2410	No

Pre-weight information from ALS

from ALS Bottle Order Number	FILTER ID	Pre-Weight Date	ALS Analyst	Weight 1 (mg)	Weight 2 (mg)	Weight 3 (mg)	Average of pre-weights (mg)
BR221278	#22	2-Aug-18	NL	81.79	81.77	81.78	81.7800000
BR221278	#21	2-Aug-18	NL	82.25	82.27	82.25	82.2566667
BR221278	#23	2-Aug-18	NL	81.98	81.99	81.99	81.9866667
BR221278	#37	2-Aug-18	NL	82.99	82.97	82.98	82.9800000
BR221278	#38	2-Aug-18	NL	82.19	82.21	82.2	82.2000000
BR221278	#39	2-Aug-18	NL	82.28	82.3	82.28	82.2866667
BR228744	17	18-Oct-22	CM	82.01	81.99	81.99	81.9966667
BR228744	16	18-Oct-22	CM	81.61	81.64	81.61	81.6200000
BR228744	18	18-Oct-22	CM	81.91	81.89	81.89	81.8966667
BR228744	19	18-Oct-22	CM	81.61	81.62	81.64	81.6233333
BR228744	20	18-Oct-22	CM	82.12	82.11	82.14	82.1233333
BR228744	21	18-Oct-22	CM	82.05	82.07	82.05	82.0566667
BR228744	27	18-Oct-22	CM	81.39	81.36	81.38	81.3766667
BR228744	26	18-Oct-22	CM	81.3	81.3	81.3	81.3000000
BR228744	25	18-Oct-22	CM	81.49	81.49	81.47	81.4833333
BR228744	24	18-Oct-22	CM	81.31	81.29	81.29	81.2966667
BR228744	23	18-Oct-22	CM	81.5	81.47	81.47	81.4800000
BR228744	22	18-Oct-22	CM	81.57	81.55	81.55	81.5566667



L2215988-COFC



ERM Consultants Canada Ltd.
ATTN: Daniel Casanova
1500-1111 West Hastings Street
Vancouver BC V6E 2J3

Date Received: 30-JAN-19
Report Date: 08-FEB-19 11:20 (MT)
Version: FINAL

Client Phone: 604-689-9460

Certificate of Analysis

Lab Work Order #: L2226619
Project P.O. #: NOT SUBMITTED
Job Reference: 0403488-0103-0002
C of C Numbers: 17-810255
Legal Site Desc:

Amber Springer, B.Sc
Account Manager

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ADDRESS: 8081 Lougheed Hwy, Suite 100, Burnaby, BC V5A 1W9 Canada | Phone: +1 604 253 4188 | Fax: +1 604 253 6700
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ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID Description Sampled Date Sampled Time Client ID		L2226619-1 Air Particulate 22-DEC-18 65089	L2226619-2 Air Particulate 23-DEC-18 65047	L2226619-3 Air Particulate 25-DEC-18 65041	L2226619-4 Air Particulate 28-DEC-18 65052	L2226619-5 Air Particulate 31-DEC-18 65076
Grouping	Analyte					
FILTER						
Particulates	Particulate - PM2.5 (ug)	<50	<50	<50	<50	50
	Particulate - PM2.5 (ug/m3)	<2.3		<2.3	<2.3	2.3
	Particulate-Fine (ug/m3)					
	Particulate-Coarse (ug)					
	Particulate-Coarse (ug/m3)					
	Particulate-PM10 (ug/m3)					

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID Description Sampled Date Sampled Time Client ID		L2226619-6 Air Particulate 03-JAN-19 65081	L2226619-7 Air Particulate 06-JAN-19 65085	L2226619-8 Air Particulate 09-JAN-19 65042	L2226619-9 Air Particulate 12-JAN-19 65087	L2226619-10 Air Particulate 15-JAN-19 65082
Grouping	Analyte					
FILTER						
Particulates	Particulate - PM2.5 (ug)	57	87	<50	<50	60
	Particulate - PM2.5 (ug/m3)	2.6	4.0	<2.3	<2.3	2.8
	Particulate-Fine (ug/m3)					
	Particulate-Coarse (ug)					
	Particulate-Coarse (ug/m3)					
	Particulate-PM10 (ug/m3)					

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID Description Sampled Date Sampled Time Client ID		L2226619-11 Air Particulate 18-JAN-19 65043	L2226619-12 Air Particulate 21-JAN-19 65079	L2226619-13 Air Particulate 22-DEC-18 65070	L2226619-14 Air Particulate 23-DEC-18 65051	L2226619-15 Air Particulate 25-DEC-18 66742
Grouping	Analyte					
FILTER						
Particulates	Particulate - PM2.5 (ug)	60	<50			
	Particulate - PM2.5 (ug/m3)	2.8	<2.3			
	Particulate-Fine (ug/m3)			<2.3		<2.3
	Particulate-Coarse (ug)			<50	<50	<50
	Particulate-Coarse (ug/m3)			<-0.019		<0.013
	Particulate-PM10 (ug/m3)			<2.3		<2.3

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID Description Sampled Date Sampled Time Client ID		L2226619-16 Air Particulate 28-DEC-18 65068	L2226619-17 Air Particulate 31-DEC-18 65049	L2226619-18 Air Particulate 03-JAN-19 65066	L2226619-19 Air Particulate 06-JAN-19 65050	L2226619-20 Air Particulate 09-JAN-19 65044
Grouping	Analyte					
FILTER						
Particulates	Particulate - PM2.5 (ug)					
	Particulate - PM2.5 (ug/m3)					
	Particulate-Fine (ug/m3)	<2.3	2.3	2.6	4.0	<2.3
	Particulate-Coarse (ug)	<50	<50	<50	<50	<50
	Particulate-Coarse (ug/m3)	<0.0043	<0.033	<0.037	<0.056	<0.024
	Particulate-PM10 (ug/m3)	<2.3	<2.3	2.6	3.5	<2.3

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID Description Sampled Date Sampled Time Client ID		L2226619-21 Air Particulate 12-JAN-19 66743	L2226619-22 Air Particulate 15-JAN-19 65062	L2226619-23 Air Particulate 18-JAN-19 67449	L2226619-24 Air Particulate 21-JAN-19 66745	
Grouping	Analyte					
FILTER						
Particulates	Particulate - PM2.5 (ug)					
	Particulate - PM2.5 (ug/m3)					
	Particulate-Fine (ug/m3)	<2.3	2.8	2.8	<2.3	
	Particulate-Coarse (ug)	<50	<50	<50	<50	
	Particulate-Coarse (ug/m3)	<-0.0087	0.276	<2.1	<2.1	
	Particulate-PM10 (ug/m3)	<2.3	3.1	<3.1	<3.1	

		Sample ID Description Sampled Date Sampled Time Client ID	L2226619-1 Air Particulate 22-DEC-18 65089	L2226619-3 Air Particulate 25-DEC-18 65041	L2226619-4 Air Particulate 28-DEC-18 65052	L2226619-5 Air Particulate 31-DEC-18 65076	L2226619-6 Air Particulate 03-JAN-19 65081
Grouping	Analyte						
MISC.							
Field Tests	Air Volume, Client Supplied (L)		21600	21600	21600	21600	21600

		Sample ID	Description	Sampled Date	Sampled Time	Client ID
		L2226619-7	Air Particulate	06-JAN-19		65085
		L2226619-8	Air Particulate	09-JAN-19		65042
		L2226619-9	Air Particulate	12-JAN-19		65087
		L2226619-10	Air Particulate	15-JAN-19		65082
		L2226619-11	Air Particulate	18-JAN-19		65043
Grouping	Analyte					
MISC.						
Field Tests	Air Volume, Client Supplied (L)	21600	21600	21600	21600	21600

		Sample ID Description Sampled Date Sampled Time Client ID	L2226619-12 Air Particulate 21-JAN-19 65079	L2226619-13 Air Particulate 22-DEC-18 65070	L2226619-15 Air Particulate 25-DEC-18 66742	L2226619-16 Air Particulate 28-DEC-18 65068	L2226619-17 Air Particulate 31-DEC-18 65049
Grouping	Analyte						
MISC.							
Field Tests	Air Volume, Client Supplied (L)		21600	2400	2410	2400	2410

		Sample ID	L2226619-18	L2226619-19	L2226619-20	L2226619-21	L2226619-22
		Description	Air Particulate	Air Particulate	Air Particulate	Air Particulate	Air Particulate
		Sampled Date	03-JAN-19	06-JAN-19	09-JAN-19	12-JAN-19	15-JAN-19
		Sampled Time					
		Client ID	65066	65050	65044	66743	65062
Grouping	Analyte						
MISC.							
Field Tests	Air Volume, Client Supplied (L)		2410	2410	2410	2410	2410

		Sample ID Description Sampled Date Sampled Time Client ID	L2226619-23 Air Particulate 18-JAN-19 67449	L2226619-24 Air Particulate 21-JAN-19 66745			
Grouping	Analyte						
MISC.							
Field Tests	Air Volume, Client Supplied (L)		2410	2410			

Reference Information

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
AIR VOLUME-VA	Misc.	Air volume (L)	HYGIENE METHOD
PART-DICHOT-PM10-VA	Filter	Total Particulate (Dichot-PM10) by Grav.	BCMOE Method
Total Particulate Matter (PM10) Method analysis is carried out in accordance with the BCMOE Lab Manual, Section G Air Constituents - Inorganics, "Total Particulate - PM10/PM02 - 47mm - HiVol" method. ALS provides pre-weighed filters (Pallflex TX40 HI20-WW 47mm) and clients typically sample using a "Dichotomus Partisol sequential Air Sampler" equivalent sample (EQPS-0509-179, EQPS-0509-180, EQPS-0311-198) as per U.S. EPA Reference Method RFPS-0694-098, fitted with a PM10 inlet. The particulate matter is determined gravimetrically. Three formulas are required for the mass concentration (um/M3) computation of fine PM (PM-2.5) Course PM (PM-10 minus PM2.5) and PM-10.			
PART-PM2.5-VA	Filter	Total Particulate (PM2.5) by Gravimetric	BCMOE METHOD
Total Particulate Matter (PM2.5) Method analysis is carried out in accordance with the BCMOE Lab Manual, Section G Air Constituents - Inorganics, "Total Particulate - PM10/PM02 - 47mm - HiVol" method. ALS provides pre-weighed filters (Pallflex TX40 HI20-WW 47mm) and clients typically sample using a "Partisol Model 2000 Air Sampler" as per U.S. EPA Reference Method RFPS-0694-098, fitted with a PM2.5 inlet. The particulate matter is determined gravimetrically.			

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

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
VA	ALS ENVIRONMENTAL - VANCOUVER, BRITISH COLUMBIA, CANADA

Chain of Custody Numbers:

17-810255

GLOSSARY OF REPORT TERMS

Surrogate - A compound that is similar in behaviour to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.

mg/kg - milligrams per kilogram based on dry weight of sample.

mg/kg wwt - milligrams per kilogram based on wet weight of sample.

mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight of sample.

mg/L - milligrams per litre.

< - Less than.

D.L. - The reported Detection Limit, also known as the Limit of Reporting (LOR).

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.

Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.



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Chain of Custody (COC) / Analytical
Request Form

Canada Toll Free: 1 800 668 9878



L2226619-COFC

COC Number: 17-810255

Page 1 of

2

Report To		Contact and company name below will appear on the final report		Report Format / Distribution		Select Report Format		Contact your AM to confirm all E&P TATs (surcharges may apply)	
Company:	ERM	Select Report Format:	☒ PDF ☒ EXCEL ☐ EDD (DIGITAL)	Regular [R] ☒ Standard TAT if received by 3 pm - business days - no surcharges apply		4 day [P4-20%] ☐		1 Business day [E - 100%] ☐	
Contact:	Daniel Casanova	Quality Control (QC) Report with Report	☐ YES ☐ NO	3 day [P3-25%] ☐		2 day [P2-50%] ☐		Same Day, Weekend or Statutory holiday [E2 - 200% (Laboratory opening fees may apply)] ☐	
Phone:	250-877-7838	☐ Compare Results to Criteria on Report - provide details below if box checked		Select Distribution:		☒ EMAIL ☐ MAIL ☐ FAX		Date and Time Required for all E&P TATs: dd-mmm-yy hh:mm	
Company address below will appear on the final report		Email 1 or Fax daniel.casanova@erm.com		Email 2 talaat.bakri@erm.com		Email 3 andres.soux@erm.com		For tests that can not be performed according to the service level selected, you will be contacted.	
Street:	3790 Alfred Ave	Invoice Distribution		Select Invoice Distribution:		☒ EMAIL ☐ MAIL ☐ FAX		Analysis Request	
City/Province:	Smithers, BC	Email 1 or Fax korina.houghton@erm.com		Email 2 daniel.casanova@erm.com		Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below		SAMPLES ON HOLD	
Postal Code:	V0J 2N0	Oil and Gas Required Fields (client use)		AFE/Cost Center:		PO#		SUSPECTED HAZARD (see Special Instructions)	
Invoice To	Same as Report To ☒ YES ☐ NO	Copy of Invoice with Report ☐ YES ☒ NO		Major/Minor Code:		Routing Code:			
Company:		Requisitioner:		Location:					
Contact:		ALS Lab Work Order # (lab use only):		ALS Contact: Amber Springer		Sampler: Daniel Casanova			
Project Information		ALS Account # / Quote #:		Job #:		PO / AFE:		LSD:	
Sample Identification and/or Coordinates (This description will appear on the report)		Date (dd-mmm-yy)		Time (hh:mm)		Sample Type			
ALS Sample # (lab use only)									
1	65089	22-Dec-18		0:00		Air Particulate		1 R R	
2	65047	23-Dec-18		0:00		Air Particulate		1 R R	
3	65041	25-Dec-18		0:00		Air Particulate		1 R R	
4	65052	28-Dec-18		0:00		Air Particulate		1 R R	
5	65076	31-Dec-18		0:00		Air Particulate		1 R R	
6	65081	3-Jan-19		0:00		Air Particulate		1 R R	
7	65085	6-Jan-19		0:00		Air Particulate		1 R R	
8	65042	9-Jan-19		0:00		Air Particulate		1 R R	
9	65087	12-Jan-19		0:00		Air Particulate		1 R R	
10	65082	15-Jan-19		0:00		Air Particulate		1 R R	
11	65043	18-Jan-19		0:00		Air Particulate		1 R R	
12	65079	21-Jan-19		0:00		Air Particulate		1 R R	
Drinking Water (DW) Samples ¹ (client use)		Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)		SAMPLE CONDITION AS RECEIVED (lab use only)		Frozen ☐ SIF Observations Yes ☐ No ☐		Ice Packs ☐ Ice Cubes ☐ Custody seal intact Yes ☐ No ☐	
Are samples taken from a Regulated DW System? ☐ YES ☐ NO		Are samples for human consumption/ use? ☐ YES ☐ NO		Sample date/time represents start date/time. See attached information sheet for pre-weights of different bottle orders, and sampling volume. Refill all cassettes (including empty cassettes) with new pre-weighed filters and ship back		Cooling Initiated ☐		INITIAL COOLER TEMPERATURES °C	
								FINAL COOLER TEMPERATURES °C	
								8.4°C	
SHIPMENT RELEASE (client use)		INITIAL SHIPMENT RECEPTION (lab use only)		FINAL SHIPMENT RECEPTION (lab use only)		Received by: 22		Date: Jan 30, 2019	
Released by:		Date:		Time:		Received by:		Time: 10:40am	

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

WHITE - LABORATORY COPY

YELLOW - CLIENT COPY

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.

1. If any water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC form.

NOV 2015 FRONT

B



L2226619-COFC

Sampling order	CassetteID	FilterID	PM Type	from ALS	Start_Date_ actual	Start_Ti me_act	Stop_Date_ actual	Stop_Time _act	Total_Sa mple_tim e	Volume of	Volume of	Blank Sample?
		(from ALS)		Bottle Order Number						(Actual Volume; m^3)	(Actual Volume; Litres)	
1	65089	n/a	PM2.5	BR232330	22-Dec-18	0:00	23-Dec-18	0:00	23:59	21.6	21600	No
2	65047	n/a	PM2.5	BR232330	23-Dec-18	0:00	23-Dec-18	0:00	0:00:00	0.00	0	Yes
3	65041	n/a	PM2.5	BR232330	25-Dec-18	0:00	26-Dec-18	0:00	24:00:00	21.6	21600	No
4	65052	n/a	PM2.5	BR232330	28-Dec-18	0:00	29-Dec-18	0:00	24:00:00	21.6	21600	No
5	65076	n/a	PM2.5	BR232330	31-Dec-18	0:00	1-Jan-19	0:00	24:00:00	21.6	21600	No
6	65081	n/a	PM2.5	BR232330	3-Jan-19	0:00	4-Jan-19	0:00	24:00:00	21.6	21600	No
7	65085	n/a	PM2.5	BR232330	6-Jan-19	0:00	7-Jan-19	0:00	24:00:00	21.6	21600	No
8	65042	n/a	PM2.5	BR232330	9-Jan-19	0:00	10-Jan-19	0:00	24:00:00	21.6	21600	No
9	65087	n/a	PM2.5	BR232330	12-Jan-19	0:00	13-Jan-19	0:00	24:00:00	21.6	21600	No
10	65082	n/a	PM2.5	BR232330	15-Jan-19	0:00	16-Jan-19	0:00	24:00:00	21.6	21600	No
11	65043	n/a	PM2.5	BR232330	18-Jan-19	0:00	19-Jan-19	0:00	24:00:00	21.6	21600	No
12	65079	n/a	PM2.5	BR232330	21-Jan-19	0:00	22-Jan-19	0:00	24:00:00	21.6	21600	No
1	65070	n/a	PMcoarse	BR232330	22-Dec-18	0:00	23-Dec-18	0:00	23:59	2.4	2400	No
2	65051	n/a	PMcoarse	BR232330	23-Dec-18	0:00	23-Dec-18	0:00	0:00	0	0	Yes
3	66742	n/a	PMcoarse	BR232330	25-Dec-18	0:00	26-Dec-18	0:00	24:00:00	2.41	2410	No
4	65068	n/a	PMcoarse	BR232330	28-Dec-18	0:00	29-Dec-18	0:00	24:00:00	2.4	2400	No
5	65049	n/a	PMcoarse	BR232330	31-Dec-18	0:00	1-Jan-19	0:00	24:00:00	2.41	2410	No
6	65066	n/a	PMcoarse	BR232330	3-Jan-19	0:00	4-Jan-19	0:00	24:00:00	2.41	2410	No
7	65050	n/a	PMcoarse	BR232330	6-Jan-19	0:00	7-Jan-19	0:00	24:00:00	2.41	2410	No
8	65044	n/a	PMcoarse	BR232330	9-Jan-19	0:00	10-Jan-19	0:00	24:00:00	2.41	2410	No
9	66743	n/a	PMcoarse	BR232330	12-Jan-19	0:00	13-Jan-19	0:00	24:00:00	2.41	2410	No
10	65062	n/a	PMcoarse	BR232330	15-Jan-19	0:00	16-Jan-19	0:00	24:00:00	2.41	2410	No
11	67449	n/a	PMcoarse	BR232330	18-Jan-19	0:00	19-Jan-19	0:00	24:00:00	2.41	2410	No
12	66745	n/a	PMcoarse	BR232330	21-Jan-19	0:00	22-Jan-19	0:00	24:00:00	2.41	2410	No



ERM Consultants Canada Ltd.
ATTN: Daniel Casanova
1500-1111 West Hastings Street
Vancouver BC V6E 2J3

Date Received: 04-MAR-19
Report Date: 13-MAR-19 10:43 (MT)
Version: FINAL

Client Phone: 604-689-9460

Certificate of Analysis

Lab Work Order #: L2239419
Project P.O. #: NOT SUBMITTED
Job Reference: TENAS; 0403488-0103-0002
C of C Numbers: 17-826850
Legal Site Desc:

Amber Springer, B.Sc
Account Manager

[This report shall not be reproduced except in full without the written authority of the Laboratory.]

ADDRESS: 8081 Lougheed Hwy, Suite 100, Burnaby, BC V5A 1W9 Canada | Phone: +1 604 253 4188 | Fax: +1 604 253 6700
ALS CANADA LTD Part of the ALS Group An ALS Limited Company

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID Description Sampled Date Sampled Time Client ID		L2239419-1 Air Particulate 27-JAN-19 65075	L2239419-2 Air Particulate 65077	L2239419-3 Air Particulate 65080	L2239419-4 Air Particulate 30-JAN-19 65078	L2239419-5 Air Particulate 02-FEB-19 65048
Grouping	Analyte					
FILTER						
Particulates	Particulate - PM2.5 (ug)	<50	<50	<50	117	<50
	Particulate - PM2.5 (ug/m3)	<2.3			5.4	<2.3
	Particulate-Fine (ug/m3)					
	Particulate-Coarse (ug)					
	Particulate-Coarse (ug/m3)					
	Particulate-PM10 (ug/m3)					

ALS ENVIRONMENTAL ANALYTICAL REPORT

		Sample ID	L2239419-6	L2239419-7	L2239419-8	L2239419-9	L2239419-10
		Description	Air Particulate	Air Particulate	Air Particulate	Air Particulate	Air Particulate
		Sampled Date	05-FEB-19	08-FEB-19	11-FEB-19	14-FEB-19	17-FEB-19
		Sampled Time					
		Client ID	66751	65063	66752	66753	66758
Grouping	Analyte						
FILTER							
Particulates	Particulate - PM2.5 (ug)	50	<50	<50	<50	<50	
	Particulate - PM2.5 (ug/m3)	2.3	<2.3	<2.3	<2.3	<2.3	
	Particulate-Fine (ug/m3)						
	Particulate-Coarse (ug)						
	Particulate-Coarse (ug/m3)						
	Particulate-PM10 (ug/m3)						

ALS ENVIRONMENTAL ANALYTICAL REPORT

		Sample ID Description Sampled Date Sampled Time Client ID	L2239419-11 Air Particulate 20-FEB-19 66754	L2239419-12 Air Particulate 23-FEB-19 66740	L2239419-13 Air Particulate 26-FEB-19 66741	L2239419-14 Air Particulate 27-JAN-19 66747	L2239419-15 Air Particulate 65067
Grouping	Analyte						
FILTER							
Particulates	Particulate - PM2.5 (ug)		80	<50	<50		
	Particulate - PM2.5 (ug/m3)		3.7	<2.3	<2.3		
	Particulate-Fine (ug/m3)					<2.3	
	Particulate-Coarse (ug)					<50	<50
	Particulate-Coarse (ug/m3)					<-0.12	
	Particulate-PM10 (ug/m3)					<2.3	

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID Description Sampled Date Sampled Time Client ID		L2239419-16 Air Particulate 66744	L2239419-17 Air Particulate 30-JAN-19 65065	L2239419-18 Air Particulate 02-FEB-19 66748	L2239419-19 Air Particulate 05-FEB-19 65061	L2239419-20 Air Particulate 08-FEB-19 66750
Grouping	Analyte					
FILTER						
Particulates	Particulate - PM2.5 (ug)					
	Particulate - PM2.5 (ug/m3)					
	Particulate-Fine (ug/m3)					
	Particulate-Coarse (ug)					
	Particulate-Coarse (ug/m3)					
	Particulate-PM10 (ug/m3)					
		<50	5.4	<2.3	2.3	<2.3
		<50	<50	<50	<50	<50
			0.569	<0.017	<0.033	0.355
			6.0	<2.3	<2.3	<2.3

ALS ENVIRONMENTAL ANALYTICAL REPORT

		Sample ID	L2239419-21	L2239419-22	L2239419-23	L2239419-24	L2239419-25
		Description	Air Particulate	Air Particulate	Air Particulate	Air Particulate	Air Particulate
		Sampled Date	11-FEB-19	14-FEB-19	17-FEB-19	20-FEB-19	23-FEB-19
		Sampled Time					
		Client ID	66739	65045	66755	65046	66746
Grouping	Analyte						
FILTER							
Particulates	Particulate - PM2.5 (ug)						
	Particulate - PM2.5 (ug/m3)						
	Particulate-Fine (ug/m3)		<2.3	<2.3	<2.3	3.7	<2.3
	Particulate-Coarse (ug)		<50	<50	<50	<50	<50
	Particulate-Coarse (ug/m3)		<0.0087	0.3	<0.017	<2.1	<2.1
	Particulate-PM10 (ug/m3)		<2.3	<2.3	<2.3	<3.1	<3.1

ALS ENVIRONMENTAL ANALYTICAL REPORT

		Sample ID Description Sampled Date Sampled Time Client ID	L2239419-26 Air Particulate 26-FEB-19 65071				
Grouping	Analyte						
FILTER							
Particulates	Particulate - PM2.5 (ug)						
	Particulate - PM2.5 (ug/m3)						
	Particulate-Fine (ug/m3)	<2.3					
	Particulate-Coarse (ug)	<50					
	Particulate-Coarse (ug/m3)	<2.1					
	Particulate-PM10 (ug/m3)	<3.1					

		Sample ID Description Sampled Date Sampled Time Client ID	L2239419-1 Air Particulate 27-JAN-19 65075	L2239419-4 Air Particulate 30-JAN-19 65078	L2239419-5 Air Particulate 02-FEB-19 65048	L2239419-6 Air Particulate 05-FEB-19 66751	L2239419-7 Air Particulate 08-FEB-19 65063
Grouping	Analyte						
MISC.							
Field Tests	Air Volume, Client Supplied (L)		21600	21600	21600	21600	21600

		Sample ID Description Sampled Date Sampled Time Client ID	L2239419-8 Air Particulate 11-FEB-19 66752	L2239419-9 Air Particulate 14-FEB-19 66753	L2239419-10 Air Particulate 17-FEB-19 66758	L2239419-11 Air Particulate 20-FEB-19 66754	L2239419-12 Air Particulate 23-FEB-19 66740
Grouping	Analyte						
MISC.							
Field Tests	Air Volume, Client Supplied (L)		21600	21600	21600	21600	21600

[illegible]

Sample ID Description Sampled Date Sampled Time Client ID		L2239419-20 Air Particulate 08-FEB-19 66750	L2239419-21 Air Particulate 11-FEB-19 66739	L2239419-22 Air Particulate 14-FEB-19 65045	L2239419-23 Air Particulate 17-FEB-19 66755	L2239419-24 Air Particulate 20-FEB-19 65046
Grouping	Analyte					
MISC.						
Field Tests	Air Volume, Client Supplied (L)	2410	2410	2410	2410	2410

[illegible]

Reference Information

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
AIR VOLUME-VA	Misc.	Air volume (L)	HYGIENE METHOD
PART-DICHOT-PM10-VA	Filter	Total Particulate (Dichot-PM10) by Grav.	BCMOE Method
Total Particulate Matter (PM10) Method analysis is carried out in accordance with the BCMOE Lab Manual, Section G Air Constituents - Inorganics, "Total Particulate - PM10/PM02 - 47mm - HiVol" method. ALS provides pre-weighed filters (Pallflex TX40 HI20-WW 47mm) and clients typically sample using a "Dichotomus Partisol sequential Air Sampler" equivalent sample (EQPS-0509-179, EQPS-0509-180, EQPS-0311-198) as per U.S. EPA Reference Method RFPS-0694-098, fitted with a PM10 inlet. The particulate matter is determined gravimetrically. Three formulas are required for the mass concentration (um/M3) computation of fine PM (PM-2.5) Course PM (PM-10 minus PM2.5) and PM-10.			
PART-PM2.5-VA	Filter	Total Particulate (PM2.5) by Gravimetric	BCMOE METHOD
Total Particulate Matter (PM2.5) Method analysis is carried out in accordance with the BCMOE Lab Manual, Section G Air Constituents - Inorganics, "Total Particulate - PM10/PM02 - 47mm - HiVol" method. ALS provides pre-weighed filters (Pallflex TX40 HI20-WW 47mm) and clients typically sample using a "Partisol Model 2000 Air Sampler" as per U.S. EPA Reference Method RFPS-0694-098, fitted with a PM2.5 inlet. The particulate matter is determined gravimetrically.			

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

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
VA	ALS ENVIRONMENTAL - VANCOUVER, BRITISH COLUMBIA, CANADA

Chain of Custody Numbers:

17-826850

GLOSSARY OF REPORT TERMS

Surrogate - A compound that is similar in behaviour to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.

mg/kg - milligrams per kilogram based on dry weight of sample.

mg/kg wwt - milligrams per kilogram based on wet weight of sample.

mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight of sample.

mg/L - milligrams per litre.

< - Less than.

D.L. - The reported Detection Limit, also known as the Limit of Reporting (LOR).

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.

Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.



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Chain of Custody (COC) / Analytical
Request Form

Canada Toll Free: 1 800 668 9878



L2239419-COFC

COC Number: 17-826850

Page 1 of

3

Report To Contact and company name below will appear on the final report		Report Format / Distribution		Select Service Level Below - Contact your AM to confirm all E&P TATs (surcharges may apply)																					
Company:	ERM	Select Report Format:	☒ PDF ☒ EXCEL ☐ EDD (DIGITAL)	Regular [R] ☒ Standard TAT if received by 3 pm - business days - no surcharges apply																					
Contact:	Daniel Casanova	Quality Control (QC) Report with Report	☐ YES ☐ NO	PRIORITY (Business Days) 4 day [P4-20%] ☐ 3 day [P3-25%] ☐ 2 day [P2-50%] ☐ EMERGENCY 1 Business day [E - 100%] ☐ Same Day, Weekend or Statutory holiday [E2 -200% (Laboratory opening fees may apply)] ☐																					
Phone:	250-877-7838	☐ Compare Results to Criteria on Report - provide details below if box checked																							
Company address below will appear on the final report		Select Distribution:	☒ EMAIL ☐ MAIL ☐ FAX	Date and Time Required for all E&P TATs: dd-mmm-yy hh:mm																					
Street:	3790 Alfred Ave	Email 1 or Fax:	daniel.casanova@erm.com	For tests that can not be performed according to the service level selected, you will be contacted.																					
City/Province:	Smithers, BC	Email 2:	talaat.bakri@erm.com																						
Postal Code:	V0J 2N0	Email 3:	andres.soux@erm.com																						
Invoice To	Same as Report To ☒ YES ☐ NO	Invoice Distribution		Analysis Request																					
Copy of Invoice with Report	☐ YES ☒ NO	Select Invoice Distribution:	☒ EMAIL ☐ MAIL ☐ FAX	Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below																					
Company:		Email 1 or Fax:	korina.houghton@erm.com	NUMBER OF CONTAINERS <table border="1"> <tr> <td>PM2.5 Mass</td> <td>PM2.5 Concentration</td> <td>PM10 Mass</td> <td>PM10 Concentration</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> </table> SAMPLES ON HOLD SUSPECTED HAZARD (see Special Instructions)		PM2.5 Mass	PM2.5 Concentration	PM10 Mass	PM10 Concentration																
PM2.5 Mass	PM2.5 Concentration	PM10 Mass	PM10 Concentration																						
Contact:		Email 2:	daniel.casanova@erm.com																						
Project Information		Oil and Gas Required Fields (client use)																							
ALS Account # / Quote #:		AFE/Cost Center:	PO#																						
Job #:	Tenas, 0403488-0103-0002	Major/Minor Code:	Routing Code:																						
PO / AFE:		Requisitioner:																							
LSD:		Location:																							
ALS Lab Work Order # (lab use only):		ALS Contact:	Amber Springer	Sampler:	Daniel Casanova																				
ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type																					
	65075	27-Jan-19	0:00	Air Particulate	1 R R																				
	65077			Air Particulate	1 R R																				
	65080			Air Particulate	1 R R																				
	65078	30-Jan-19	0:00	Air Particulate	1 R R																				
	65048	2-Feb-19	0:00	Air Particulate	1 R R																				
	66751	5-Feb-19	0:00	Air Particulate	1 R R																				
	65063	8-Feb-19	0:00	Air Particulate	1 R R																				
	66752	11-Feb-19	0:00	Air Particulate	1 R R																				
	66753	14-Feb-19	0:00	Air Particulate	1 R R																				
	66758	17-Feb-19	0:00	Air Particulate	1 R R																				
	66754	20-Feb-19	0:00	Air Particulate	1 R R																				
	66740	23-Feb-19	0:00	Air Particulate	1 R R																				
Drinking Water (DW) Samples¹ (client use)		Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)		SAMPLE CONDITION AS RECEIVED (lab use only)																					
Are samples taken from a Regulated DW System? ☐ YES ☐ NO				Frozen ☐ SIF Observations Yes ☐ No ☐																					
Are samples for human consumption/ use? ☐ YES ☐ NO				Ice Packs ☐ Ice Cubes ☐ Custody seal intact Yes ☐ No ☐																					
		Sample date/time represents STARTING date/time. See attached information sheet for pre-weights of different bottle orders, and sampling volume.		Cooling Initiated ☐																					
				INITIAL COOLER TEMPERATURES °C																					
				8°C																					
SHIPMENT RELEASE (client use)		INITIAL SHIPMENT RECEPTION (lab use only)		FINAL SHIPMENT RECEPTION (lab use only)																					
Released by:	Date:	Time:	Received by:	Date:	Time:																				
Dan Casanova	March 1, 2019			March 4, 2019	11:55am																				

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

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1. If any water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC form.

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Chain of Custody (COC) / Analytical
Request Form

Canada Toll Free: 1 800 668 9878



L2239419-COFC

COC Number: 17-826850

Page 2 of

3

Report To		Contact and company name below will appear on the final report		Report Format / Distribution		Select Service Level Below - Contact your AM to confirm all E&P TATs (surcharges may apply)																																																													
Company:	ERM		Select Report Format: ☒ PDF ☒ EXCEL ☐ EDD (DIGITAL)		Regular ☒ Standard TAT if received by 3 pm - business days - no surcharges apply																																																														
Contact:	Daniel Casanova		Quality Control (QC) Report with Report ☐ YES ☐ NO		4 day [P4-20%] ☐		1 Business day [E - 100%] ☐																																																												
Phone:	250-877-7838		☐ Compare Results to Criteria on Report - provide details below if box checked		3 day [P3-25%] ☐		Same Day, Weekend or Statutory holiday [E2 - 200% (Laboratory opening fees may apply)] ☐																																																												
Company address below will appear on the final report				Select Distribution: ☒ EMAIL ☐ MAIL ☐ FAX		2 day [P2-50%] ☐																																																													
Street:	3790 Alfred Ave		Email 1 or Fax: daniel.casanova@erm.com		Date and Time Required for all E&P TATs:		dd-mmm-yy hh:mm																																																												
City/Province:	Smithers, BC		Email 2: talaat.bakri@erm.com		For tests that can not be performed according to the service level selected, you will be contacted.																																																														
Postal Code:	V0J 2N0		Email 3: andres.soux@erm.com		Analysis Request																																																														
Invoice To	Same as Report To ☒ YES ☐ NO		Invoice Distribution		<table border="1"> <thead> <tr> <th colspan="12">Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below</th> </tr> <tr> <th colspan="12">NUMBER OF CONTAINERS</th> </tr> </thead> <tbody> <tr> <td>PM2.5 Mass</td> <td>PM2.5 Concentration</td> <td>PM10 Concentration</td> <td>PM10 Concentration</td> <td>PM10 Concentration</td> <td>PM10 Concentration</td> <td>PM10 Concentration</td> <td>PM10 Concentration</td> <td>PM10 Concentration</td> <td>PM10 Concentration</td> <td>PM10 Concentration</td> <td>PM10 Concentration</td> </tr> <tr> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> </tbody> </table>			Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below												NUMBER OF CONTAINERS												PM2.5 Mass	PM2.5 Concentration	PM10 Concentration	PM10 Concentration	PM10 Concentration	PM10 Concentration	PM10 Concentration	PM10 Concentration	PM10 Concentration	PM10 Concentration	PM10 Concentration	PM10 Concentration																								
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ALS Lab Work Order # (lab use only):		ALS Contact: Amber Springer		Sampler: Daniel Casanova																																																															
ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)		Date (dd-mmm-yy)	Time (hh:mm)	Sample Type																																																														
66741			26-Feb-19	0:00	Air Particulate																																																														
66747			27-Jan-19	0:00	Air Particulate																																																														
65067					Air Particulate																																																														
66744					Air Particulate																																																														
65065			30-Jan-19	0:00	Air Particulate																																																														
66748			2-Feb-19	0:00	Air Particulate																																																														
65061			5-Feb-19	0:00	Air Particulate																																																														
66750			8-Feb-19	0:00	Air Particulate																																																														
66739			11-Feb-19	0:00	Air Particulate																																																														
65045			14-Feb-19	0:00	Air Particulate																																																														
66755			17-Feb-19	0:00	Air Particulate																																																														
Drinking Water (DW) Samples ¹ (client use)		Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)																																																																	
Are samples taken from a Regulated DW System? ☐ YES ☐ NO		Sample date/time represents STARTING date/time. See attached information sheet for pre-weights of different bottle orders, and sampling volume.																																																																	
Are samples for human consumption/ use? ☐ YES ☐ NO																																																																			
SHIPMENT RELEASE (client use)		INITIAL SHIPMENT RECEPTION (lab use only)		FINAL SHIPMENT RECEPTION (lab use only)																																																															
Released by: <i>Dan Casanova</i>	Date: <i>March 1, 2019</i>	Time:	Received by:	Date:	Time:	Received by: <i>m</i>	Date: <i>March 4, 2019</i>																																																												
Time: <i>11:55am</i>		Time: <i>11:55am</i>		Time: <i>11:55am</i>		Time: <i>11:55am</i>																																																													

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1. If any water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC form.

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Canada Toll Free: 1 800 668 9878



12239419-COFC

COC Number: 17-826850

Page 3 of 3

[illegible]

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1. If any water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC form.

MỘT SỐ ÁI ERON



Instructions for ALS: Please include this page on the COC scan for inclusion into the COA pdf.

L2239419-COFC

Sampling order	CassetteID	PM Type	Start_Date_ actual	Start_Time_ act	Stop_Date_ actual	Stop_Time_ act	Total_Samp le_time	Volume of air sampled (Actual Volume; m^3)	Volume of air sampled (Actual Volume; Litres)	Blank Sample?
1	65075	PM2.5	1/27/2019	0:00	1/28/2019	0:00	24:00:00	21.6	21600	no
2	65077	PM2.5							0	YES
3	65080	PM2.5							0	YES
4	65078	PM2.5	1/30/2019	0:00	1/31/2019	0:00	24:00:00	21.6	21600	no
5	65048	PM2.5	2/2/2019	0:00	2/3/2019	0:00	24:00:00	21.6	21600	no
6	66751	PM2.5	2/5/2019	0:00	2/6/2019	0:00	24:00:00	21.6	21600	no
7	65063	PM2.5	2/8/2019	0:00	2/9/2019	0:00	24:00:00	21.6	21600	no
8	66752	PM2.5	2/11/2019	0:00	2/12/2019	0:00	24:00:00	21.6	21600	no
9	66753	PM2.5	2/14/2019	0:00	2/15/2019	0:00	24:00:00	21.6	21600	no
10	66758	PM2.5	2/17/2019	0:00	2/18/2019	0:00	24:00:00	21.6	21600	no
11	66754	PM2.5	2/20/2019	0:00	2/21/2019	0:00	24:00:00	21.6	21600	no
12	66740	PM2.5	2/23/2019	0:00	2/24/2019	0:00	24:00:00	21.6	21600	no
13	66741	PM2.5	2/26/2019	0:00	2/27/2019	0:00	24:00:00	21.6	21600	no
1	66747	PMcoarse	1/27/2019	0:00	1/28/2019	0:00	24:00:00	2.41	2410	no
2	65067	PMcoarse							0	YES
3	66744	PMcoarse							0	YES
4	65065	PMcoarse	1/30/2019	0:00	1/31/2019	0:00	24:00:00	2.41	2410	no
5	66748	PMcoarse	2/2/2019	0:00	2/3/2019	0:00	24:00:00	2.41	2410	no
6	65061	PMcoarse	2/5/2019	0:00	2/6/2019	0:00	24:00:00	2.41	2410	no
7	66750	PMcoarse	2/8/2019	0:00	2/9/2019	0:00	24:00:00	2.41	2410	no
8	66739	PMcoarse	2/11/2019	0:00	2/12/2019	0:00	24:00:00	2.41	2410	no
9	65045	PMcoarse	2/14/2019	0:00	2/15/2019	0:00	24:00:00	2.41	2410	no
10	66755	PMcoarse	2/17/2019	0:00	2/18/2019	0:00	24:00:00	2.41	2410	no
11	65046	PMcoarse	2/20/2019	0:00	2/21/2019	0:00	24:00:00	2.41	2410	no
12	66746	PMcoarse	2/23/2019	0:00	2/24/2019	0:00	24:00:00	2.41	2410	no
13	65071	PMcoarse	2/26/2019	0:00	2/27/2019	0:00	24:00:00	2.41	2410	no

8c

22 March 4, 2019 11:55am



ERM Consultants Canada Ltd.
ATTN: Daniel Casanova
1500-1111 West Hastings Street
Vancouver BC V6E 2J3

Date Received: 05-APR-19
Report Date: 10-APR-19 13:09 (MT)
Version: FINAL REV. 2

Client Phone: 604-689-9460

Certificate of Analysis

Lab Work Order #: L2254176
Project P.O. #: NOT SUBMITTED
Job Reference: TENAS; 0403488-103-0002
C of C Numbers: 17-719987
Legal Site Desc:

Comments:

10-APR-2019 Data has been updated for L2254176-19.

Amber Springer, B.Sc
Account Manager

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ADDRESS: 8081 Lougheed Hwy, Suite 100, Burnaby, BC V5A 1W9 Canada | Phone: +1 604 253 4188 | Fax: +1 604 253 6700
ALS CANADA LTD Part of the ALS Group An ALS Limited Company

ALS ENVIRONMENTAL ANALYTICAL REPORT

		Sample ID	L2254176-1	L2254176-2	L2254176-3	L2254176-4	L2254176-5
		Description	Air Part	Air Part	Air Part	Air Part	Air Part
		Sampled Date	01-MAR-19	02-MAR-19	04-MAR-19	07-MAR-19	10-MAR-19
		Sampled Time					
		Client ID	65086	65088	64480	64478	64477
Grouping	Analyte						
FILTER							
Particulates	Particulate - PM2.5 (ug)	<50	<50	<50	<50	57	
	Particulate - PM2.5 (ug/m3)	<2.3		<2.3	<2.3	2.6	
	Particulate-Fine (ug/m3)						
	Particulate-Coarse (ug)						
	Particulate-Coarse (ug/m3)						
	Particulate-PM10 (ug/m3)						

ALS ENVIRONMENTAL ANALYTICAL REPORT

		Sample ID	L2254176-6	L2254176-7	L2254176-8	L2254176-9	L2254176-10
		Description	Air Part	Air Part	Air Part	Air Part	Air Part
		Sampled Date	13-MAR-19	16-MAR-19	19-MAR-19	22-MAR-19	25-MAR-19
		Sampled Time	10:00	10:00	10:00	10:00	10:00
		Client ID	64475	64482	64481	64473	64472
Grouping	Analyte						
FILTER							
Particulates	Particulate - PM2.5 (ug)	<50	<50	73	113	<50	
	Particulate - PM2.5 (ug/m3)	<2.3	<2.3	3.4	5.2	<2.3	
	Particulate-Fine (ug/m3)						
	Particulate-Coarse (ug)						
	Particulate-Coarse (ug/m3)						
	Particulate-PM10 (ug/m3)						

ALS ENVIRONMENTAL ANALYTICAL REPORT

		Sample ID	L2254176-11	L2254176-12	L2254176-13	L2254176-14	L2254176-15
		Description	Air Part	Air Part	Air Part	Air Part	Air Part
		Sampled Date	01-MAR-19	02-MAR-19	04-MAR-19	07-MAR-19	10-MAR-19
		Sampled Time	12:00	12:00	12:00	12:00	12:00
		Client ID	65072	65074	16076	15064	64447
Grouping	Analyte						
FILTER							
Particulates	Particulate - PM2.5 (ug)						
	Particulate - PM2.5 (ug/m3)						
	Particulate-Fine (ug/m3)		<2.3		<2.3	<2.3	2.6
	Particulate-Coarse (ug)		<50	50	<50	67	<50
	Particulate-Coarse (ug/m3)		1.06		<0.028	2.62	<0.037
	Particulate-PM10 (ug/m3)		2.9		<2.3	4.2	2.6

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID Description Sampled Date Sampled Time Client ID		L2254176-16 Air Part 13-MAR-19 10:00 64448	L2254176-17 Air Part 16-MAR-19 10:00 64463	L2254176-18 Air Part 19-MAR-19 10:00 64464	L2254176-19 Air Part 22-MAR-19 10:00 64454	L2254176-20 Air Part 25-MAR-19 10:00 64461
Grouping	Analyte					
FILTER						
Particulates	Particulate - PM2.5 (ug)					
	Particulate - PM2.5 (ug/m3)					
	Particulate-Fine (ug/m3)	<2.3	<2.3	3.4	5.2	<2.3
	Particulate-Coarse (ug)	<50	<50	80	<50	<50
	Particulate-Coarse (ug/m3)	0.154	0.262	2.99	1.14	0.801
	Particulate-PM10 (ug/m3)	<2.3	<2.3	6.4	6.4	2.5

		Sample ID	Description	Sampled Date	Sampled Time	Client ID
		L2254176-1	Air Part	01-MAR-19		65086
		L2254176-3	Air Part	04-MAR-19		64480
		L2254176-4	Air Part	07-MAR-19		64478
		L2254176-5	Air Part	10-MAR-19		64477
		L2254176-6	Air Part	13-MAR-19	10:00	64475
Grouping	Analyte					
MISC.						
Field Tests	Air Volume, Client Supplied (L)	21600	21600	21600	21600	21600

		Sample ID	Description	Sampled Date	Sampled Time	Client ID
		L2254176-7	Air Part	16-MAR-19	10:00	64482
		L2254176-8	Air Part	19-MAR-19	10:00	64481
		L2254176-9	Air Part	22-MAR-19	10:00	64473
		L2254176-10	Air Part	25-MAR-19	10:00	64472
		L2254176-11	Air Part	01-MAR-19	12:00	65072
Grouping	Analyte					
MISC.						
Field Tests	Air Volume, Client Supplied (L)	21600	21600	21600	21600	2400

		Sample ID	Description	Sampled Date	Sampled Time	Client ID
		L2254176-13	Air Part	04-MAR-19	12:00	16076
		L2254176-14	Air Part	07-MAR-19	12:00	15064
		L2254176-15	Air Part	10-MAR-19	12:00	64447
		L2254176-16	Air Part	13-MAR-19	10:00	64448
		L2254176-17	Air Part	16-MAR-19	10:00	64463
Grouping	Analyte					
MISC.						
Field Tests	Air Volume, Client Supplied (L)	2410	2410	2410	2400	2410

	Sample ID Description Sampled Date Sampled Time Client ID	L2254176-18 Air Part 19-MAR-19 10:00 64464	L2254176-19 Air Part 22-MAR-19 10:00 64454	L2254176-20 Air Part 25-MAR-19 10:00 64461		
Grouping	Analyte					
MISC.						
Field Tests	Air Volume, Client Supplied (L)	2410	2410	2410		

Reference Information

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
AIR VOLUME-VA	Misc.	Air volume (L)	HYGIENE METHOD
PART-DICHOT-PM10-VA	Filter	Total Particulate (Dichot-PM10) by Grav.	BCMOE Method
Total Particulate Matter (PM10) Method analysis is carried out in accordance with the BCMOE Lab Manual, Section G Air Constituents - Inorganics, "Total Particulate - PM10/PM02 - 47mm - HiVol" method. ALS provides pre-weighed filters (Pallflex TX40 HI20-WW 47mm) and clients typically sample using a "Dichotomus Partisol sequential Air Sampler" equivalent sample (EQPS-0509-179, EQPS-0509-180, EQPS-0311-198) as per U.S. EPA Reference Method RFPS-0694-098, fitted with a PM10 inlet. The particulate matter is determined gravimetrically. Three formulas are required for the mass concentration (um/M3) computation of fine PM (PM-2.5) Course PM (PM-10 minus PM2.5) and PM-10.			
PART-PM2.5-VA	Filter	Total Particulate (PM2.5) by Gravimetric	BCMOE METHOD
Total Particulate Matter (PM2.5) Method analysis is carried out in accordance with the BCMOE Lab Manual, Section G Air Constituents - Inorganics, "Total Particulate - PM10/PM02 - 47mm - HiVol" method. ALS provides pre-weighed filters (Pallflex TX40 HI20-WW 47mm) and clients typically sample using a "Partisol Model 2000 Air Sampler" as per U.S. EPA Reference Method RFPS-0694-098, fitted with a PM2.5 inlet. The particulate matter is determined gravimetrically.			

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

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
VA	ALS ENVIRONMENTAL - VANCOUVER, BRITISH COLUMBIA, CANADA

Chain of Custody Numbers:

17-719987

GLOSSARY OF REPORT TERMS

Surrogate - A compound that is similar in behaviour to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.

mg/kg - milligrams per kilogram based on dry weight of sample.

mg/kg wwt - milligrams per kilogram based on wet weight of sample.

mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight of sample.

mg/L - milligrams per litre.

< - Less than.

D.L. - The reported Detection Limit, also known as the Limit of Reporting (LOR).

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.

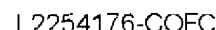
UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.

Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.



Canada Toll Free: 1 800 668 9878

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COC Number: 17-719987

Page 1 of 1

Report To Company: ERM Contact: Daniel Casanova Phone: 250-877-8998 Company address below will appear on the final report		Report Format / Distribution Select Report Format: ☒ PDF ☒ EXCEL ☐ EDD (DIGITAL) Quality Control (QC) Report with Report ☐ YES ☐ NO ☐ Compare Results to Criteria on Report - provide details below if box checked Select Distribution: ☒ EMAIL ☐ MAIL ☐ FAX		Select Service Level Below - Contact your AM to confirm all E&P TATs (surcharges may apply) Regular [R] ☐ Standard TAT if received by 3 pm - business days - no surcharges apply PRIORITY (Business Days) 4 day [P4-20%] ☐ 3 day [P3-25%] ☐ 2 day [P2-50%] ☒ EMERGENCY 1 Business day [E-100%] Same Day, Weekend or Statutory holiday [E2-200%] (Laboratory opening fees may apply.) Date and Time Required for all E&P TATs: dd-mm-yy hh:mm For tests that can not be performed according to the service level selected, you will be contacted.			
Street: 2790 Alfred Ave City/Province: Smiths BC Postal Code: V0T 2N0		Email 1 or Fax: daniel.casanova@erm.com Email 2: telast.bakri@erm.com Email 3: andres.coux@erm.com		Analysis Request Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below PM2.5 mass PM2.5 concentration			
Invoice To: Same as Report To ☒ YES ☐ NO Copy of Invoice with Report ☐ YES ☒ NO Company: / Contact: /		Invoice Distribution Select Invoice Distribution: ☒ EMAIL ☐ MAIL ☐ FAX Email 1 or Fax: Korina.houghton@erm.com Email 2: daniel.casanova@erm.com		SAMPLES ON HOLD Sample is hazardous (please provide further details) NUMBER OF CONTAINERS			
Project Information ALS Account # / Quote #: / Job #: Tenas, 0403488-103-0002 PO / AFE: / LSD: /		Oil and Gas Required Fields (client use) AFE/Cost Center: / PO#: / Major/Minor Code: / Routing Code: / Requisitioner: / Location: /					
ALS Lab Work Order # (lab use only): /		ALS Contact: / Sampler: /					
ALS Sample # (lab use only) ☒		Sample Identification and/or Coordinates (This description will appear on the report)					
Start Date (dd-mm-yy)		Start Time (hh:mm)		Sample Type			
1 65086		1-Mar-19		0:00		Air Part.	
2 65088		2-		↓		↓	
3 64480		4-		↓		↓	
4 64478		7-		↓		↓	
5 64477		10-		↓		↓	
6 64475		13-		1:00		↓	
7 64482		16-		↓		↓	
8 64481		19-		↓		↓	
9 64473		22-		↓		↓	
10 64472		25-		↓		↓	
Drinking Water (DW) Samples¹ (client use) Are samples taken from a Regulated DW System? ☐ YES ☐ NO Are samples for human consumption/ use? ☐ YES ☐ NO		Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only) See attached information sheet		SAMPLE CONDITION AS RECEIVED (lab use only) Frozen ☐ SIF Observations Yes ☐ No ☐ Ice Packs ☐ Ice Cubes ☐ Custody seal intact Yes ☐ No ☐ Cooling Initiated ☒ INITIAL COOLER TEMPERATURES °C: 10°C FINAL COOLER TEMPERATURES °C: 10°C			
SHIPMENT RELEASE (client use) Released by: Daniel Casanova Date: March 3 Time: /		INITIAL SHIPMENT RECEPTION (lab use only) Received by: / Date: / Time: /		FINAL SHIPMENT RECEPTION (lab use only) Received by: DC Date: Apr 5 19 Time: 1:35			

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

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 to the Terms and Conditions as specified on the back page of the white - report copy.

1. If any water samples are taken from a **Regulated Drinking Water (DW) System**, please submit using an **Authorized DW COC form**.

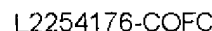
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Page 2 of 2

Page 2 of 2

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JULY 2017 FROM

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1. If any water samples are taken from a **Regulated Drinking Water (DW) System**, please submit using an **Authorized DW COC form**.

Instructions for ALS: Please include this page on the COC scan for inclusion into the COA pdf.

Sampling order	CassetteID	PM Type	Start Date actual	Start Time act	Stop Date actual	Stop Time act	Total Sample time	Volume of air sampled (Actual Volume; m^3)	Volume of air sampled (Actual Volume; Litres)	Blank Sample?
1	65086	PM2.5	3/1/2019	0:00	3/1/2019	23:59	23:59	21.6	21600	no
2	65088	PM2.5	3/2/2019	0:00	3/2/2019	0:00	0:00	0.00	0	YES
3	64480	PM2.5	3/4/2019	0:00	3/5/2019	0:00	24:00:00	21.6	21600	no
4	64478	PM2.5	3/7/2019	0:00	3/8/2019	0:00	24:00:00	21.6	21600	no
5	64477	PM2.5	3/10/2019	0:00	3/11/2019	1:00	24:00:00	21.6	21600	no
6	64475	PM2.5	3/13/2019	1:00	3/14/2019	1:00	24:00:00	21.6	21600	no
7	64482	PM2.5	3/16/2019	1:00	3/17/2019	1:00	24:00:00	21.6	21600	no
8	64481	PM2.5	3/19/2019	1:00	3/20/2019	1:00	24:00:00	21.6	21600	no
9	64473	PM2.5	3/22/2019	1:00	3/23/2019	1:00	24:00:00	21.6	21600	no
10	64472	PM2.5	3/25/2019	1:00	3/26/2019	1:00	24:00:00	21.6	21600	no
1	65072	PMcoarse	3/1/2019	0:00	3/1/2019	23:59	23:59	2.4	2400	no
2	65074	PMcoarse	3/2/2019	0:00	3/2/2019	0:00	0:00	0	0	YES
3	16076	PMcoarse	3/4/2019	0:00	3/5/2019	0:00	24:00:00	2.41	2410	no
4	15064	PMcoarse	3/7/2019	0:00	3/8/2019	0:00	24:00:00	2.41	2410	no
5	64447	PMcoarse	3/10/2019	0:00	3/11/2019	1:00	24:00:00	2.41	2410	no
6	64448	PMcoarse	3/13/2019	1:00	3/14/2019	1:00	24:00:00	2.4	2400	no
7	64463	PMcoarse	3/16/2019	1:00	3/17/2019	1:00	24:00:00	2.41	2410	no
8	64464	PMcoarse	3/19/2019	1:00	3/20/2019	1:00	24:00:00	2.41	2410	no
9	64454	PMcoarse	3/22/2019	1:00	3/23/2019	1:00	24:00:00	2.41	2410	no
10	64461	PMcoarse	3/25/2019	1:00	3/26/2019	1:00	24:00:00	2.41	2410	no



L2254176-COFC



ERM Consultants Canada Ltd.
ATTN: Daniel Casanova
1500-1111 West Hastings Street
Vancouver BC V6E 2J3

Date Received: 06-MAY-19
Report Date: 14-MAY-19 12:22 (MT)
Version: FINAL

Client Phone: 604-689-9460

Certificate of Analysis

Lab Work Order #: L2267928
Project P.O. #: NOT SUBMITTED
Job Reference: TENAS; 0403488-0103-0002
C of C Numbers: 17-718465
Legal Site Desc:

Amber Springer, B.Sc
Account Manager

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ADDRESS: 8081 Lougheed Hwy, Suite 100, Burnaby, BC V5A 1W9 Canada | Phone: +1 604 253 4188 | Fax: +1 604 253 6700
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ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID Description Sampled Date Sampled Time Client ID		L2267928-1 Air Particulate 03-APR-19 57306	L2267928-2 Air Particulate 04-APR-19 34159	L2267928-3 Air Particulate 06-APR-19 4220	L2267928-4 Air Particulate 09-APR-19 34121	L2267928-5 Air Particulate 12-APR-19 54603
Grouping	Analyte					
FILTER						
Particulates	Particulate - PM2.5 (ug)	123	<50	<50	80	<50
	Particulate - PM2.5 (ug/m3)	5.7		<2.3	3.7	<2.3
	Particulate-Fine (ug/m3)					
	Particulate-Coarse (ug)					
	Particulate-Coarse (ug/m3)					
	Particulate-PM10 (ug/m3)					

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID Description Sampled Date Sampled Time Client ID		L2267928-6 Air Particulate 15-APR-19 27306	L2267928-7 Air Particulate 18-APR-19 25405	L2267928-8 Air Particulate 21-APR-19 25074	L2267928-9 Air Particulate 24-APR-19 57313	L2267928-10 Air Particulate 27-APR-19 4235
Grouping	Analyte					
FILTER						
Particulates	Particulate - PM2.5 (ug)	93	67	83	<50	63
	Particulate - PM2.5 (ug/m3)	4.3	3.1	3.9	<2.3	2.9
	Particulate-Fine (ug/m3)					
	Particulate-Coarse (ug)					
	Particulate-Coarse (ug/m3)					
	Particulate-PM10 (ug/m3)					

ALS ENVIRONMENTAL ANALYTICAL REPORT

		Sample ID Description Sampled Date Sampled Time Client ID	L2267928-11 Air Particulate 30-APR-19 15261	L2267928-12 Air Particulate 03-APR-19 57307	L2267928-13 Air Particulate 04-APR-19 41682	L2267928-14 Air Particulate 06-APR-19 57299	L2267928-15 Air Particulate 09-APR-19 57296
Grouping	Analyte						
FILTER							
Particulates	Particulate - PM2.5 (ug)	83					
	Particulate - PM2.5 (ug/m3)	3.9					
	Particulate-Fine (ug/m3)			5.7		<2.3	3.7
	Particulate-Coarse (ug)			90	<50	50	50
	Particulate-Coarse (ug/m3)			3.2		<2.1	<2.1
	Particulate-PM10 (ug/m3)			8.9		<3.1	5.4

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID Description Sampled Date Sampled Time Client ID		L2267928-16 Air Particulate 12-APR-19 15526	L2267928-17 Air Particulate 15-APR-19 41635	L2267928-18 Air Particulate 18-APR-19 41652	L2267928-19 Air Particulate 21-APR-19 34145	L2267928-20 Air Particulate 24-APR-19 34144
Grouping	Analyte					
FILTER						
Particulates	Particulate - PM2.5 (ug)					
	Particulate - PM2.5 (ug/m3)					
	Particulate-Fine (ug/m3)	<2.3	4.3	3.1	3.9	<2.3
	Particulate-Coarse (ug)	50	<50	57	77	77
	Particulate-Coarse (ug/m3)	<2.1	<2.1	<2.1	2.8	3.2
	Particulate-PM10 (ug/m3)	3.5	5.8	5.1	6.7	3.5

ALS ENVIRONMENTAL ANALYTICAL REPORT

		Sample ID	L2267928-21	L2267928-22			
		Description	Air Particulate	Air Particulate			
		Sampled Date	27-APR-19	30-APR-19			
		Sampled Time					
		Client ID	15496	57303			
Grouping	Analyte						
FILTER							
Particulates	Particulate - PM2.5 (ug)						
	Particulate - PM2.5 (ug/m3)						
	Particulate-Fine (ug/m3)		2.9	3.9			
	Particulate-Coarse (ug)		63	<50			
	Particulate-Coarse (ug/m3)		2.3	<2.1			
	Particulate-PM10 (ug/m3)		5.3	5.3			

Sample ID Description Sampled Date Sampled Time Client ID		L2267928-1 Air Particulate 03-APR-19 57306	L2267928-3 Air Particulate 06-APR-19 4220	L2267928-4 Air Particulate 09-APR-19 34121	L2267928-5 Air Particulate 12-APR-19 54603	L2267928-6 Air Particulate 15-APR-19 27306
Grouping	Analyte					
MISC.						
Field Tests	Air Volume, Client Supplied (L)	21600	21600	21600	21600	21600

Sample ID Description Sampled Date Sampled Time Client ID		L2267928-7 Air Particulate 18-APR-19 25405	L2267928-8 Air Particulate 21-APR-19 25074	L2267928-9 Air Particulate 24-APR-19 57313	L2267928-10 Air Particulate 27-APR-19 4235	L2267928-11 Air Particulate 30-APR-19 15261
Grouping	Analyte					
MISC.						
Field Tests	Air Volume, Client Supplied (L)	21600	21600	21600	21600	21600

		Sample ID	L2267928-12	L2267928-14	L2267928-15	L2267928-16	L2267928-17
		Description	Air Particulate	Air Particulate	Air Particulate	Air Particulate	Air Particulate
		Sampled Date	03-APR-19	06-APR-19	09-APR-19	12-APR-19	15-APR-19
		Sampled Time					
		Client ID	57307	57299	57296	15526	41635
Grouping	Analyte						
MISC.							
Field Tests	Air Volume, Client Supplied (L)	2400	2410	2410	2410	2410	2410

		Sample ID Description Sampled Date Sampled Time Client ID	L2267928-18 Air Particulate 18-APR-19 41652	L2267928-19 Air Particulate 21-APR-19 34145	L2267928-20 Air Particulate 24-APR-19 34144	L2267928-21 Air Particulate 27-APR-19 15496	L2267928-22 Air Particulate 30-APR-19 57303
Grouping	Analyte						
MISC.							
Field Tests	Air Volume, Client Supplied (L)		2410	2410	2410	2410	2410

Reference Information

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
AIR VOLUME-VA	Misc.	Air volume (L)	HYGIENE METHOD
PART-DICHOT-PM10-VA	Filter	Total Particulate (Dichot-PM10) by Grav.	BCMOE Method
Total Particulate Matter (PM10) Method analysis is carried out in accordance with the BCMOE Lab Manual, Section G Air Constituents - Inorganics, "Total Particulate - PM10/PM02 - 47mm - HiVol" method. ALS provides pre-weighed filters (Pallflex TX40 HI20-WW 47mm) and clients typically sample using a "Dichotomus Partisol sequential Air Sampler" equivalent sample (EQPS-0509-179, EQPS-0509-180, EQPS-0311-198) as per U.S. EPA Reference Method RFPS-0694-098, fitted with a PM10 inlet. The particulate matter is determined gravimetrically. Three formulas are required for the mass concentration (um/M3) computation of fine PM (PM-2.5) Course PM (PM-10 minus PM2.5) and PM-10.			
PART-PM2.5-VA	Filter	Total Particulate (PM2.5) by Gravimetric	BCMOE METHOD
Total Particulate Matter (PM2.5) Method analysis is carried out in accordance with the BCMOE Lab Manual, Section G Air Constituents - Inorganics, "Total Particulate - PM10/PM02 - 47mm - HiVol" method. ALS provides pre-weighed filters (Pallflex TX40 HI20-WW 47mm) and clients typically sample using a "Partisol Model 2000 Air Sampler" as per U.S. EPA Reference Method RFPS-0694-098, fitted with a PM2.5 inlet. The particulate matter is determined gravimetrically.			

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

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
VA	ALS ENVIRONMENTAL - VANCOUVER, BRITISH COLUMBIA, CANADA

Chain of Custody Numbers:

17-718465

GLOSSARY OF REPORT TERMS

Surrogate - A compound that is similar in behaviour to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.

mg/kg - milligrams per kilogram based on dry weight of sample.

mg/kg wwt - milligrams per kilogram based on wet weight of sample.

mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight of sample.

mg/L - milligrams per litre.

< - Less than.

D.L. - The reported Detection Limit, also known as the Limit of Reporting (LOR).

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

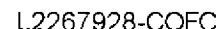
Test results reported relate only to the samples as received by the laboratory.

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

Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.



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COC Number: 17-718465

Page 1 of 1

Report To		Contact and company name below will appear on the final report		Report Format / Distribution		Select Report Format: ☒ PDF ☒ EXCEL ☐ EDD (DIGITAL)						Select Service Level Below - Contact your AM to confirm all E&P TATs (surcharges may apply)													
Company:		ERM		Quality Control (QC) Report with Report ☐ YES ☐ NO		Regular [R] ☒ Standard TAT if received by 3 pm - business days - no surcharges apply																			
Contact:		Daniel Casanova		☐ Compare Results to Criteria on Report - provide details below if box checked		PROPERTY (Business Days) 4 day [P4-20%] ☐ 3 day [P3-25%] ☐ 2 day [P2-50%] ☐						EMERGENCY 1 Business day [E - 100%] Same Day, Weekend or Statutory holiday [E2 -200%] (Laboratory opening fees may apply)] ☐													
Phone:		250-877-7838		Select Distribution: ☒ EMAIL ☐ MAIL ☐ FAX		Date and Time Required for all E&P TATs:						dd-mmm-yy hh:mm													
Street:		3790 Alfred Ave		Email 1 or Fax daniel.casanova@erm.com		For tests that can not be performed according to the service level selected, you will be contacted.																			
City/Province:		Smithers, BC		Email 2 talaat.bakri@erm.com																					
Postal Code:		V0J 2N0		Email 3 andres.soux@erm.com																					
Invoice To		Same as Report To ☒ YES ☐ NO		Invoice Distribution																					
		Copy of Invoice with Report ☐ YES ☒ NO		Select Invoice Distribution: ☒ EMAIL ☐ MAIL ☐ FAX																					
Company:				Email 1 or Fax korina.houghton@erm.com																					
Contact:				Email 2 daniel.casanova@erm.com																					
Project Information						Oil and Gas Required Fields (client use)																			
ALS Account # / Quote #:						AFE/Cost Center:				PO#															
Job #: Tenas; 0403488-0103-0002						Major/Minor Code:				Routing Code:															
PG / AFE:						Requisitioner:																			
LSD:						Location:																			
ALS Lab Work Order # (lab use only):						ALS Contact: Amber Springer				Sampler: Daniel Casanova															
ALS Sample # (lab use only)		Sample Identification and/or Coordinates (This description will appear on the report)				Date (dd-mmm-yy)		Time (hh:mm)		Sample Type															
		57306				3-Apr-19		0:00		Air Particulate															
		34159				4-Apr-19		0:00		Air Particulate															
		4220				6-Apr-19		0:00		Air Particulate															
		34121				9-Apr-19		0:00		Air Particulate															
		54603				12-Apr-19		0:00		Air Particulate															
		27306				15-Apr-19		0:00		Air Particulate															
		25405				18-Apr-19		0:00		Air Particulate															
		25074				21-Apr-19		0:00		Air Particulate															
		57313				24-Apr-19		0:00		Air Particulate															
		4235				27-Apr-19		0:00		Air Particulate															
		15261				30-Apr-19		0:00		Air Particulate															
Drinking Water (DW) Samples¹ (client use)						SAMPLE CONDITION AS RECEIVED (lab use only)																			
Are samples taken from a Regulated DW System? ☐ YES ☐ NO						Frozen ☐ SIF Observations Yes ☐ No ☐																			
Are samples for human consumption/ use? ☐ YES ☐ NO						Ice Packs ☐ Ice Cubes ☐ Custody seal intact Yes ☐ No ☐																			
Sample date/time represents STARTING date/time. See attached information sheet for sampling volume.						Cooling Initiated ☐																			
						INITIAL COOLER TEMPERATURES °C																			
						FINAL COOLER TEMPERATURES °C																			
						16°																			
SHIPMENT RELEASE (client use)						INITIAL SHIPMENT RECEPTION (lab use only)																			
Released by: D. Casanova		Date: May 3 1/9		Time:		Received by:		Date:		Time:		Received by: T.		Date: May 6		Time: 10:46									

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1. If any water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC form.

NOV 2011 EBCA



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Chain of Custody (COC) / Analytical
Request Form

Canada Toll Free: 1 800 668 9878



L2267928-COFC

COC Number: 17-718465

Page 2 of

2

Report To Contact and company name below will appear on the final report		Report Format / Distribution		Select Service Level Below - Contact your AM to confirm all E&P TATs (surcharges may apply)	
Company:	ERM	Select Report Format:	☒ PDF ☒ EXCEL ☐ EDD (DIGITAL)	Regular [R] ☒ Standard TAT if received by 3 pm - business days - no surcharges apply	
Contact:	Daniel Casanova	Quality Control (QC) Report with Report	☐ YES ☐ NO	4 day [P4-20%] ☐	
Phone:	250-877-7838	☐ Compare Results to Criteria on Report - provide details below if box checked		3 day [P3-25%] ☐	
Company address below will appear on the final report		Select Distribution:	☒ EMAIL ☐ MAIL ☐ FAX	2 day [P2-50%] ☐	
Street:	3790 Alfred Ave	Email 1 or Fax	daniel.casanova@erm.com	1 Business day [E - 100%] ☐	
City/Province:	Smithers, BC	Email 2	talaat.bakri@erm.com	Same Day, Weekend or Statutory holiday [E2 -200%] ☐	
Postal Code:	V0J 2N0	Email 3	andres.soux@erm.com	(Laboratory opening fees may apply)	
Invoice To	Same as Report To ☒ YES ☐ NO	Invoice Distribution		Date and Time Required for all E&P TATs: dd-mm-yy hh:mm	
	Copy of Invoice with Report ☐ YES ☒ NO	Select Invoice Distribution:	☒ EMAIL ☐ MAIL ☐ FAX	For tests that can not be performed according to the service level selected, you will be contacted.	
Company:		Email 1 or Fax	korina.houghton@erm.com	Analysis Request	
Contact:		Email 2	daniel.casanova@erm.com	Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below	
Project Information		Oil and Gas Required Fields (client use)		NUMBER OF CONTAINERS	
ALS Account # / Quote #:		AFE/Cost Center:		PO#	
Job #:		Major/Minor Code:		Routing Code:	
PO / AFE:		Requisitioner:		Location:	
LSD:		ALS Contact: Amber Springer		Sampler: Daniel Casanova	
ALS Lab Work Order # (lab use only):					
ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mm-yy)	Time (hh:mm)	Sample Type	
57307		3-Apr-19	0:00	Air Particulate	1
41682		4-Apr-19	0:00	Air Particulate	1
57299		6-Apr-19	0:00	Air Particulate	1
57296		9-Apr-19	0:00	Air Particulate	1
15526		12-Apr-19	0:00	Air Particulate	1
41635		15-Apr-19	0:00	Air Particulate	1
41652		18-Apr-19	0:00	Air Particulate	1
34145		21-Apr-19	0:00	Air Particulate	1
34144		24-Apr-19	0:00	Air Particulate	1
15496		27-Apr-19	0:00	Air Particulate	1
57303		30-Apr-19	0:00	Air Particulate	1
Drinking Water (DW) Samples¹ (client use)		Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)		SAMPLE CONDITION AS RECEIVED (lab use only)	
Are samples taken from a Regulated DW System?				Frozen ☐ SIF Observations Yes ☐ No ☐	
☐ YES ☐ NO				Ice Packs ☐ Ice Cubes ☐ Custody seal intact Yes ☐ No ☐	
Are samples for human consumption/ use?				Cooling Initiated: ☐	
☐ YES ☐ NO		Sample date/time represents STARTING date/time. See attached information sheet for sampling volume.		INITIAL COOLER TEMPERATURES °C	
				FINAL COOLER TEMPERATURES °C	
SHIPMENT RELEASE (client use)		INITIAL SHIPMENT RECEPTION (lab use only)		FINAL SHIPMENT RECEPTION (lab use only)	
Released by:	Date:	Time:	Received by:	Date:	Time:
				May 6	10:45

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

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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.

1. If any water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC form.

NOV 2013 FINAL

Instructions for ALS: Please include this page on the COC scan for inclusion into the COA pdf.

Sampling order	CassetteID	PM Type	Start_Date_ actual	Start_Time_ act	Stop_Date_ actual	Stop_Time_ act	Total_Samp le_time	Volume of air sampled (Actual Volume; m^3)	Volume of air sampled (Actual Volume; Litres)	Blank Sample?
1	57306	PM2.5	3-Apr-19	0:00	3-Apr-19	23:59	23:59:00	21.6	21600	no
2	34159	PM2.5	4-Apr-19	0:00	4-Apr-19	0:00	0:00:00	0.00	0	YES
3	4220	PM2.5	6-Apr-19	0:00	7-Apr-19	0:00	24:00:00	21.6	21600	no
4	34121	PM2.5	9-Apr-19	0:00	10-Apr-19	0:00	24:00:00	21.6	21600	no
5	54603	PM2.5	12-Apr-19	0:00	13-Apr-19	0:00	24:00:00	21.6	21600	no
6	27306	PM2.5	15-Apr-19	0:00	16-Apr-19	0:00	24:00:00	21.6	21600	no
7	25405	PM2.5	18-Apr-19	0:00	19-Apr-19	0:00	24:00:00	21.6	21600	no
8	25074	PM2.5	21-Apr-19	0:00	22-Apr-19	0:00	24:00:00	21.6	21600	no
9	57313	PM2.5	24-Apr-19	0:00	25-Apr-19	0:00	24:00:00	21.6	21600	no
10	4235	PM2.5	27-Apr-19	0:00	28-Apr-19	0:00	24:00:00	21.6	21600	no
11	15261	PM2.5	30-Apr-19	0:00	1-May-19	0:00	24:00:00	21.60	21600	no
1	57307	PMcoarse	3-Apr-19	0:00	3-Apr-19	23:59	23:59:00	2.4	2400	no
2	41682	PMcoarse	4-Apr-19	0:00	4-Apr-19	0:00	0:00:00	0	0	YES
3	57299	PMcoarse	6-Apr-19	0:00	7-Apr-19	0:00	24:00:00	2.41	2410	no
4	57296	PMcoarse	9-Apr-19	0:00	10-Apr-19	0:00	24:00:00	2.41	2410	no
5	15526	PMcoarse	12-Apr-19	0:00	13-Apr-19	0:00	24:00:00	2.41	2410	no
6	41635	PMcoarse	15-Apr-19	0:00	16-Apr-19	0:00	24:00:00	2.41	2410	no
7	41652	PMcoarse	18-Apr-19	0:00	19-Apr-19	0:00	24:00:00	2.41	2410	no
8	34145	PMcoarse	21-Apr-19	0:00	22-Apr-19	0:00	24:00:00	2.41	2410	no
9	34144	PMcoarse	24-Apr-19	0:00	25-Apr-19	0:00	24:00:00	2.41	2410	no
10	15496	PMcoarse	27-Apr-19	0:00	28-Apr-19	0:00	24:00:00	2.41	2410	no
11	57303	PMcoarse	30-Apr-19	0:00	1-May-19	0:00	24:00:00	2.41	2410	no



L2267928-COFC



ERM Consultants Canada Ltd.
ATTN: Daniel Casanova
1500-1111 West Hastings Street
Vancouver BC V6E 2J3

Date Received: 10-JUN-19
Report Date: 19-JUN-19 12:21 (MT)
Version: FINAL

Client Phone: 604-689-9460

Certificate of Analysis

Lab Work Order #: L2288327
Project P.O. #: NOT SUBMITTED
Job Reference: TENAS; 0403488-0203-0001
C of C Numbers: 17-830837
Legal Site Desc:

Amber Springer, B.Sc
Account Manager

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ADDRESS: 8081 Lougheed Hwy, Suite 100, Burnaby, BC V5A 1W9 Canada | Phone: +1 604 253 4188 | Fax: +1 604 253 6700
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ALS ENVIRONMENTAL ANALYTICAL REPORT

		Sample ID	L2288327-1	L2288327-2	L2288327-3	L2288327-4	L2288327-5
		Description	Air Particulate	Air Particulate	Air Particulate	Air Particulate	Air Particulate
		Sampled Date	03-MAY-19	04-MAY-19	06-MAY-19	09-MAY-19	12-MAY-19
		Sampled Time					
		Client ID	64482	64472	64475	65088	65086
Grouping	Analyte						
FILTER							
Particulates	Particulate - PM2.5 (ug)		<50	<50	53	53	67
	Particulate - PM2.5 (ug/m3)		<2.3		2.5	2.5	3.1
	Particulate-Fine (ug/m3)						
	Particulate-Coarse (ug)						
	Particulate-Coarse (ug/m3)						
	Particulate-PM10 (ug/m3)						

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID Description Sampled Date Sampled Time Client ID		L2288327-6 Air Particulate 15-MAY-19 64480	L2288327-7 Air Particulate 18-MAY-19 64478	L2288327-8 Air Particulate 21-MAY-19 64477	L2288327-9 Air Particulate 24-MAY-19 15279	L2288327-10 Air Particulate 27-MAY-19 57309
Grouping	Analyte					
FILTER						
Particulates	Particulate - PM2.5 (ug)	<50	<50	87	<50	317
	Particulate - PM2.5 (ug/m3)	<2.3	<2.3	4.0	<2.3	14.7
	Particulate-Fine (ug/m3)					
	Particulate-Coarse (ug)					
	Particulate-Coarse (ug/m3)					
	Particulate-PM10 (ug/m3)					

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID Description Sampled Date Sampled Time Client ID		L2288327-11 Air Particulate 30-MAY-19 27408	L2288327-12 Air Particulate 02-JUN-19 41680	L2288327-13 Air Particulate 03-MAY-19 15064	L2288327-14 Air Particulate 04-MAY-19 65074	L2288327-15 Air Particulate 06-MAY-19 64463
Grouping	Analyte					
FILTER						
Particulates	Particulate - PM2.5 (ug)	97	<50			
	Particulate - PM2.5 (ug/m3)	4.5	<2.3			
	Particulate-Fine (ug/m3)			<2.3		2.5
	Particulate-Coarse (ug)			60	<50	103
	Particulate-Coarse (ug/m3)			2.62		4.06
	Particulate-PM10 (ug/m3)			<2.3		6.5

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID Description Sampled Date Sampled Time Client ID		L2288327-16 Air Particulate 09-MAY-19 64447	L2288327-17 Air Particulate 12-MAY-19 64464	L2288327-18 Air Particulate 15-MAY-19 64454	L2288327-19 Air Particulate 18-MAY-19 64461	L2288327-20 Air Particulate 21-MAY-19 64448
Grouping	Analyte					
FILTER						
Particulates	Particulate - PM2.5 (ug)					
	Particulate - PM2.5 (ug/m3)					
	Particulate-Fine (ug/m3)	2.5	3.1	<2.3	<2.3	4.0
	Particulate-Coarse (ug)	93	180	<50	<50	97
	Particulate-Coarse (ug/m3)	3.64	7.19	1.26	0.570	3.62
	Particulate-PM10 (ug/m3)	6.1	10.3	2.5	<2.3	7.6

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID Description Sampled Date Sampled Time Client ID		L2288327-21 Air Particulate 24-MAY-19 9909	L2288327-22 Air Particulate 27-MAY-19 17843	L2288327-23 Air Particulate 30-MAY-19 24543	L2288327-24 Air Particulate 02-JUN-19 17820	
Grouping	Analyte					
FILTER						
Particulates	Particulate - PM2.5 (ug)					
	Particulate - PM2.5 (ug/m3)					
	Particulate-Fine (ug/m3)	<2.3	14.7	4.5	<2.3	
	Particulate-Coarse (ug)	73	187	123	53	
	Particulate-Coarse (ug/m3)	2.87	6.3	4.7	<2.1	
	Particulate-PM10 (ug/m3)	4.7	21.0	9.2	4.2	

		Sample ID Description Sampled Date Sampled Time Client ID	L2288327-1 Air Particulate 03-MAY-19 64482	L2288327-3 Air Particulate 06-MAY-19 64475	L2288327-4 Air Particulate 09-MAY-19 65088	L2288327-5 Air Particulate 12-MAY-19 65086	L2288327-6 Air Particulate 15-MAY-19 64480
Grouping	Analyte						
MISC.							
Field Tests	Air Volume, Client Supplied (L)	21600	21600	21600	21600	21600	21600

		Sample ID Description Sampled Date Sampled Time Client ID	L2288327-7 Air Particulate 18-MAY-19 64478	L2288327-8 Air Particulate 21-MAY-19 64477	L2288327-9 Air Particulate 24-MAY-19 15279	L2288327-10 Air Particulate 27-MAY-19 57309	L2288327-11 Air Particulate 30-MAY-19 27408
Grouping	Analyte						
MISC.							
Field Tests	Air Volume, Client Supplied (L)		21600	21600	21600	21600	21600

		Sample ID Description Sampled Date Sampled Time Client ID	L2288327-12 Air Particulate 02-JUN-19 41680	L2288327-13 Air Particulate 03-MAY-19 15064	L2288327-15 Air Particulate 06-MAY-19 64463	L2288327-16 Air Particulate 09-MAY-19 64447	L2288327-17 Air Particulate 12-MAY-19 64464
Grouping	Analyte						
MISC.							
Field Tests	Air Volume, Client Supplied (L)		21600	2400	2410	2410	2410

		Sample ID	Description	Sampled Date	Sampled Time	Client ID
		L2288327-18	Air Particulate	15-MAY-19		64454
		L2288327-19	Air Particulate	18-MAY-19		64461
		L2288327-20	Air Particulate	21-MAY-19		64448
		L2288327-21	Air Particulate	24-MAY-19		9909
		L2288327-22	Air Particulate	27-MAY-19		17843
Grouping	Analyte					
MISC.						
Field Tests	Air Volume, Client Supplied (L)	2410	2410	2410	2410	2410

		Sample ID Description Sampled Date Sampled Time Client ID	L2288327-23 Air Particulate 30-MAY-19 24543	L2288327-24 Air Particulate 02-JUN-19 17820			
Grouping	Analyte						
MISC.							
Field Tests	Air Volume, Client Supplied (L)		2410	2410			

Reference Information

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
AIR VOLUME-VA	Misc.	Air volume (L)	HYGIENE METHOD
PART-DICHOT-PM10-VA	Filter	Total Particulate (Dichot-PM10) by Grav.	BCMOE Method
Total Particulate Matter (PM10) Method analysis is carried out in accordance with the BCMOE Lab Manual, Section G Air Constituents - Inorganics, "Total Particulate - PM10/PM02 - 47mm - HiVol" method. ALS provides pre-weighed filters (Pallflex TX40 HI20-WW 47mm) and clients typically sample using a "Dichotomus Partisol sequential Air Sampler" equivalent sample (EQPS-0509-179, EQPS-0509-180, EQPS-0311-198) as per U.S. EPA Reference Method RFPS-0694-098, fitted with a PM10 inlet. The particulate matter is determined gravimetrically. Three formulas are required for the mass concentration (um/M3) computation of fine PM (PM-2.5) Course PM (PM-10 minus PM2.5) and PM-10.			
PART-PM2.5-VA	Filter	Total Particulate (PM2.5) by Gravimetric	BCMOE METHOD
Total Particulate Matter (PM2.5) Method analysis is carried out in accordance with the BCMOE Lab Manual, Section G Air Constituents - Inorganics, "Total Particulate - PM10/PM02 - 47mm - HiVol" method. ALS provides pre-weighed filters (Pallflex TX40 HI20-WW 47mm) and clients typically sample using a "Partisol Model 2000 Air Sampler" as per U.S. EPA Reference Method RFPS-0694-098, fitted with a PM2.5 inlet. The particulate matter is determined gravimetrically.			

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

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
VA	ALS ENVIRONMENTAL - VANCOUVER, BRITISH COLUMBIA, CANADA

Chain of Custody Numbers:

17-830837

GLOSSARY OF REPORT TERMS

Surrogate - A compound that is similar in behaviour to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.

mg/kg - milligrams per kilogram based on dry weight of sample.

mg/kg wwt - milligrams per kilogram based on wet weight of sample.

mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight of sample.

mg/L - milligrams per litre.

< - Less than.

D.L. - The reported Detection Limit, also known as the Limit of Reporting (LOR).

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.

Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.



Canada Toll Free: 1 800 668 9878



L2288327-COFC

COC Number: 17-830837

Page 1 of 1

2

Report To			Contact and company name below will appear on the final report			Report Format / Distribution						Select Service Level below - Contact your AM to confirm all E&P TATs (surcharges may apply)									
Company:			ERM			Select Report Format: ☒ PDF ☒ EXCEL ☐ EDD (DIGITAL)						Regular [R] ☒ Standard TAT if received by 3 pm - business days - no surcharges apply									
Contact:			Daniel Casanova			Quality Control (QC) Report with Report ☐ YES ☐ NO						PRIORITY (Business Days) 4 day [P4-20%] ☐ 3 day [P3-25%] ☐ 2 day [P2-50%] ☐									
Phone:			250-877-7838			☐ Compare Results to Criteria on Report - provide details below if box checked						EMERGENCY 1 Business day [E - 100%] Same Day, Weekend or Statutory holiday [E2 -200%] (Laboratory opening fees may apply)]									
Company address below will appear on the final report						Select Distribution: ☒ EMAIL ☐ MAIL ☐ FAX						Date and Time Required for all E&P TATs: dd-mm-yyyy hh:mm									
Street:			3790 Alfred Ave			Email 1 or Fax daniel.casanova@erm.com						For tests that can not be performed according to the service level selected, you will be contacted.									
City/Province:			Smithers, BC			Email 2 talaat.bakri@erm.com															
Postal Code:			V0J 2N0			Email 3 andres.soux@erm.com															
Invoice To			Same as Report To ☒ YES ☐ NO			Invoice Distribution															
			Copy of Invoice with Report ☐ YES ☒ NO			Select Invoice Distribution: ☒ EMAIL ☐ MAIL ☐ FAX															
Company:						Email 1 or Fax korina.houghton@erm.com															
Contact:						Email 2 daniel.casanova@erm.com															
Project Information						Oil and Gas Required Fields (client use)															
ALS Account # / Quote #:						AFE/Cost Center:				PO#:											
Job #: Tenas; 0403488-0203-0001						Major/Minor Code:				Routing Code:											
PO / AFE:						Requisitioner:															
LSD:						Location:															
ALS Lab Work Order # (lab use only):						ALS Contact: Amber Springer				Sampler:		Daniel Casanova									
ALS Sample # (lab use only)		Sample Identification and/or Coordinates (This description will appear on the report)				Date (dd-mm-yy)		Time (hh:mm)		Sample Type		NUMBER OF CONTAINERS Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below PM2.5 Mass PM2.5 Concentration PMcoarse Mass PMcoarse Concentration PM10 Mass PM10 Concentration SAMPLES ON HOLD SUSPECTED HAZARD (see Special Instructions)									
64482						3-May-19		0:00		Air Particulate											
64472						4-May-19		0:00		Air Particulate											
64475						6-May-19		0:00		Air Particulate											
65088						9-May-19		0:00		Air Particulate											
65086						12-May-19		0:00		Air Particulate											
64480						15-May-19		0:00		Air Particulate											
64478						18-May-19		0:00		Air Particulate											
64477						21-May-19		0:00		Air Particulate											
15279						24-May-19		0:00		Air Particulate											
57309						27-May-19		0:00		Air Particulate											
27408						30-May-19		0:00		Air Particulate											
41680						2-Jun-19		0:00		Air Particulate											
Drinking Water (DW) Samples¹ (client use)						Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)															
Are samples taken from a Regulated DW System? ☐ YES ☐ NO						Sample date/time represents STARTING date/time. See attached information sheet for sampling volume.															
Are samples for human consumption/ use? ☐ YES ☐ NO																					
SHIPMENT RELEASE (client use)						INITIAL SHIPMENT RECEPTION (lab use only)															
Released by:		Date:		Time:		Received by:		Date:		Time:		FINAL SHIPMENT RECEPTION (lab use only)									
												Received by: <i>[Signature]</i> Date: June 10 Time: 10:05									

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

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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.

1. If any water samples are taken from a **Regulated Drinking Water (DW) System**, please submit using an **Authorized DW COC form**.

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Chain of Custody (COC) / Analytical
Request Form

Canada Toll Free: 1 800 668 9878



L2288327-COFC

COC Number: 17-830837

Page 2 of 2

Report To Contact and company name below will appear on the final report		Report Format / Distribution		Select Service Level below - Contact your AM to confirm all E&P TATs (surcharges may apply)													
Company:		Select Report Format: ☐ PDF ☐ EXCEL ☐ EDD (DIGITAL)		Regular [R] ☐ Standard TAT if received by 3 pm - business days - no surcharges apply													
Contact:		Quality Control (QC) Report with Report ☐ YES ☐ NO		PRIORITY (Business Days)		4 day [P4-20%] ☐				EMERGENCY		1 Business day [E - 100%] ☐					
Phone:		☐ Compare Results to Criteria on Report - provide details below if box checked				3 day [P3-25%] ☐						Same Day, Weekend or Statutory holiday [E2 -200% (Laboratory opening fees may apply)] ☐					
Company address below will appear on the final report		Select Distribution: ☐ EMAIL ☐ MAIL ☐ FAX				2 day [P2-50%] ☐											
Street:		Email 1 or Fax				Date and Time Required for all E&P TATs:				dd-mmm-yy hh:mm							
City/Province:		Email 2				For tests that can not be performed according to the service level selected, you will be contacted.											
Postal Code:		Email 3				Analysis Request											
Invoice To		Invoice Distribution				Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below											
Same as Report To ☐ YES ☐ NO		Select Invoice Distribution: ☐ EMAIL ☐ MAIL ☐ FAX															
Copy of Invoice with Report ☐ YES ☐ NO		Email 1 or Fax															
Company:		Email 2															
Contact:																	
Project Information		Oil and Gas Required Fields (client use)															
ALS Account # / Quote #:		AFE/Cost Center:		PO#													
Job #:		Major/Minor Code:		Routing Code:													
PO / AFE:		Requisitioner:															
LSD:		Location:															
ALS Lab Work Order # (lab use only):		ALS Contact:		Sampler:													
ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	NUMBER OF CONTAINERS	PM2.5 Mass	PM2.5 Concentration	PM10 coarse Mass	PM10 coarse Concentration	PM10 Mass	PM10 Concentration					SAMPLES ON HOLD	SUSPECTED HAZARD (see Special Instructions)
	15064	3-May-19	0:00	Air Particulate	1			R	R	R	R						
	65074	4-May-19	0:00	Air Particulate	1			R	R	R	R						
	64463	6-May-19	0:00	Air Particulate	1			R	R	R	R						
	64447	9-May-19	0:00	Air Particulate	1			R	R	R	R						
	64464	12-May-19	0:00	Air Particulate	1			R	R	R	R						
	64454	15-May-19	0:00	Air Particulate	1			R	R	R	R						
	64461	18-May-19	0:00	Air Particulate	1			R	R	R	R						
	64448	21-May-19	0:00	Air Particulate	1			R	R	R	R						
	9909	24-May-19	0:00	Air Particulate	1			R	R	R	R						
	17843	27-May-19	0:00	Air Particulate	1			R	R	R	R						
	24543	30-May-19	0:00	Air Particulate	1			R	R	R	R						
	17820	2-Jun-19	0:00	Air Particulate	1			R	R	R	R						
Drinking Water (DW) Samples¹ (client use)		Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)		SAMPLE CONDITION AS RECEIVED (lab use only)													
Are samples taken from a Regulated DW System? ☐ YES ☐ NO		Sample date/time represents STARTING date/time. See attached information sheet for sampling volume.		Frozen ☐ SIF Observations Yes ☐ No ☐													
Are samples for human consumption/ use? ☐ YES ☐ NO				Ice Packs ☐ Ice Cubes ☐ Custody seal intact Yes ☐ No ☐													
				Cooling Initiated ☐													
				INITIAL COOLER TEMPERATURES °C													
				FINAL COOLER TEMPERATURES °C													
				18°C													
SHIPMENT RELEASE (client use)		INITIAL SHIPMENT RECEPTION (lab use only)		FINAL SHIPMENT RECEPTION (lab use only)													
Released by:		Date:		Time:		Received by:		Date:		Time:		Received by:		Date:		Time:	
												w		June 10		10:55am	

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

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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.

1. If any water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC form.

2019

NOV 2018 FRONT

Instructions for ALS: Please include this page on the COC scan for inclusion into the COA pdf.



L2288327-COFC

Sampling order	CassetteID	PM Type	Start_Date_ actual	Start_Time_ act	Stop_Date_ actual	Stop_Time_ act	Total_Samp le_time	Volume of air sampled (Actual Volume; m^3)	Volume of air sampled (Actual Volume; Litres)	Blank Sample?
1	64482	PM2.5	3-May-19	0:00	3-May-19	23:59	23:59:00	21.6	21600	no
2	64472	PM2.5	4-May-19	0:00	4-May-19	0:00	0:00:00	0.0	0	YES
3	64475	PM2.5	6-May-19	0:00	7-May-19	0:00	24:00:00	21.6	21600	no
4	65088	PM2.5	9-May-19	0:00	10-May-19	0:00	24:00:00	21.6	21600	no
5	65086	PM2.5	12-May-19	0:00	13-May-19	0:00	24:00:00	21.6	21600	no
6	64480	PM2.5	15-May-19	0:00	16-May-19	0:00	24:00:00	21.6	21600	no
7	64478	PM2.5	18-May-19	0:00	19-May-19	0:00	24:00:00	21.6	21600	no
8	64477	PM2.5	21-May-19	0:00	22-May-19	0:00	24:00:00	21.6	21600	no
9	15279	PM2.5	24-May-19	0:00	25-May-19	0:00	24:00:00	21.6	21600	no
10	57309	PM2.5	27-May-19	0:00	28-May-19	0:00	24:00:00	21.6	21600	no
11	27408	PM2.5	30-May-19	0:00	31-May-19	0:00	24:00:00	21.6	21600	no
12	41680	PM2.5	2-Jun-19	0:00	3-Jun-19	0:00	24:00:00	21.6	21600	no
1	15064	PMcoarse	3-May-19	0:00	3-May-19	23:59	23:59:00	2.4	2400	no
2	65074	PMcoarse	4-May-19	0:00	4-May-19	0:00	0:00:00	0	0	YES
3	64463	PMcoarse	6-May-19	0:00	7-May-19	0:00	24:00:00	2.41	2410	no
4	64447	PMcoarse	9-May-19	0:00	10-May-19	0:00	24:00:00	2.41	2410	no
5	64464	PMcoarse	12-May-19	0:00	13-May-19	0:00	24:00:00	2.41	2410	no
6	64454	PMcoarse	15-May-19	0:00	16-May-19	0:00	24:00:00	2.41	2410	no
7	64461	PMcoarse	18-May-19	0:00	19-May-19	0:00	24:00:00	2.41	2410	no
8	64448	PMcoarse	21-May-19	0:00	22-May-19	0:00	24:00:00	2.41	2410	no
9	9909	PMcoarse	24-May-19	0:00	25-May-19	0:00	24:00:00	2.41	2410	no
10	17843	PMcoarse	27-May-19	0:00	28-May-19	0:00	24:00:00	2.41	2410	no
11	24543	PMcoarse	30-May-19	0:00	31-May-19	0:00	24:00:00	2.41	2410	no
12	17820	PMcoarse	2-Jun-19	0:00	3-Jun-19	0:00	24:00:00	2.41	2410	no



ERM Consultants Canada Ltd.
ATTN: Daniel Casanova
3790 Alfred Ave.
Smithers BC V0J 2N0

Date Received: 08-JUL-19
Report Date: 17-JUL-19 17:07 (MT)
Version: FINAL

Client Phone: 604-689-9460

Certificate of Analysis

Lab Work Order #: L2305424
Project P.O. #: NOT SUBMITTED
Job Reference: TENAS; 0403488-0203-0001
C of C Numbers: 17-828532
Legal Site Desc:

Amber Springer, B.Sc
Account Manager

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ALS ENVIRONMENTAL ANALYTICAL REPORT

		Sample ID	L2305424-1	L2305424-2	L2305424-3	L2305424-4	L2305424-5
		Description	Air Particulate	Air Particulate	Air Particulate	Air Particulate	Air Particulate
		Sampled Date	08-JUN-19	09-JUN-19	11-JUN-19	14-JUN-19	17-JUN-19
		Sampled Time					
		Client ID	57307	57306	34145	57303	34144
Grouping	Analyte						
FILTER							
Particulates	Particulate - PM2.5 (ug)		77	53	70	53	70
	Particulate - PM2.5 (ug/m3)		3.5		3.2	2.5	3.2
	Particulate-Fine (ug/m3)						
	Particulate-Coarse (ug)						
	Particulate-Coarse (ug/m3)						
	Particulate-PM10 (ug/m3)						

ALS ENVIRONMENTAL ANALYTICAL REPORT

		Sample ID	L2305424-6	L2305424-7	L2305424-8	L2305424-9	L2305424-10
		Description	Air Particulate	Air Particulate	Air Particulate	Air Particulate	Air Particulate
		Sampled Date	20-JUN-19	23-JUN-19	26-JUN-19	29-JUN-19	02-JUL-19
		Sampled Time					
		Client ID	4220	57296	15526	57299	57313
Grouping	Analyte						
FILTER							
Particulates	Particulate - PM2.5 (ug)		73	67	110	140	270
	Particulate - PM2.5 (ug/m3)		3.4	3.1	5.1	6.5	12.5
	Particulate-Fine (ug/m3)						
	Particulate-Coarse (ug)						
	Particulate-Coarse (ug/m3)						
	Particulate-PM10 (ug/m3)						

ALS ENVIRONMENTAL ANALYTICAL REPORT

		Sample ID	L2305424-11	L2305424-12	L2305424-13	L2305424-14	L2305424-15
		Description	Air Particulate	Air Particulate	Air Particulate	Air Particulate	Air Particulate
		Sampled Date	08-JUN-19	09-JUN-19	11-JUN-19	14-JUN-19	17-JUN-19
		Sampled Time					
		Client ID	16076	65072	34121	15496	41682
Grouping	Analyte						
FILTER							
Particulates	Particulate - PM2.5 (ug)						
	Particulate - PM2.5 (ug/m3)						
	Particulate-Fine (ug/m3)		3.5		3.2	2.5	3.2
	Particulate-Coarse (ug)		70	50	63	107	93
	Particulate-Coarse (ug/m3)		2.6		2.3	4.2	3.6
	Particulate-PM10 (ug/m3)		6.1		5.6	6.7	6.8

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID Description Sampled Date Sampled Time Client ID		L2305424-16 Air Particulate 20-JUN-19 27306	L2305424-17 Air Particulate 23-JUN-19 64473	L2305424-18 Air Particulate 26-JUN-19 25074	L2305424-19 Air Particulate 29-JUN-19 64465	L2305424-20 Air Particulate 02-JUL-19 54603
Grouping	Analyte					
FILTER						
Particulates	Particulate - PM2.5 (ug)					
	Particulate - PM2.5 (ug/m3)					
	Particulate-Fine (ug/m3)	3.4	3.1	5.1	6.5	12.5
	Particulate-Coarse (ug)	150	117	143	113	167
	Particulate-Coarse (ug/m3)	5.9	4.5	5.5	4.1	5.7
	Particulate-PM10 (ug/m3)	9.3	7.6	10.6	10.6	18.2

		Sample ID	L2305424-1	L2305424-3	L2305424-4	L2305424-5	L2305424-6
		Description	Air Particulate	Air Particulate	Air Particulate	Air Particulate	Air Particulate
		Sampled Date	08-JUN-19	11-JUN-19	14-JUN-19	17-JUN-19	20-JUN-19
		Sampled Time					
		Client ID	57307	34145	57303	34144	4220
Grouping	Analyte						
MISC.							
Field Tests	Air Volume, Client Supplied (L)	21600	21600	21600	21600	21600	

Sample ID Description Sampled Date Sampled Time Client ID		L2305424-7 Air Particulate 23-JUN-19 57296	L2305424-8 Air Particulate 26-JUN-19 15526	L2305424-9 Air Particulate 29-JUN-19 57299	L2305424-10 Air Particulate 02-JUL-19 57313	L2305424-11 Air Particulate 08-JUN-19 16076
Grouping	Analyte					
MISC.						
Field Tests	Air Volume, Client Supplied (L)	21600	21600	21600	21600	2400

		Sample ID	L2305424-13	L2305424-14	L2305424-15	L2305424-16	L2305424-17
		Description	Air Particulate	Air Particulate	Air Particulate	Air Particulate	Air Particulate
		Sampled Date	11-JUN-19	14-JUN-19	17-JUN-19	20-JUN-19	23-JUN-19
		Sampled Time					
		Client ID	34121	15496	41682	27306	64473
Grouping	Analyte						
MISC.							
Field Tests	Air Volume, Client Supplied (L)	2410	2410	2410	2410	2410	2410

		Sample ID Description Sampled Date Sampled Time Client ID	L2305424-18 Air Particulate 26-JUN-19 25074	L2305424-19 Air Particulate 29-JUN-19 64465	L2305424-20 Air Particulate 02-JUL-19 54603		
Grouping	Analyte						
MISC.							
Field Tests	Air Volume, Client Supplied (L)		2400	2410	2410		

Reference Information

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
AIR VOLUME-VA	Misc.	Air volume (L)	HYGIENE METHOD
PART-DICHOT-PM10-VA	Filter	Total Particulate (Dichot-PM10) by Grav.	BCMOE Method
Total Particulate Matter (PM10) Method analysis is carried out in accordance with the BCMOE Lab Manual, Section G Air Constituents - Inorganics, "Total Particulate - PM10/PM02 - 47mm - HiVol" method. ALS provides pre-weighed filters (Pallflex TX40 HI20-WW 47mm) and clients typically sample using a "Dichotomus Partisol sequential Air Sampler" equivalent sample (EQPS-0509-179, EQPS-0509-180, EQPS-0311-198) as per U.S. EPA Reference Method RFPS-0694-098, fitted with a PM10 inlet. The particulate matter is determined gravimetrically. Three formulas are required for the mass concentration (um/M3) computation of fine PM (PM-2.5) Course PM (PM-10 minus PM2.5) and PM-10.			
PART-PM2.5-VA	Filter	Total Particulate (PM2.5) by Gravimetric	BCMOE METHOD
Total Particulate Matter (PM2.5) Method analysis is carried out in accordance with the BCMOE Lab Manual, Section G Air Constituents - Inorganics, "Total Particulate - PM10/PM02 - 47mm - HiVol" method. ALS provides pre-weighed filters (Pallflex TX40 HI20-WW 47mm) and clients typically sample using a "Partisol Model 2000 Air Sampler" as per U.S. EPA Reference Method RFPS-0694-098, fitted with a PM2.5 inlet. The particulate matter is determined gravimetrically.			

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

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
VA	ALS ENVIRONMENTAL - VANCOUVER, BRITISH COLUMBIA, CANADA

Chain of Custody Numbers:

17-828532

GLOSSARY OF REPORT TERMS

Surrogate - A compound that is similar in behaviour to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.

mg/kg - milligrams per kilogram based on dry weight of sample.

mg/kg wwt - milligrams per kilogram based on wet weight of sample.

mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight of sample.

mg/L - milligrams per litre.

< - Less than.

D.L. - The reported Detection Limit, also known as the Limit of Reporting (LOR).

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

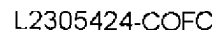
Test results reported relate only to the samples as received by the laboratory.

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

Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.



Canada Toll Free: 1 800 668 9878



COC Number: 17-828532

Page 1 of 1

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REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

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1. If any water samples are taken from a Regulated Drinking Water (RDW) System, please submit using an Authorized DW COC form

NOV 20 14 5:00 PM



Report To		Report Format / Distribution		Select Service Level Below - Contact your AM to confirm all E&P TATs (surcharges may apply)															
Contact and company name below will appear on the final report		Select Report Format: ☐ PDF ☒ EXCEL ☐ EDD (DIGITAL)		Regular [R] ☐ Standard TAT if received by 3 pm - business days - no surcharges apply															
Company:		Quality Control (QC) Report with Report ☐ YES ☐ NO		PRIORITY (Business Days)				EMERGENCY											
Contact:		☐ Compare Results to Criteria on Report - provide details below if box checked		4 day [P4-20%] ☐				1 Business day [E - 100%] ☐											
Phone:		Select Distribution: ☐ EMAIL ☐ MAIL ☐ FAX		3 day [P3-25%] ☐				Same Day, Weekend or Statutory holiday [E2 - 200%] ☐											
Company address below will appear on the final report		Email 1 or Fax		2 day [P2-50%] ☐				[Laboratory opening fees may apply]											
Street:		Email 2		Date and Time Required for all E&P TATs:				dd-mmm-yy hh:mm											
City/Province:		Email 3		For tests that can not be performed according to the service level selected, you will be contacted.															
Postal Code:				Analysis Request															
Invoice To		Same as Report To ☐ YES ☐ NO		Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below															
Company:		Copy of Invoice with Report ☐ YES ☐ NO																	
Contact:				NUMBER OF CONTAINERS															
Project Information		Oil and Gas Required Fields (client use)		SAMPLES ON HOLD															
ALS Account # / Quote #:		AFE/Cost Center:																	
Job #:		Major/Minor Code:		SUSPECTED HAZARD (see Special Instructions)															
PO / AFE:		Routing Code:																	
LSD:		Requisitioner:		PM2 5 Mass															
		Location:																	
ALS Lab Work Order # (lab use only):		ALS Contact:		PM2.5 Concentration															
		Sampler:																	
ALS Sample # (lab use only)		Sample Identification and/or Coordinates (This description will appear on the report)		PMcoarse Mass															
		Date (dd-mmm-yy)		PMcoarse Concentration															
		Time (hh:mm)		PM10 Mass															
		Sample Type		PM10 Concentration															
16076		8-Jun-19		PM2 5 Mass															
65072		9-Jun-19																	
34121		11-Jun-19		PM2.5 Concentration															
15496		14-Jun-19																	
41682		17-Jun-19		PMcoarse Mass															
27306		20-Jun-19																	
64473		23-Jun-19		PMcoarse Concentration															
25074		26-Jun-19																	
64465		29-Jun-19		PM10 Mass															
54603		2-Jul-19																	
				PM10 Concentration															
				PM2 5 Mass															
				PM2.5 Concentration															
				PMcoarse Mass															
				PMcoarse Concentration															
				PM10 Mass															
				PM10 Concentration															
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				PMcoarse Mass															
				PMcoarse Concentration															
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				PM2 5 Mass															
				PM2.5 Concentration															
				PMcoarse Mass															
				PMcoarse Concentration															
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				PM2 5 Mass															
				PM2.5 Concentration															
				PMcoarse Mass															
				PMcoarse Concentration															
				PM10 Mass															
				PM10 Concentration															
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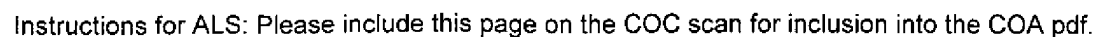
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1. If any water samples are taken from a **Regulated Drinking Water (DW) System**, please submit using an **Authorized DW COC form**.

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L2305424-COFC

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ERM Consultants Canada Ltd.
ATTN: Daniel Casanova
1500-1111 West Hastings Street
Vancouver BC V6E 2J3

Date Received: 21-AUG-19
Report Date: 30-AUG-19 12:55 (MT)
Version: FINAL

Client Phone: 604-689-9460

Certificate of Analysis

Lab Work Order #: L2332928
Project P.O. #: NOT SUBMITTED
Job Reference: TENAS; 0403488-0203-0001
C of C Numbers: 17-759166
Legal Site Desc:

Amber Springer, B.Sc
Account Manager

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ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID Description Sampled Date Sampled Time Client ID		L2332928-1 Air Particulate 05-JUL-19 4235	L2332928-2 Air Particulate 06-JUL-19 15261	L2332928-3 Air Particulate 08-JUL-19 41674	L2332928-4 Air Particulate 11-JUL-19 15064	L2332928-5 Air Particulate 14-JUL-19 64454
Grouping	Analyte					
FILTER						
Particulates	Particulate - PM2.5 (ug)	127	57	197	<50	67
	Particulate - PM2.5 (ug/m3)	5.9		9.1	<2.3	3.1
	Particulate-Fine (ug/m3)					
	Particulate-Coarse (ug)					
	Particulate-Coarse (ug/m3)					
	Particulate-PM10 (ug/m3)					

ALS ENVIRONMENTAL ANALYTICAL REPORT

		Sample ID	L2332928-6	L2332928-7	L2332928-8	L2332928-9	L2332928-10
		Description	Air Particulate	Air Particulate	Air Particulate	Air Particulate	Air Particulate
		Sampled Date	17-JUL-19	20-JUL-19	23-JUL-19	26-JUL-19	29-JUL-19
		Sampled Time					
		Client ID	64447	17843	64478	27408	90549
Grouping	Analyte						
FILTER							
Particulates	Particulate - PM2.5 (ug)	<50	87	77	<50	83	
	Particulate - PM2.5 (ug/m3)	<2.3	4.0	3.5	<2.3	3.9	
	Particulate-Fine (ug/m3)						
	Particulate-Coarse (ug)						
	Particulate-Coarse (ug/m3)						
	Particulate-PM10 (ug/m3)						

ALS ENVIRONMENTAL ANALYTICAL REPORT

		Sample ID	L2332928-11	L2332928-12	L2332928-13	L2332928-14	L2332928-15
		Description	Air Particulate	Air Particulate	Air Particulate	Air Particulate	Air Particulate
		Sampled Date	01-AUG-19	04-AUG-19	07-AUG-19	10-AUG-19	13-AUG-19
		Sampled Time					
		Client ID	65088	64472	64477	64469	64462
Grouping	Analyte						
FILTER							
Particulates	Particulate - PM2.5 (ug)		103	117	153	67	77
	Particulate - PM2.5 (ug/m3)		4.8	5.4	7.1	3.1	3.5
	Particulate-Fine (ug/m3)						
	Particulate-Coarse (ug)						
	Particulate-Coarse (ug/m3)						
	Particulate-PM10 (ug/m3)						

ALS ENVIRONMENTAL ANALYTICAL REPORT

		Sample ID	Description	Sampled Date	Sampled Time	Client ID
		L2332928-16	Air Particulate	05-JUL-19		64468
		L2332928-17	Air Particulate	06-JUL-19		64452
		L2332928-18	Air Particulate	08-JUL-19		64482
		L2332928-19	Air Particulate	11-JUL-19		24543
		L2332928-20	Air Particulate	14-JUL-19		65074
Grouping	Analyte					
FILTER						
Particulates	Particulate - PM2.5 (ug)					
	Particulate - PM2.5 (ug/m3)					
	Particulate-Fine (ug/m3)	5.9		9.1	<2.3	3.1
	Particulate-Coarse (ug)	167	53	117	60	93
	Particulate-Coarse (ug/m3)	6.4		3.9	2.3	3.6
	Particulate-PM10 (ug/m3)	12.2		13.1	4.4	6.7

ALS ENVIRONMENTAL ANALYTICAL REPORT

		Sample ID	L2332928-21	L2332928-22	L2332928-23	L2332928-24	L2332928-25
		Description	Air Particulate	Air Particulate	Air Particulate	Air Particulate	Air Particulate
		Sampled Date	17-JUL-19	20-JUL-19	23-JUL-19	26-JUL-19	29-JUL-19
		Sampled Time					
		Client ID	15279	64480	64463	17820	9909
Grouping	Analyte						
FILTER							
Particulates	Particulate - PM2.5 (ug)						
	Particulate - PM2.5 (ug/m3)						
	Particulate-Fine (ug/m3)	<2.3	4.0	3.5	<2.3	3.9	
	Particulate-Coarse (ug)	63	110	137	140	137	
	Particulate-Coarse (ug/m3)	2.5	4.2	5.3	5.6	5.3	
	Particulate-PM10 (ug/m3)	4.0	8.2	8.9	7.8	9.2	

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID Description Sampled Date Sampled Time Client ID		L2332928-26 Air Particulate 01-AUG-19 65086	L2332928-27 Air Particulate 04-AUG-19 64464	L2332928-28 Air Particulate 07-AUG-19 41680	L2332928-29 Air Particulate 10-AUG-19 64461	L2332928-30 Air Particulate 13-AUG-19 57309
Grouping	Analyte					
FILTER						
Particulates	Particulate - PM2.5 (ug)					
	Particulate - PM2.5 (ug/m3)					
	Particulate-Fine (ug/m3)	4.8	5.4	7.1	3.1	3.5
	Particulate-Coarse (ug)	143	263	200	173	150
	Particulate-Coarse (ug/m3)	5.5	10.4	7.6	6.9	5.9
	Particulate-PM10 (ug/m3)	10.3	15.8	14.7	10.0	9.4

		Sample ID Description Sampled Date Sampled Time Client ID	L2332928-1 Air Particulate 05-JUL-19 4235	L2332928-3 Air Particulate 08-JUL-19 41674	L2332928-4 Air Particulate 11-JUL-19 15064	L2332928-5 Air Particulate 14-JUL-19 64454	L2332928-6 Air Particulate 17-JUL-19 64447
Grouping	Analyte						
MISC.							
Field Tests	Air Volume, Client Supplied (L)		21600	21600	21600	21600	21600

		Sample ID Description Sampled Date Sampled Time Client ID	L2332928-7 Air Particulate 20-JUL-19 17843	L2332928-8 Air Particulate 23-JUL-19 64478	L2332928-9 Air Particulate 26-JUL-19 27408	L2332928-10 Air Particulate 29-JUL-19 90549	L2332928-11 Air Particulate 01-AUG-19 65088
Grouping	Analyte						
MISC.							
Field Tests	Air Volume, Client Supplied (L)		21600	21600	21600	21600	21600

		Sample ID Description Sampled Date Sampled Time Client ID	L2332928-12 Air Particulate 04-AUG-19 64472	L2332928-13 Air Particulate 07-AUG-19 64477	L2332928-14 Air Particulate 10-AUG-19 64469	L2332928-15 Air Particulate 13-AUG-19 64462	L2332928-16 Air Particulate 05-JUL-19 64468
Grouping	Analyte						
MISC.							
Field Tests	Air Volume, Client Supplied (L)		21600	21600	21600	21600	2400

		Sample ID Description Sampled Date Sampled Time Client ID	L2332928-18 Air Particulate 08-JUL-19 64482	L2332928-19 Air Particulate 11-JUL-19 24543	L2332928-20 Air Particulate 14-JUL-19 65074	L2332928-21 Air Particulate 17-JUL-19 15279	L2332928-22 Air Particulate 20-JUL-19 64480
Grouping	Analyte						
MISC.							
Field Tests	Air Volume, Client Supplied (L)		2410	2410	2410	2410	2410

		Sample ID Description Sampled Date Sampled Time Client ID	L2332928-23 Air Particulate 23-JUL-19 64463	L2332928-24 Air Particulate 26-JUL-19 17820	L2332928-25 Air Particulate 29-JUL-19 9909	L2332928-26 Air Particulate 01-AUG-19 65086	L2332928-27 Air Particulate 04-AUG-19 64464
Grouping	Analyte						
MISC.							
Field Tests	Air Volume, Client Supplied (L)		2410	2410	2410	2410	2410

		Sample ID Description Sampled Date Sampled Time Client ID	L2332928-28 Air Particulate 07-AUG-19 41680	L2332928-29 Air Particulate 10-AUG-19 64461	L2332928-30 Air Particulate 13-AUG-19 57309		
Grouping	Analyte						
MISC.							
Field Tests	Air Volume, Client Supplied (L)		2410	2410	2410		

Reference Information

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
AIR VOLUME-VA	Misc.	Air volume (L)	HYGIENE METHOD
PART-DICHOT-PM10-VA	Filter	Total Particulate (Dichot-PM10) by Grav.	BCMOE Method
Total Particulate Matter (PM10) Method analysis is carried out in accordance with the BCMOE Lab Manual, Section G Air Constituents - Inorganics, "Total Particulate - PM10/PM02 - 47mm - HiVol" method. ALS provides pre-weighed filters (Pallflex TX40 HI20-WW 47mm) and clients typically sample using a "Dichotomus Partisol sequential Air Sampler" equivalent sample (EQPS-0509-179, EQPS-0509-180, EQPS-0311-198) as per U.S. EPA Reference Method RFPS-0694-098, fitted with a PM10 inlet. The particulate matter is determined gravimetrically. Three formulas are required for the mass concentration (um/M3) computation of fine PM (PM-2.5) Course PM (PM-10 minus PM2.5) and PM-10.			
PART-PM2.5-VA	Filter	Total Particulate (PM2.5) by Gravimetric	BCMOE METHOD
Total Particulate Matter (PM2.5) Method analysis is carried out in accordance with the BCMOE Lab Manual, Section G Air Constituents - Inorganics, "Total Particulate - PM10/PM02 - 47mm - HiVol" method. ALS provides pre-weighed filters (Pallflex TX40 HI20-WW 47mm) and clients typically sample using a "Partisol Model 2000 Air Sampler" as per U.S. EPA Reference Method RFPS-0694-098, fitted with a PM2.5 inlet. The particulate matter is determined gravimetrically.			

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

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
VA	ALS ENVIRONMENTAL - VANCOUVER, BRITISH COLUMBIA, CANADA

Chain of Custody Numbers:

17-759166

GLOSSARY OF REPORT TERMS

Surrogate - A compound that is similar in behaviour to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.

mg/kg - milligrams per kilogram based on dry weight of sample.

mg/kg ww - milligrams per kilogram based on wet weight of sample.

mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight of sample.

mg/L - milligrams per litre.

< - Less than.

D.L. - The reported Detection Limit, also known as the Limit of Reporting (LOR).

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.

Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.



www.alsglobal.com

Chain of Custody (COC) / Analytical
Request Form

Canada Toll Free: 1 800 668 9878



L2332928-COFC

COC Number: 17-759166

Page 1 of 4

Report To Contact and company name below will appear on the final report		Report Format / Distribution		Select Service Level below - Contact your AM to confirm all E&P TATs (surcharges may apply)																																																			
Company:	ERM	Select Report Format:	☒ PDF ☒ EXCEL ☐ EDD (DIGITAL)	Regular [R] ☒ Standard TAT if received by 3 pm - business days - no surcharges apply																																																			
Contact:	Daniel Casanova	Quality Control (QC) Report with Report	☐ YES ☐ NO	1 Business day [E - 100%] ☐																																																			
Phone:	250-877-7838	☐ Compare Results to Criteria on Report - provide details below if box checked		Same Day, Weekend or Statutory holiday [E2 - 200%] ☐ (Laboratory opening fees may apply)																																																			
Company address below will appear on the final report		Select Distribution:	☒ EMAIL ☐ MAIL ☐ FAX																																																				
Street:	3790 Alfred Ave	Email 1 or Fax:	daniel.casanova@erm.com	Date and Time Required for all E&P TATs: dd-mm-yy hh:mm																																																			
City/Province:	Smithers, BC	Email 2:	talaat.bakri@erm.com	For tests that can not be performed according to the service level selected, you will be contacted.																																																			
Postal Code:	V0J 2N0	Email 3:	andres.soux@erm.com																																																				
Invoice To	Same as Report To ☒ YES ☐ NO	Invoice Distribution		Analysis Request																																																			
	Copy of Invoice with Report ☐ YES ☒ NO	Select Invoice Distribution:	☒ EMAIL ☐ MAIL ☐ FAX	Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below																																																			
Company:		Email 1 or Fax:	korina.houghton@erm.com	<table border="1"> <tr> <th colspan="2">NUMBER OF CONTAINERS</th> <th colspan="10"></th> <th rowspan="4">SAMPLES ON HOLD</th> <th rowspan="4">SUSPECTED HAZARD (see Special Instructions)</th> </tr> <tr> <th>PM2.5 Mass</th> <th>PM2.5 Concentration</th> <th>PM10 coarse Mass</th> <th>PM10 coarse Concentration</th> <th>PM10 Mass</th> <th>PM10 Concentration</th> <th></th><th></th><th></th><th></th><th></th><th></th> </tr> <tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> </table>		NUMBER OF CONTAINERS												SAMPLES ON HOLD	SUSPECTED HAZARD (see Special Instructions)	PM2.5 Mass	PM2.5 Concentration	PM10 coarse Mass	PM10 coarse Concentration	PM10 Mass	PM10 Concentration																														
NUMBER OF CONTAINERS												SAMPLES ON HOLD	SUSPECTED HAZARD (see Special Instructions)																																										
PM2.5 Mass	PM2.5 Concentration	PM10 coarse Mass	PM10 coarse Concentration			PM10 Mass	PM10 Concentration																																																
Contact:		Email 2:	daniel.casanova@erm.com																																																				
Project Information		Oil and Gas Required Fields (client use)																																																					
ALS Account # / Quote #:		AFE/Cost Center:		PO#																																																			
Job #:		Major/Minor Code:		Routing Code:																																																			
PO / AFE:		Requisitioner:																																																					
LSD:		Location:																																																					
ALS Lab Work Order # (lab use only):		ALS Contact:	Amber Springer	Sampler:	Talaat Bakri																																																		
ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mm-yy)	Time (hh:mm)	Sample Type																																																			
	4235	5-Jul-19	0:00	Air Particulate	1 R R																																																		
	15261	6-Jul-19	0:00	Air Particulate	1 R R																																																		
	41674	8-Jul-19	0:00	Air Particulate	1 R R																																																		
	15064	11-Jul-19	0:00	Air Particulate	1 R R																																																		
	64454	14-Jul-19	0:00	Air Particulate	1 R R																																																		
	64447	17-Jul-19	0:00	Air Particulate	1 R R																																																		
	17843	20-Jul-19	0:00	Air Particulate	1 R R																																																		
	64478	23-Jul-19	0:00	Air Particulate	1 R R																																																		
	27408	26-Jul-19	0:00	Air Particulate	1 R R																																																		
	90549	29-Jul-19	0:00	Air Particulate	1 R R																																																		
	65088	1-Aug-19	0:00	Air Particulate	1 R R																																																		
	64472	4-Aug-19	0:00	Air Particulate	1 R R																																																		
Drinking Water (DW) Samples¹ (client use)		Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)																																																					
Are samples taken from a Regulated DW System? ☐ YES ☐ NO		Sample date/time represents STARTING date/time. See attached information sheet for sampling volume.																																																					
Are samples for human consumption/ use? ☐ YES ☐ NO																																																							
		SAMPLE CONDITION AS RECEIVED (lab use only) Frozen ☐ SIF Observations Yes ☐ No ☐ Ice Packs ☐ Ice Cubes ☐ Custody seal intact Yes ☐ No ☐ Cooling Initiated ☐ INITIAL COOLER TEMPERATURES °C: 20 FINAL COOLER TEMPERATURES °C:																																																					
SHIPMENT RELEASE (client use)		INITIAL SHIPMENT RECEPTION (lab use only)		FINAL SHIPMENT RECEPTION (lab use only)																																																			
Released by:	Date:	Received by:	Date:	Received by:	Date:																																																		
Don Casanova	Aug 19 19 12:00			JC	AUG 21 2019																																																		

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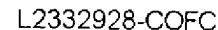
NOV 2018 F01T

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.

1. If any water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC form.



Canada Toll Free: 1 800 668 9878



COC Number: 17-759166

Page 2 of 2

1

Report To Contact and company name below will appear on the final report				Report Format / Distribution				Contact your AM to confirm all E&P TATs (surcharges may apply)															
Company:				Select Report Format: ☐ PDF ☐ EXCEL ☐ EDD (DIGITAL)				Regular [R] ☐ Standard TAT if received by 3 pm - business days - no surcharges apply															
Contact:				Quality Control (QC) Report with Report: ☐ YES ☐ NO				PRIORITY (Business Days) 4 day [P4-20%] ☐ 3 day [P3-25%] ☐ 2 day [P2-50%] ☐				EMERGENCY 1 Business day [E - 100%] Same Day, Weekend or Statutory holiday [E2 - 200%] (Laboratory opening fees may apply)] ☐											
Phone:				Compare Results to Criteria on Report - provide details below if box checked ☐																			
Company address below will appear on the final report				Select Distribution: ☐ EMAIL ☐ MAIL ☐ FAX																			
Street:				Email 1 or Fax				Date and Time Required for all E&P TATs:				dd-mmm-yy hh:mm											
City/Province:				Email 2				For tests that can not be performed according to the service level selected, you will be contacted.															
Postal Code:				Email 3																			
Invoice To				Invoice Distribution				Analysis Request															
Same as Report To ☐ YES ☐ NO				Select Invoice Distribution: ☐ EMAIL ☐ MAIL ☐ FAX				Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below															
Copy of Invoice with Report ☐ YES ☐ NO																							
Company:				Email 1 or Fax																			
Contact:				Email 2																			
Project Information				Oil and Gas Required Fields (client use)																			
ALS Account # / Quote #:				AFE/Cost Center:				PO#															
Job #:				Major/Minor Code:				Routing Code:															
PO / AFE:				Requisitioner:																			
LSD:				Location:																			
ALS Lab Work Order # (lab use only):				ALS Contact:				Sampler:															
ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)			Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	NUMBER OF CONTAINERS	PM2.5 Mass	PM2.5 Concentration	PMcoarse Mass	PMcoarse Concentration	PM10 Mass	PM10 Concentration								SAMPLES ON HOLD	SUSPECTED HAZARD (see Special Instructions)	
	64477			7-Aug-19	0:00	Air Particulate	1	R	R														
	64469			10-Aug-19	0:00	Air Particulate	1	R	R														
	64462			13-Aug-19	0:00	Air Particulate	1	R	R														
	64468			5-Jul-19	0:00	Air Particulate	1			R	R	R	R										
	64452			6-Jul-19	0:00	Air Particulate	1			R	R	R	R										
	64482			8-Jul-19	0:00	Air Particulate	1			R	R	R	R										
	24543			11-Jul-19	0:00	Air Particulate	1			R	R	R	R										
	65074			14-Jul-19	0:00	Air Particulate	1			R	R	R	R										
	15279			17-Jul-19	0:00	Air Particulate	1			R	R	R	R										
	64480			20-Jul-19	0:00	Air Particulate	1			R	R	R	R										
	64463			23-Jul-19	0:00	Air Particulate	1			R	R	R	R										
Drinking Water (DW) Samples¹ (client use)				Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)				SAMPLE CONDITION AS RECEIVED (lab use only)															
Are samples taken from a Regulated DW System? ☐ YES ☐ NO				Sample date/time represents STARTING date/time. See attached information sheet for sampling volume.				Frozen ☐ SIF Observations Yes ☐ No ☐															
Are samples for human consumption/ use? ☐ YES ☐ NO								Ice Packs ☐ Ice Cubes ☐ Custody seal intact Yes ☐ No ☐															
								Cooling Initiated ☐															
SHIPMENT RELEASE (client use)				INITIAL SHIPMENT RECEPTION (lab use only)				FINAL SHIPMENT RECEPTION (lab use only)															
Released by:		Date:		Time:		Received by:		Date:		Time:		Received by:		Date:		Time:							
												SC		AUG 21 2019		10:30							

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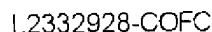
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1. If any water samples are taken from a **Regulated Drinking Water (DW) System**, please submit using an **Authorized DW COC form**.

NOV 2016 FRONT



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COC Number: 17-759166

Page 3 of 3

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REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

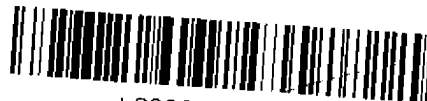
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NOV 2018 FROM



Instructions for ALS: Please include this page on the COC scan for inclusion into the

L2332928-COFC

Page 4 of 4

Sampling order	CassetteID	PM Type	Start_Date_ actual	Start_Time_ act	Stop_Date_ actual	Stop_Time_ act	Total_Samp le_time	Volume of air sampled (Actual Volume; m^3)	Volume of air sampled (Actual Volume; Litres)	Blank Sample?
1	4235	PM2.5	5-Jul-19	0:00	5-Jul-19	23:59	23:59:00	21.6	21600	no
2	15261	PM2.5	6-Jul-19	0:00	6-Jul-19	0:00	0:00:00	0.0	0	YES
3	41674	PM2.5	8-Jul-19	0:00	9-Jul-19	0:00	24:00:00	21.6	21600	no
4	15064	PM2.5	11-Jul-19	0:00	12-Jul-19	0:00	24:00:00	21.6	21600	no
5	64454	PM2.5	14-Jul-19	0:00	15-Jul-19	0:00	24:00:00	21.6	21600	no
6	64447	PM2.5	17-Jul-19	0:00	18-Jul-19	0:00	24:00:00	21.6	21600	no
7	17843	PM2.5	20-Jul-19	0:00	21-Jul-19	0:00	24:00:00	21.6	21600	no
8	64478	PM2.5	23-Jul-19	0:00	24-Jul-19	0:00	24:00:00	21.6	21600	no
9	27408	PM2.5	26-Jul-19	0:00	27-Jul-19	0:00	24:00:00	21.6	21600	no
10	90549	PM2.5	29-Jul-19	0:00	30-Jul-19	0:00	24:00:00	21.6	21600	no
11	65088	PM2.5	1-Aug-19	0:00	2-Aug-19	0:00	24:00:00	21.6	21600	no
12	64472	PM2.5	4-Aug-19	0:00	5-Aug-19	0:00	24:00:00	21.6	21600	no
13	64477	PM2.5	7-Aug-19	0:00	8-Aug-19	0:00	24:00:00	21.60	21600	no
14	64469	PM2.5	10-Aug-19	0:00	11-Aug-19	0:00	24:00:00	21.60	21600	no
15	64462	PM2.5	13-Aug-19	0:00	14-Aug-19	0:00	24:00:00	21.60	21600	no
1	64468	PMcoarse	5-Jul-19	0:00	5-Jul-19	23:59	23:59:00	2.4	2400	no
2	64452	PMcoarse	6-Jul-19	0:00	6-Jul-19	0:00	0:00:00	0	0	YES
3	64482	PMcoarse	8-Jul-19	0:00	9-Jul-19	0:00	24:00:00	2.41	2410	no
4	24543	PMcoarse	11-Jul-19	0:00	12-Jul-19	0:00	24:00:00	2.41	2410	no
5	65074	PMcoarse	14-Jul-19	0:00	15-Jul-19	0:00	24:00:00	2.41	2410	no
6	15279	PMcoarse	17-Jul-19	0:00	18-Jul-19	0:00	24:00:00	2.41	2410	no
7	64480	PMcoarse	20-Jul-19	0:00	21-Jul-19	0:00	24:00:00	2.41	2410	no
8	64463	PMcoarse	23-Jul-19	0:00	24-Jul-19	0:00	24:00:00	2.41	2410	no
9	17820	PMcoarse	26-Jul-19	0:00	27-Jul-19	0:00	24:00:00	2.41	2410	no
10	9909	PMcoarse	29-Jul-19	0:00	30-Jul-19	0:00	24:00:00	2.41	2410	no
11	65086	PMcoarse	1-Aug-19	0:00	2-Aug-19	0:00	24:00:00	2.41	2410	no
12	64464	PMcoarse	4-Aug-19	0:00	5-Aug-19	0:00	24:00:00	2.41	2410	no
13	41680	PMcoarse	7-Aug-19	0:00	8-Aug-19	0:00	24:00:00	2.41	2410	no
14	64461	PMcoarse	10-Aug-19	0:00	11-Aug-19	0:00	24:00:00	2.41	2410	no
15	57309	PMcoarse	13-Aug-19	0:00	14-Aug-19	0:00	24:00:00	2.41	2410	no



ERM Consultants Canada Ltd.
ATTN: Daniel Casanova
1500-1111 West Hastings Street
Vancouver BC V6E 2J3

Date Received: 07-NOV-19
Report Date: 22-NOV-19 13:21 (MT)
Version: FINAL

Client Phone: 604-689-9460

Certificate of Analysis

Lab Work Order #: L2379079
Project P.O. #: NOT SUBMITTED
Job Reference: TENAS; 0403488-0223-0001
C of C Numbers: 17-759166
Legal Site Desc:

Amber Springer, B.Sc
Account Manager

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ALS CANADA LTD Part of the ALS Group An ALS Limited Company

ALS ENVIRONMENTAL ANALYTICAL REPORT

		Sample ID	L2379079-1	L2379079-2	L2379079-3	L2379079-4	L2379079-5
		Description	Air Particulate	Air Particulate	Air Particulate	Air Particulate	Air Particulate
		Sampled Date	16-AUG-19	17-AUG-19	19-AUG-19	22-AUG-19	25-AUG-19
		Sampled Time					
		Client ID	64475	4220	15526	34144	34145
Grouping	Analyte						
FILTER							
Particulates	Particulate - PM2.5 (ug)		<50	<50	<50	<50	57
	Particulate - PM2.5 (ug/m3)		<2.3		<2.3	<2.3	2.6
	Particulate-Fine (ug/m3)						
	Particulate-Coarse (ug)						
	Particulate-Coarse (ug/m3)						
	Particulate-PM10 (ug/m3)						

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID Description Sampled Date Sampled Time Client ID		L2379079-6 Air Particulate 28-AUG-19 57296	L2379079-7 Air Particulate 31-AUG-19 57299	L2379079-8 Air Particulate 03-SEP-19 57303	L2379079-9 Air Particulate 06-SEP-19 57306	L2379079-10 Air Particulate 09-SEP-19 57307
Grouping	Analyte					
FILTER						
Particulates	Particulate - PM2.5 (ug)	73	80	50	<50	50
	Particulate - PM2.5 (ug/m3)	3.4	3.7	2.3	<2.3	2.3
	Particulate-Fine (ug/m3)					
	Particulate-Coarse (ug)					
	Particulate-Coarse (ug/m3)					
	Particulate-PM10 (ug/m3)					

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID Description Sampled Date Sampled Time Client ID		L2379079-11 Air Particulate 12-SEP-19 57313	L2379079-12 Air Particulate 16-AUG-19 64448	L2379079-13 Air Particulate 17-AUG-19 80608	L2379079-14 Air Particulate 19-AUG-19 54603	L2379079-15 Air Particulate 22-AUG-19 65072
Grouping	Analyte					
FILTER						
Particulates	Particulate - PM2.5 (ug)	<50				
	Particulate - PM2.5 (ug/m3)	<2.3				
	Particulate-Fine (ug/m3)		<2.3		<2.3	<2.3
	Particulate-Coarse (ug)		<50	123 ^{RRV}	<50	80
	Particulate-Coarse (ug/m3)		<2.1		<2.1	3.3
	Particulate-PM10 (ug/m3)		<3.1		<3.1	3.7

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID Description Sampled Date Sampled Time Client ID		L2379079-16 Air Particulate 25-AUG-19 64473	L2379079-17 Air Particulate 28-AUG-19 64465	L2379079-18 Air Particulate 31-AUG-19 41682	L2379079-19 Air Particulate 03-SEP-19 34121	L2379079-20 Air Particulate 06-SEP-19 27306
Grouping	Analyte					
FILTER						
Particulates	Particulate - PM2.5 (ug)					
	Particulate - PM2.5 (ug/m3)					
	Particulate-Fine (ug/m3)	2.6	3.4	3.7	2.3	<2.3
	Particulate-Coarse (ug)	73	110	113	80	143
	Particulate-Coarse (ug/m3)	2.8	4.2	4.3	3.1	5.8
	Particulate-PM10 (ug/m3)	5.4	7.6	8.1	5.4	7.8

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

		Sample ID Description Sampled Date Sampled Time Client ID	L2379079-21 Air Particulate 09-SEP-19 25074	L2379079-22 Air Particulate 12-SEP-19 16076			
Grouping	Analyte						
FILTER							
Particulates	Particulate - PM2.5 (ug)						
	Particulate - PM2.5 (ug/m3)						
	Particulate-Fine (ug/m3)		2.3	<2.3			
	Particulate-Coarse (ug)		123	103			
	Particulate-Coarse (ug/m3)		4.9	4.2			
	Particulate-PM10 (ug/m3)		7.2	4.9			

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

Sample ID Description Sampled Date Sampled Time Client ID		L2379079-1 Air Particulate 16-AUG-19 64475	L2379079-3 Air Particulate 19-AUG-19 15526	L2379079-4 Air Particulate 22-AUG-19 34144	L2379079-5 Air Particulate 25-AUG-19 34145	L2379079-6 Air Particulate 28-AUG-19 57296
Grouping	Analyte					
MISC.						
Field Tests	Air Volume, Client Supplied (L)	21600	21600	21600	21600	21600

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

		Sample ID	L2379079-7	L2379079-8	L2379079-9	L2379079-10	L2379079-11
		Description	Air Particulate	Air Particulate	Air Particulate	Air Particulate	Air Particulate
		Sampled Date	31-AUG-19	03-SEP-19	06-SEP-19	09-SEP-19	12-SEP-19
		Sampled Time					
		Client ID	57299	57303	57306	57307	57313
Grouping	Analyte						
MISC.							
Field Tests	Air Volume, Client Supplied (L)		21600	21600	21600	21600	21600

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

		Sample ID	L2379079-12	L2379079-14	L2379079-15	L2379079-16	L2379079-17
		Description	Air Particulate	Air Particulate	Air Particulate	Air Particulate	Air Particulate
		Sampled Date	16-AUG-19	19-AUG-19	22-AUG-19	25-AUG-19	28-AUG-19
		Sampled Time					
		Client ID	64448	54603	65072	64473	64465
Grouping	Analyte						
MISC.							
Field Tests	Air Volume, Client Supplied (L)	2400	2410	2410	2410	2410	2410

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

Reference Information

Qualifiers for Individual Parameters Listed:

Qualifier	Description
RRV	Reported Result Verified By Repeat Analysis

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
AIR VOLUME-VA	Misc.	Air volume (L)	HYGIENE METHOD
PART-DICHOT-PM10-VA	Filter	Total Particulate (Dichot-PM10) by Grav.	BCMOE Method
Total Particulate Matter (PM10) Method analysis is carried out in accordance with the BCMOE Lab Manual, Section G Air Constituents - Inorganics, "Total Particulate - PM10/PM02 - 47mm - HiVol" method. ALS provides pre-weighed filters (Pallflex TX40 HI20-WW 47mm) and clients typically sample using a "Dichotomus Partisol sequential Air Sampler" equivalent sample (EQPS-0509-179, EQPS-0509-180, EQPS-0311-198) as per U.S. EPA Reference Method RFPS-0694-098, fitted with a PM10 inlet. The particulate matter is determined gravimetrically. Three formulas are required for the mass concentration (um/M3) computation of fine PM (PM-2.5) Course PM (PM-10 minus PM2.5) and PM-10.			
PART-PM2.5-VA	Filter	Total Particulate (PM2.5) by Gravimetric	BCMOE METHOD
Total Particulate Matter (PM2.5) Method analysis is carried out in accordance with the BCMOE Lab Manual, Section G Air Constituents - Inorganics, "Total Particulate - PM10/PM02 - 47mm - HiVol" method. ALS provides pre-weighed filters (Pallflex TX40 HI20-WW 47mm) and clients typically sample using a "Partisol Model 2000 Air Sampler" as per U.S. EPA Reference Method RFPS-0694-098, fitted with a PM2.5 inlet. The particulate matter is determined gravimetrically.			

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

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
VA	ALS ENVIRONMENTAL - VANCOUVER, BRITISH COLUMBIA, CANADA

Chain of Custody Numbers:

17-759166

GLOSSARY OF REPORT TERMS

Surrogate - A compound that is similar in behaviour to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.

mg/kg - milligrams per kilogram based on dry weight of sample.

mg/kg ww - milligrams per kilogram based on wet weight of sample.

mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight of sample.

mg/L - milligrams per litre.

< - Less than.

D.L. - The reported Detection Limit, also known as the Limit of Reporting (LOR).

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.

Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.



www.alsglobal.com

Chain of Custody (COC) / Analytical
Request Form

Canada Toll Free: 1 800 668 9878



L2379079-COFC

COC Number: 17-759166

Page 1 of 4

Report To Contact and company name below will appear on the final report		Report Format / Distribution		Select ☐ Standard TAT if received by 3 pm - business days - no surcharges apply																									
Company:	ERM	Select Report Format:	☒ PDF ☒ EXCEL ☐ EDD (DIGITAL)	Regular [R] ☒ Standard TAT if received by 3 pm - business days - no surcharges apply																									
Contact:	Daniel Casanova	Quality Control (QC) Report with Report	☐ YES ☐ NO	4 day [P4-20%] ☐																									
Phone:	250-877-7838	☐ Compare Results to Criteria on Report - provide details below if box checked		3 day [P3-25%] ☐																									
Company address below will appear on the final report		Select Distribution:	☒ EMAIL ☐ MAIL ☐ FAX	2 day [P2-50%] ☐																									
Street:	3790 Alfred Ave	Email 1 or Fax	daniel.casanova@erm.com	1 Business day [E - 100%] ☐																									
City/Province:	Smithers, BC	Email 2	ta'at.bakri@erm.com	Same Day, Weekend or Statutory holiday [E2 -200%] ☐																									
Postal Code:	V0J 2N0	Email 3	andres.soux@erm.com	(Laboratory opening fees may apply) ☐																									
Invoice To	Same as Report To ☒ YES ☐ NO	Invoice Distribution		Date and Time Required for all E&P TATs: dd-mm-yy hh:mm																									
	Copy of Invoice with Report ☐ YES ☒ NO	Select Invoice Distribution:	☒ EMAIL ☐ MAIL ☐ FAX	For tests that can not be performed according to the service level selected, you will be contacted.																									
Company:		Email 1 or Fax	korina.houghton@erm.com	Analysis Request																									
Contact:		Email 2	daniel.casanova@erm.com	Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below																									
Project Information		Oil and Gas Required Fields (client use)		NUMBER OF CONTAINERS																									
ALS Account # / Quote #:		AFE/Cost Center:	PO#	<table border="1"> <tr><td>PM2.5 Mass</td><td>PM2.5 Concentration</td><td>PMcoarse Mass</td><td>PMcoarse Concentration</td><td>PM10 Mass</td><td>PM10 Concentration</td></tr> <tr><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td></td><td></td><td></td><td></td><td></td><td></td></tr> </table>		PM2.5 Mass	PM2.5 Concentration	PMcoarse Mass	PMcoarse Concentration	PM10 Mass	PM10 Concentration																		
PM2.5 Mass	PM2.5 Concentration	PMcoarse Mass	PMcoarse Concentration			PM10 Mass	PM10 Concentration																						
Job #:	Tenas; 0403488-0223-0001	Major/Minor Code:	Routing Code:																										
PO / AFE:		Requisitioner:																											
LSD:		Location:																											
ALS Lab Work Order # (lab use only):		ALS Contact: Amber Springer	Sampler: Talaat Bakri	SAMPLES ON HOLD																									
ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mm-yy)	Time (hh:mm)	Sample Type	SUSPECTED HAZARD (see Special Instructions)																								
64475		16-Aug-19	0:00	Air Particulate																									
4220		17-Aug-19	0:00	Air Particulate																									
15526		19-Aug-19	0:00	Air Particulate																									
34144		22-Aug-19	0:00	Air Particulate																									
34145		25-Aug-19	0:00	Air Particulate																									
57296		28-Aug-19	0:00	Air Particulate																									
57299		31-Aug-19	0:00	Air Particulate																									
57303		3-Sep-19	0:00	Air Particulate																									
57306		6-Sep-19	0:00	Air Particulate																									
57307		9-Sep-19	0:00	Air Particulate																									
57313		12-Sep-19	0:00	Air Particulate																									
			0:00	Air Particulate																									
Drinking Water (DW) Samples¹ (client use)		Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)		SAMPLE CONDITION AS RECEIVED (lab use only)																									
Are samples taken from a Regulated DW System? ☐ YES ☐ NO		Sample date/time represents STARTING date/time. See attached information sheet for sampling volume.		Frozen ☐ SIF Observations Yes ☐ No ☐																									
Are samples for human consumption/ use? ☐ YES ☐ NO				Ice Packs ☐ Ice Cubes ☐ Custody seal intact Yes ☐ No ☐																									
				Cooling Initiated ☐																									
				INITIAL COOLER TEMPERATURES °C																									
				FINAL COOLER TEMPERATURES °C																									
				90																									
SHIPMENT RELEASE (client use)		INITIAL SHIPMENT RECEPTION (lab use only)		FINAL SHIPMENT RECEPTION (lab use only)																									
Released by:	Date:	Time:	Received by:	Date:	Time:																								
				Nov 7, 19	RD																								

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

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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.

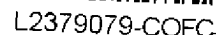
1. If any water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC form.

NOV 2018 FRONT

11:10 Am



Canada Toll Free: 1 800 668 9878



DOC Number: 17-759166

Page 2 of 2

Report To				Report Format / Distribution				Select Service Level Below - Contact your AM to confirm all E&P TATs (surcharges may apply)																														
Contact and company name below will appear on the final report				Select Report Format: ☐ PDF ☐ EXCEL ☐ EDD (DIGITAL)				Regular [R] ☐ Standard TAT if received by 3 pm - business days - no surcharges apply																														
Company:				Quality Control (QC) Report with Report ☐ YES ☐ NO				PRIORITY (Business Days) 4 day [P4-20%] 3 day [P3-25%] 2 day [P2-50%]								EMERGENCY 1 Business day [E - 100%] Same Day, Weekend or Statutory holiday [E2 -200% (Laboratory opening fees may apply)]																						
Phone:				Compare Results to Criteria on Report - provide details below if box checked																																		
Company address below will appear on the final report				Select Distribution: ☐ EMAIL ☐ MAIL ☐ FAX																																		
Street:				Email 1 or Fax				Date and Time Required for all E&P TATs: dd-mmm-yy hh:mm																														
City/Province:				Email 2				For tests that can not be performed according to the service level selected, you will be contacted.																														
Postal Code:				Email 3				Analysis Request																														
Invoice To Same as Report To ☐ YES ☐ NO				Invoice Distribution				Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below																														
Copy of Invoice with Report ☐ YES ☐ NO				Select Invoice Distribution: ☐ EMAIL ☐ MAIL ☐ FAX																																		
Company:				Email 1 or Fax																																		
Contact:				Email 2																																		
Project Information				Oil and Gas Required Fields (client use)				NUMBER OF CONTAINERS																														
ALS Account # / Quote #:				AFE/Cost Center:		PO#																																
Job #:				Major/Minor Code:		Routing Code:																																
PO / AFE:				Requisitioner:																																		
LSD:				Location:																																		
ALS Lab Work Order # (lab use only):				ALS Contact:				Sampler:				SAMPLES ON HOLD SUSPECTED HAZARD (see Special Instructions)																										
ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)			Date (dd-mmm-yy)	Time (hh:mm)	Sample Type																																
	64448			16-Aug-19	0:00	Air Particulate																																
	80608			17-Aug-19	0:00	Air Particulate																																
	54603			19-Aug-19	0:00	Air Particulate																																
	65072			22-Aug-19																																		
	64473			25-Aug-19	0:00	Air Particulate																																
	64465			28-Aug-19	0:00	Air Particulate																																
	41682			31-Aug-19	0:00	Air Particulate																																
	34121			3-Sep-19	0:00	Air Particulate																																
	27306			6-Sep-19	0:00	Air Particulate																																
25074			9-Sep-19	0:00	Air Particulate																																	
18076			12-Sep-19	0:00	Air Particulate																																	
				0:00	Air Particulate																																	
Drinking Water (DW) Samples ¹ (client use)				Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)				SAMPLE CONDITION AS RECEIVED (lab use only)																														
Are samples taken from a Regulated DW System? ☐ YES ☐ NO				Sample date/time represents STARTING date/time. See attached information sheet for sampling volume.				Frozen ☐ SIF Observations Yes ☐ No ☐																														
Are samples for human consumption/ use? ☐ YES ☐ NO								Ice Packs ☐ Ice Cubes ☐ Custody seal intact Yes ☐ No ☐																														
								Cooling Initiated ☐																														
								INITIAL COOLER TEMPERATURES °C FINAL COOLER TEMPERATURES °C																														
SHIPMENT RELEASE (client use)				INITIAL SHIPMENT RECEPTION (lab use only)				FINAL SHIPMENT RECEPTION (lab use only)																														
Released by:	Date:	Time:	Received by:	Date:	Time:	Received by:	Date:	Time:																														

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1. If any water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC form.

NOV 20 11 51:02 AM

Sampling order	CassetteID	PM Type	Start_Date_ actual	Start_Time_ act	Stop_Date_ actual	Stop_Time_ act	Total_Samp le_time	Volume of air sampled (Actual Volume; m^3)	Volume of air sampled (Actual Volume; Litres)	Blank Sample?
1	64475	PM2.5	16-Aug-19	0:00	16-Aug-19	23:59	23:59:00	21.6	21600	no
2	4220	PM2.5	17-Aug-19	0:00	17-Aug-19	0:00	0:00:00	0.0	0	YES
3	15526	PM2.5	19-Aug-19	0:00	19-Aug-19	0:00	24:00:00	21.6	21600	no
4	34144	PM2.5	22-Aug-19	0:00	22-Aug-19	0:00	24:00:00	21.6	21600	no
5	34145	PM2.5	25-Aug-19	0:00	25-Aug-19	0:00	24:00:00	21.6	21600	no
6	57296	PM2.5	28-Aug-19	0:00	28-Aug-19	0:00	24:00:00	21.6	21600	no
7	57299	PM2.5	31-Aug-19	0:00	31-Aug-19	0:00	24:00:00	21.6	21600	no
8	57303	PM2.5	3-Sep-19	0:00	3-Sep-19	0:00	24:00:00	21.6	21600	no
9	57306	PM2.5	6-Sep-19	0:00	6-Sep-19	0:00	24:00:00	21.6	21600	no
10	57307	PM2.5	9-Sep-19	0:00	9-Sep-19	0:00	24:00:00	21.6	21600	no
11	57313	PM2.5	12-Sep-19	0:00	12-Sep-19	0:00	24:00:00	21.6	21600	no
1	64448	PMcoarse	16-Aug-19	0:00	16-Aug-19	23:59	23:59:00	2.4	2400	no
2	80608	PMcoarse	17-Aug-19	0:00	17-Aug-19	0:00	0:00:00	0	0	YES
3	54603	PMcoarse	19-Aug-19	0:00	19-Aug-19	0:00	24:00:00	2.41	2410	no
4	65072	PMcoarse	22-Aug-19	0:00	22-Aug-19	0:00	24:00:00	2.41	2410	no
5	64473	PMcoarse	25-Aug-19	0:00	25-Aug-19	0:00	24:00:00	2.41	2410	no
6	64465	PMcoarse	28-Aug-19	0:00	28-Aug-19	0:00	24:00:00	2.41	2410	no
7	41682	PMcoarse	31-Aug-19	0:00	31-Aug-19	0:00	24:00:00	2.41	2410	no
8	34121	PMcoarse	3-Sep-19	0:00	3-Sep-19	0:00	24:00:00	2.41	2410	no
9	27306	PMcoarse	6-Sep-19	0:00	6-Sep-19	0:00	24:00:00	2.41	2410	no
10	25074	PMcoarse	9-Sep-19	0:00	9-Sep-19	0:00	24:00:00	2.41	2410	no
11	16076	PMcoarse	12-Sep-19	0:00	12-Sep-19	0:00	24:00:00	2.41	2410	no



L2379079-COFC



ERM Consultants Canada Ltd.
ATTN: Daniel Casanova
1500-1111 West Hastings Street
Vancouver BC V6E 2J3

Date Received: 19-DEC-19
Report Date: 02-JAN-20 16:46 (MT)
Version: FINAL

Client Phone: 604-689-9460

Certificate of Analysis

Lab Work Order #: L2398904
Project P.O. #: NOT SUBMITTED
Job Reference: TENAS:0403488-0223-0001
C of C Numbers: 17-764927
Legal Site Desc:

Amber Springer, B.Sc
Account Manager

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ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID Description Sampled Date Sampled Time Client ID		L2398904-1 Air Particulate 02-NOV-19 24543	L2398904-2 Air Particulate 03-NOV-19 15261	L2398904-3 Air Particulate 04-NOV-19 23:00 27408	L2398904-4 Air Particulate 07-NOV-19 23:00 90549	L2398904-5 Air Particulate 10-NOV-19 23:00 4235
Grouping	Analyte					
FILTER						
Particulates	Particulate - PM2.5 (ug)	<50	<50	<50	50	133
	Particulate - PM2.5 (ug/m3)	<2.3		<2.3	2.3	6.2
	Particulate-Fine (ug/m3)					
	Particulate-Coarse (ug)					
	Particulate-Coarse (ug/m3)					
	Particulate-PM10 (ug/m3)					

ALS ENVIRONMENTAL ANALYTICAL REPORT

		Sample ID	L2398904-6	L2398904-7	L2398904-8	L2398904-9	L2398904-10
		Description	Air Particulate	Air Particulate	Air Particulate	Air Particulate	Air Particulate
		Sampled Date	13-NOV-19	16-NOV-19	19-NOV-19	22-NOV-19	25-NOV-19
		Sampled Time	23:00	23:00	23:00	23:00	23:00
		Client ID	17843	64478	41674	15064	64454
Grouping	Analyte						
FILTER							
Particulates	Particulate - PM2.5 (ug)	<50	<50	<50	<50	87	
	Particulate - PM2.5 (ug/m3)	<2.3	<2.3	<2.3	<2.3	4.0	
	Particulate-Fine (ug/m3)						
	Particulate-Coarse (ug)						
	Particulate-Coarse (ug/m3)						
	Particulate-PM10 (ug/m3)						

ALS ENVIRONMENTAL ANALYTICAL REPORT

		Sample ID	L2398904-11	L2398904-12	L2398904-13	L2398904-14	L2398904-15
		Description	Air Particulate	Air Particulate	Air Particulate	Air Particulate	Air Particulate
		Sampled Date	28-NOV-19	01-DEC-19	04-DEC-19	07-DEC-19	02-NOV-19
		Sampled Time	23:00	23:00	23:00	23:00	
		Client ID	64447	65088	64472	64477	27297
Grouping	Analyte						
FILTER							
Particulates	Particulate - PM2.5 (ug)	60	<50	53	60		
	Particulate - PM2.5 (ug/m3)	2.8	<2.3	2.5	2.8		
	Particulate-Fine (ug/m3)					<2.3	
	Particulate-Coarse (ug)					<50	
	Particulate-Coarse (ug/m3)					<2.1	
	Particulate-PM10 (ug/m3)					<3.1	

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID Description Sampled Date Sampled Time Client ID		L2398904-16 Air Particulate 03-NOV-19 24928	L2398904-17 Air Particulate 04-NOV-19 23:00 64464	L2398904-18 Air Particulate 07-NOV-19 11:00 41680	L2398904-19 Air Particulate 10-NOV-19 23:00 57309	L2398904-20 Air Particulate 13-NOV-19 23:00 15279
Grouping	Analyte					
FILTER						
Particulates	Particulate - PM2.5 (ug)					
	Particulate - PM2.5 (ug/m3)					
	Particulate-Fine (ug/m3)		<2.3	2.3	6.2	<2.3
	Particulate-Coarse (ug)	<50	53	<50	60	<50
	Particulate-Coarse (ug/m3)		<2.1	<2.1	<2.1	<2.1
	Particulate-PM10 (ug/m3)		4.2	<3.1	8.1	<3.1

ALS ENVIRONMENTAL ANALYTICAL REPORT

		Sample ID	L2398904-21	L2398904-22	L2398904-23	L2398904-24	L2398904-25
		Description	Air Particulate	Air Particulate	Air Particulate	Air Particulate	Air Particulate
		Sampled Date	16-NOV-19	19-NOV-19	22-NOV-19	25-NOV-19	28-NOV-19
		Sampled Time	23:00	23:00	23:00	23:00	23:00
		Client ID	65074	65086	64461	64468	64480
Grouping	Analyte						
FILTER							
Particulates	Particulate - PM2.5 (ug)						
	Particulate - PM2.5 (ug/m3)						
	Particulate-Fine (ug/m3)		<2.3	<2.3	<2.3	4.0	2.8
	Particulate-Coarse (ug)		<50	<50	<50	<50	<50
	Particulate-Coarse (ug/m3)		<2.1	<2.1	<2.1	<2.1	<2.1
	Particulate-PM10 (ug/m3)		<3.1	<3.1	<3.1	5.3	3.6

ALS ENVIRONMENTAL ANALYTICAL REPORT

		Sample ID	L2398904-26	L2398904-27	L2398904-28		
		Description	Air Particulate	Air Particulate	Air Particulate		
		Sampled Date	01-DEC-19	04-DEC-19	07-DEC-19		
		Sampled Time	23:00	23:00	23:00		
		Client ID	606600	17820	64463		
Grouping	Analyte						
FILTER							
Particulates	Particulate - PM2.5 (ug)						
	Particulate - PM2.5 (ug/m3)						
	Particulate-Fine (ug/m3)		<2.3	2.5	2.8		
	Particulate-Coarse (ug)		<50	<50	<50		
	Particulate-Coarse (ug/m3)		<2.1	<2.1	<2.1		
	Particulate-PM10 (ug/m3)		<3.1	3.3	<3.1		

		Sample ID Description Sampled Date Sampled Time Client ID	L2398904-1 Air Particulate 02-NOV-19 24543	L2398904-3 Air Particulate 04-NOV-19 23:00 27408	L2398904-4 Air Particulate 07-NOV-19 23:00 90549	L2398904-5 Air Particulate 10-NOV-19 23:00 4235	L2398904-6 Air Particulate 13-NOV-19 23:00 17843
Grouping	Analyte						
MISC.							
Field Tests	Air Volume, Client Supplied (L)		21600	21600	21600	21600	21600

		Sample ID Description Sampled Date Sampled Time Client ID	L2398904-7 Air Particulate 16-NOV-19 23:00 64478	L2398904-8 Air Particulate 19-NOV-19 23:00 41674	L2398904-9 Air Particulate 22-NOV-19 23:00 15064	L2398904-10 Air Particulate 25-NOV-19 23:00 64454	L2398904-11 Air Particulate 28-NOV-19 23:00 64447
Grouping	Analyte						
MISC.							
Field Tests	Air Volume, Client Supplied (L)	21600	21600	21600	21600	21600	21600

		Sample ID Description Sampled Date Sampled Time Client ID	L2398904-12 Air Particulate 01-DEC-19 23:00 65088	L2398904-13 Air Particulate 04-DEC-19 23:00 64472	L2398904-14 Air Particulate 07-DEC-19 23:00 64477	L2398904-15 Air Particulate 02-NOV-19 27297	L2398904-17 Air Particulate 04-NOV-19 23:00 64464
Grouping	Analyte						
MISC.							
Field Tests	Air Volume, Client Supplied (L)		21600	21600	21600	2400	2410

		Sample ID Description Sampled Date Sampled Time Client ID	L2398904-18 Air Particulate 07-NOV-19 11:00 41680	L2398904-19 Air Particulate 10-NOV-19 23:00 57309	L2398904-20 Air Particulate 13-NOV-19 23:00 15279	L2398904-21 Air Particulate 16-NOV-19 23:00 65074	L2398904-22 Air Particulate 19-NOV-19 23:00 65086
Grouping	Analyte						
MISC.							
Field Tests	Air Volume, Client Supplied (L)		2410	2410	2410	2400	2410

		Sample ID Description Sampled Date Sampled Time Client ID	L2398904-23 Air Particulate 22-NOV-19 23:00 64461	L2398904-24 Air Particulate 25-NOV-19 23:00 64468	L2398904-25 Air Particulate 28-NOV-19 23:00 64480	L2398904-26 Air Particulate 01-DEC-19 23:00 606600	L2398904-27 Air Particulate 04-DEC-19 23:00 17820
Grouping	Analyte						
MISC.							
Field Tests	Air Volume, Client Supplied (L)		2400	2410	2410	2410	2410

		Sample ID Description Sampled Date Sampled Time Client ID	L2398904-28 Air Particulate 07-DEC-19 23:00 64463				
Grouping	Analyte						
MISC.							
Field Tests	Air Volume, Client Supplied (L)	2410					

Reference Information

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
AIR VOLUME-VA	Misc.	Air volume (L)	HYGIENE METHOD
PART-DICHOT-PM10-VA	Filter	Total Particulate (Dichot-PM10) by Grav.	BCMOE Method
Total Particulate Matter (PM10) Method analysis is carried out in accordance with the BCMOE Lab Manual, Section G Air Constituents - Inorganics, "Total Particulate - PM10/PM02 - 47mm - HiVol" method. ALS provides pre-weighed filters (Pallflex TX40 HI20-WW 47mm) and clients typically sample using a "Dichotomus Partisol sequential Air Sampler" equivalent sample (EQPS-0509-179, EQPS-0509-180, EQPS-0311-198) as per U.S. EPA Reference Method RFPS-0694-098, fitted with a PM10 inlet. The particulate matter is determined gravimetrically. Three formulas are required for the mass concentration (um/M3) computation of fine PM (PM-2.5) Course PM (PM-10 minus PM2.5) and PM-10.			
PART-PM2.5-VA	Filter	Total Particulate (PM2.5) by Gravimetric	BCMOE METHOD
Total Particulate Matter (PM2.5) Method analysis is carried out in accordance with the BCMOE Lab Manual, Section G Air Constituents - Inorganics, "Total Particulate - PM10/PM02 - 47mm - HiVol" method. ALS provides pre-weighed filters (Pallflex TX40 HI20-WW 47mm) and clients typically sample using a "Partisol Model 2000 Air Sampler" as per U.S. EPA Reference Method RFPS-0694-098, fitted with a PM2.5 inlet. The particulate matter is determined gravimetrically.			

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

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
VA	ALS ENVIRONMENTAL - VANCOUVER, BRITISH COLUMBIA, CANADA

Chain of Custody Numbers:

17-764927

GLOSSARY OF REPORT TERMS

Surrogate - A compound that is similar in behaviour to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.

mg/kg - milligrams per kilogram based on dry weight of sample.

mg/kg wwt - milligrams per kilogram based on wet weight of sample.

mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight of sample.

mg/L - milligrams per litre.

< - Less than.

D.L. - The reported Detection Limit, also known as the Limit of Reporting (LOR).

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.

Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.



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L2398904-COFC

COC Number: 17-764927

Page 1 of 4

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Company:	ERM	Select Report Format: ☒ PDF ☒ EXCEL ☐ EDD (DIGITAL)		Regular [R] ☐ Standard TAT if received by 3 pm - business days - no surcharges apply																																																										
Contact:	Daniel Casanova	Quality Control (QC) Report with Report ☐ YES ☐ NO		PRIORITY (Business Days)		4 day [P4-20%] ☐		EMERGENCY		1 Business day [E - 100%] ☐																																																				
Phone:	250-877-7838	☐ Compare Results to Criteria on Report - provide details below if box checked		3 day [P3-25%] ☐		2 day [P2-50%] ☐		Same Day, Weekend or Statutory holiday [E2 -200% (Laboratory opening fees may apply)] ☐																																																						
Company address below will appear on the final report		Select Distribution: ☒ EMAIL ☐ MAIL ☐ FAX		Date and Time Required for all E&P TATs: dd-mmm-yy hh:mm																																																										
Street:	3790 Alfred Ave	Email 1 or Fax daniel.casanova@erm.com		For tests that can not be performed according to the service level selected, you will be contacted.																																																										
City/Province:	Smithers, BC	Email 2 talaat.bakri@erm.com		Analysis Request																																																										
Postal Code:	V0J 2N0	Email 3 andres.soux@erm.com		Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below																																																										
Invoice To	Same as Report To ☒ YES ☐ NO	Invoice Distribution		<table border="1"> <tr> <td rowspan="4">NUMBER OF CONTAINERS</td> <td rowspan="4">PM2.5 Mass</td> <td rowspan="4">PM2.5 Concentration</td> <td rowspan="4">PMcoarse Mass</td> <td rowspan="4">PMcoarse Concentration</td> <td rowspan="4">PM10 Mass</td> <td rowspan="4">PM10 Concentration</td> <td colspan="10"></td> <td rowspan="4">SAMPLES ON HOLD</td> <td rowspan="4">SUSPECTED HAZARD (see Special Instructions)</td> </tr> <tr><td colspan="10"></td></tr> <tr><td colspan="10"></td></tr> <tr><td colspan="10"></td></tr> </table>										NUMBER OF CONTAINERS	PM2.5 Mass	PM2.5 Concentration	PMcoarse Mass	PMcoarse Concentration	PM10 Mass	PM10 Concentration											SAMPLES ON HOLD	SUSPECTED HAZARD (see Special Instructions)																														
NUMBER OF CONTAINERS	PM2.5 Mass	PM2.5 Concentration	PMcoarse Mass																		PMcoarse Concentration	PM10 Mass	PM10 Concentration											SAMPLES ON HOLD	SUSPECTED HAZARD (see Special Instructions)																											
	Copy of Invoice with Report ☐ YES ☒ NO	Select Invoice Distribution: ☒ EMAIL ☐ MAIL ☐ FAX																																																												
Company:		Email 1 or Fax korina.houghton@erm.com																																																												
Contact:		Email 2 daniel.casanova@erm.com																																																												
Project Information		Oil and Gas Required Fields (client use)																																																												
ALS Account # / Quote #:		AFE/Cost Center:		PO#																																																										
Job #: Tenas; 0403488-0223-0001		Major/Minor Code:		Routing Code:																																																										
PO / AFE:		Requisitioner:																																																												
LSD:		Location:																																																												
ALS Lab Work Order # (lab use only):		ALS Contact: Amber Springer		Sampler: Talaat Bakri																																																										
ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type																																																										
	24543	2-Nov-19	0:00	Air Particulate	1	R	R																																																							
	15261	3-Nov-19	0:00	Air Particulate	1	R	R																																																							
	27408	4-Nov-19	23:00	Air Particulate	1	R	R																																																							
	90549	7-Nov-19	23:00	Air Particulate	1	R	R																																																							
	4235	10-Nov-19	23:00	Air Particulate	1	R	R																																																							
	17843	13-Nov-19	23:00	Air Particulate	1	R	R																																																							
	64478	16-Nov-19	23:00	Air Particulate	1	R	R																																																							
	41674	19-Nov-19	23:00	Air Particulate	1	R	R																																																							
	15064	22-Nov-19	23:00	Air Particulate	1	R	R																																																							
	64454	25-Nov-19	23:00	Air Particulate	1	R	R																																																							
	64447	28-Nov-19	23:00	Air Particulate	1	R	R																																																							
	65088	1-Dec-19	23:00	Air Particulate	1	R	R																																																							
Drinking Water (DW) Samples¹ (client use)		Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)		SAMPLE CONDITION AS RECEIVED (lab use only)																																																										
Are samples taken from a Regulated DW System? ☐ YES ☐ NO		DO NOT analyze samples# 64452, 29317, 64469, 15496, only send new filters. Sample date/time represents STARTING date/time. See attached information sheet for sampling volume		Frozen ☐ SIF Observations Yes ☐ No ☐																																																										
Are samples for human consumption/ use? ☐ YES ☐ NO				Ice Packs ☐ Ice Cubes ☐ Custody seal intact Yes ☐ No ☐																																																										
				Cooling Initiated ☐																																																										
				INITIAL COOLER TEMPERATURES °C					FINAL COOLER TEMPERATURES °C																																																					
									9°																																																					
SHIPMENT RELEASE (client use)		INITIAL SHIPMENT RECEPTION (lab use only)		FINAL SHIPMENT RECEPTION (lab use only)																																																										
Released by:	Date:	Time:	Received by:	Date:	Time:	Received by:	Date:	Time:	Received by:	Date:	Time:	Received by:	Date:	Time:																																																

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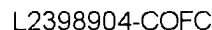
Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

1. If any water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC form.

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COC Number: 17-764927

Page 2 of 2

Report To Contact and company name below will appear on the final report			Report Format / Distribution Select Report Format: ☐ PDF ☐ EXCEL ☐ EDD (DIGITAL) Quality Control (QC) Report with Report ☐ YES ☐ NO ☐ Compare Results to Criteria on Report - provide details below if box checked Select Distribution: ☐ EMAIL ☐ MAIL ☐ FAX			Select Service Level Below - Contact your AM to confirm all E&P TATs (surcharges may apply) Regular [R] ☐ Standard TAT if received by 3 pm - business days - no surcharges apply <table border="1"><tr><td rowspan="3">PRIORITY (Business Days)</td><td>4 day [P4-20%]</td><td>☐</td><td rowspan="3">EMERGENCY</td><td colspan="10">1 Business day [E - 100%] Same Day, Weekend or Statutory holiday [E2 -200%] (Laboratory opening fees may apply)]</td><td>☐</td></tr><tr><td>3 day [P3-25%]</td><td>☐</td><td colspan="10"></td><td>☐</td></tr><tr><td>2 day [P2-50%]</td><td>☐</td><td colspan="10"></td><td>☐</td></tr></table>												PRIORITY (Business Days)	4 day [P4-20%]	☐	EMERGENCY	1 Business day [E - 100%] Same Day, Weekend or Statutory holiday [E2 -200%] (Laboratory opening fees may apply)]										☐	3 day [P3-25%]	☐											☐	2 day [P2-50%]	☐											☐
PRIORITY (Business Days)	4 day [P4-20%]	☐	EMERGENCY	1 Business day [E - 100%] Same Day, Weekend or Statutory holiday [E2 -200%] (Laboratory opening fees may apply)]										☐																																												
	3 day [P3-25%]	☐												☐																																												
	2 day [P2-50%]	☐												☐																																												
Company address below will appear on the final report			Email 1 or Fax			Date and Time Required for all E&P TATs: dd-mmm-yy hh:mm																																																				
Street:			Email 2			For tests that can not be performed according to the service level selected, you will be contacted.																																																				
City/Province:			Email 3			Analysis Request																																																				
Postal Code:																																																										
Invoice To Same as Report To ☐ YES ☐ NO Copy of Invoice with Report ☐ YES ☐ NO			Invoice Distribution Select Invoice Distribution: ☐ EMAIL ☐ MAIL ☐ FAX																																																							
Company:			Email 1 or Fax																																																							
Contact:			Email 2																																																							
Project Information			Oil and Gas Required Fields (client use)																																																							
ALS Account # / Quote #:			AFE/Cost Center:																																																							
Job #:			Major/Minor Code:																																																							
PO / AFE:			Requisitioner:																																																							
LSD:			Location:																																																							
ALS Lab Work Order # (lab use only):			ALS Contact:			Sampler:																																																				
ALS Sample # (lab use only)			Sample Identification and/or Coordinates (This description will appear on the report)			Date (dd-mmm-yy)		Time (hh:mm)		Sample Type																																																
			64472			4-Dec-19		23:00		Air Particulate																																																
			64477			7-Dec-19		23:00		Air Particulate																																																
			27297			2-Nov-19		0:00		Air Particulate																																																
			24928			3-Nov-19		0:00		Air Particulate																																																
			64464			4-Nov-19		23:00		Air Particulate																																																
			41680			7-Nov-19		23:00		Air Particulate																																																
			57309			10-Nov-19		23:00		Air Particulate																																																
			15279			13-Nov-19		23:00		Air Particulate																																																
			65074			16-Nov-19		23:00		Air Particulate																																																
			65086			19-Nov-19		23:00		Air Particulate																																																
Drinking Water (DW) Samples¹ (client use)			Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)									SAMPLE CONDITION AS RECEIVED (lab use only)																																														
Are samples taken from a Regulated DW System? ☐ YES ☐ NO			DO NOT analyze samples# 64452, 29317, 64469, 15496, only send new filters. Sample date/time represents STARTING date/time. See attached information sheet for sampling volume									Frozen ☐ SIF Observations Yes ☐ No ☐																																														
Are samples for human consumption/ use? ☐ YES ☐ NO												Ice Packs ☐ Ice Cubes ☐ Custody seal intact Yes ☐ No ☐																																														
												Cooling Initiated ☐																																														
												INITIAL COOLER TEMPERATURES °C																																														
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SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)									FINAL SHIPMENT RECEPTION (lab use only)																																														
Released by:			Date:			Time:			Received by:			Date:			Time:			Received by:			Date:			Time:																																		

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1. If any water samples are taken from a **Regulated Drinking Water (DW) System**, please submit using an **Authorized DW COC form**.

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L2398904-COFC

Number: 17-764927

Page 2 of 4

Report To Contact and company name below will appear on the final report		Report Format / Distribution		Select Service Level Below - Contact your AM to confirm all E&P TATs (surcharges may apply)	
Company:		Select Report Format: ☐ PDF ☐ EXCEL ☐ EDD (DIGITAL)		Regular [R] ☐ Standard TAT if received by 3 pm - business days - no surcharges apply	
Contact:		Quality Control (QC) Report with Report ☐ YES ☐ NO		4 day [P4-20%] ☐	
Phone:		☐ Compare Results to Criteria on Report - provide details below if box checked		3 day [P3-25%] ☐	
Company address below will appear on the final report		Select Distribution: ☐ EMAIL ☐ MAIL ☐ FAX		2 day [P2-50%] ☐	
Street:		Email 1 or Fax		1 Business day [E - 100%] ☐	
City/Province:		Email 2		Same Day, Weekend or Statutory holiday [E2 -200% (Laboratory opening fees may apply)] ☐	
Postal Code:		Email 3		Date and Time Required for all E&P TATs: dd-mmm-yy hh:mm	
Invoice To Same as Report To ☐ YES ☐ NO		Invoice Distribution		For tests that can not be performed according to the service level selected, you will be contacted.	
Copy of Invoice with Report ☐ YES ☐ NO		Select Invoice Distribution: ☐ EMAIL ☐ MAIL ☐ FAX		Analysis Request	
Company:		Email 1 or Fax		Indicate Filtered (F), Preserved (P) or Filtered and Preserved (FP) below	
Contact:		Email 2		NUMBER OF CONTAINERS	
Project Information		Oil and Gas Required Fields (client use)		PM2.5 Mass	
ALS Account # / Quote #:		AFE/Cost Center:		PM2.5 Concentration	
Job #:		Major/Minor Code:		PMcoarse Mass	
PO / AFE:		Routing Code:		PMcoarse Concentration	
LSD:		Requisitioner:		PM10 Mass	
ALS Lab Work Order # (lab use only):		Location:		PM10 Concentration	
ALS Contact:		Sampler:		SAMPLES ON HOLD	
ALS Sample # (lab use only)		Sample Identification and/or Coordinates (This description will appear on the report)		Date (dd-mmm-yy)	
				Time (hh:mm)	
				Sample Type	
64461		22-Nov-19		23:00	
64468		25-Nov-19		23:00	
64480		28-Nov-19		23:00	
606600		1-Dec-19		23:00	
17820		4-Dec-19		23:00	
64463		7-Dec-19		23:00	
64452		void			
29317		void			
64469		void			
15496		void			
Drinking Water (DW) Samples¹ (client use)		Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)		SAMPLE CONDITION AS RECEIVED (lab use only)	
Are samples taken from a Regulated DW System? ☐ YES ☐ NO		DO NOT analyze samples# 64452, 29317, 64469, 15496, only send new filters. Sample date/time represents STARTING date/time. See attached information sheet for sampling volume		Frozen ☐ SIF Observations Yes ☐ No ☐	
Are samples for human consumption/ use? ☐ YES ☐ NO				Ice Packs ☐ Ice Cubes ☐ Custody seal intact Yes ☐ No ☐	
				Cooling Initiated ☐	
				INITIAL COOLER TEMPERATURES °C	
				FINAL COOLER TEMPERATURES °C	
SHIPMENT RELEASE (client use)		INITIAL SHIPMENT RECEPTION (lab use only)		FINAL SHIPMENT RECEPTION (lab use only)	
Released by:		Received by:		Received by:	
Date:		Date:		Date:	
Time:		Time:		Time:	

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1. If any water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC form.

Sampling order	CassetteID	PM Type	Start_Date_ actual	Start_Time_ act	Stop_Date_ actual	Stop_Time_ act	Total_Samp le_time	Volume of air sampled (Actual Volume; m^3)	Volume of air sampled (Actual Volume; Litres)	Blank Sample?
1	24543	PM2.5	2-Nov-19	0:00	2-Nov-19	23:59	23:59	21.6	21600	no
2	15261	PM2.5	3-Nov-19	0:00	3-Nov-19	0:00	0:00	0	0	YES
3	27408	PM2.5	4-Nov-19	23:00	5-Nov-19	23:00	24:00:00	21.6	21600	no
4	90549	PM2.5	7-Nov-19	23:00	8-Nov-19	23:00	24:00:00	21.6	21600	no
5	4235	PM2.5	10-Nov-19	23:00	11-Nov-19	23:00	24:00:00	21.6	21600	no
6	17843	PM2.5	13-Nov-19	23:00	14-Nov-19	23:00	24:00:00	21.6	21600	no
7	64478	PM2.5	16-Nov-19	23:00	17-Nov-19	23:00	23:57	21.6	21600	no
8	41674	PM2.5	19-Nov-19	23:00	20-Nov-19	23:00	24:00:00	21.6	21600	no
9	15064	PM2.5	22-Nov-19	23:00	23-Nov-19	23:00	24:00:00	21.6	21600	no
10	64454	PM2.5	25-Nov-19	23:00	26-Nov-19	23:00	24:00:00	21.6	21600	no
11	64447	PM2.5	28-Nov-19	23:00	29-Nov-19	23:00	24:00:00	21.6	21600	no
	65088	PM2.5	1-Dec-19	23:00	2-Dec-19	23:00	24:00:00	21.6	21600	no
	64472	PM2.5	4-Dec-19	23:00	5-Dec-19	23:00	24:00:00	21.6	21600	no
	64477	PM2.5	7-Dec-19	23:00	8-Dec-19	23:00	24:00:00	21.6	21600	no
1	27297	PMcoarse	2-Nov-19	0:00	2-Nov-19	23:59	23:59	2.4	2400	no
2	24928	PMcoarse	3-Nov-19	0:00	3-Nov-19	0:00	0:00	0	0	YES
3	64464	PMcoarse	4-Nov-19	23:00	5-Nov-19	23:00	24:00:00	2.41	2410	no
4	41680	PMcoarse	7-Nov-19	23:00	8-Nov-19	23:00	24:00:00	2.41	2410	no
5	57309	PMcoarse	10-Nov-19	23:00	11-Nov-19	23:00	24:00:00	2.41	2410	no
6	15279	PMcoarse	13-Nov-19	23:00	14-Nov-19	23:00	24:00:00	2.41	2410	no
7	65074	PMcoarse	16-Nov-19	23:00	17-Nov-19	23:00	23:57	2.4	2400	no
8	65086	PMcoarse	19-Nov-19	23:00	20-Nov-19	23:00	24:00:00	2.41	2410	no
9	64461	PMcoarse	22-Nov-19	23:00	23-Nov-19	23:00	24:00:00	2.4	2400	no
10	64468	PMcoarse	25-Nov-19	23:00	26-Nov-19	23:00	24:00:00	2.41	2410	no
11	64480	PMcoarse	28-Nov-19	23:00	29-Nov-19	23:00	24:00:00	2.41	2410	no
	606600	PMcoarse	1-Dec-19	23:00	2-Dec-19	23:00	24:00:00	2.41	2410	no
	17820	PMcoarse	4-Dec-19	23:00	5-Dec-19	23:00	24:00:00	2.41	2410	no
	64463	PMcoarse	7-Dec-19	23:00	8-Dec-19	23:00	24:00:00	2.41	2410	no



L2398904-COFC



ERM Consultants Canada Ltd.
ATTN: Daniel Casanova
1500-1111 West Hastings Street
Vancouver BC V6E 2J3

Date Received: 12-MAR-20
Report Date: 25-MAR-20 13:08 (MT)
Version: FINAL

Client Phone: 604-689-9460

Certificate of Analysis

Lab Work Order #: L2427317
Project P.O. #: NOT SUBMITTED
Job Reference: TENAS; 0403488-0203-0001
C of C Numbers:
Legal Site Desc:

Amber Springer, B.Sc
Account Manager

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ADDRESS: 8081 Lougheed Hwy, Suite 100, Burnaby, BC V5A 1W9 Canada | Phone: +1 604 253 4188 | Fax: +1 604 253 6700
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ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID Description Sampled Date Sampled Time Client ID		L2427317-1 Air Particulate 14-DEC-19 64462	L2427317-2 Air Particulate 15-DEC-19 00:01 25072	L2427317-3 Air Particulate 17-DEC-19 27584	L2427317-4 Air Particulate 20-DEC-19 24944	L2427317-5 Air Particulate 23-DEC-19 27798
Grouping	Analyte					
FILTER						
Particulates	Particulate - PM2.5 (ug)	<50	<50	<50	<50	<50
	Particulate - PM2.5 (ug/m3)	<2.3		<2.3	<2.3	<2.3
	Particulate-Fine (ug/m3)					
	Particulate-Coarse (ug)					
	Particulate-Coarse (ug/m3)					
	Particulate-PM10 (ug/m3)					

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID Description Sampled Date Sampled Time Client ID		L2427317-6 Air Particulate 26-DEC-19 16188	L2427317-7 Air Particulate 29-DEC-19 27810	L2427317-8 Air Particulate 01-JAN-20 41640	L2427317-9 Air Particulate 04-JAN-20 34136	L2427317-10 Air Particulate 07-JAN-20 27731
Grouping	Analyte					
FILTER						
Particulates	Particulate - PM2.5 (ug)	<50	<50	<50	<50	<50
	Particulate - PM2.5 (ug/m3)	<2.3	<2.3	<2.3	<2.3	<2.3
	Particulate-Fine (ug/m3)					
	Particulate-Coarse (ug)					
	Particulate-Coarse (ug/m3)					
	Particulate-PM10 (ug/m3)					

ALS ENVIRONMENTAL ANALYTICAL REPORT

		Sample ID Description Sampled Date Sampled Time Client ID	L2427317-11 Air Particulate 10-JAN-20 41642	L2427317-12 Air Particulate 13-JAN-20 27799	L2427317-13 Air Particulate 16-JAN-20 10326	L2427317-14 Air Particulate 14-DEC-19 64482	L2427317-15 Air Particulate 15-DEC-19 00:01 15106
Grouping	Analyte						
FILTER							
Particulates	Particulate - PM2.5 (ug)		90	63	50		
	Particulate - PM2.5 (ug/m3)		4.2	2.9	2.3		
	Particulate-Fine (ug/m3)					<2.3	
	Particulate-Coarse (ug)					<50	<50
	Particulate-Coarse (ug/m3)					<2.1	
	Particulate-PM10 (ug/m3)					<3.1	

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID Description Sampled Date Sampled Time Client ID		L2427317-16 Air Particulate 17-DEC-19 25401	L2427317-17 Air Particulate 20-DEC-19 27478	L2427317-18 Air Particulate 23-DEC-19 107619	L2427317-19 Air Particulate 26-DEC-19 41657	L2427317-20 Air Particulate 29-DEC-19 41641
Grouping	Analyte					
FILTER						
Particulates	Particulate - PM2.5 (ug)					
	Particulate - PM2.5 (ug/m3)					
	Particulate-Fine (ug/m3)	<2.3	<2.3	<2.3	<2.3	<2.3
	Particulate-Coarse (ug)	<50	60	<50	<50	<50
	Particulate-Coarse (ug/m3)	<2.1	2.4	<2.1	<2.1	<2.1
	Particulate-PM10 (ug/m3)	<3.1	3.6	<3.1	<3.1	<3.1

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID Description Sampled Date Sampled Time Client ID		L2427317-21 Air Particulate 01-JAN-20 15127	L2427317-22 Air Particulate 04-JAN-20 41651	L2427317-23 Air Particulate 07-JAN-20 27442	L2427317-24 Air Particulate 10-JAN-20 24925	L2427317-25 Air Particulate 13-JAN-20 89020
Grouping	Analyte					
FILTER						
Particulates	Particulate - PM2.5 (ug)					
	Particulate - PM2.5 (ug/m3)					
	Particulate-Fine (ug/m3)	<2.3	<2.3	<2.3	4.2	2.9
	Particulate-Coarse (ug)	<50	<50	<50	<50	<50
	Particulate-Coarse (ug/m3)	<2.1	<2.1	<2.1	<2.1	<2.1
	Particulate-PM10 (ug/m3)	<3.1	<3.1	<3.1	5.7	3.9

ALS ENVIRONMENTAL ANALYTICAL REPORT

		Sample ID Description Sampled Date Sampled Time Client ID	L2427317-26 Air Particulate 16-JAN-20 27301				
Grouping	Analyte						
FILTER							
Particulates	Particulate - PM2.5 (ug)						
	Particulate - PM2.5 (ug/m3)						
	Particulate-Fine (ug/m3)	2.3					
	Particulate-Coarse (ug)	<50					
	Particulate-Coarse (ug/m3)	<2.1					
	Particulate-PM10 (ug/m3)	<3.1					

	Sample ID Description Sampled Date Sampled Time Client ID	L2427317-1 Air Particulate 14-DEC-19 64462	L2427317-3 Air Particulate 17-DEC-19 27584	L2427317-4 Air Particulate 20-DEC-19 24944	L2427317-5 Air Particulate 23-DEC-19 27798	L2427317-6 Air Particulate 26-DEC-19 16188
Grouping	Analyte					
MISC.						
Field Tests	Air Volume, Client Supplied (L)	21600	21600	21600	21600	21600

[illegible]

Sample ID Description Sampled Date Sampled Time Client ID		L2427317-12 Air Particulate 13-JAN-20 27799	L2427317-13 Air Particulate 16-JAN-20 10326	L2427317-14 Air Particulate 14-DEC-19 64482	L2427317-16 Air Particulate 17-DEC-19 25401	L2427317-17 Air Particulate 20-DEC-19 27478
Grouping	Analyte					
MISC.						
Field Tests	Air Volume, Client Supplied (L)	21600	21600	2410	2410	2410

	Sample ID Description Sampled Date Sampled Time Client ID	L2427317-18 Air Particulate 23-DEC-19 107619	L2427317-19 Air Particulate 26-DEC-19 41657	L2427317-20 Air Particulate 29-DEC-19 41641	L2427317-21 Air Particulate 01-JAN-20 15127	L2427317-22 Air Particulate 04-JAN-20 41651
Grouping	Analyte					
MISC.						
Field Tests	Air Volume, Client Supplied (L)	2410	2410	2410	2410	2410

		Sample ID Description Sampled Date Sampled Time Client ID	L2427317-23 Air Particulate 07-JAN-20 27442	L2427317-24 Air Particulate 10-JAN-20 24925	L2427317-25 Air Particulate 13-JAN-20 89020	L2427317-26 Air Particulate 16-JAN-20 27301	
Grouping	Analyte						
MISC.							
Field Tests	Air Volume, Client Supplied (L)		2410	2400	2410	2410	

Reference Information

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
AIR VOLUME-VA	Misc.	Air volume (L)	HYGIENE METHOD
PART-DICHOT-PM10-VA	Filter	Total Particulate (Dichot-PM10) by Grav.	BCMOE Method
Total Particulate Matter (PM10) Method analysis is carried out in accordance with the BCMOE Lab Manual, Section G Air Constituents - Inorganics, "Total Particulate - PM10/PM02 - 47mm - HiVol" method. ALS provides pre-weighed filters (Pallflex TX40 HI20-WW 47mm) and clients typically sample using a "Dichotomus Partisol sequential Air Sampler" equivalent sample (EQPS-0509-179, EQPS-0509-180, EQPS-0311-198) as per U.S. EPA Reference Method RFPS-0694-098, fitted with a PM10 inlet. The particulate matter is determined gravimetrically. Three formulas are required for the mass concentration (um/M3) computation of fine PM (PM-2.5) Course PM (PM-10 minus PM2.5) and PM-10.			
PART-PM2.5-VA	Filter	Total Particulate (PM2.5) by Gravimetric	BCMOE METHOD
Total Particulate Matter (PM2.5) Method analysis is carried out in accordance with the BCMOE Lab Manual, Section G Air Constituents - Inorganics, "Total Particulate - PM10/PM02 - 47mm - HiVol" method. ALS provides pre-weighed filters (Pallflex TX40 HI20-WW 47mm) and clients typically sample using a "Partisol Model 2000 Air Sampler" as per U.S. EPA Reference Method RFPS-0694-098, fitted with a PM2.5 inlet. The particulate matter is determined gravimetrically.			

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

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
VA	ALS ENVIRONMENTAL - VANCOUVER, BRITISH COLUMBIA, CANADA

Chain of Custody Numbers:

GLOSSARY OF REPORT TERMS

Surrogate - A compound that is similar in behaviour to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.

mg/kg - milligrams per kilogram based on dry weight of sample.

mg/kg ww - milligrams per kilogram based on wet weight of sample.

mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight of sample.

mg/L - milligrams per litre.

< - Less than.

D.L. - The reported Detection Limit, also known as the Limit of Reporting (LOR).

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.

Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.



www.alsglobal.com

Chain of Custody (COC) / Analytical
Request Form

Canada Toll Free: 1 800 668 9878



L2427317-COFC

COC Number: 17-835710

Page 1 of 4

Report To Contact and company name below will appear on the final report		Report Format / Distribution		Regular [R] ☒ Standard TAT if received by 3 pm - business days - no surcharges apply																																																																																																																																																																																																																																																												
Company:	ERM	Select Report Format:	☒ PDF ☒ EXCEL ☐ EDD (DIGITAL)	Emergency [E] ☐ Standard TAT if received by 3 pm - business days - no surcharges apply 1 Business day [E - 100%] ☐ Same Day, Weekend or Statutory holiday [E2 -200% (Laboratory opening fees may apply)] ☐																																																																																																																																																																																																																																																												
Contact:	Daniel Casanova	Quality Control (QC) Report with Report	☐ YES ☐ NO																																																																																																																																																																																																																																																													
Phone:	250-877-7838	☐ Compare Results to Criteria on Report - provide details below if box checked																																																																																																																																																																																																																																																														
Company address below will appear on the final report		Select Distribution:	☒ EMAIL ☐ MAIL ☐ FAX																																																																																																																																																																																																																																																													
Street:	3790 Alfred Ave	Email 1 or Fax	daniel.casanova@erm.com	Date and Time Required for all E&P TATs: dd-mm-yy hh:mm																																																																																																																																																																																																																																																												
City/Province:	Smithers, BC	Email 2	talaat.bakri@erm.com	For tests that can not be performed according to the service level selected, you will be contacted.																																																																																																																																																																																																																																																												
Postal Code:	V0J 2N0	Email 3	andres.soux@erm.com																																																																																																																																																																																																																																																													
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Same as Report To ☒ YES ☐ NO		Select Invoice Distribution: ☒ EMAIL ☐ MAIL ☐ FAX		<table border="1" style="width:100%; border-collapse: collapse;"> <tr> <th colspan="12">Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below</th> </tr> <tr> <th colspan="12"></th> </tr> <tr> <td rowspan="4" style="writing-mode: vertical-rl; transform: rotate(180deg);">NUMBER OF CONTAINERS</td> <td>PM2.5 Mass</td> <td>PM2.5 Concentration</td> <td>PMcoarse Mass</td> <td>PMcoarse Concentration</td> <td>PM10 Mass</td> <td>PM10 Concentration</td> <td></td><td></td><td></td><td></td><td></td> </tr> <tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr> <td colspan="2">Copy of Invoice with Report ☐ YES ☒ NO</td> <td colspan="2">Email 1 or Fax korina.houghton@erm.com</td> <td colspan="2" rowspan="4" style="writing-mode: vertical-rl; transform: rotate(180deg);">SAMPLES ON HOLD</td> </tr> <tr> <td colspan="2">Company:</td> <td colspan="2">Email 2 daniel.casanova@erm.com</td> </tr> <tr> <td colspan="2">Contact:</td> <td colspan="2"></td> </tr> <tr> <td colspan="2"></td> <td colspan="2"></td> </tr> <tr> <td colspan="2">Project Information</td> <td colspan="2">Oil and Gas Required Fields (client use)</td> <td colspan="2"></td> </tr> <tr> <td colspan="2">ALS Account # / Quote #:</td> <td colspan="2">AFE/Cost Center:</td> <td colspan="2">PO#</td> </tr> <tr> <td colspan="2">Job #: Tenas; 0403488-0203-0001</td> <td colspan="2">Major/Minor Code:</td> <td colspan="2">Routing Code:</td> </tr> <tr> <td colspan="2">PO / AFE:</td> <td colspan="2">Requisitioner:</td> <td colspan="2"></td> </tr> <tr> <td colspan="2">LSD:</td> <td colspan="2">Location:</td> <td colspan="2"></td> </tr> <tr> <td colspan="2">ALS Lab Work Order # (lab use only):</td> <td colspan="2">ALS Contact: Amber Springer</td> <td colspan="2">Sampler: Talaat Bakri</td> </tr> <tr> <td>ALS Sample # (lab use only)</td> <td>Sample Identification and/or Coordinates (This description will appear on the report)</td> <td>Date (dd-mm-yy)</td> <td>Time (hh:mm)</td> <td>Sample Type</td> <td></td> </tr> <tr><td>64462</td><td></td><td>14-Dec-19</td><td>0:00</td><td>Air Particulate</td><td>1 R R</td></tr> <tr><td>25072</td><td></td><td>15-Dec-19</td><td>0:01</td><td>Air Particulate</td><td>1 R R</td></tr> <tr><td>27584</td><td></td><td>17-Dec-19</td><td>0:00</td><td>Air Particulate</td><td>1 R R</td></tr> <tr><td>24944</td><td></td><td>20-Dec-19</td><td>0:00</td><td>Air Particulate</td><td>1 R R</td></tr> <tr><td>27798</td><td></td><td>23-Dec-19</td><td>0:00</td><td>Air Particulate</td><td>1 R R</td></tr> <tr><td>16188</td><td></td><td>26-Dec-19</td><td>0:00</td><td>Air Particulate</td><td>1 R R</td></tr> <tr><td>27810</td><td></td><td>29-Dec-19</td><td>0:00</td><td>Air Particulate</td><td>1 R R</td></tr> <tr><td>41640</td><td></td><td>1-Jan-20</td><td>0:00</td><td>Air Particulate</td><td>1 R R</td></tr> <tr><td>34136</td><td></td><td>4-Jan-20</td><td>0:00</td><td>Air Particulate</td><td>1 R R</td></tr> <tr><td>27731</td><td></td><td>7-Jan-20</td><td>0:00</td><td>Air Particulate</td><td>1 R R</td></tr> <tr><td>41642</td><td></td><td>10-Jan-20</td><td>0:00</td><td>Air Particulate</td><td>1 R R</td></tr> <tr><td>27799</td><td></td><td>13-Jan-20</td><td>0:00</td><td>Air Particulate</td><td>1 R R</td></tr> <tr> <td colspan="2">Drinking Water (DW) Samples¹ (client use)</td> <td colspan="2">Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)</td> <td colspan="2">SAMPLE CONDITION AS RECEIVED (lab use only)</td> </tr> <tr> <td colspan="2">Are samples taken from a Regulated DW System? ☐ YES ☐ NO</td> <td colspan="2" rowspan="3">Sample date/time represents STARTING date/time. See attached information sheet for sampling volume.</td> <td colspan="2">Frozen ☐ SIF Observations Yes ☐ No ☐</td> </tr> <tr> <td colspan="2">Are samples for human consumption/ use? ☐ YES ☐ NO</td> <td colspan="2">Ice Packs ☐ Ice Cubes ☐ Custody seal intact Yes ☐ No ☐</td> </tr> <tr> <td colspan="2"></td> <td colspan="2">Cooling Initiated ☐</td> </tr> <tr> <td colspan="2"></td> <td colspan="2"></td> <td colspan="2">INITIAL COOLER TEMPERATURES °C</td> </tr> <tr> <td colspan="2"></td> <td colspan="2"></td> <td colspan="2">FINAL COOLER TEMPERATURES °C</td> </tr> <tr> <td colspan="2"></td> <td colspan="2"></td> <td colspan="2">7</td> </tr> <tr> <td colspan="2">SHIPMENT RELEASE (client use)</td> <td colspan="2">INITIAL SHIPMENT RECEPTION (lab use only)</td> <td colspan="2">FINAL SHIPMENT RECEPTION (lab use only)</td> </tr> <tr> <td>Released by: Dan Casanova</td> <td>Date: March 10 2020</td> <td>Time: 2:00</td> <td>Received by:</td> <td>Date: 12 March 20</td> <td>Time: 9:30am</td> </tr> </table>		Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below																								NUMBER OF CONTAINERS	PM2.5 Mass	PM2.5 Concentration	PMcoarse Mass	PMcoarse Concentration	PM10 Mass	PM10 Concentration																																							Copy of Invoice with Report ☐ YES ☒ NO		Email 1 or Fax korina.houghton@erm.com		SAMPLES ON HOLD		Company:		Email 2 daniel.casanova@erm.com		Contact:								Project Information		Oil and Gas Required Fields (client use)				ALS Account # / Quote #:		AFE/Cost Center:		PO#		Job #: Tenas; 0403488-0203-0001		Major/Minor Code:		Routing Code:		PO / AFE:		Requisitioner:				LSD:		Location:				ALS Lab Work Order # (lab use only):		ALS Contact: Amber Springer		Sampler: Talaat Bakri		ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mm-yy)	Time (hh:mm)	Sample Type		64462		14-Dec-19	0:00	Air Particulate	1 R R	25072		15-Dec-19	0:01	Air Particulate	1 R R	27584		17-Dec-19	0:00	Air Particulate	1 R R	24944		20-Dec-19	0:00	Air Particulate	1 R R	27798		23-Dec-19	0:00	Air Particulate	1 R R	16188		26-Dec-19	0:00	Air Particulate	1 R R	27810		29-Dec-19	0:00	Air Particulate	1 R R	41640		1-Jan-20	0:00	Air Particulate	1 R R	34136		4-Jan-20	0:00	Air Particulate	1 R R	27731		7-Jan-20	0:00	Air Particulate	1 R R	41642		10-Jan-20	0:00	Air Particulate	1 R R	27799		13-Jan-20	0:00	Air Particulate	1 R R	Drinking Water (DW) Samples¹ (client use)		Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)		SAMPLE CONDITION AS RECEIVED (lab use only)		Are samples taken from a Regulated DW System? ☐ YES ☐ NO		Sample date/time represents STARTING date/time. 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LSD:		Location:																																																																																																																																																																																																																																																														
ALS Lab Work Order # (lab use only):		ALS Contact: Amber Springer		Sampler: Talaat Bakri																																																																																																																																																																																																																																																												
ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mm-yy)	Time (hh:mm)	Sample Type																																																																																																																																																																																																																																																												
64462		14-Dec-19	0:00	Air Particulate	1 R R																																																																																																																																																																																																																																																											
25072		15-Dec-19	0:01	Air Particulate	1 R R																																																																																																																																																																																																																																																											
27584		17-Dec-19	0:00	Air Particulate	1 R R																																																																																																																																																																																																																																																											
24944		20-Dec-19	0:00	Air Particulate	1 R R																																																																																																																																																																																																																																																											
27798		23-Dec-19	0:00	Air Particulate	1 R R																																																																																																																																																																																																																																																											
16188		26-Dec-19	0:00	Air Particulate	1 R R																																																																																																																																																																																																																																																											
27810		29-Dec-19	0:00	Air Particulate	1 R R																																																																																																																																																																																																																																																											
41640		1-Jan-20	0:00	Air Particulate	1 R R																																																																																																																																																																																																																																																											
34136		4-Jan-20	0:00	Air Particulate	1 R R																																																																																																																																																																																																																																																											
27731		7-Jan-20	0:00	Air Particulate	1 R R																																																																																																																																																																																																																																																											
41642		10-Jan-20	0:00	Air Particulate	1 R R																																																																																																																																																																																																																																																											
27799		13-Jan-20	0:00	Air Particulate	1 R R																																																																																																																																																																																																																																																											
Drinking Water (DW) Samples¹ (client use)		Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)		SAMPLE CONDITION AS RECEIVED (lab use only)																																																																																																																																																																																																																																																												
Are samples taken from a Regulated DW System? ☐ YES ☐ NO		Sample date/time represents STARTING date/time. See attached information sheet for sampling volume.		Frozen ☐ SIF Observations Yes ☐ No ☐																																																																																																																																																																																																																																																												
Are samples for human consumption/ use? ☐ YES ☐ NO				Ice Packs ☐ Ice Cubes ☐ Custody seal intact Yes ☐ No ☐																																																																																																																																																																																																																																																												
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SHIPMENT RELEASE (client use)		INITIAL SHIPMENT RECEPTION (lab use only)		FINAL SHIPMENT RECEPTION (lab use only)																																																																																																																																																																																																																																																												
Released by: Dan Casanova	Date: March 10 2020	Time: 2:00	Received by:	Date: 12 March 20	Time: 9:30am																																																																																																																																																																																																																																																											

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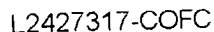
Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

1. If any water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC form.

NOV 2018 EBR01



Canada Toll Free: 1 800 668 9878



COC Number: 17-835710

Page 2 of 2

1

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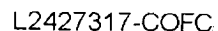
NOV 2018 FROM

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.

1. If any water samples are taken from a **Regulated Drinking Water (DW) System**, please submit using an **Authorized DW COC form**.



Canada Toll Free: 1 800 668 9878



COC Number: 17-835710

Page 3 of 3

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1. If any water samples are taken from a **Regulated Drinking Water (DW) System**, please submit using an **Authorized DW COC form**.

Sampling order	CassetteID	PM Type	Start_Date_ actual	Start_Time_ act	Stop_Date_ actual	Stop_Time_ act	Total_Samp le_time	Volume of air sampled (Actual Volume; m^3)	Volume of air sampled (Actual Volume; Litres)	Blank Sample?
1	64462	PM2.5	14-Dec-19	0:00	15-Dec-19	0:00	24:00:00	21.6	21600	no
2	25072	PM2.5	15-Dec-19	0:01	15-Dec-19	0:01	0:00:00	0.0	0	YES
3	27584	PM2.5	17-Dec-19	0:00	18-Dec-19	0:00	24:00:00	21.6	21600	no
4	24944	PM2.5	20-Dec-19	0:00	21-Dec-19	0:00	24:00:00	21.6	21600	no
5	27798	PM2.5	23-Dec-19	0:00	24-Dec-19	0:00	24:00:00	21.6	21600	no
6	16188	PM2.5	26-Dec-19	0:00	27-Dec-19	0:00	24:00:00	21.6	21600	no
7	27810	PM2.5	29-Dec-19	0:00	30-Dec-19	0:00	24:00:00	21.6	21600	no
8	41640	PM2.5	1-Jan-20	0:00	2-Jan-20	0:00	24:00:00	21.6	21600	no
9	34136	PM2.5	4-Jan-20	0:00	5-Jan-20	0:00	24:00:00	21.6	21600	no
10	27731	PM2.5	7-Jan-20	0:00	8-Jan-20	0:00	24:00:00	21.6	21600	no
11	41642	PM2.5	10-Jan-20	0:00	11-Jan-20	0:00	24:00:00	21.6	21600	no
12	27799	PM2.5	13-Jan-20	0:00	14-Jan-20	0:00	24:00:00	21.6	21600	no
13	10326	PM2.5	16-Jan-20	0:00	17-Jan-20	0:00	24:00:00	21.6	21600	no
1	64482	PMcoarse	14-Dec-19	0:00	15-Dec-19	0:00	23:59:00	2.41	2410	no
2	15106	PMcoarse	15-Dec-19	0:01	15-Dec-19	0:01	0:00:00	0	0	YES
3	25401	PMcoarse	17-Dec-19	0:00	18-Dec-19	0:00	24:00:00	2.41	2410	no
4	27478	PMcoarse	20-Dec-19	0:00	21-Dec-19	0:00	24:00:00	2.41	2410	no
5	107619	PMcoarse	23-Dec-19	0:00	24-Dec-19	0:00	24:00:00	2.41	2410	no
6	41657	PMcoarse	26-Dec-19	0:00	27-Dec-19	0:00	24:00:00	2.41	2410	no
7	41641	PMcoarse	29-Dec-19	0:00	30-Dec-19	0:00	24:00:00	2.41	2410	no
8	15127	PMcoarse	1-Jan-20	0:00	2-Jan-20	0:00	24:00:00	2.41	2410	no
9	41651	PMcoarse	4-Jan-20	0:00	5-Jan-20	0:00	24:00:00	2.41	2410	no
10	27442	PMcoarse	7-Jan-20	0:00	8-Jan-20	0:00	24:00:00	2.41	2410	no
11	24925	PMcoarse	10-Jan-20	0:00	11-Jan-20	0:00	24:00:00	2.40	2400	no
12	89020	PMcoarse	13-Jan-20	0:00	14-Jan-20	0:00	24:00:00	2.41	2410	no
13	27301	PMcoarse	16-Jan-20	0:00	17-Jan-20	0:00	24:00:00	2.41	2410	no



L2427317-COFC

Appendix 4-A *Baseline Noise Monitoring Field Notes*

Noise Baseline Study - Field Data Sheet

Sampler Location:

Project Name Telkwa Coal

Project # 0403488-7

ID (e.g. S1) S-Mill S-Plant

UTM Coordinates: 618794 E. 6053543 N

UTM Datum WGS-84

Ground Cover (e.g. soil/vegetation type): cutblock, dead trees, small

Start Date/Time Oct. 16 '17 11:58

Terrain (e.g. flat, hills, mountains): generally flat, gentle mtn slope

Finish Date/Time Oct. 17 '17 12:56

Weather:

at setup

Temperature (°C): -1°C

Cloud Cover (%): 100

Precipitation: ☐ Heavy ☒ Moderate ☐ Mild ☐ None

☒ Snow ☐ Rain ☐ Other

Wind: Speed ☐ Strong ☐ Moderate ☐ Light ☒ None

Direction

Instrument:

Type B&K 2250

Serial # 3023697

Calibration: ☒ Before ☐ After

Method 4231 Calibrator

Weighting (i.e. A) A and C

Other Settings 50.17 mV/Pa

Response (i.e. fast/slow) slow, 1-minute log

dev. from initial 0.20 dB

Observations:

****Include directions and estimated distances to the instrument in this section****

Audible noise observed falling snow on ground
at setup

Potential noise sources - aircraft, gunshots, windy train animals

Obstacles (e.g. trees, buildings) 1-2m high trees, in surrounding area

Notes:

station picked-up at 4:45pm on Oct. 17

- station location chosen by Ardea Bio Consulting instructions

****Please be sure to take a few photos of the instrument and the surrounding area (i.e. one in each direction) and put them in the project folder with appropriate labels upon return to the office!****

Noise Baseline Study - Field Data Sheet

Sampler Location:

Project Name Telkwa Coal

Project # 0403488-7

ID (e.g. S1) S-Tenas Dep

UTM Coordinates: 616490 E 6051477 N

UTM Datum WGS-84

Ground Cover (e.g. soil/vegetation type): full grown forest

Start Date/Time Oct. 17 '17, 17:21¹⁸

Terrain (e.g. flat, hills, mountains): gentle mountain slope

Finish Date/Time Oct 18 '17, 18:18

Weather: at setup

Temperature (°C): ~ 4°C

Cloud Cover (%): 50

Precipitation: ☐ Heavy ☐ Moderate ☐ Mild ☒ None

☐ Snow ☐ Rain ☐ Other _____

Wind: Speed ☐ Strong ☐ Moderate ☐ Light ☒ None

Direction _____

Instrument:

Type B&K 2250

Serial # 3023697

Calibration: ☒ Before ☐ After

Method H231 calibrator

Weighting (i.e. A) A and C

Other Settings 49.99 mV/Pa

Response (i.e. fast/slow) slow, 1-minute lag

dev. from initial: 0.17dB

Observations: ****Include directions and estimated distances to the instrument in this section****

Audible noise observed at setup - water dripping from trees / melting snow

- gunshots, aircraft

Potential noise sources - wind, train horn, animals

Obstacles (e.g. trees, buildings) - full grown trees

Notes:

- location is inside a fully grown forest, as per
Ardea Bio Consulting instructions

- station picked-up ~~at~~ on Oct 19

****Please be sure to take a few photos of the instrument and the surrounding area (i.e. one in each direction) and put them in the project folder with appropriate labels upon return to the office!****

Noise Baseline Study - Field Data Sheet

Sampler Location:

Project Name Texas Project

Project # 0403488-7

ID (e.g. S1) S-Texas Dep

(Same as last)

UTM Coordinates: _____ E _____ N

UTM Datum _____

Ground Cover (e.g. soil/vegetation type): shrub

Start Date/Time Dec 11 '17, ~10:40¹⁸

Terrain (e.g. flat, hills, mountains): gentle hills local and regional

Finish Date/Time Dec 12 '17, ~10:40

Weather:

Temperature (°C): ~1°C

Cloud Cover (%): 100

Precipitation: ☐ Heavy ☐ Moderate ☐ Mild ☒ None

☐ Snow ☐ Rain ☐ Other _____

Wind: Speed ☐ Strong ☐ Moderate ☐ Light ☒ None

Direction _____

Instrument:

Type B&K 2250

Serial # 3023697

Calibration: ☒ Before ☐ After

Method

4231 calibrator

Sensitivity: 50.73 mV/Pa
Dev. from last: 0.18 dB

Weighting (i.e. A) Broadband: A/C

Other Settings

broadband peak: C

Response (i.e. fast/slow) 1 minute log, fast response

spectrum Z, Full stats

Observations:

****Include directions and estimated distances to the instrument in this section****

Audible noise observed - Birds, snow melting, squirrels, truck, aircraft

Potential noise sources - other animals, windy, falling snow from trees

Obstacles (e.g. trees, buildings) - in forest as per wildlife monitoring instructions

Notes:

File name: Unit 9 001

****Please be sure to take a few photos of the instrument and the surrounding area (i.e. one in each direction) and put them in the project folder with appropriate labels upon return to the office!****

Noise Baseline Study - Field Data Sheet

Sampler Location:

Project Name Texas Project

Project # 0403488-7
030

ID (e.g. S1) S-Plant

Same as last

UTM Coordinates: _____ E _____ N

UTM Datum _____

Ground Cover (e.g. soil/vegetation type): Shrub, small new trees

Start Date/Time Dec 12, '17 11:55

Terrain (e.g. flat, hills, mountains): -gentle slope

Finish Date/Time Dec 13 12:56

Weather:

Temperature (°C): ~5°C

Cloud Cover (%): 100 (thin)

Precipitation: ☐ Heavy ☐ Moderate ☒ Mild ☐ None

☐ Snow ☒ Rain ☐ Other _____

Wind: Speed ☐ Strong ☐ Moderate ☐ Light ☒ None

Direction _____

Instrument:

Type B&K 2250

Serial # 3023697

Calibration: ☒ Before ☐ After

Method Type 4231, sensi 50.44 uV/Pa, dev. from last: 0.25 dB

Weighting (i.e. A) Broadband A,C Other Settings Broadband Peak: C 1/3 octave

Response (i.e. fast/slow) 1-min logging, fast response Spectrum: Z

Observations: ****Include directions and estimated distances to the instrument in this section****

Audible noise observed - hearing snow birds

Potential noise sources = animals, aircraft, gunshots, train, snowmobiles

Obstacles (e.g. trees, buildings) - small trees in catblock

Notes:

File: Unit 9 003

****Please be sure to take a few photos of the instrument and the surrounding area (i.e. one in each direction) and put them in the project folder with appropriate labels upon return to the office!****

Noise Baseline Study - Field Data Sheet

Sampler Location:

Project Name 8 Texas Project

Project # 0403488-7

New station ID (e.g. S1) S-Rail

UTM Coordinates: 630146 E 6058143 N

UTM Datum WGS-84

Ground Cover (e.g. soil/vegetation type): show nearby small trees

Start Date/Time Dec 15 ~10:15

Terrain (e.g. flat, hills, mountains): locally flat, small hill to S.

Finish Date/Time Dec 18 ~10:15

Weather:

Temperature (°C): -5°C

Cloud Cover (%): 10

Precipitation: ☐ Heavy ☐ Moderate ☐ Mild ☒ None

☐ Snow ☐ Rain ☐ Other

Wind: Speed ☐ Strong ☐ Moderate ☒ Light ☐ None

Direction from E

Instrument:

Type B&K 2250

Serial # 4231 calibrator 3023697

Calibration: ☒ Before ☒ After

Method 4231 calibrator

Sensitivity: 51.10 mV/Pa

dev from last: 0.11 dB

Weighting (i.e. A) Broadband: A, C

Other Settings broadband peak: C

Response (i.e. fast/slow) 1 min log, fast response

spectrum: Z, Full stats

Observations: ****Include directions and estimated distances to the instrument in this section****

Audible noise observed - Birds, highway traffic, snow melting

Potential noise sources - train, animals, windy snowmobiles, livestock

Obstacles (e.g. trees, buildings) - in forest clearings, small 10m high hill to south

Notes:

File name: Unit 9 008 ~~I think first file~~

2250 set up on timer to measure 3 consecutive days

+ deployed Friday, pick up on Monday

→ need to check calibration at end of monitoring

to determine if all 3 days are OK.

★ End Calibration sensitivity: 48.72 mV/Pa

Date: Dec 18 Deviation from last: -0.41 dB

****Please be sure to take a few photos of the instrument and the surrounding area (i.e. one in each direction) and put them in the project folder with appropriate labels upon return to the office!****

Files 008, 009, 010 cut short, only 21 hours

Noise Baseline Study - Field Data Sheet

Sampler Location:

Project Name Tenas

Project # 0403488-7

ID (e.g. S1) S-Tenas Dep

UTM Coordinates: 616490 E 6051477 N

UTM Datum 96

Ground Cover (e.g. soil/vegetation type): snow w/ some veg exposed
in grown forest

Start Date/Time 3/21/2018 10:48AM

Terrain (e.g. flat, hills, mountains): gentle slope

Finish Date/Time 3/22/2018 9:35AM

Weather:

Temperature (°C): -1

Cloud Cover (%): 100

Precipitation: ☐ Heavy ☐ Moderate ☐ Mild ☒ None

☐ Snow ☐ Rain ☐ Other

Wind: Speed ☐ Strong ☒ Moderate ☒ Light ☐ None

Direction

Instrument:

Type B&K 2250

Serial # 3007892

Calibration: ☒ Before ☐ After

Method 4231 Calibrator 45.53 mV/pa

Weighting (i.e. A) Broadband AC

Other Settings broadband peak A

Response (i.e. fast/slow) 2-min log

-0.55 dB dev. from last
spectrum 2

Observations:

****Include directions and estimated distances to the instrument in this section****

Audible noise observed -wind, trees moving, snow melting

Potential noise sources -wind, trees, animals, train horn, hunters, aircraft

Obstacles (e.g. trees, buildings) -located in dense mature forest

Notes:

Lynx spotted at helicopter land landing spot
-windier than normal on deployment, compared to Oct. and
Dec. sampling

Files: Unit 2003 files spit/saved at 7:00 AM
Unit 2004

-combine w/ Evaluator software

****Please be sure to take a few photos of the instrument and the surrounding area (i.e. one in each direction) and put them in the project folder with appropriate labels upon return to the office!****

Noise Baseline Study - Field Data Sheet

Sampler Location:

Project Name Texas

Project # 0403488-7

ID (e.g. S1) S-Plant

★ UTM Coordinates: 618827 E 6053599 N

UTM Datum QU

Ground Cover (e.g. soil/vegetation type): snow covered

Start Date/Time 3/20/2018 9:32 AM

Terrain (e.g. flat, hills, mountains): locally flat, regional gentl slope

Finish Date/Time 3/21/2018 9:43 AM

Weather:

Temperature (°C): 1°C

Cloud Cover (%): 50%

Precipitation: ☐ Heavy ☐ Moderate ☐ Mild ☒ None

☐ Snow ☐ Rain ☐ Other _____

Wind: Speed ☐ Strong ☐ Moderate ☒ Light ☐ None

Direction _____

Instrument:

Type B&K 2250

Serial # 3007892

Calibration: ☒ Before ☐ After

Method 4251 Calibrator 48 mV/Pa

1.23 dB dev. from 1m1

Weighting (i.e. A) Broadband A, C

Other Settings broadband peak A

Response (i.e. fast/slow) spectrum 2

spectrum 2 fast

7-min log

Observations:

****Include directions and estimated distances to the instrument in this section****

Audible noise observed -wolves howling

-aircraft

Potential noise sources -wind, trees, animals, train horn, hunters, aircraft

Obstacles (e.g. trees, buildings) -trees (new cutblock)

Notes:

Fieldcrew install: CH, GK (DC was sick)

★ - installed at different location than usual → error

- approx 70 m northeast of the usual spot

- noise difference should be negligible

Files ~~2005~~ Unit 2005

Files split/saved at 7:00 AM

2006 Unit 2006

-combine w/ Evaluator software

****Please be sure to take a few photos of the instrument and the surrounding area (i.e. one in each direction) and put them in the project folder with appropriate labels upon return to the office!****

Noise Baseline Study - Field Data Sheet

Sampler Location:

Project Name Texas

Project # 0403488-7

ID (e.g. S1) S-Rail

UTM Coordinates: 63946 E 6058143 N

UTM Datum 961

Ground Cover (e.g. soil/vegetation type): snow cover, open cutblock

Start Date/Time 3/22/2018 1:04 PM

Terrain (e.g. flat, hills, mountains): local flat, hill to south

Finish Date/Time 3/23/2018 2:04 PM

Weather:

Temperature (°C): -1°C

Cloud Cover (%): 100

Precipitation: ☐ Heavy ☐ Moderate ☐ Mild ☒ None

☐ Snow ☐ Rain ☐ Other _____

Wind: Speed ☐ Strong ☐ Moderate ☐ Light ☒ None

Direction _____

Instrument:

Type B&K 2250

Serial # 3007892

Calibration: ☒ Before ☐ After

Method 4231 Calibrator 45.49 mV/Pa

Weighting (i.e. A) Bruidbad A,C

Other Settings Bruidbad peak A

Response (i.e. fast/slow) 1-min log

spectrum 2

Observations:

****Include directions and estimated distances to the instrument in this section****

Audible noise observed -highway, train, birds

Potential noise sources -highway, train moving + horn, animals, wind,
trees swaying

Obstacles (e.g. trees, buildings) -some scattered small trees in cutblock

-hill to south, 40m away

Notes:

Files: Unit 2007 file split/saved at 00:00
Unit 2008

-combine w/ Evaluator software

****Please be sure to take a few photos of the instrument and the surrounding area (i.e. one in each direction) and put them in the project folder with appropriate labels upon return to the office!****

Appendix 4-B *Baseline Noise Monitoring One-minute
Data Graphs*

Figure 4-B1

**One-minute LAeq Noise Levels, S-Plant,
October 16 - 17, 2017**

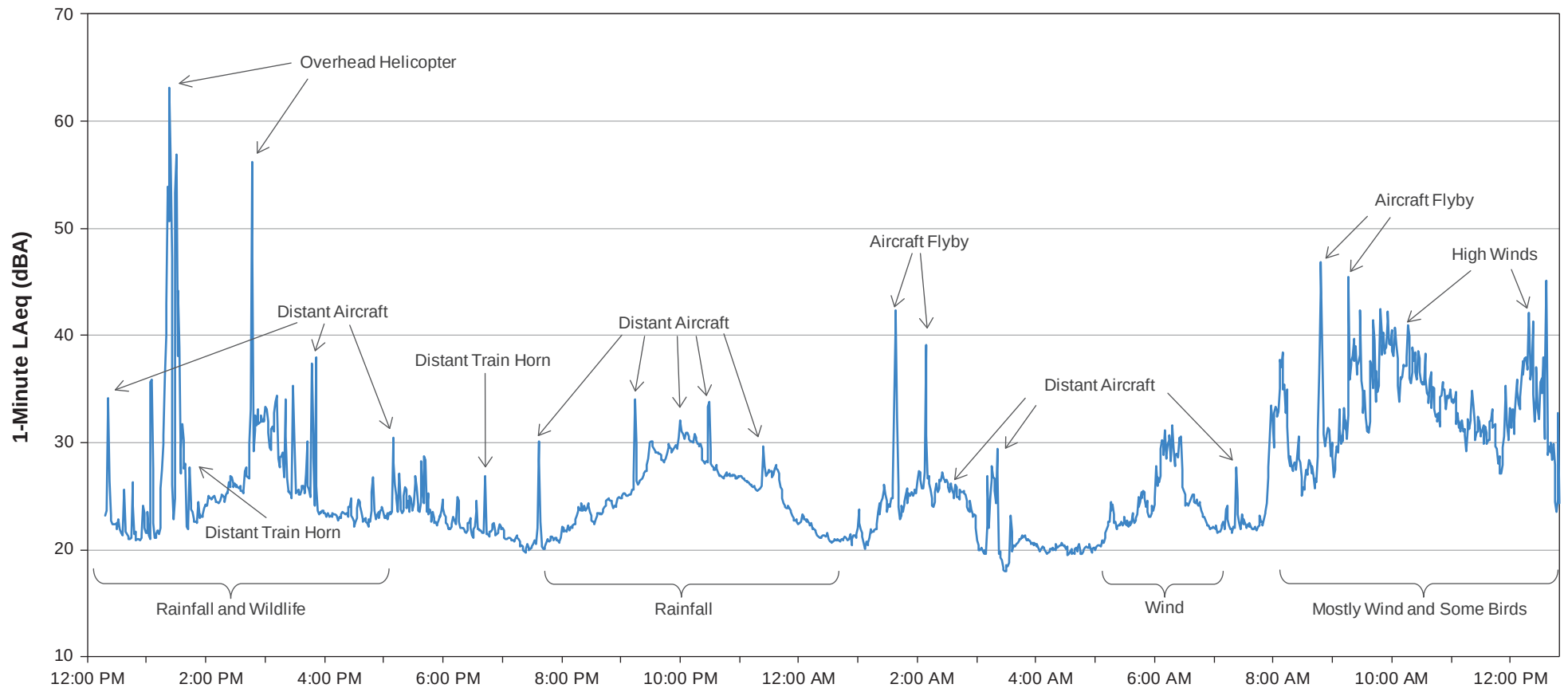
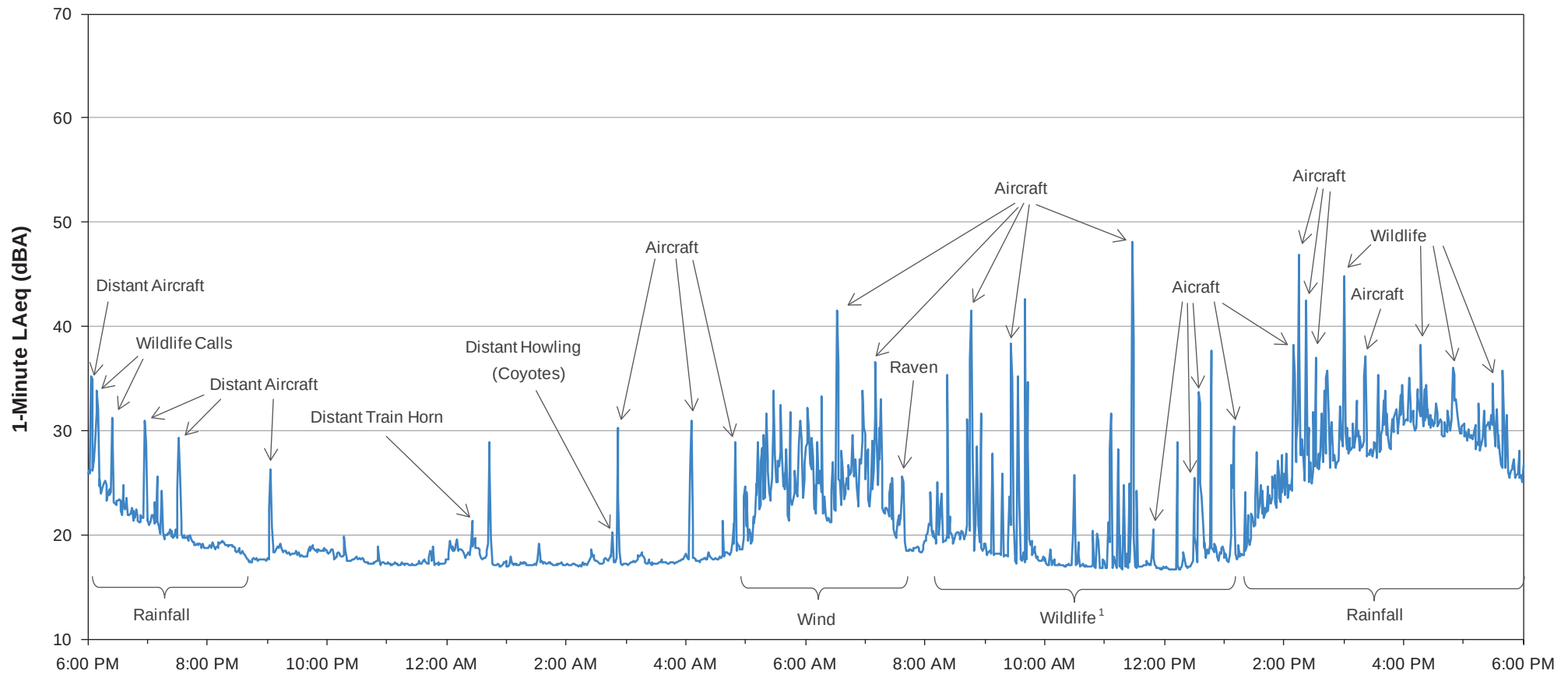


Figure 4-B2

**One-minute LAeq Noise Levels, S-TenasDep,
October 17 - 18, 2017**



Note: 1. Noise spikes were caused by wildlife unless noted otherwise in graph.

Figure 4-B3

**One-minute LAeq Noise Levels, S-Plant,
December 12 - 13, 2017**

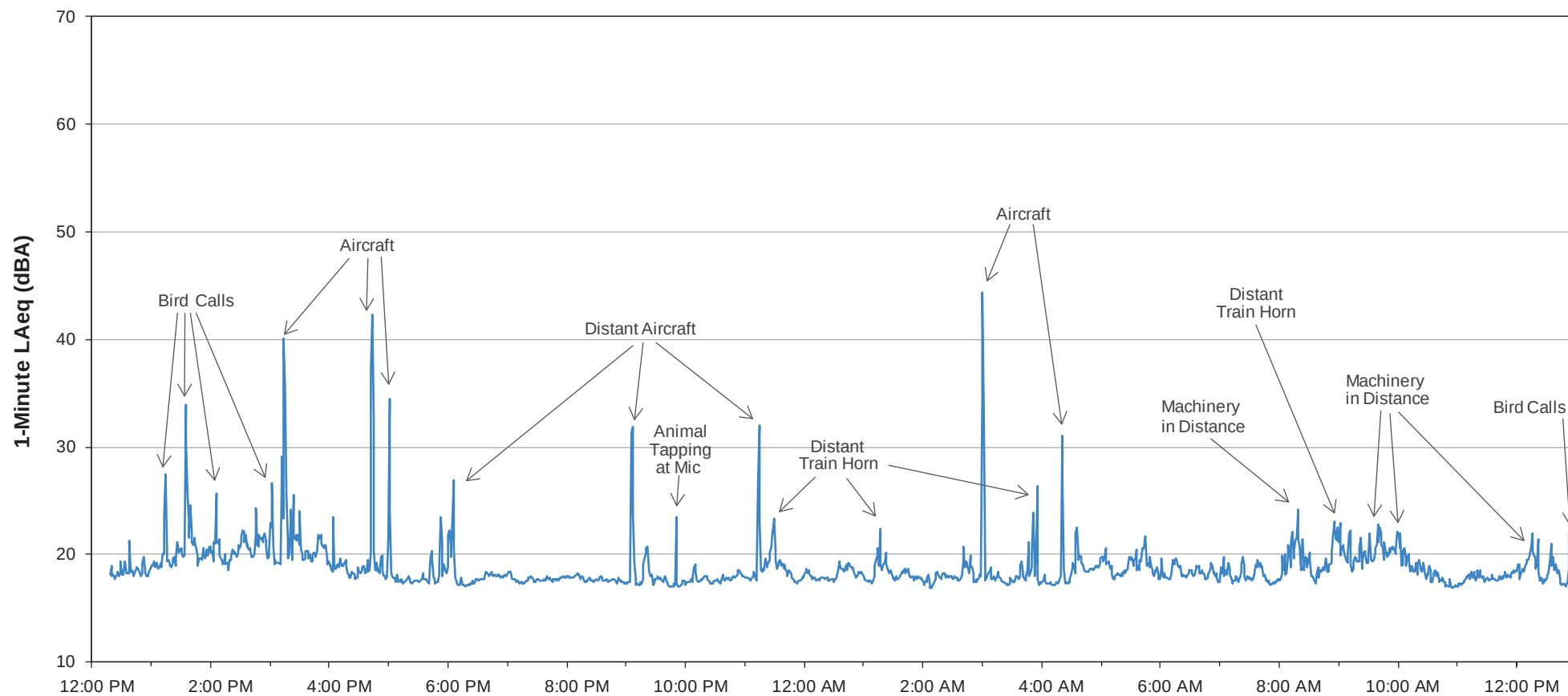


Figure 4-B4

**One-minute LAeq Noise Levels, S-TenasDep,
December 11 - 12, 2017**

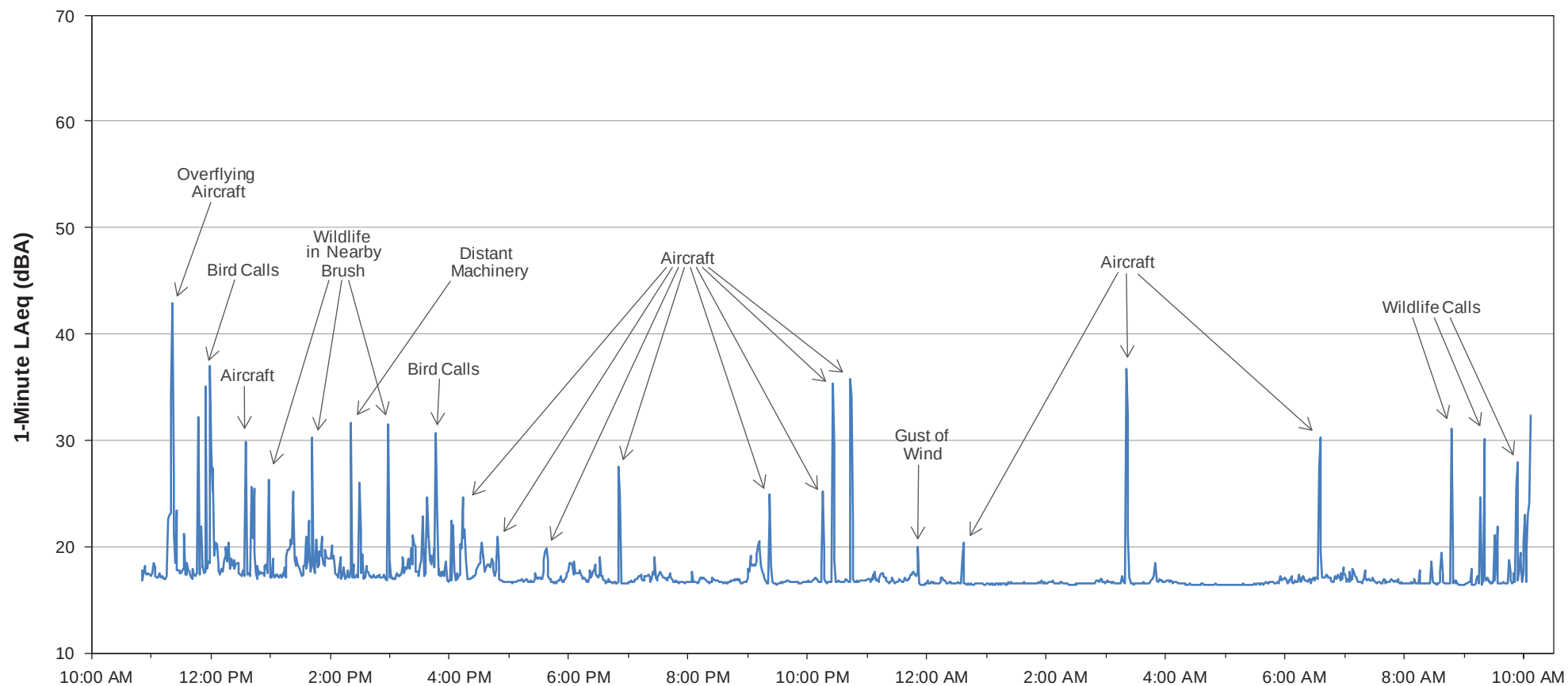


Figure 4-B5

One-minute LAeq Noise Levels, S-Rail,
December 15 - 16, 2017

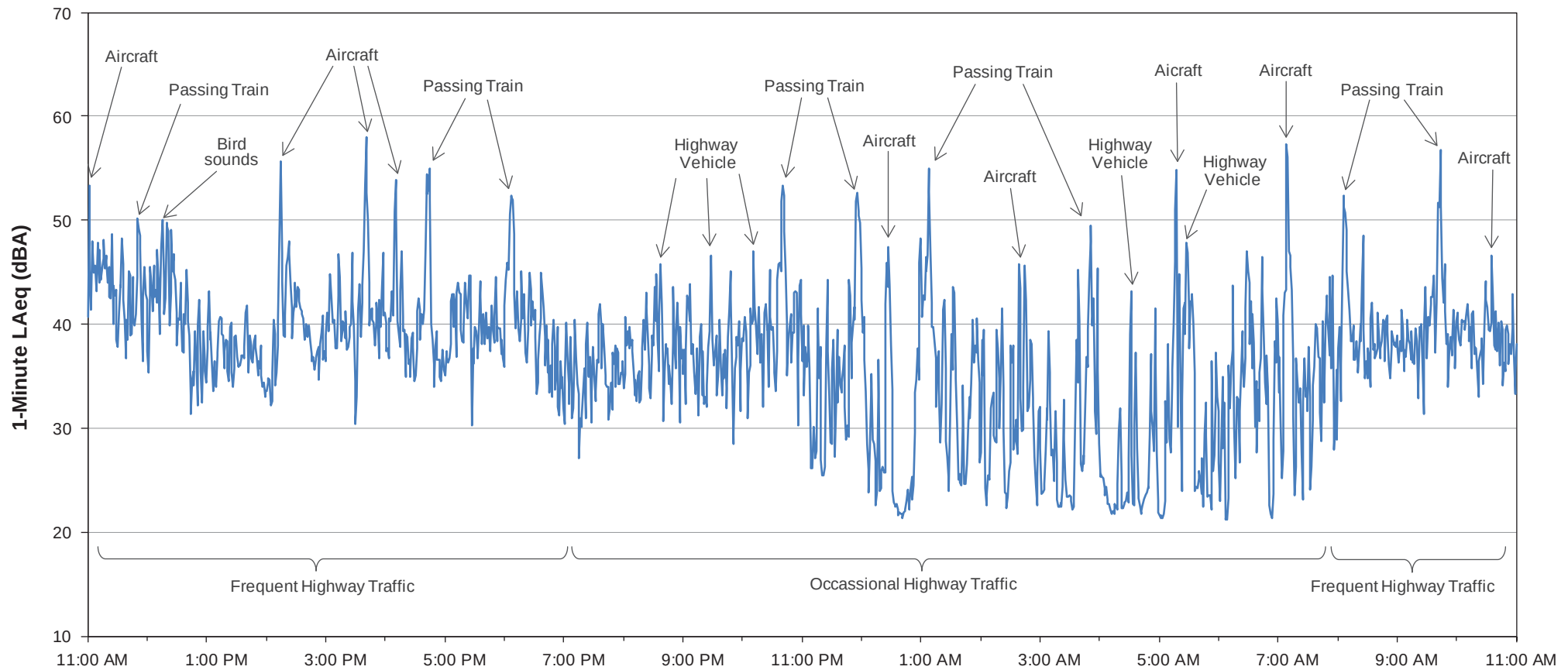


Figure 4-B6

One-minute LAeq Noise Levels, S-Plant,
March 20 - 21, 2018

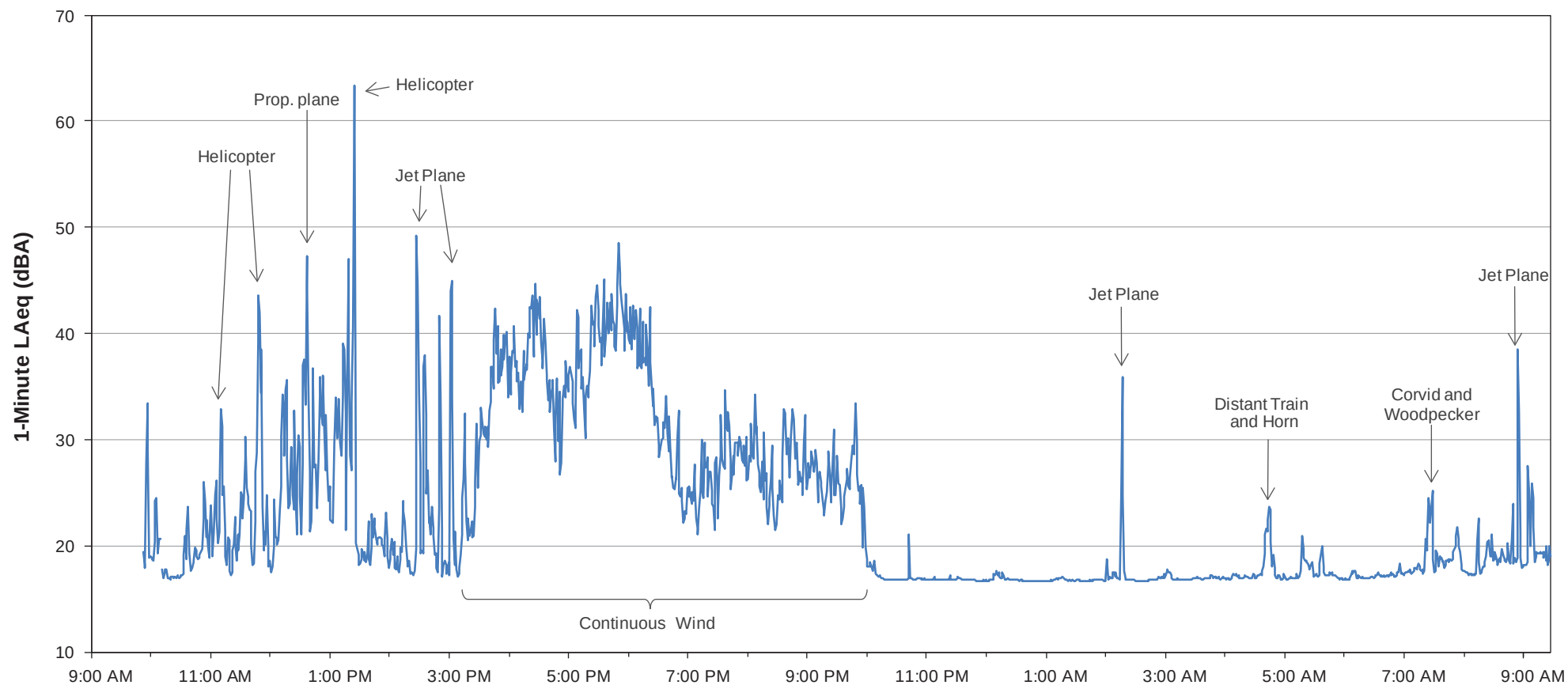


Figure 4-B7

**One-minute LAeq Noise Levels, S-TenasDep,
March 21 - 22, 2018**

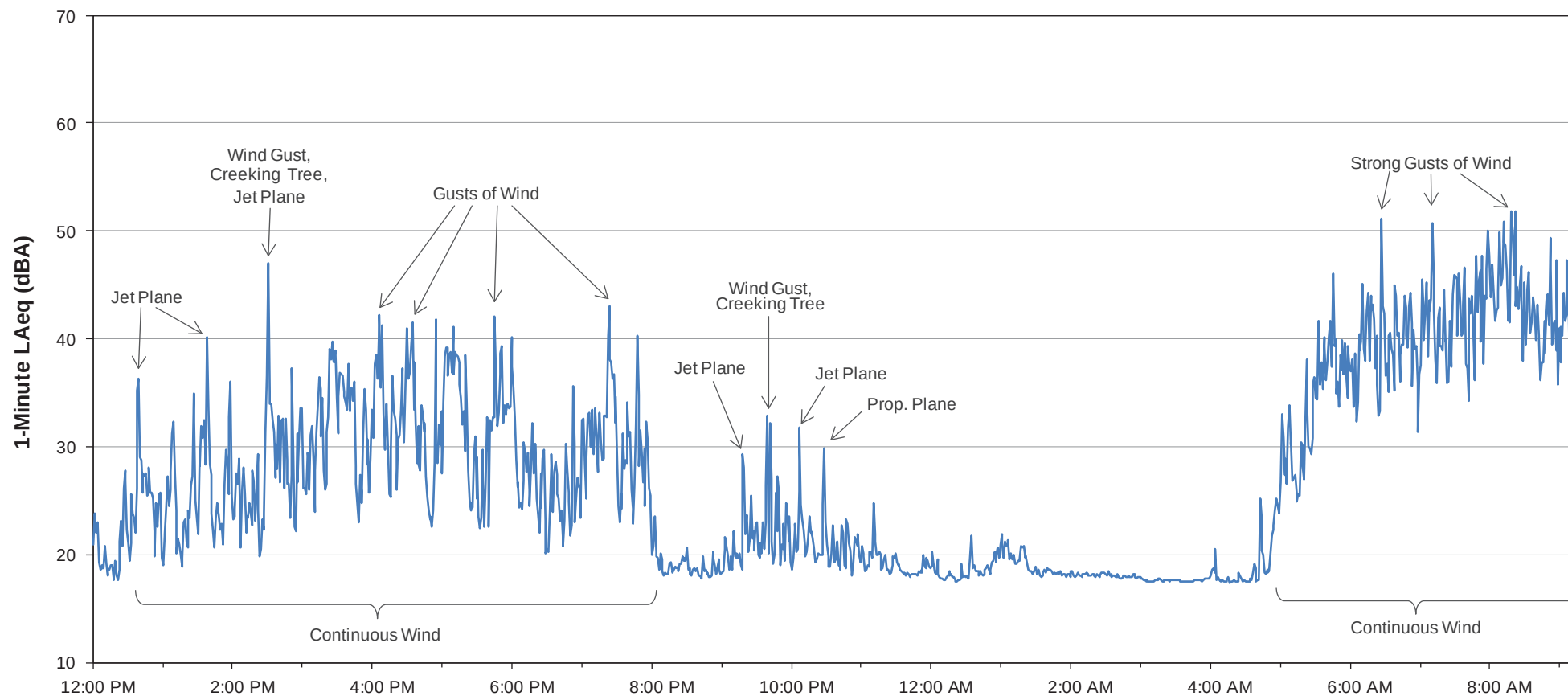
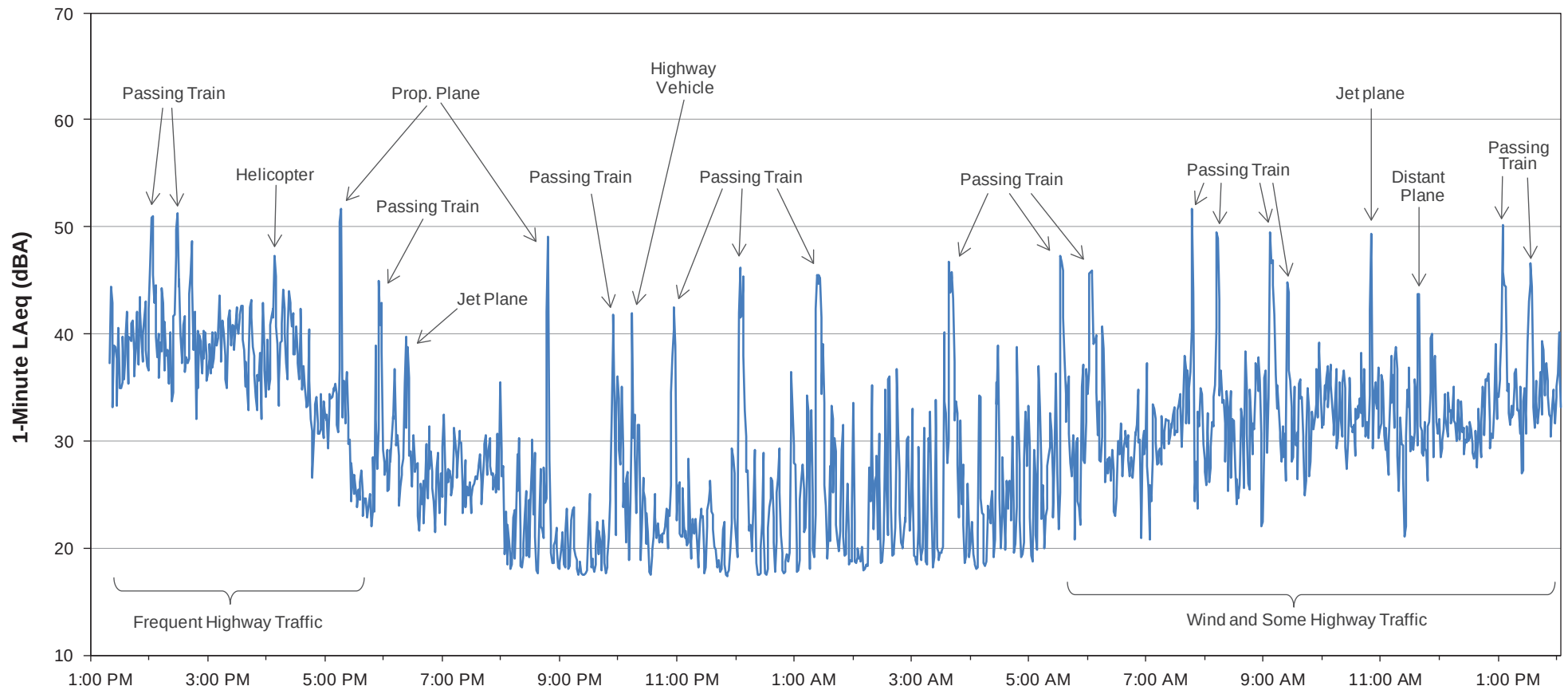


Figure 4-B8

One-minute LAeq Noise Levels, S-Rail,
March 22 - 23, 2018



Appendix 4-C *Baseline Noise Monitoring Hourly Data Tables*

Appendix 4-C1. Noise Monitoring Summary for S-Plant, October 16 to 17, 2017

Period	Start Time	End time	Duration (hh:mm)	LAeq	LAmix	LA10	LA90	LAmin	Weather Conditions Measured at Tenas Deposit Met. Stn.		
									Mean Wind Speed (m/s)	Mean Air Temp. (°C)	Total Precipitation (mm)
Time Block 1	12:18, Oct. 16	13:00, Oct. 16	0:42	24.6	44.5	25.3	20.6	19.8	n/a. sensor frozen	0.4	1.0
Time Block 2	13:00, Oct. 16	14:00, Oct. 16	1:00	47.9	71.1	44.0	21.4	20.1	n/a. sensor frozen	0.8	1.0
Time Block 3	14:00, Oct. 16	15:00, Oct. 16	1:00	39.5	61.9	32.1	24.2	22.9	1.1	0.8	0.5
Time Block 4	15:00, Oct. 16	16:00, Oct. 16	1:00	29.9	54.9	32.4	23.5	22.6	0.6	0.9	0.0
Time Block 5	16:00, Oct. 16	17:00, Oct. 16	1:00	23.4	34.7	24.4	22.4	21.4	1.1	0.3	0.0
Time Block 6	17:00, Oct. 16	18:00, Oct. 16	1:00	24.9	45.9	25.9	22.6	21.1	1.2	0.4	0.0
Time Block 7	18:00, Oct. 16	19:00, Oct. 16	1:00	22.4	35.0	23.2	21.3	20.5	1.1	0.7	0.0
Time Block 8	19:00, Oct. 16	20:00, Oct. 16	1:00	21.7	38.9	21.5	20.1	19.2	0.8	0.6	0.6
Time Block 9	20:00, Oct. 16	21:00, Oct. 16	1:00	23.6	36.3	24.7	22.0	20.8	0.2	0.4	1.4
Time Block 10	21:00, Oct. 16	22:00, Oct. 16	1:00	28.7	45.3	30.3	25.1	24.1	0.4	0.1	2.0
Time Block 11	22:00, Oct. 16	23:00, Oct. 16	1:00	29.0	40.4	30.8	26.5	25.6	n/a. sensor frozen	0.0	1.5
Time Block 12	23:00, Oct. 16	00:00, Oct. 17	1:00	26.0	40.2	27.5	22.9	21.5	n/a. sensor frozen	0.0	2.1
Time Block 13	00:00, Oct. 17	01:00, Oct. 17	1:00	21.6	34.1	22.7	20.6	19.8	n/a. sensor frozen	-0.4	3.0
Time Block 14	01:00, Oct. 17	02:00, Oct. 17	1:00	29.0	47.6	26.9	20.9	19.5	n/a. sensor frozen	-0.2	1.9
Time Block 15	02:00, Oct. 17	03:00, Oct. 17	1:00	27.0	46.2	27.4	23.3	19.9	n/a. sensor frozen	0.1	0.8
Time Block 16	03:00, Oct. 17	04:00, Oct. 17	1:00	22.3	37.8	25.4	18.7	17.5	n/a. sensor frozen	0.1	0.3
Time Block 17	04:00, Oct. 17	05:00, Oct. 17	1:00	20.1	35.3	20.7	19.5	18.7	n/a. sensor frozen	0.2	0.1
Time Block 18	05:00, Oct. 17	06:00, Oct. 17	1:00	23.1	37.1	24.8	20.7	19.3	n/a. sensor frozen	-0.1	0.2
Time Block 19	06:00, Oct. 17	07:00, Oct. 17	1:00	27.2	43.4	30.2	22.2	20.8	n/a. sensor frozen	-0.4	0.0
Time Block 20	07:00, Oct. 17	08:00, Oct. 17	1:00	25.0	37.9	27.7	21.6	20.6	n/a. sensor frozen	-0.4	0.0
Time Block 21	08:00, Oct. 17	09:00, Oct. 17	1:00	34.3	62.6	36.2	26.1	23.9	n/a. sensor frozen	-0.1	0.0
Time Block 22	09:00, Oct. 17	10:00, Oct. 17	1:00	37.6	55.0	40.2	29.7	25.8	n/a. sensor frozen	0.2	0.2
Time Block 23	10:00, Oct. 17	11:00, Oct. 17	1:00	36.5	50.4	39.1	32.7	30.0	1.9	1.1	2.6
Time Block 24	11:00, Oct. 17	12:00, Oct. 17	1:00	31.7	44.9	33.8	29.0	25.7	1.7	1.7	0.0
Time Block 25	12:00, Oct. 17	12:48, Oct. 17	0:48	35.8	54.4	38.3	26.9	22.3	1.8	2.2	0.0
Overall											
Total (Day and Night)	12:18, Oct. 16	12:48, Oct. 17	24:30	35.9	71.1	33.9	20.7	17.5			
Daytime Period ¹	12:18, Oct. 16	12:48, Oct. 17	15:30	37.7	71.1	35.8	21.5	19.2			
Nighttime Period ¹	22:00, Oct. 16	07:00, Oct. 17	9:00	26.1	47.6	28.4	20.0	17.5			
Excluded Period ²	11:48, Oct. 16	12:18, Oct. 16	0:29	55.0	76.2	51.5	21.7	20.8			

Notes:

¹ Daytime noise occurs between 7:00 and 22:00; Nighttime noise occurs between 22:00 and 7:00.

² Excluded periods were times when the noise monitor recorded sounds from the noise field crew such as during instrument setup and travel to/from the station.

Appendix 4-C2. Noise Monitoring Summary for S-TenasDep, October 17 to 18, 2017

Period	Start time	End time	Duration (hh:mm)	LAeq	LAmax	LA10	LA90	LAmin	Weather Conditions Measured at Tenas Deposit Met. Stn.		
									Mean Wind Speed (m/s)	Mean Air Temp. (°C)	Total Precipitation (mm)
Time Block 1	17:40, Oct. 17	18:00, Oct. 17	0:20	32.4	64.3	35.3	24.2	21.3	1.0	-0.1	0.0
Time Block 2	18:00, Oct. 17	19:00, Oct. 17	1:00	26.6	60.0	28.3	20.2	19.0	1.3	-0.1	0.0
Time Block 3	19:00, Oct. 17	20:00, Oct. 17	1:00	21.1	42.9	22.1	18.6	17.9	1.0	-0.8	0.0
Time Block 4	20:00, Oct. 17	21:00, Oct. 17	1:00	18.4	33.3	19.1	17.4	16.9	0.8	-0.8	0.0
Time Block 5	21:00, Oct. 17	22:00, Oct. 17	1:00	18.9	35.6	18.9	17.9	17.2	0.7	-1.1	0.0
Time Block 6	22:00, Oct. 17	23:00, Oct. 17	1:00	17.7	27.7	18.3	17.2	16.8	1.0	-1.3	0.0
Time Block 7	23:00, Oct. 17	00:00, Oct. 18	1:00	17.3	41.0	17.6	17.0	16.7	0.8	-1.5	0.0
Time Block 8	00:00, Oct. 18	01:00, Oct. 18	1:00	19.3	39.0	19.5	17.1	16.6	1.1	-0.8	0.0
Time Block 9	01:00, Oct. 18	02:00, Oct. 18	1:00	17.3	34.6	17.4	17.0	16.7	1.4	-1.2	0.0
Time Block 10	02:00, Oct. 18	03:00, Oct. 18	1:00	18.8	39.6	18.0	17.0	16.6	0.8	-1.4	0.0
Time Block 11	03:00, Oct. 18	04:00, Oct. 18	1:00	17.5	31.8	17.9	17.1	16.7	1.3	-1.2	0.1
Time Block 12	04:00, Oct. 18	05:00, Oct. 18	1:00	20.5	40.5	20.4	17.5	17.0	2.5	-0.9	0.2
Time Block 13	05:00, Oct. 18	06:00, Oct. 18	1:00	26.8	42.3	29.3	20.7	18.6	2.9	-1.1	0.4
Time Block 14	06:00, Oct. 18	07:00, Oct. 18	1:00	28.9	48.0	30.5	21.6	19.9	1.7	-1.0	0.4
Time Block 15	07:00, Oct. 18	08:00, Oct. 18	1:00	25.3	46.1	27.4	18.4	17.8	1.4	-0.8	0.2
Time Block 16	08:00, Oct. 18	09:00, Oct. 18	1:00	27.5	48.4	25.5	18.8	17.8	0.8	-0.6	0.3
Time Block 17	09:00, Oct. 18	10:00, Oct. 18	1:00	28.5	57.6	24.1	17.4	16.9	1.3	-0.5	0.2
Time Block 18	10:00, Oct. 18	11:00, Oct. 18	1:00	17.8	39.6	17.4	16.8	16.5	1.3	-0.2	0.0
Time Block 19	11:00, Oct. 18	12:00, Oct. 18	1:00	31.1	60.0	19.1	16.7	16.4	0.9	0.3	0.0
Time Block 20	12:00, Oct. 18	13:00, Oct. 18	1:00	24.0	57.2	21.4	16.6	16.3	0.5	1.4	0.0
Time Block 21	13:00, Oct. 18	14:00, Oct. 18	1:00	23.2	52.6	24.4	17.3	16.6	0.6	1.1	0.0
Time Block 22	14:00, Oct. 18	15:00, Oct. 18	1:00	34.7	62.6	32.7	22.0	18.8	1.0	0.8	0.8
Time Block 23	15:00, Oct. 18	16:00, Oct. 18	1:00	30.6	59.0	32.1	24.4	21.3	1.0	0.7	0.0
Time Block 24	16:00, Oct. 18	17:00, Oct. 18	1:00	31.9	61.1	33.5	26.8	23.6	0.8	0.1	0.0
Time Block 25	17:00, Oct. 18	18:00, Oct. 18	1:00	29.4	58.9	31.8	23.3	19.7	0.9	-0.4	0.0
Time Block 26	18:00, Oct. 18	18:18, Oct. 18	0:18	27.0	47.3	29.9	21.4	19.3	0.9	-0.7	0.0
Overall											
Total (Day and Night)	17:40, Oct. 17	18:18, Oct. 18	24:38	27.3	64.3	28.4	17.1	16.3			
Daytime Period ¹	17:40, Oct. 17	18:18, Oct. 18	15:38	28.6	64.3	29.5	17.0	16.3			
Nighttime Period ¹	22:00, Oct. 17	07:00, Oct. 18	9:00	22.9	48.0	25.3	17.1	16.6			
Excluded Period ²	17:18, Oct. 17	17:40, Oct. 17	0:21	46.6	80.4	46.7	25.5	22.8			

Notes:

¹ Daytime noise occurs between 7:00 and 22:00; Nighttime noise occurs between 22:00 and 7:00.

² Excluded periods were times when the noise monitor recorded sounds from the noise field crew such as during instrument setup and travel to/from the station.

Appendix 4-C3. Noise Monitoring Summary for S-Plant, December 12 to 13, 2017

Period	Start time	End time	Duration (hh:mm)	LAeq	LAmax	LA10	LA90	LAmin	Weather Conditions Measured at Tenas Deposit Met. Stn.		
									Mean Wind Speed (m/s)	Mean Air Temp. (°C)	Total Precipitation (mm)
Time Block 1	12:18, Dec. 12	13:00, Dec. 12	0:42	18.5	44.3	19.0	17.5	17.0	1.1	2.4	0.0
Time Block 2	13:00, Dec. 12	14:00, Dec. 12	1:00	22.4	50.3	21.3	18.4	17.5	1.3	2.7	0.0
Time Block 3	14:00, Dec. 12	15:00, Dec. 12	1:00	20.8	48.4	22.1	18.9	17.8	0.8	2.0	0.0
Time Block 4	15:00, Dec. 12	16:00, Dec. 12	1:00	25.7	50.3	22.8	19.0	18.0	0.4	0.9	0.0
Time Block 5	16:00, Dec. 12	17:00, Dec. 12	1:00	26.8	49.0	20.2	17.8	17.2	0.6	0.8	0.0
Time Block 6	17:00, Dec. 12	18:00, Dec. 12	1:00	20.6	44.3	19.2	17.3	16.8	0.3	0.5	0.0
Time Block 7	18:00, Dec. 12	19:00, Dec. 12	1:00	18.8	35.4	19.0	17.1	16.7	0.3	0.2	0.1
Time Block 8	19:00, Dec. 12	20:00, Dec. 12	1:00	17.7	25.8	18.1	17.3	16.9	0.9	0.1	0.0
Time Block 9	20:00, Dec. 12	21:00, Dec. 12	1:00	17.7	24.6	18.1	17.4	17.0	0.4	0.1	0.0
Time Block 10	21:00, Dec. 12	22:00, Dec. 12	1:00	20.5	46.9	19.7	17.0	16.6	0.3	-0.1	0.0
Time Block 11	22:00, Dec. 12	23:00, Dec. 12	1:00	17.8	26.6	18.2	17.3	16.9	0.5	-0.1	0.0
Time Block 12	23:00, Dec. 12	00:00, Dec. 13	1:00	20.4	39.7	20.7	17.5	16.9	1.0	0.2	0.0
Time Block 13	00:00, Dec. 13	01:00, Dec. 13	1:00	18.2	36.5	18.9	17.6	17.1	1.2	-0.5	0.0
Time Block 14	01:00, Dec. 13	02:00, Dec. 13	1:00	18.4	31.0	19.3	17.5	17.0	0.8	-1.1	0.0
Time Block 15	02:00, Dec. 13	03:00, Dec. 13	1:00	20.5	50.0	18.9	17.3	16.5	1.5	-1.1	0.0
Time Block 16	03:00, Dec. 13	04:00, Dec. 13	1:00	27.6	53.0	19.6	17.3	16.7	0.5	-1.3	0.0
Time Block 17	04:00, Dec. 13	05:00, Dec. 13	1:00	20.0	41.6	19.8	17.2	16.7	0.8	-1.4	0.0
Time Block 18	05:00, Dec. 13	06:00, Dec. 13	1:00	19.1	40.8	20.2	17.9	17.1	0.9	-1.3	0.0
Time Block 19	06:00, Dec. 13	07:00, Dec. 13	1:00	18.4	24.6	19.2	17.7	16.9	0.8	-1.8	0.0
Time Block 20	07:00, Dec. 13	08:00, Dec. 13	1:00	18.2	41.6	19.0	17.3	16.7	0.7	-2.2	0.0
Time Block 21	08:00, Dec. 13	09:00, Dec. 13	1:00	19.9	44.6	21.7	17.7	16.8	0.5	-2.6	0.0
Time Block 22	09:00, Dec. 13	10:00, Dec. 13	1:00	20.5	33.9	22.1	18.6	17.3	0.7	-2.2	0.0
Time Block 23	10:00, Dec. 13	11:00, Dec. 13	1:00	18.6	28.8	19.9	17.0	16.6	0.3	-1.5	0.0
Time Block 24	11:00, Dec. 13	12:00, Dec. 13	1:00	17.9	26.8	18.5	17.3	16.6	0.6	-1.7	0.0
Time Block 25	12:00, Dec. 13	12:55, Dec. 13	0:55	18.9	39.0	20.2	17.2	16.7	0.5	0.1	0.0
Overall											
Total (Day and Night)	12:18, Dec. 12	12:55, Dec. 13	24:37	21.3	53.0	20.4	17.4	16.5			
Daytime Period ¹	12:18, Dec. 12	12:55, Dec. 13	15:37	21.3	50.3	20.8	17.3	16.6			
Nighttime Period ¹	22:00, Dec. 12	07:00, Dec. 13	9:00	21.4	53.0	19.5	17.4	16.5			
Excluded Period ²	11:55, Dec. 12	12:18, Dec. 12	0:22	68.9	90.2	71.7	19.1	17.4			

Notes:

¹ Daytime noise occurs between 7:00 and 22:00; Nighttime noise occurs between 22:00 and 7:00.

² Excluded periods were times when the noise monitor recorded sounds from the noise field crew such as during instrument setup and travel to/from the station.

Appendix 4-C4. Noise Monitoring Summary for S-TenasDep, December 11 to 12, 2017

Period	Start time	End time	Duration (hh:mm)	LAeq	LAmax	LA10	LA90	LAmin	Weather Conditions Measured at Tenas Deposit Met. Stn.		
									Mean Wind Speed (m/s)	Mean Air Temp. (°C)	Total Precipitation (mm)
Time Block 1	10:54, Dec. 11	11:00, Dec. 11	0:06	17.4	20.9	17.9	17.0	16.7	0.1	-1.0	0.0
Time Block 2	11:00, Dec. 11	12:00, Dec. 11	1:00	27.9	54.1	23.0	16.9	16.5	0.3	-0.1	0.0
Time Block 3	12:00, Dec. 11	13:00, Dec. 11	1:00	21.0	49.4	20.6	17.0	16.5	0.5	-0.5	0.0
Time Block 4	13:00, Dec. 11	14:00, Dec. 11	1:00	19.9	48.1	20.2	16.9	16.5	0.4	0.2	0.0
Time Block 5	14:00, Dec. 11	15:00, Dec. 11	1:00	20.4	55.4	18.5	16.8	16.4	0.1	-0.5	0.0
Time Block 6	15:00, Dec. 11	16:00, Dec. 11	1:00	19.7	54.3	19.0	16.9	16.3	0.2	-1.6	0.0
Time Block 7	16:00, Dec. 11	17:00, Dec. 11	1:00	18.5	43.8	19.6	16.7	16.3	0.6	-2.5	0.0
Time Block 8	17:00, Dec. 11	18:00, Dec. 11	1:00	17.1	24.0	17.4	16.6	16.3	0.7	-3.1	0.0
Time Block 9	18:00, Dec. 11	19:00, Dec. 11	1:00	18.2	36.1	18.1	16.5	16.2	0.3	-2.9	0.0
Time Block 10	19:00, Dec. 11	20:00, Dec. 11	1:00	17.0	23.1	17.5	16.6	16.3	0.8	-3.2	0.0
Time Block 11	20:00, Dec. 11	21:00, Dec. 11	1:00	16.8	20.9	17.0	16.5	16.2	0.6	-2.9	0.0
Time Block 12	21:00, Dec. 11	22:00, Dec. 11	1:00	17.9	31.5	19.1	16.5	16.1	1.0	-2.3	0.0
Time Block 13	22:00, Dec. 11	23:00, Dec. 11	1:00	23.6	45.0	19.3	16.6	16.3	1.1	-2.7	0.0
Time Block 14	23:00, Dec. 11	00:00, Dec. 12	1:00	17.0	34.6	17.5	16.5	16.1	1.3	-2.1	0.0
Time Block 15	00:00, Dec. 12	01:00, Dec. 12	1:00	16.7	30.5	16.8	16.4	16.1	1.1	-2.1	0.0
Time Block 16	01:00, Dec. 12	02:00, Dec. 12	1:00	16.5	22.4	16.7	16.4	16.1	0.6	-2.2	0.0
Time Block 17	02:00, Dec. 12	03:00, Dec. 12	1:00	16.6	25.1	16.8	16.4	16.1	0.8	-2.2	0.0
Time Block 18	03:00, Dec. 12	04:00, Dec. 12	1:00	21.8	49.9	17.2	16.4	16.1	1.1	-2.3	0.0
Time Block 19	04:00, Dec. 12	05:00, Dec. 12	1:00	16.5	22.2	16.7	16.3	16.1	0.7	-2.3	0.0
Time Block 20	05:00, Dec. 12	06:00, Dec. 12	1:00	16.5	18.2	16.8	16.3	16.1	0.3	-1.9	0.0
Time Block 21	06:00, Dec. 12	07:00, Dec. 12	1:00	18.8	40.9	17.6	16.6	16.2	0.5	-2.6	0.0
Time Block 22	07:00, Dec. 12	08:00, Dec. 12	1:00	16.8	21.9	17.3	16.5	16.1	0.7	-1.7	0.0
Time Block 23	08:00, Dec. 12	09:00, Dec. 12	1:00	18.3	43.7	16.9	16.4	16.1	0.7	-1.3	0.0
Time Block 24	09:00, Dec. 12	10:00, Dec. 12	1:00	19.5	43.1	17.6	16.4	16.1	0.5	-0.3	0.0
Time Block 25	10:00, Dec:12	10:03, Dec:12	0:03	20.7	37.2	23.3	16.4	16.2	1.1	0.7	0.4
Overall											
Total (Day and Night)	10:54, Dec. 11	10:03, Dec. 12	23:09	20.0	55.4	18.1	16.4	16.1			
Daytime Period ¹	10:54, Dec. 11	10:03, Dec. 12	14:09	20.5	55.4	18.7	16.5	16.1			
Nighttime Period ¹	21:59, Dec. 11	07:00, Dec. 12	9:00	19.1	49.9	17.1	16.4	16.1			
Excluded Period ²	10:17, Dec. 11	10:54, Dec. 11	0:36	49.4	78.0	48.1	16.8	16.4			
Excluded Period ²	10:03, Dec. 12	10:39, Dec. 12	0:36	50.3	80.4	45.3	16.4	16.2			

Notes:

¹ Daytime noise occurs between 7:00 and 22:00; Nighttime noise occurs between 22:00 and 7:00.

² Excluded periods were times when the noise monitor recorded sounds from the noise field crew such as during instrument setup and travel to/from the station.

Appendix 4-C5. Noise Monitoring Summary for S-Rail, December 15 to 16, 2017

Period	Start time	End time	Duration (hh:mm)	LAeq	LAmax	LA10	LA90	LAmin	Weather Conditions Measured at Tenas Deposit Met. Stn.		
									Mean Wind Speed (m/s)	Mean Air Temp. (°C)	Total Precipitation (mm)
Time Block 1	10:37, Dec. 15	11:00, Dec. 15	0:23	44.0	55.7	47.9	36.2	26.4	1.0	-2.6	0.0
Time Block 2	11:00, Dec. 15	12:00, Dec. 15	1:00	45.2	70.9	48.5	37.1	32.0	0.8	-1.9	0.0
Time Block 3	12:00, Dec. 15	13:00, Dec. 15	1:00	43.3	62.9	47.2	33.2	26.1	2.4	-1.0	0.0
Time Block 4	13:00, Dec. 15	14:00, Dec. 15	1:00	37.8	49.6	40.6	33.2	28.0	1.8	-0.5	0.0
Time Block 5	14:00, Dec. 15	15:00, Dec. 15	1:00	42.9	60.8	44.2	33.5	28.6	1.1	-1.3	0.0
Time Block 6	15:00, Dec. 15	16:00, Dec. 15	1:00	45.1	66.0	47.0	36.3	26.6	1.2	-2.1	0.0
Time Block 7	16:00, Dec. 15	17:00, Dec. 15	1:00	45.5	61.9	51.7	34.7	30.4	1.9	-2.4	0.0
Time Block 8	17:00, Dec. 15	18:00, Dec. 15	1:00	40.5	50.8	43.7	35.0	26.7	1.4	-3.1	0.0
Time Block 9	18:00, Dec. 15	19:00, Dec. 15	1:00	43.5	55.6	47.0	32.7	28.4	2.0	-3.3	0.0
Time Block 10	19:00, Dec. 15	20:00, Dec. 15	1:00	36.2	47.9	39.5	29.9	25.0	2.2	-3.2	0.0
Time Block 11	20:00, Dec. 15	21:00, Dec. 15	1:00	38.8	53.9	42.2	31.5	25.3	2.2	-3.1	0.0
Time Block 12	21:00, Dec. 15	22:00, Dec. 15	1:00	38.5	52.5	42.1	30.3	23.5	2.3	-3.4	0.0
Time Block 13	22:00, Dec. 15	23:00, Dec. 15	1:00	43.4	56.1	46.6	32.2	25.2	2.4	-3.7	0.0
Time Block 14	23:00, Dec. 15	00:00, Dec. 16	1:00	42.1	57.3	45.2	25.6	22.6	2.2	-4.0	0.0
Time Block 15	00:00, Dec. 16	01:00, Dec. 16	1:00	37.7	55.8	41.0	21.8	20.4	2.4	-4.1	0.0
Time Block 16	01:00, Dec. 16	02:00, Dec. 16	1:00	42.2	60.3	44.1	24.9	22.1	2.2	-3.7	0.0
Time Block 17	02:00, Dec. 16	03:00, Dec. 16	1:00	36.0	53.8	39.2	23.5	20.6	1.7	-3.5	0.0
Time Block 18	03:00, Dec. 16	04:00, Dec. 16	1:00	37.7	56.0	41.0	22.7	21.0	1.2	-3.2	0.0
Time Block 19	04:00, Dec. 16	05:00, Dec. 16	1:00	31.2	51.1	32.7	21.9	20.5	0.9	-3.4	0.0
Time Block 20	05:00, Dec. 16	06:00, Dec. 16	1:00	41.3	63.8	43.1	21.9	20.2	1.3	-3.9	0.0
Time Block 21	06:00, Dec. 16	07:00, Dec. 16	1:00	38.1	55.4	42.5	22.0	19.9	1.0	-3.9	0.0
Time Block 22	07:00, Dec. 16	08:00, Dec. 16	1:00	43.6	70.6	44.8	25.9	21.6	0.9	-4.3	0.0
Time Block 23	08:00, Dec. 16	09:00, Dec. 16	1:00	42.4	55.3	45.3	33.5	27.5	0.8	-4.2	0.0
Time Block 24	09:00, Dec. 16	10:00, Dec. 16	1:00	44.2	64.8	46.1	33.8	26.9	1.2	-3.6	0.0
Time Block 25	10:00, Dec. 16	11:00, Dec. 16	1:00	39.7	56.5	42.1	34.0	28.4	0.7	-3.3	0.0
Time Block 26	11:00, Dec. 16	11:17, Dec. 16	0:17	44.4	53.1	48.8	35.3	30.4	1.7	-2.9	0.0
Overall											
Total (Day and Night)	10:37, Dec. 15	11:17, Dec. 16	24:40	41.9	70.9	44.7	24.9	19.9			
Daytime Period ¹	10:37, Dec. 15	11:17, Dec. 16	15:40	42.7	70.9	45.3	32.4	21.6			
Nighttime Period ¹	22:00, Dec. 15	07:00, Dec. 16	9:00	40.1	63.8	43.0	22.5	19.9			
Excluded Period ²	10:18, Dec. 15	10:37, Dec. 15	0:19	53.2	78.4	54.7	38.0	29.4			

Notes:

¹ Daytime noise occurs between 7:00 and 22:00; Nighttime noise occurs between 22:00 and 7:00.

² Excluded periods were times when the noise monitor recorded sounds from the noise field crew such as during instrument setup and travel to/from the station.

Appendix 4-C6. Noise Monitoring Summary for S-Rail, December 16 to 17, 2017

Period	Start time	End time	Duration (hh:mm)	LAeq	LAmax	LA10	LA90	LAmin	Weather Conditions Measured at Tenas Deposit Met. Stn.		
									Mean Wind Speed (m/s)	Mean Air Temp. (°C)	Total Precipitation (mm)
Time Block 1	11:46, Dec. 16	12:00, Dec. 16	0:14	40.4	65.0	43.1	33.7	30.4	1.7	-2.9	0.0
Time Block 2	12:00, Dec. 16	13:00, Dec. 16	1:00	42.3	62.5	41.6	34.6	26.8	1.8	-2.5	0.0
Time Block 3	13:00, Dec. 16	14:00, Dec. 16	1:00	40.6	62.9	42.9	32.3	25.5	1.8	-2.4	0.0
Time Block 4	14:00, Dec. 16	15:00, Dec. 16	1:00	44.6	61.9	45.0	32.1	23.6	1.6	-1.9	0.0
Time Block 5	15:00, Dec. 16	16:00, Dec. 16	1:00	39.0	50.6	42.5	32.3	26.0	1.0	-2.0	0.0
Time Block 6	16:00, Dec. 16	17:00, Dec. 16	1:00	41.7	58.3	42.9	31.5	25.9	1.0	-2.1	0.3
Time Block 7	17:00, Dec. 16	18:00, Dec. 16	1:00	39.8	53.4	43.1	32.9	26.5	1.2	-1.7	0.1
Time Block 8	18:00, Dec. 16	19:00, Dec. 16	1:00	37.7	50.4	40.9	31.9	27.4	1.4	-1.7	0.1
Time Block 9	19:00, Dec. 16	20:00, Dec. 16	1:00	37.6	50.8	41.2	27.8	22.4	1.0	-0.8	0.1
Time Block 10	20:00, Dec. 16	21:00, Dec. 16	1:00	42.3	55.5	47.5	26.2	23.6	1.6	1.1	0.0
Time Block 11	21:00, Dec. 16	22:00, Dec. 16	1:00	43.4	58.5	46.4	29.8	25.9	1.8	1.1	0.2
Time Block 12	22:00, Dec. 16	23:00, Dec. 16	1:00	36.2	53.4	39.4	27.1	24.2	1.7	0.7	0.2
Time Block 13	23:00, Dec. 16	00:00, Dec. 17	1:00	41.2	58.3	44.4	24.4	21.7	1.2	0.6	0.2
Time Block 14	00:00, Dec. 17	01:00, Dec. 17	1:00	40.9	56.1	41.7	24.2	21.1	1.3	0.6	0.1
Time Block 15	01:00, Dec. 17	02:00, Dec. 17	1:00	30.2	48.0	33.5	22.9	20.3	2.0	0.3	0.1
Time Block 16	02:00, Dec. 17	03:00, Dec. 17	1:00	44.3	62.2	43.7	27.0	25.0	3.4	0.0	0.2
Time Block 17	03:00, Dec. 17	04:00, Dec. 17	1:00	30.1	49.9	31.4	26.9	24.7	2.6	-0.7	0.0
Time Block 18	04:00, Dec. 17	05:00, Dec. 17	1:00	31.5	47.5	33.8	27.3	25.5	3.1	-1.1	0.0
Time Block 19	05:00, Dec. 17	06:00, Dec. 17	1:00	44.1	60.9	40.2	26.0	24.0	2.4	-1.7	0.0
Time Block 20	06:00, Dec. 17	07:00, Dec. 17	1:00	41.7	55.0	45.5	26.7	24.1	2.5	-2.1	0.0
Time Block 21	07:00, Dec. 17	08:00, Dec. 17	1:00	34.4	49.6	37.3	29.6	26.1	2.7	-2.3	0.0
Time Block 22	08:00, Dec. 17	09:00, Dec. 17	1:00	43.1	61.4	39.8	28.5	25.3	1.9	-2.6	0.0
Time Block 23	09:00, Dec. 17	10:00, Dec. 17	1:00	44.0	59.1	49.4	31.6	25.4	1.6	-2.5	0.0
Time Block 24	10:00, Dec. 17	11:00, Dec. 17	1:00	37.3	55.3	40.6	28.9	24.9	1.4	-2.1	0.0
Time Block 25	11:00, Dec. 17	12:00, Dec. 17	1:00	43.1	58.0	47.9	32.6	25.1	1.0	-1.8	0.0
Time Block 26	12:00, Dec. 17	12:45, Dec. 17	0:45	38.1	54.7	42.0	28.8	23.4	0.6	-1.1	0.0
Overall											
Total (Day and Night)	11:46, Dec. 16	12:45, Dec. 17	24:59	41.1	65.0	42.3	27.2	20.3			
Daytime Period ¹	11:46, Dec. 16	12:45, Dec. 17	15:59	41.4	65.0	43.0	30.4	22.4			
Nighttime Period ¹	22:00, Dec. 16	07:00, Dec. 17	9:00	40.5	62.2	39.6	25.7	20.3			
Excluded Period ²	-	-	-	-	-	-	-	-			

Notes:

¹ Daytime noise occurs between 7:00 and 22:00; Nighttime noise occurs between 22:00 and 7:00.

² Excluded periods were times when the noise monitor recorded sounds from the noise field crew such as during instrument setup and travel to/from the station.

Appendix 4-C7. Noise Monitoring Summary for S-Rail, December 17 to 18, 2017

Period	Start time	End time	Duration (hh:mm)	LAeq	LAmix	LA10	LA90	LAmin	Weather Conditions Measured at Teras Deposit Met. Stn.		
									Mean Wind Speed (m/s)	Mean Air Temp. (°C)	Total Precipitation (mm)
Time Block 1	13:00, Dec. 17	14:00, Dec. 17	1:00	36.9	53.0	39.8	29.5	22.9	1.2	-0.9	0.0
Time Block 2	14:00, Dec. 17	15:00, Dec. 17	1:00	34.8	49.1	37.7	29.3	25.2	1.9	-1.2	0.0
Time Block 3	15:00, Dec. 17	16:00, Dec. 17	1:00	40.6	52.2	42.9	31.5	26.2	1.8	-2.3	0.0
Time Block 4	16:00, Dec. 17	17:00, Dec. 17	1:00	38.1	52.5	41.6	31.7	26.5	0.8	-3.9	0.0
Time Block 5	17:00, Dec. 17	18:00, Dec. 17	1:00	41.0	56.0	42.5	30.8	26.3	1.3	-4.3	0.0
Time Block 6	18:00, Dec. 17	19:00, Dec. 17	1:00	39.1	53.2	42.5	30.2	23.4	1.8	-4.5	0.0
Time Block 7	19:00, Dec. 17	20:00, Dec. 17	1:00	36.9	58.0	40.1	29.1	22.3	1.9	-4.1	0.0
Time Block 8	20:00, Dec. 17	21:00, Dec. 17	1:00	44.0	57.4	46.9	28.6	21.9	2.0	-4.2	0.0
Time Block 9	21:00, Dec. 17	22:00, Dec. 17	1:00	39.5	55.4	43.2	27.7	22.2	2.0	-4.0	0.0
Time Block 10	22:00, Dec. 17	23:00, Dec. 17	1:00	39.6	56.3	42.5	27.0	22.0	2.2	-4.1	0.0
Time Block 11	23:00, Dec. 17	00:00, Dec. 18	1:00	37.0	52.9	39.2	22.0	20.3	1.1	-5.0	0.0
Time Block 12	00:00, Dec. 18	01:00, Dec. 18	1:00	32.8	50.1	36.9	21.9	20.1	1.6	-5.5	0.0
Time Block 13	01:00, Dec. 18	02:00, Dec. 18	1:00	41.5	52.8	46.6	23.4	20.9	1.5	-5.5	0.0
Time Block 14	02:00, Dec. 18	03:00, Dec. 18	1:00	37.5	50.9	40.8	24.1	20.2	1.6	-6.2	0.0
Time Block 15	03:00, Dec. 18	04:00, Dec. 18	1:00	34.2	50.2	38.1	21.2	19.4	1.1	-5.9	0.0
Time Block 16	04:00, Dec. 18	05:00, Dec. 18	1:00	41.7	56.9	44.4	22.0	18.8	0.9	-6.3	0.0
Time Block 17	05:00, Dec. 18	06:00, Dec. 18	1:00	42.4	58.4	45.2	21.4	19.2	1.1	-5.5	0.0
Time Block 18	06:00, Dec. 18	07:00, Dec. 18	1:00	42.4	55.8	46.5	25.7	19.8	1.0	-5.0	0.0
Time Block 19	07:00, Dec. 18	08:00, Dec. 18	1:00	39.0	55.1	42.6	31.3	23.9	1.8	-4.7	0.0
Time Block 20	08:00, Dec. 18	09:00, Dec. 18	1:00	43.9	57.4	47.5	36.2	29.9	1.4	-4.8	0.0
Time Block 21	09:00, Dec. 18	10:00, Dec. 18	1:00	42.4	67.3	44.6	32.4	27.1	2.0	-4.7	0.0
Time Block 22	10:00, Dec. 18	10:02, Dec. 18	0:02	40.3	48.7	43.5	36.5	34.6	1.1	-4.4	0.0
Overall											
Total (Day and Night)	13:00, Dec. 17	10:02, Dec. 18	21:01	40.3	67.3	43.2	25.1	18.8			
Daytime Period ¹	14:00, Dec. 17	10:02, Dec. 18	11:02	40.8	67.3	43.3	30.3	21.9			
Nighttime Period ¹	22:00, Dec. 17	07:00, Dec. 18	9:00	39.9	58.4	43.3	22.2	18.8			
Excluded Period ²	10:02, Dec. 18	10:09, Dec. 18	0:07	56.7	76.5	60.3	32.7	29.1			

Notes:

¹ Daytime noise occurs between 7:00 and 22:00; Nighttime noise occurs between 22:00 and 7:00.

² Excluded periods were times when the noise monitor recorded sounds from the noise field crew such as during instrument setup and travel to/from the station.

Table 4-C-8. Noise Monitoring Summary for S-Plant, Mar. 20 to 21, 2018

Period	Start time	End time	Duration (hh:mm)	LAeq	LAmix	LA10	LA90	LAmin	Weather Conditions Measured at Tenas Deposit Met. Stn.		
									Mean Wind Speed (m/s)	Mean Air Temp. (°C)	Total Precipitation (mm)
Time Block 1	10:13, Mar. 20	11:00, Mar. 20	0:47	19.5	35.7	21.5	16.9	16.5	2.0	3.3	0.0
Time Block 2	11:00, Mar. 20	12:00, Mar. 20	1:00	30.8	54.0	31.6	18.0	17.0	2.4	3.9	0.0
Time Block 3	12:00, Mar. 20	13:00, Mar. 20	1:00	33.9	57.1	35.7	20.3	17.0	1.5	2.2	0.6
Time Block 4	13:00, Mar. 20	14:00, Mar. 20	1:00	45.8	73.3	35.5	18.4	17.4	1.2	2.7	0.2
Time Block 5	14:00, Mar. 20	15:00, Mar. 20	1:00	34.1	61.1	32.0	17.3	16.7	2.3	3.6	0.0
Time Block 6	15:00, Mar. 20	16:00, Mar. 20	1:00	35.3	57.5	38.6	18.2	16.7	2.9	2.8	0.0
Time Block 7	16:00, Mar. 20	17:00, Mar. 20	1:00	38.2	51.1	41.6	30.9	25.0	2.9	2.2	0.0
Time Block 8	17:00, Mar. 20	18:00, Mar. 20	1:00	41.0	60.4	44.0	33.0	27.6	3.1	0.3	0.0
Time Block 9	18:00, Mar. 20	19:00, Mar. 20	1:00	36.4	53.0	40.3	24.1	21.0	2.1	-0.5	0.0
Time Block 10	19:00, Mar. 20	20:00, Mar. 20	1:00	28.1	49.8	30.7	22.5	19.5	2.6	-1.0	0.0
Time Block 11	20:00, Mar. 20	21:00, Mar. 20	1:00	28.6	39.6	32.1	22.8	19.8	1.9	-1.5	0.0
Time Block 12	21:00, Mar. 20	22:00, Mar. 20	1:00	26.8	40.2	29.4	22.3	17.9	2.0	-1.7	0.0
Time Block 13	22:00, Mar. 20	23:00, Mar. 20	1:00	17.2	37.7	17.7	16.7	16.5	1.1	-2.1	0.0
Time Block 14	23:00, Mar. 20	00:00, Mar. 21	1:00	16.8	32.8	17.0	16.6	16.4	1.3	-2.0	0.0
Time Block 15	00:00, Mar. 21	01:00, Mar. 21	1:00	16.9	25.3	17.2	16.6	16.4	0.7	-2.0	0.0
Time Block 16	01:00, Mar. 21	02:00, Mar. 21	1:00	16.8	21.4	17.0	16.6	16.4	0.8	-2.6	0.0
Time Block 17	02:00, Mar. 21	03:00, Mar. 21	1:00	20.8	45.9	17.3	16.6	16.4	1.0	-3.0	0.0
Time Block 18	03:00, Mar. 21	04:00, Mar. 21	1:00	17.0	20.2	17.3	16.7	16.5	1.2	-3.4	0.0
Time Block 19	04:00, Mar. 21	05:00, Mar. 21	1:00	18.2	31.3	20.1	16.8	16.5	1.2	-3.6	0.0
Time Block 20	05:00, Mar. 21	06:00, Mar. 21	1:00	17.6	25.0	18.7	16.8	16.5	1.1	-3.9	0.0
Time Block 21	06:00, Mar. 21	07:00, Mar. 21	1:00	17.2	27.0	17.5	16.9	16.5	1.2	-4.4	0.0
Time Block 22	07:00, Mar. 21	08:00, Mar. 21	1:00	19.4	38.6	20.0	17.4	17.0	1.4	-4.1	0.0
Time Block 23	08:00, Mar. 21	09:00, Mar. 21	1:00	23.5	47.3	20.3	17.2	16.8	2.2	-3.3	0.0
Time Block 24	09:00, Mar. 21	09:28, Mar. 21	0:28	21.1	39.7	23.4	18.1	17.4	2.4	-2.3	0.0
Overall											
Total (Day and Night)	10:13, Mar. 20	09:28, Mar. 21	23:15	35.0	73.3	35.5	16.8	16.4			
Daytime Period ¹	10:13, Mar. 20	09:28, Mar. 21	14:15	37.1	73.3	38.2	17.7	16.5			
Nighttime Period ¹	22:00, Mar. 20	07:00, Mar. 21	9:00	17.8	45.9	17.5	16.7	16.4			
Excluded Period ²	09:32, Mar. 20	10:13, Mar. 20	0:40	71.1	111.9	54.7	18.2	-3.5			
Excluded Period ²	09:28, Mar. 21	09:43, Mar. 21	0:15	70.5	89.2	72.8	19.7	18.3			

Notes:

¹ Daytime noise occurs between 7:00 and 22:00; Nighttime noise occurs between 22:00 and 7:00.

² Excluded periods were times when the noise monitor recorded sounds from the noise field crew such as during instrument setup and travel to/from the station.

Appendix 4-C9. Noise Monitoring Summary for S-TenasDep, March 21 to 22, 2018

Period	Start time	End time	Duration (hh:mm)	LAeq	LAmax	LA10	LA90	LAmin	Weather Conditions Measured at Tenas Deposit Met. Stn.		
									Mean Wind Speed (m/s)	Mean Air Temp. (°C)	Total Precipitation (mm)
Time Block 1	11:42, Mar. 21	12:00, Mar. 21	0:18	19.6	34.2	21.4	18.0	17.5	2.2	0.2	0.0
Time Block 2	12:00, Mar. 21	13:00, Mar. 21	1:00	25.6	49.0	27.8	18.1	17.2	2.9	0.9	0.0
Time Block 3	13:00, Mar. 21	14:00, Mar. 21	1:00	29.0	50.7	32.0	20.1	18.0	2.8	2.9	0.0
Time Block 4	14:00, Mar. 21	15:00, Mar. 21	1:00	32.4	56.9	34.2	21.1	18.9	3.7	3.1	0.0
Time Block 5	15:00, Mar. 21	16:00, Mar. 21	1:00	33.7	48.9	37.7	24.7	21.1	3.6	2.5	0.0
Time Block 6	16:00, Mar. 21	17:00, Mar. 21	1:00	35.2	48.6	38.9	24.4	20.1	3.4	2.3	0.0
Time Block 7	17:00, Mar. 21	18:00, Mar. 21	1:00	35.4	49.4	39.4	23.5	20.6	2.9	2.4	0.0
Time Block 8	18:00, Mar. 21	19:00, Mar. 21	1:00	28.4	45.4	31.1	21.2	19.1	4.0	1.3	0.0
Time Block 9	19:00, Mar. 21	20:00, Mar. 21	1:00	33.1	53.1	36.5	23.7	19.7	2.2	-0.1	0.5
Time Block 10	20:00, Mar. 21	21:00, Mar. 21	1:00	19.0	41.7	20.0	17.9	17.4	3.1	0.2	0.2
Time Block 11	21:00, Mar. 21	22:00, Mar. 21	1:00	23.7	44.3	25.7	18.6	17.8	2.8	0.1	0.4
Time Block 12	22:00, Mar. 21	23:00, Mar. 21	1:00	22.3	46.0	23.8	18.6	17.7	2.2	0.0	0.8
Time Block 13	23:00, Mar. 21	00:00, Mar. 22	1:00	19.3	39.1	20.4	18.0	17.5	2.1	0.1	0.9
Time Block 14	00:00, Mar. 22	01:00, Mar. 22	1:00	18.7	35.9	19.7	17.6	17.2	1.3	-0.4	2.5
Time Block 15	01:00, Mar. 22	02:00, Mar. 22	1:00	19.2	30.3	20.7	17.9	17.5	1.3	-0.6	1.9
Time Block 16	02:00, Mar. 22	03:00, Mar. 22	1:00	18.1	24.5	18.4	17.7	17.3	1.3	-0.7	0.2
Time Block 17	03:00, Mar. 22	04:00, Mar. 22	1:00	17.6	25.8	17.8	17.4	17.2	1.9	-1.1	0.1
Time Block 18	04:00, Mar. 22	05:00, Mar. 22	1:00	19.7	44.3	21.8	17.4	17.1	4.4	-2.0	0.6
Time Block 19	05:00, Mar. 22	06:00, Mar. 22	1:00	36.7	57.9	40.0	24.3	19.9	5.3	-2.9	0.4
Time Block 20	06:00, Mar. 22	07:00, Mar. 22	1:00	41.1	68.0	44.4	32.1	26.5	7.0	-3.3	1.0
Time Block 21	07:00, Mar. 22	08:00, Mar. 22	1:00	43.7	68.8	47.4	34.8	30.1	7.4	-3.8	1.2
Time Block 22	08:00, Mar. 22	09:00, Mar. 22	1:00	45.2	63.4	48.8	36.5	31.3	6.6	-4.0	1.4
Time Block 23	09:00, Mar. 22	09:14, Mar. 22	0:14	42.6	59.3	46.2	34.7	30.9	5.9	-3.9	1.2
Overall											
Total (Day and Night)	11:42, Mar. 21	09:14, Mar. 22	21:32	36.4	68.8	39.5	17.8	17.1			
Daytime Period ¹	11:42, Mar. 21	09:14, Mar. 22	12:32	37.8	68.8	40.9	18.9	17.2			
Nighttime Period ¹	22:00, Mar. 21	07:00, Mar. 22	9:00	33.1	68.0	36.6	17.6	17.1			
Excluded Period ²	10:48, Mar. 21	11:42, Mar. 21	0:53	51.1	80.6	40.8	19.1	17.6			
Excluded Period ²	09:14, Mar. 22	09:35, Mar. 22	0:21	56.7	82.5	52.9	33.0	27.8			

Notes:

¹ Daytime noise occurs between 7:00 and 22:00; Nighttime noise occurs between 22:00 and 7:00.

² Excluded periods were times when the noise monitor recorded sounds from the noise field crew such as during instrument setup and travel to/from the station.

Appendix 4-C10. Noise Monitoring Summary for S-Rail, March 22 to 23, 2018

Period	Start time	End time	Duration (hh:mm)	LAeq	LAmax	LA10	LA90	LAmin	Weather Conditions Measured at Tenas Deposit Met. Stn.		
									Mean Wind Speed (m/s)	Mean Air Temp. (°C)	Total Precipitation (mm)
Time Block 1	13:10, Mar. 22	14:00, Mar. 22	0:50	51.3	80.4	44.1	33.7	26.5	2.9	-4.2	0.2
Time Block 2	14:00, Mar. 22	15:00, Mar. 22	1:00	43.3	54.4	47.6	34.1	25.9	2.4	-4.0	1.1
Time Block 3	15:00, Mar. 22	16:00, Mar. 22	1:00	39.5	50.6	42.4	33.7	26.0	1.2	-4.0	1.4
Time Block 4	16:00, Mar. 22	17:00, Mar. 22	1:00	39.3	51.7	43.0	30.2	24.2	1.4	-4.0	1.8
Time Block 5	17:00, Mar. 22	18:00, Mar. 22	1:00	38.3	61.6	37.7	23.3	20.8	1.8	-4.2	1.3
Time Block 6	18:00, Mar. 22	19:00, Mar. 22	1:00	30.2	51.4	31.6	22.0	19.3	1.7	-4.4	1.0
Time Block 7	19:00, Mar. 22	20:00, Mar. 22	1:00	28.0	38.8	30.8	23.0	19.4	1.4	-4.5	0.8
Time Block 8	20:00, Mar. 22	21:00, Mar. 22	1:00	32.7	57.3	28.6	18.1	17.3	1.4	-4.7	0.4
Time Block 9	21:00, Mar. 22	22:00, Mar. 22	1:00	28.2	45.6	25.8	17.6	17.1	1.1	-4.9	0.2
Time Block 10	22:00, Mar. 22	23:00, Mar. 22	1:00	31.6	51.9	34.6	18.5	17.2	1.5	-5.1	0.4
Time Block 11	23:00, Mar. 22	00:00, Mar. 23	1:00	22.7	38.0	25.9	17.7	17.1	1.4	-5.5	0.4
Time Block 12	00:00, Mar. 23	01:00, Mar. 23	1:00	33.9	51.0	36.3	17.5	17.1	0.8	-5.7	0.3
Time Block 13	01:00, Mar. 23	02:00, Mar. 23	1:00	35.2	48.2	38.6	18.6	17.3	0.4	-5.8	0.2
Time Block 14	02:00, Mar. 23	03:00, Mar. 23	1:00	28.0	49.8	31.7	18.3	17.5	0.5	-6.0	0.2
Time Block 15	03:00, Mar. 23	04:00, Mar. 23	1:00	35.5	52.2	38.5	18.5	17.7	0.6	-6.3	0.2
Time Block 16	04:00, Mar. 23	05:00, Mar. 23	1:00	28.7	50.1	32.0	18.6	17.5	0.2	-6.8	0.1
Time Block 17	05:00, Mar. 23	06:00, Mar. 23	1:00	35.8	51.7	37.8	20.1	17.9	0.3	-6.6	0.0
Time Block 18	06:00, Mar. 23	07:00, Mar. 23	1:00	36.1	49.4	39.8	22.8	19.4	0.4	-6.7	0.1
Time Block 19	07:00, Mar. 23	08:00, Mar. 23	1:00	36.7	57.1	36.6	24.0	19.2	0.3	-6.4	0.0
Time Block 20	08:00, Mar. 23	09:00, Mar. 23	1:00	37.0	52.1	38.0	23.4	19.4	0.6	-5.5	0.0
Time Block 21	09:00, Mar. 23	10:00, Mar. 23	1:00	38.9	55.4	43.6	26.2	21.1	0.9	-4.9	0.0
Time Block 22	10:00, Mar. 23	11:00, Mar. 23	1:00	36.0	62.1	37.0	28.1	22.3	1.1	-4.7	0.0
Time Block 23	11:00, Mar. 23	12:00, Mar. 23	1:00	34.6	57.5	36.8	25.8	19.3	1.4	-4.0	0.1
Time Block 24	12:00, Mar. 23	13:00, Mar. 23	1:00	32.4	47.1	35.4	27.6	23.0	1.1	-2.5	0.0
Time Block 25	13:00, Mar. 23	14:00, Mar. 23	1:00	39.2	56.0	43.9	29.4	21.4	1.1	-2.0	0.0
Time Block 26	14:00, Mar. 23	14:04, Mar. 23	0:04	37.1	54.7	38.8	31.5	29.1	1.1	-1.4	0.0
Overall											
Total (Day and Night)	13:10, Mar. 22	14:04, Mar. 23	24:54	39.4	80.4	40.0	19.1	17.1			
Daytime Period ¹	13:10, Mar. 22	14:04, Mar. 23	15:54	40.9	80.4	41.0	21.9	17.1			
Nighttime Period ¹	22:00, Mar. 22	07:00, Mar. 23	9:00	33.5	52.2	35.3	18.4	17.1			
Excluded Period ²	13:04, Mar. 22	13:10, Mar. 22	0:05	63.4	80.9	67.6	42.3	34.6			
Excluded Period ²	10:10, Mar. 23	10:11, Mar. 23	0:01	86.6	112.6	83.0	29.2	-3.6			

Notes:

¹ Daytime noise occurs between 7:00 and 22:00; Nighttime noise occurs between 22:00 and 7:00.

² Excluded periods were times when the noise monitor recorded sounds from the noise field crew such as during instrument setup and travel to/from the station.

Appendix 5-A *Field Notes and Photos, Well Investigation,
Tenas Project, July 2017*

July 25, 2017 Telkwa Coal

Sunny + 18°C 10am

Depth to

mbpc

Depth to

Checks

Well ID

Damaged

bottom mbpc

Water

Already

T95R-15C

no

62.17

0.45

Y

T97R-108C-70

Yes

1.245

0.27

Y

T0896-02-06

no

6.79

2.93

Y

T0896-02-20

no

n/a

n/a

Y

T0896-11-04

no

4.43

2.48

Y

T0896-11-19

Yes

~~1.43~~ 1.46 (15.8) dry

Y

T0896-12-04

Yes

1.47

dry

Y

T0897-06-21

no

20.28

Y

T0897-07-24

no

23.54

dry

Y

T95R-39C

Yes

T95R-40 1030

no

52.24

7.945

T95R-64 1130a

no

>90m

7.535

T96R-16-19

no

18.61

2.69

T96R-16-28

no

28.58

2.69

T96R-34-87 930am

no

68.67

0.53 mbpc

T96R-34-87 930am

no

86.83

0.845

T96R-56C-83 1215p

no

31.37

0.75

T0896-01-05

no

5.165

2.70

T96TP-01-10

no

6.125

2.14

T96TP-02-07

no

7.65

3.42

T93R-17

no

T93R-18

no

could not find - no evidence of the well

~~T93R-40~~

3

July 25, 2017 Telkwa Coal

Stick up (mags)

T96R-34-67 0.94m pretty tough
 T96R-34-87 0.97m access-heli land

≈ 280m away

T95R-40 0.26m tough walk in

- there is a cap ≈ 300m from

- some of the cap fell into heli. landing

the well. Not a problem though

T95R-64 Stick-up ≈ 100m from

- ~~relocated~~ remarked the 1.225 heli spot. There
 waypoint as TR95-64 mags. is a cut road

- this well has a
 dedicated bailer that
 is attached to the cap.
 - we dropped the bailer
 in T95R-40

T96R-56C-83 1.18m ≈ 500m walk

- depth to bottom is much fairly tough

shallower than the provided info.

- well casing looks disturbed
 and tilted

- no cap

- moose prints beside the well

- seems damaged

Tacoma, WA, USA • RiteintheRain.com
 JL DARLING LLC

No.392

3

July 28, 2017 Telkwa Coal

Stick-up (mags)

T0896-01-05 0.745

not bad access

- well looks good ≈ 350m from the

- dedicated bailer attached road

to the cap

T96TP-01-10 1.24m

- is this the well? - bottom needs cleaning

- 3" ID surrounded by a fence

- Looks to be a testing area.

- we are not exactly on the coordinates
 ≈ 26m off

- helicopter can land right here

- has a threaded coupler on top of it we
 measured from the top of the coupler.

- remarked the waypoint

- not sure if this is the well. We walked around
 and could not find another well.

T96TP-02-07 1.305m

- soft bottom - needs to be cleaned

- easy to walk to from the helicopter

- 3" diameter

- surrounded by a fence

Rite in the Rain

4/ July 25th, 2017 Telkwa Coal
Stick-up (mags)

T95R-39C

- well could not be found. The dedicated bailer was found buried in the mud. Fragments of the 2" PVC found.
- 1.5m x 1.5m depression filled with 2" of water. Most likely the old well location.

T96R-16-19

0.745m

- no dedicated bailer
- fairly good access
- wells are in good shape
- hidden in the trees

T96R-16-28

0.815m

- dedicated bailer in the well

T93R-18 - no evidence of a well

Done at 415 pm - leaving for the helibase.

No. 392

1/ July 26th, 2017 Telkwa Coal

- arrived at Silver King at 830am
- did safety plan with Dallas
- T93R-17 - arrived at 935am
- no evidence of a well - tough walk in
- wet in the forest + 15°C

10304m

Stick-up (mags)

T0896-11-04 shallow

0.87

- well looks fine
- has dedicated waterline tubing
- easy access - helicopter landed close
- steel casing looks good.

T0896-11-19 Deep

- rebar measuring tape could not get past 1.46m b.toc.
- PVC is cracked and broken - cap on the ground. Steel casing looks good.
- water level tape is getting down with ease
- dedicated waterline tubing was in the well. Dallas pulled this out easily
- 19.80 m.toc (broken casing) for depth to bottom used the water level tape - some mud at the bottom
- well is dry
- 0.31m stick up

3 July 26, 2017 Telkwa Coal

1230pm

TOB 97-07-24

Stick-up

0.96m

- well looks good
- no damage
- there is a cap
- nice walking access - helicopter probably could land

TOB 96-02-06

0.38m

- has a dedicated bailer
- good condition
- tough access

TOB 96-02-20

0.34m

- could not get the cap off
- has a dedicated bailer
- good condition
- tough access

T95R-15C

1.08 m

- well is cracked but functional
- dedicated water tubing
- no cap
- PVC extends above the steel casing
- no protective steel lid
- easy access

No. 392

3

July 26, 2017

Stick-up

TOB 97-06-21

0.74m

- no damage
- easy access
- no dedicated tubing or bailer

T97R-108C-70

0.42m

4:02pm

- could not get past 1.25 mbdc
- damaged
- casing is bent and the ground around it is depressed
- still has a well cap
- no dedicated tubing
- fairly difficult access

TOB 96-12-04

0.42m

4:35pm

- well is damaged
- casing is bent over
- dedicated bailer
- dry

Site Photos



Photo 1 - Damaged Well T96R-56C-83



Photo 2 – All that remains at well location T95R-39C (dedicated bailer)



Photo 3 – Well nest T96R-34-67 and T96R-34-67-87. Wells are in good shape although the caps are missing.



Photo 4 – Monitoring well T95R-40



Photo 5 – Monitoring well T95R-64

Appendix 5-B *Telkwa 2018 Winter Hydro Field Program*
(SRK Consulting Ltd. 2018)

Memo

To:	Dan Farmer, Telkwa Coal Ltd.	Client:	Telkwa Coal Limited
From:	Ryan Burgess, SRK Consulting	Project No:	1CT027.002
Cc:	Michael Herrell, SRK	Date:	October 11, 2018
Subject:	Telkwa 2018 Winter Hydro Field Program		

1 Introduction

SRK Consulting (Canada) Inc. recommended that Telkwa Coal Ltd attempt to install monitoring wells and collect additional hydraulic conductivity (K) information to enhance the hydrogeological database and improve predictions of the slope pore pressures, pit inflow, and potential dewatering requirements (SRK 2017).

This memo presents a summary of the 2018 Winter Hydrogeological Field Program that was undertaken to meet these recommendations.

2 Scope of Work

The 2018 Winter Hydrogeological Field Program was undertaken in tandem with geotechnical and geochemical subsurface investigations. The scope of work of the hydrogeological component was:

- Undertake pneumatic packer testing on formations below the lowest coal seam and through the profile of the volcanic formation to the west of the Tenas deposit (Hazelton volcanics);
- Install nested monitoring wells at three (3) locations around the perimeter of the Tenas deposit; and
- Install a larger diameter well (3") below the lowest coal seam.

The drilling, testing, and well installation occurred between late January through February. The majority of the on the ground field supervision was provided by Cassiar Geoscience, with SRK providing office based technical support and a short (10 day) field supervision stint.

3 Methodology

PQ size vertical boreholes were drilled using a diamond drill rig with a PW surface casing advanced to bedrock or as deep as possible, excepted at location, W2, where a tri-cone without a casing shoe was used. The tri cone was necessary to overcome issues related to the inside diameter of the surface casing shoe (see Section 4.3, W1 below).

Boreholes that intercepted sedimentary formations (e.g. coal seams, sandstones, mudstones, etc.) were geophysically logged using downhole neutron density.

Packer testing was conducted using a RST P-size pneumatic packer system set up in a straddle configuration. Two types of test intervals were targeted depending on the location/lithology:

- Where sedimentary formations below the lowest coal seam were intercepted (at ARD01 and ARD06), the entire formation was the target; and
- Where the Hazelton Volcanics were intercepted (W01), approximately uniform zones 5 m in length were tested.

The hydraulic tests methodology consisted of a single step pressure injection. The injection rate and surface pressure were measured using an analogue flow totaliser and surface pressure gauge, respectively, while the downhole pressure was measured using an Insitu TROLL pressure transducer. The pressure transducer ran out of memory during the testing at W1 (Test 1). At all other locations the downhole pressure was collected without issue. The results were analysed using the Thiem equation for steady state flow in a confined aquifer (Thiem, 1906).

4 Findings

4.1 Drillhole Lithology

Three main lithology types were encountered:

- Glacial Till (i.e., made up the majority of the unconsolidated sediments encountered);
- Sedimentary sequences of coal, siltstone, mudstone, and sandstone (i.e., below the Tenas deposit); and
- The rhyolitic Hazelton Volcanics (i.e., to the west and to the North of the Tenas deposit).

The lithology occurrences were largely as expected, except for the depth to bedrock (i.e., thickness of unconsolidated sediments) at W2 and W3. The expected depth to bedrock was half as much (~60 mbgs) at W2 and twice as much (~100 mbgs) at W3.

Individual lithology units encountered are summarized in Table 1.

Table 1 Drillhole Lithology

Location ID	Drillhole ID	Lithology	From (mbgs)	To (mbgs)	Comments
W1	T18-04D	Till	0	11.5	-
		Volcanics	11.5	70	-
W2	T18-06D	Unable to be logged	0	42.2	Drilled with tri-cone; poor sample quality
		Till	42.2	102.7	-
		Cobbles	102.7	117.8	-
		Volcanics	117.8	131.3	-
W3	T18-08D	Gravelly Sand	0	1.5	-
		Till	1.5	44.2	-
		Volcanic Rock	44.2	53.2	-
ARD01	T18-03D	Overburden	0	10.5	-
		Mudstone interbedded with Coal	10.5	38.10	-
		Mudstone interbedded with Conglomerate and Siltstone	38.1	102.57	-
ARD02	T18-01D	Overburden	0	16.5	-
		Mudstone interbedded with Coal	21.4	44.7	-
		Mudstone interbedded with Conglomerate and Siltstone	44.7	78.55	-
ARD06	T18-07D	Overburden	0	6.9	-
		Mudstone interbedded with Coal and Siltstone	6.9	146.4	-
		Siltstone	146.4	169.0	-
		Mudstone	169.0	213.7	-

4.2 Packer Testing

Analyses of the packer tests are summarized in Table 2. The measured hydraulic conductivity (K) values are consistent with literature values (e.g. Heath, 1983). The geometric mean estimated K value of the volcanics (1.8×10^{-7} m/s) is an order of magnitude higher than the geometric mean of the sedimentary sequence tested below the lowest coal seam (2.9×10^{-8} m/s). There is moderate to little variation in the estimated K values, the log standard deviation of K values for both the volcanics and sedimentary sequence is ~0.5 (half an order of magnitude). In general, there is a decrease in K with depth at each test location.

Table 2 Packer Test Analysis Summary

Hole ID	Test Number	Top of Test Interval (m bgs)	Bottom of Test Interval (m bgs)	Lithology	Estimated Hydraulic Conductivity (m/s)	Notes
W01	1	63.2	68.0	Volcanics	4.6×10^{-8}	
	2	54.2	59.0		7.6×10^{-8}	No downhole pressure measurement
	3	45.2	50.0		1.0×10^{-7}	No downhole pressure measurement
	4	33.2	38.0		8.9×10^{-7}	No downhole pressure measurement
	5	21.2	26.0		5.4×10^{-7}	No downhole pressure measurement
ARD01	1	90.2	97.0	Mudstone/Siltstone	8.0×10^{-9}	
	2	81.2	88.0	Conglomerate	6.5×10^{-9}	
	3	63.2	71.5	Siltstone	1.2×10^{-8}	Fractures noted
	4	42.2	48.5	Mudstone	1.7×10^{-8}	
ARD06	1	200.2	207.0	Conglomerate	6.4×10^{-8}	
	2	176.2	183.0	Siltstone	9.7×10^{-8}	Steady state drawdown not reached
	3	170.2	174.0	Sandstone	3.7×10^{-8}	
	4	149.2	156.0	Siltstone	2.2×10^{-7}	

4.3 Well Installation

Well installation details are summarized in Table 3. Well construction logs are provided in Attachment A.

All the wells were confirmed to be operational following development except the shallow well at W1. This shallow monitoring well is not suitable for use because the shallow installation was caught on the lip of the casing shoe when the surface casing was pulled to expose the shallow well slotted section causing the shallow well to rise with the surface casing. The removal of surface casing was abandoned and another 2" shallow monitoring was installed adjacent to the original borehole as a replacement.

Table 3 Well Construction Summary

Location ID	Total Depth (m bgs)	Well diameter (inch)	Slotted Interval (m bgs)	Well Stickup (b ags)	Screened Lithology	Notes
ARD02	72.9	3	69.8 to 72.9	0.99	Sandstone	
W1	12	2	10.5 to 12	0.83	Overburden	Shallow Well – not useable
	59.5		56.4 to 59.5	1.00	Fractured Volcanics	Deep Well
	13.1		10.1-13.1	0.80	Gravelly Clay	Shallow Well - useable
W2	117.8	2	114.8 to 117.8	0.80	Sand	
W3	43.1	1 ½	40.0 to 43.1	1	Sand	Shallow Well
	47.8	2	44.7 to 47.8	1	Fractured Volcanics	Deep Well

Prepared by

SRK Consulting (Canada) Inc.

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Ryan Burgess, MSc.
 Consultant (Hydrogeology)

And reviewed by:

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Gregory Fagerlund, P. Geo
 Senior Consultant (Hydrogeology)

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The opinions expressed in this report have been based on the information available to SRK at the time of preparation. SRK has exercised all due care in reviewing information supplied by others for use on this project. Whilst SRK has compared key supplied data with expected values, the accuracy of the results and conclusions from the review are entirely reliant on the accuracy and completeness of the supplied data. SRK does not accept responsibility for any errors or omissions in the supplied information, except to the extent that SRK was hired to verify the data.

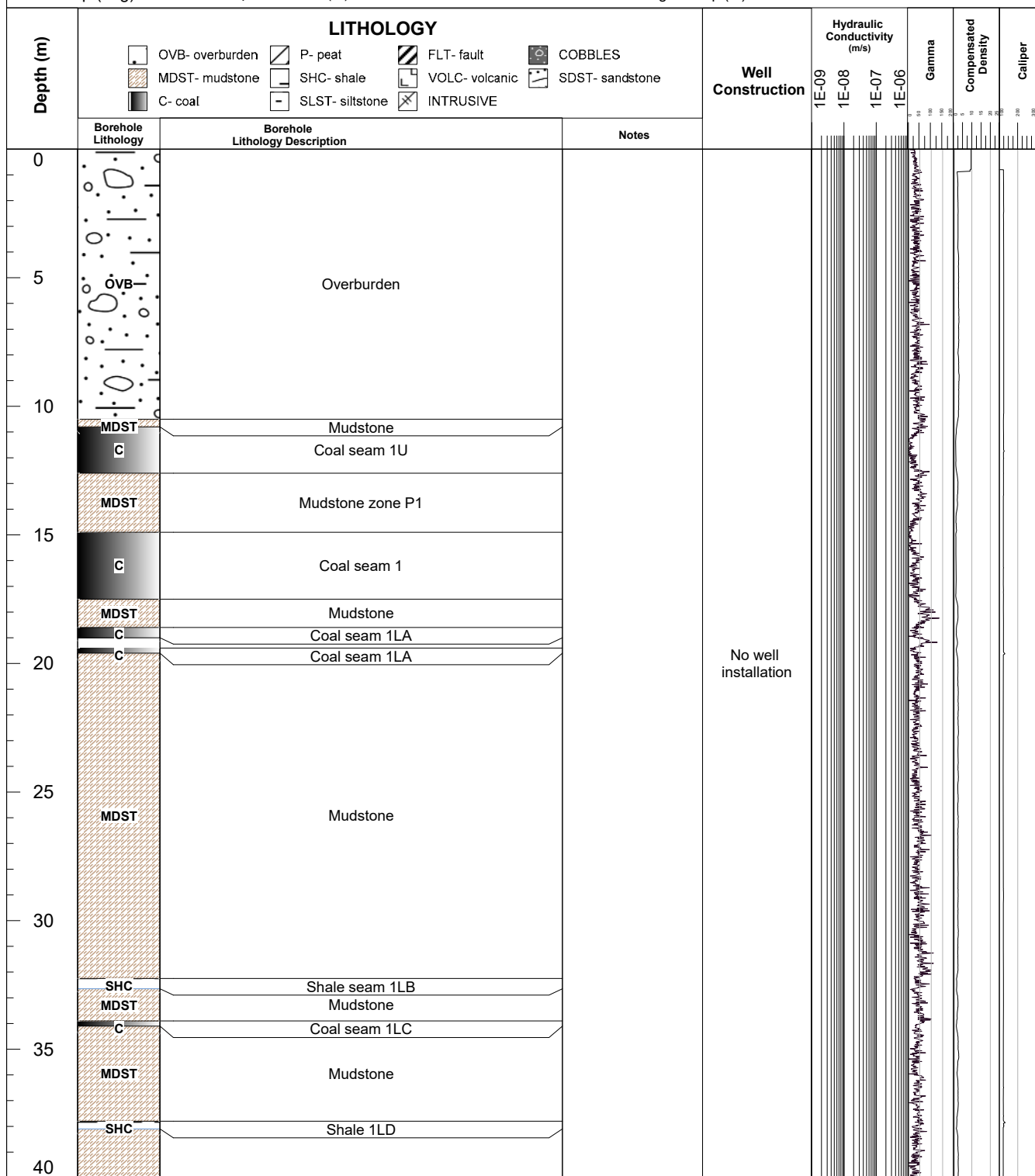
5 References

Heath, R.C.. 1983. Ground-water Hydrology. U.S. Geological Survey Water Supply Paper 2220, 84 p. <http://pubs.er.usgs.gov/publication/wsp2220>.

Thiem, G.. 1906. Hydrologische Methoden; Gebhardt, Leipzig.

SRK Consulting (Canada) Inc. (SRK). 2017. 2018 Winter Field Program Recommendations. Memo prepared for Telkwa Coal Ltd. SRK Project Number 1CT27.002. December 2017.

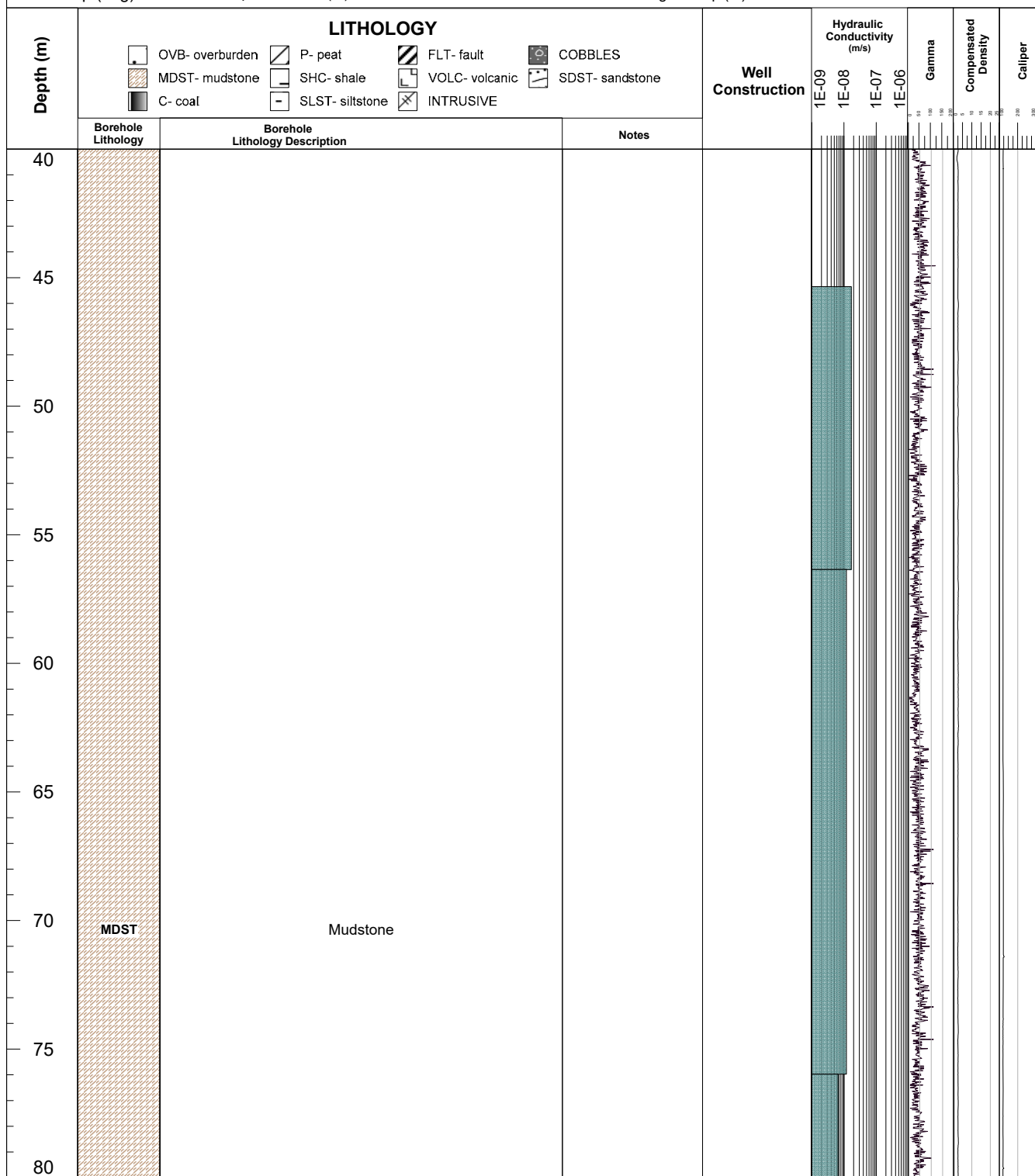
Attachment A – Well Logs

Project No.: **1CT027.002**Client: **Telkwa Coal Limited**Project: **Telkwa Coal**Drilling Contractor: **Driftwood**Drilling Equipment: **Diamond Drill**Logged By: **RP**Depth to Rock(m): **10.50**Final Depth(m): **102.6**Start Date: **2/1/2018**End Date: **2/4/2018**Borehole Coordinates: **E: 617,080 (m) N: 6,051,772 (m)**Ground Elevation (m): **904.32**EOH Elevation (m): **803.42**Collar Dip (deg): **0/-90**Depth to Water (m): **N/A**Casing Stickup (m): **N/A**

No well installation

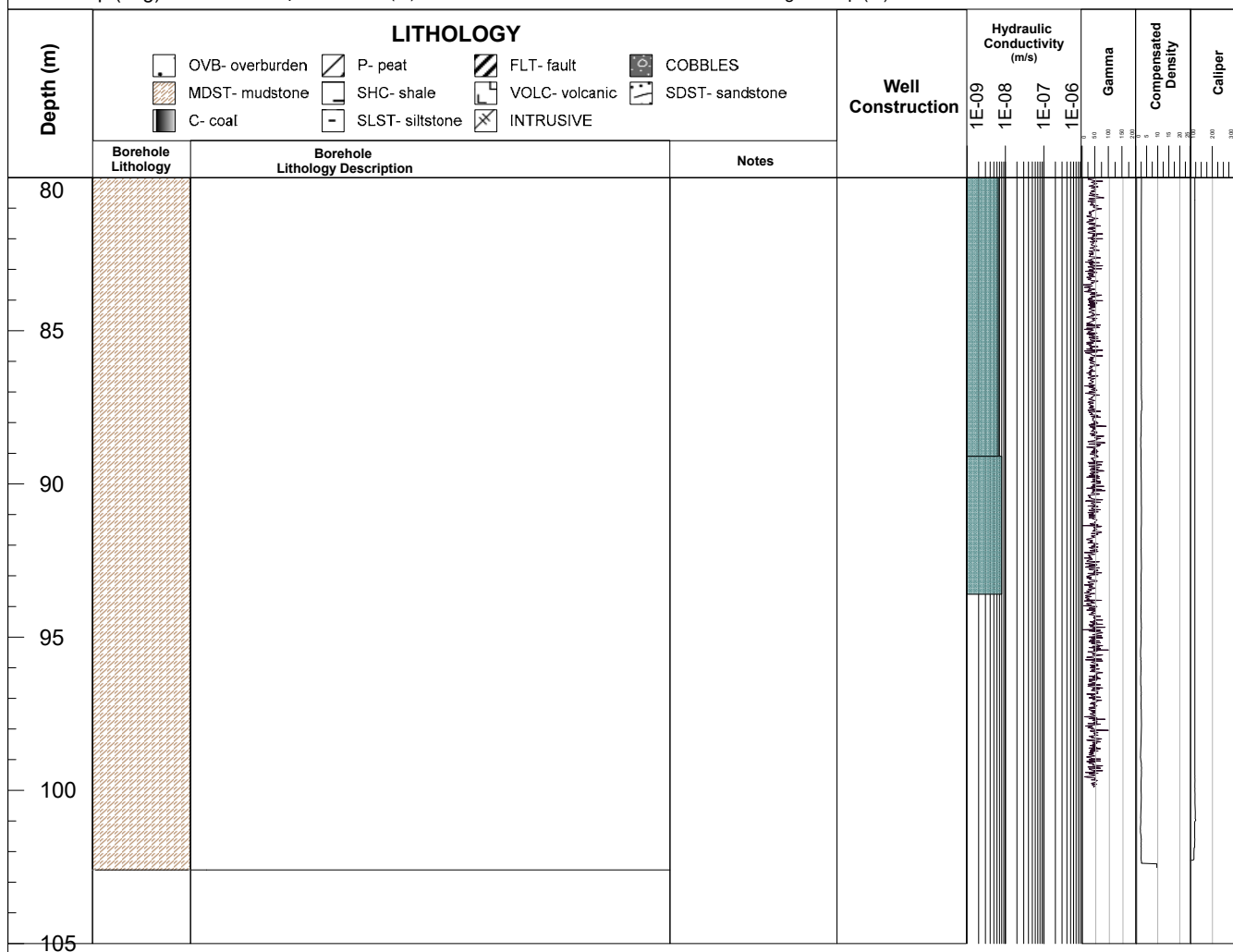
Installation Legend

 Bento Chips
  Coated Pellets
  Sand
  Cave
  PVC
  Screen
  Monument

Project No.: **1CT027.002**Client: **Telkwa Coal Limited**Project: **Telkwa Coal**Drilling Contractor: **Driftwood**Drilling Equipment: **Diamond Drill**Logged By: **RP**Depth to Rock(m): **10.50**Final Depth(m): **102.6**Start Date: **2/1/2018**End Date: **2/4/2018**Borehole Coordinates: **E: 617,080 (m) N: 6,051,772 (m)**Ground Elevation (m): **904.32**EOH Elevation (m): **803.42**Collar Dip (deg): **0/-90**Depth to Water (m): **N/A**Casing Stickup (m): **N/A**

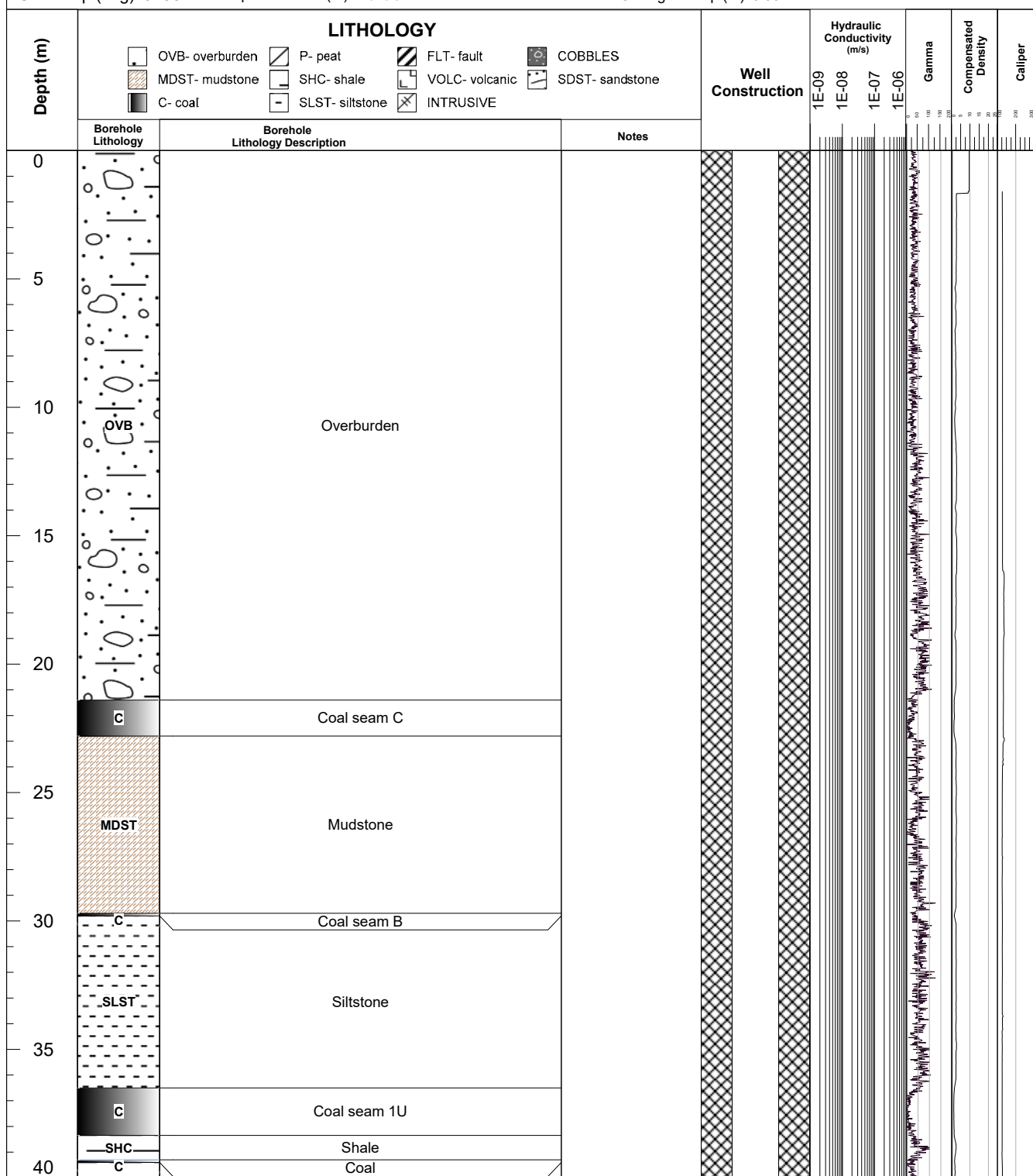
Installation Legend

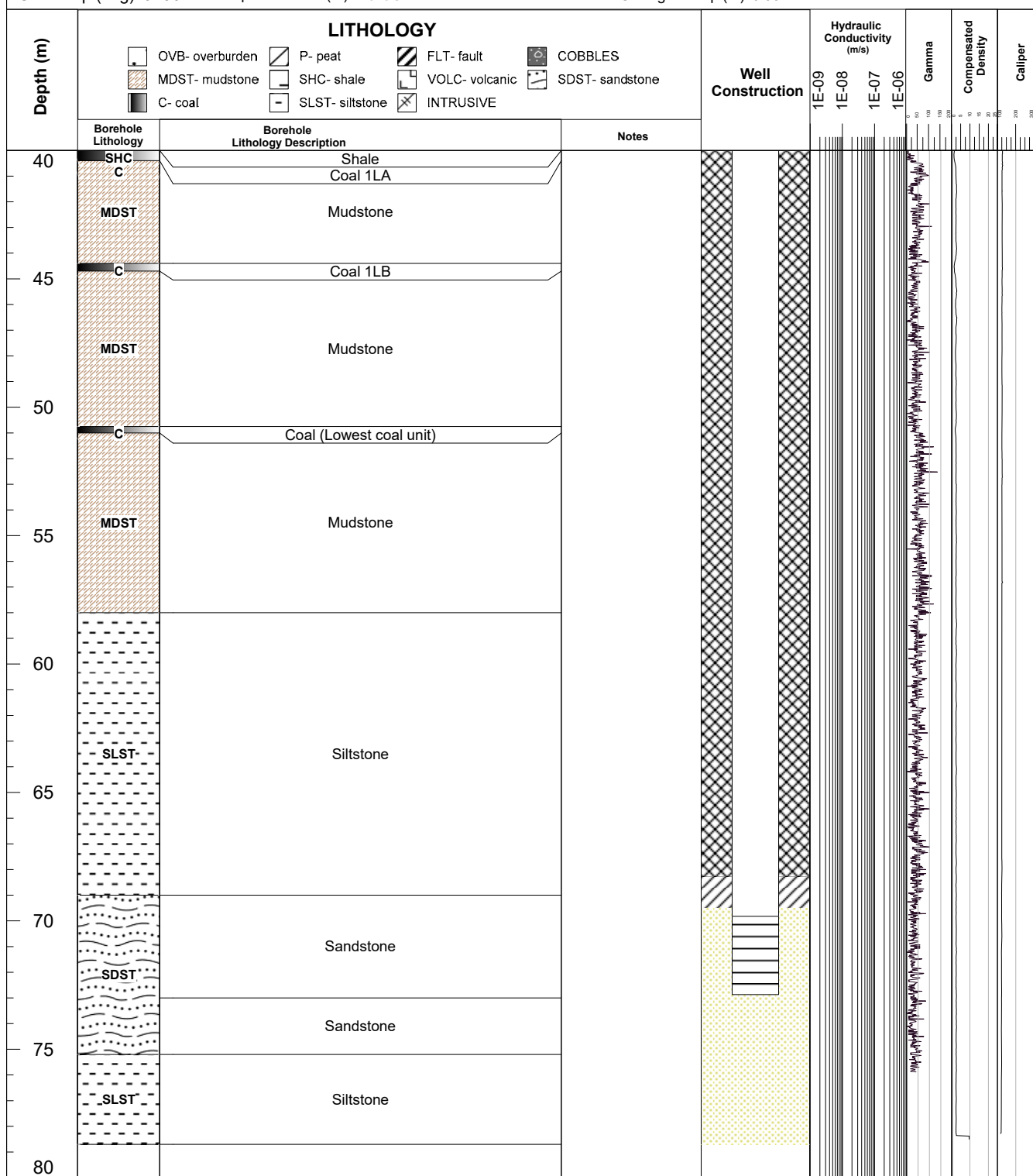
Bento Chips
 Coated Pellets
 Sand
 Cave
 PVC
 Screen
 Monument

Project No.: **1CT027.002**Client: **Telkwa Coal Limited**Project: **Telkwa Coal**Drilling Contractor: **Driftwood**Drilling Equipment: **Diamond Drill**Logged By: **RP**Depth to Rock(m): **10.50**Final Depth(m): **102.6**Start Date: **2/1/2018**End Date: **2/4/2018**Borehole Coordinates: **E: 617,080 (m) N: 6,051,772 (m)**Ground Elevation (m): **904.32**EOH Elevation (m): **803.42**Collar Dip (deg): **0/-90**Depth to Water (m): **N/A**Casing Stickup (m): **N/A**

Installation Legend

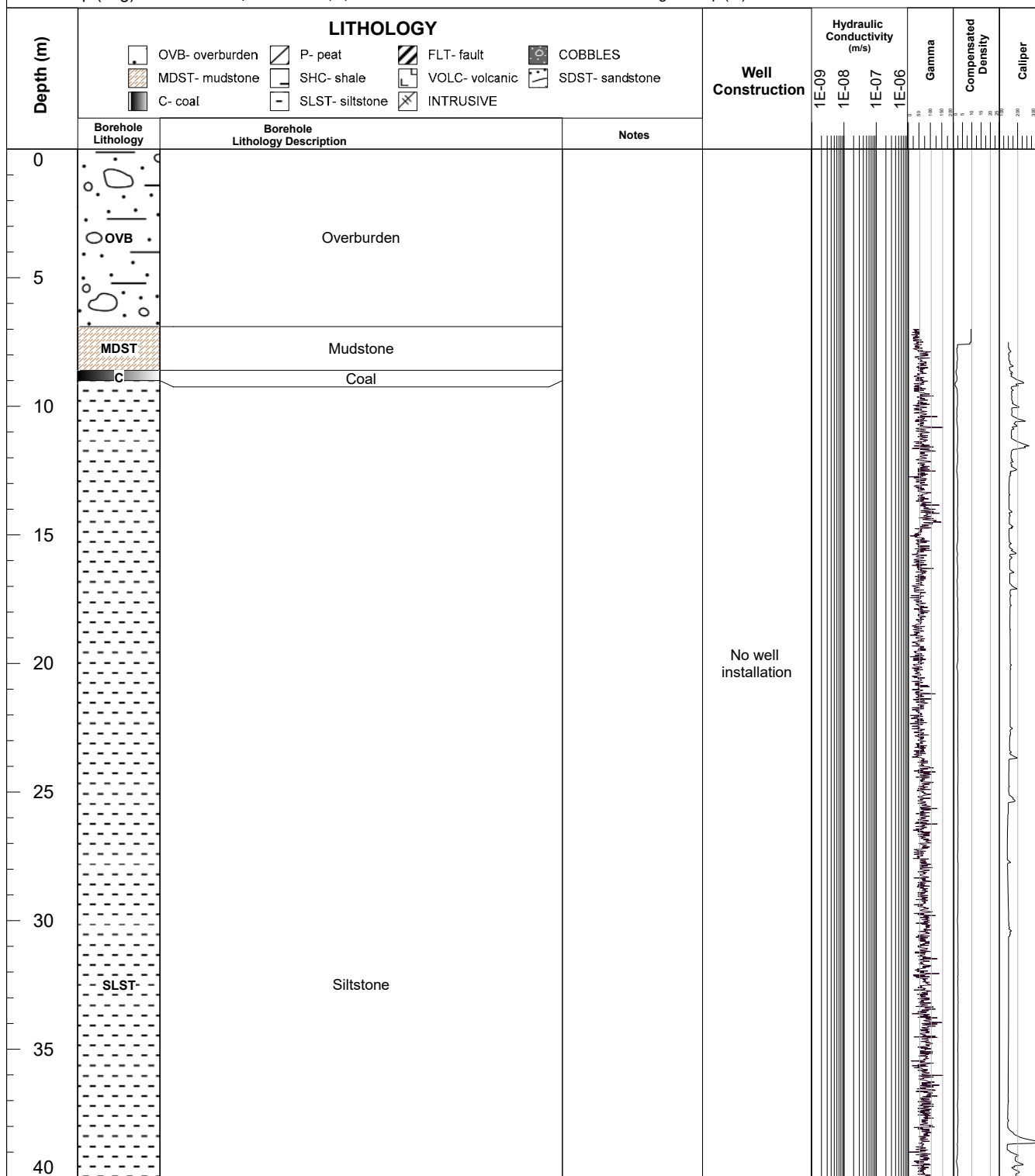
Bento Chips
 Coated Pellets
 Sand
 Cave
 PVC
 Screen
 Monument

Project No.: **1CT027.002**Client: **Telkwa Coal Limited**Project: **Telkwa Coal**Drilling Contractor: **Driftwood**Drilling Equipment: **Diamond Drill**Logged By: **CC/RP**Depth to Rock(m): **21.40**Final Depth(m): **78.5**Start Date: **1/27/2018**End Date: **1/31/2018**Borehole Coordinates: **E: 618,412 (m) N: 6,050,732 (m)**Ground Elevation (m): **927.92**EOH Elevation (m): **849.22**Collar Dip (deg): **0/-90**Depth to Water (m): **6.95**Casing Stickup (m): **0.99**

Project No.: **1CT027.002**Client: **Telkwa Coal Limited**Project: **Telkwa Coal**Drilling Contractor: **Driftwood**Drilling Equipment: **Diamond Drill**Logged By: **CC/RP**Depth to Rock(m): **21.40**Final Depth(m): **78.5**Start Date: **1/27/2018**End Date: **1/31/2018**Borehole Coordinates: **E: 618,412 (m) N: 6,050,732 (m)**Ground Elevation (m): **927.92**EOH Elevation (m): **849.22**Collar Dip (deg): **0/-90**Depth to Water (m): **6.95**Casing Stickup (m): **0.99**

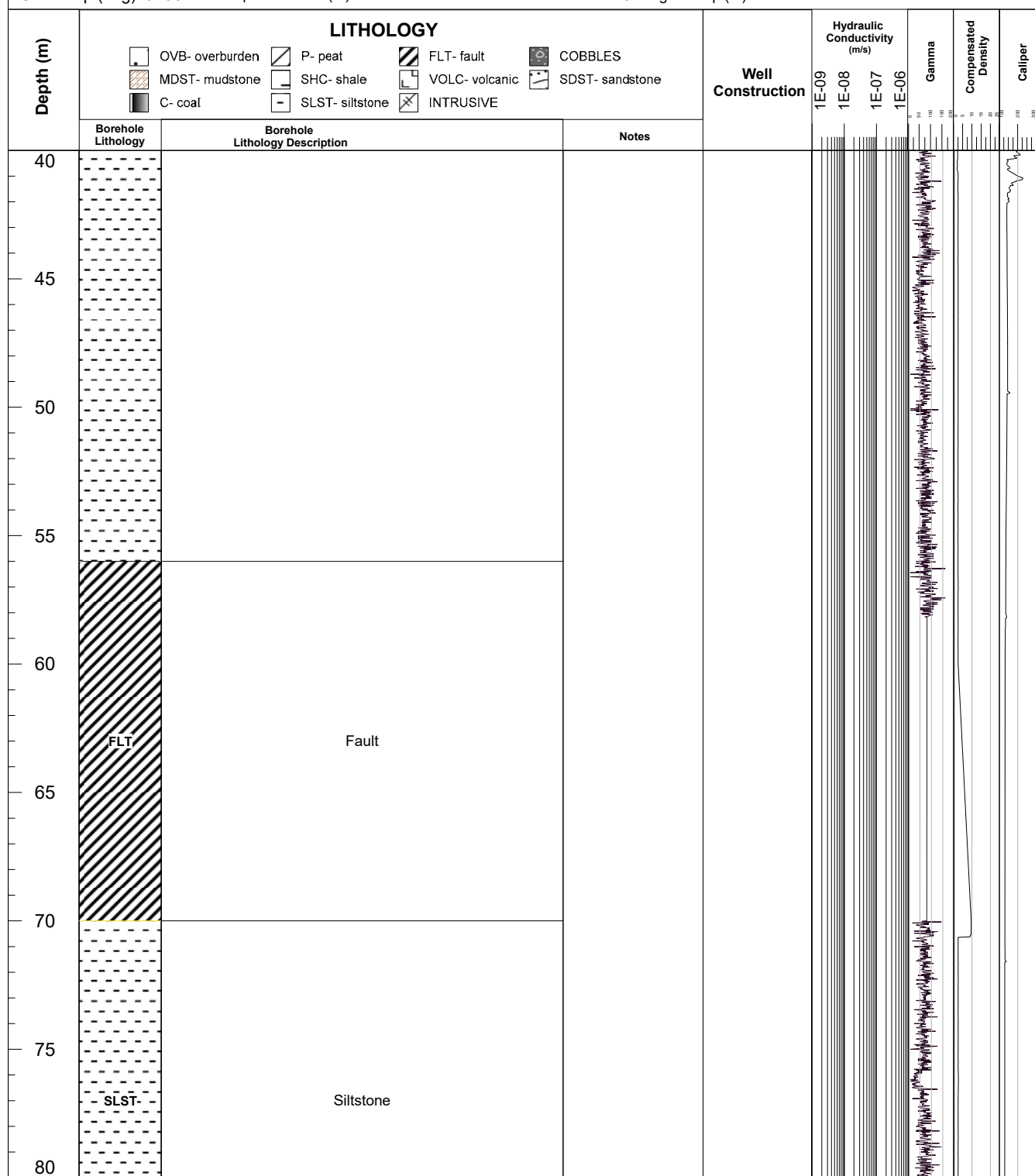
Installation Legend

 Bento Chips
  Coated Pellets
  Sand
  Cave
  PVC
  Screen
  Monument

Project No.: **1CT027.002**Client: **Telkwa Coal Limited**Project: **Telkwa Coal**Drilling Contractor: **Driftwood**Drilling Equipment: **Diamond Drill**Logged By: **RP**Depth to Rock(m): **6.90**Final Depth(m): **213.7**Start Date: **2/25/2018**End Date: **2/26/2018**Borehole Coordinates: **E: 617,318 (m) N: 6,052,051 (m)**Ground Elevation (m): **864.16**EOH Elevation (m): **650.46**Collar Dip (deg): **0/-90**Depth to Water (m): **N/A**Casing Stickup (m): **N/A**

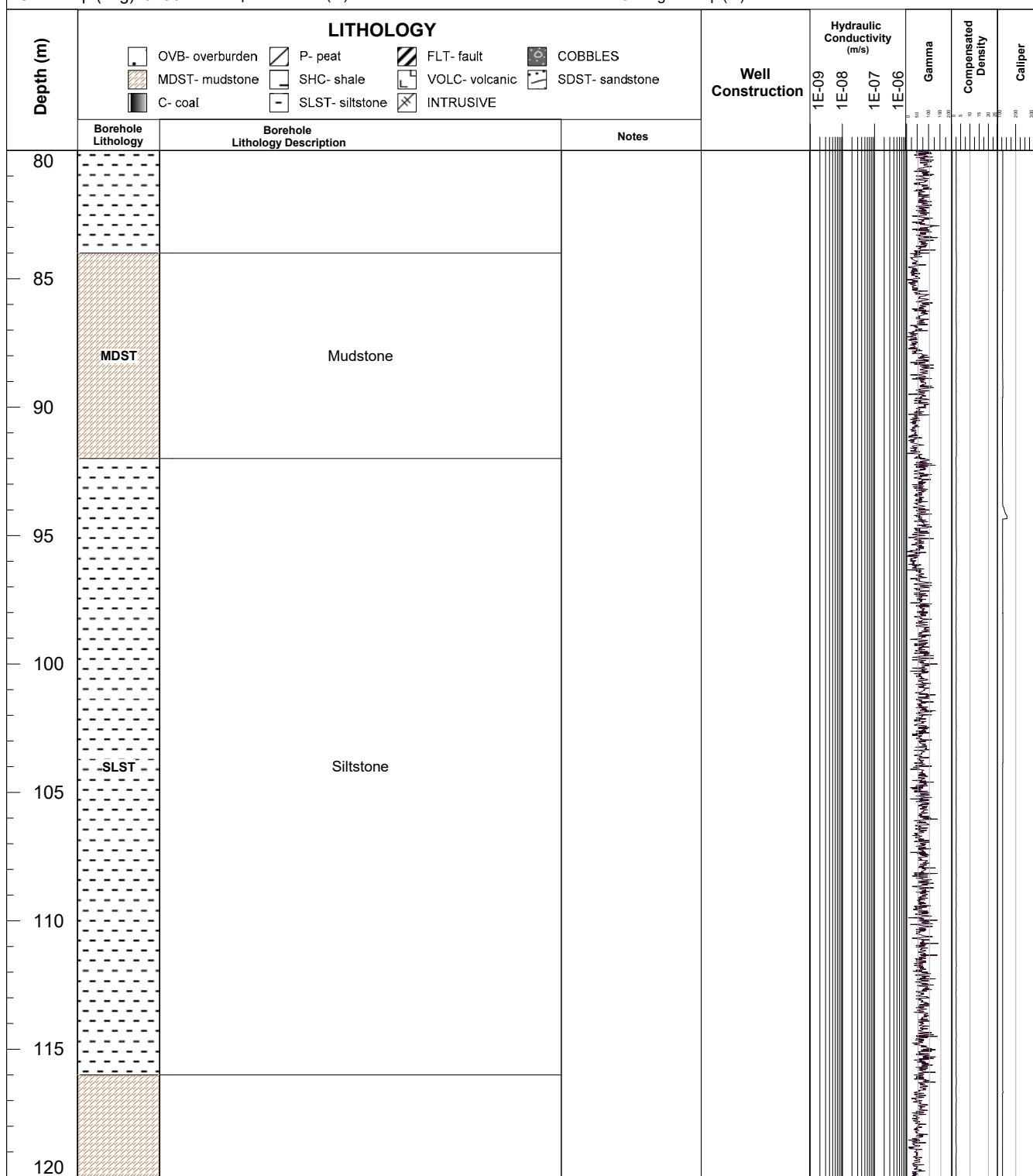
Installation Legend

 Bento Chips
  Coated Pellets
  Sand
  Cave
  PVC
  Screen
  Monument

Project No.: **1CT027.002**Client: **Telkwa Coal Limited**Project: **Telkwa Coal**Drilling Contractor: **Driftwood**Drilling Equipment: **Diamond Drill**Logged By: **RP**Depth to Rock(m): **6.90**Final Depth(m): **213.7**Start Date: **2/25/2018**End Date: **2/26/2018**Borehole Coordinates: **E: 617,318 (m) N: 6,052,051 (m)**Ground Elevation (m): **864.16**EOH Elevation (m): **650.46**Collar Dip (deg): **0/-90**Depth to Water (m): **N/A**Casing Stickup (m): **N/A**

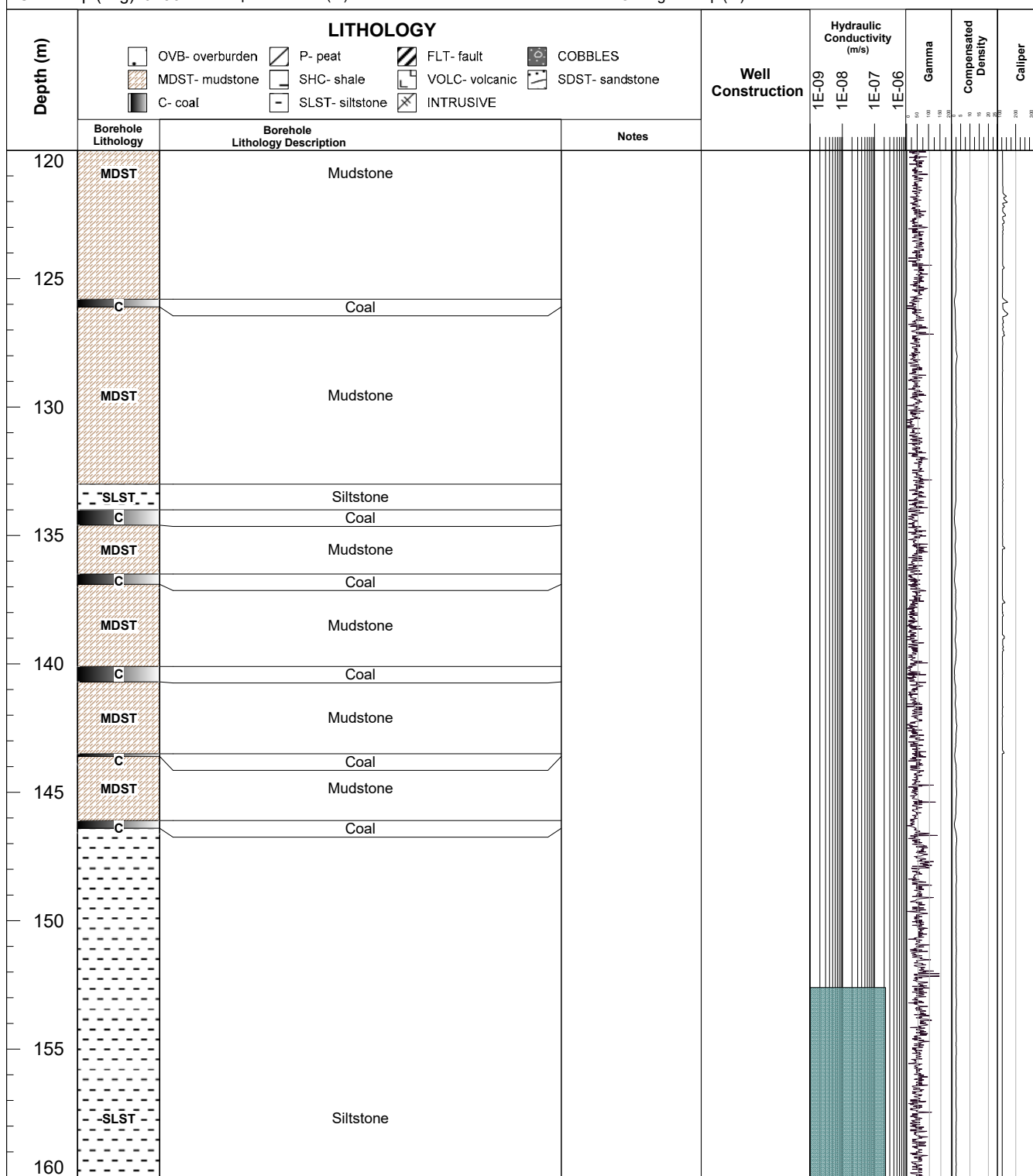
Installation Legend

 Bento Chips
  Coated Pellets
  Sand
  Cave
  PVC
  Screen
  Monument

Project No.: **1CT027.002**Client: **Telkwa Coal Limited**Project: **Telkwa Coal**Drilling Contractor: **Driftwood**Drilling Equipment: **Diamond Drill**Logged By: **RP**Depth to Rock(m): **6.90**Final Depth(m): **213.7**Start Date: **2/25/2018**End Date: **2/26/2018**Borehole Coordinates: **E: 617,318 (m) N: 6,052,051 (m)**Ground Elevation (m): **864.16**EOH Elevation (m): **650.46**Collar Dip (deg): **0/-90**Depth to Water (m): **N/A**Casing Stickup (m): **N/A**

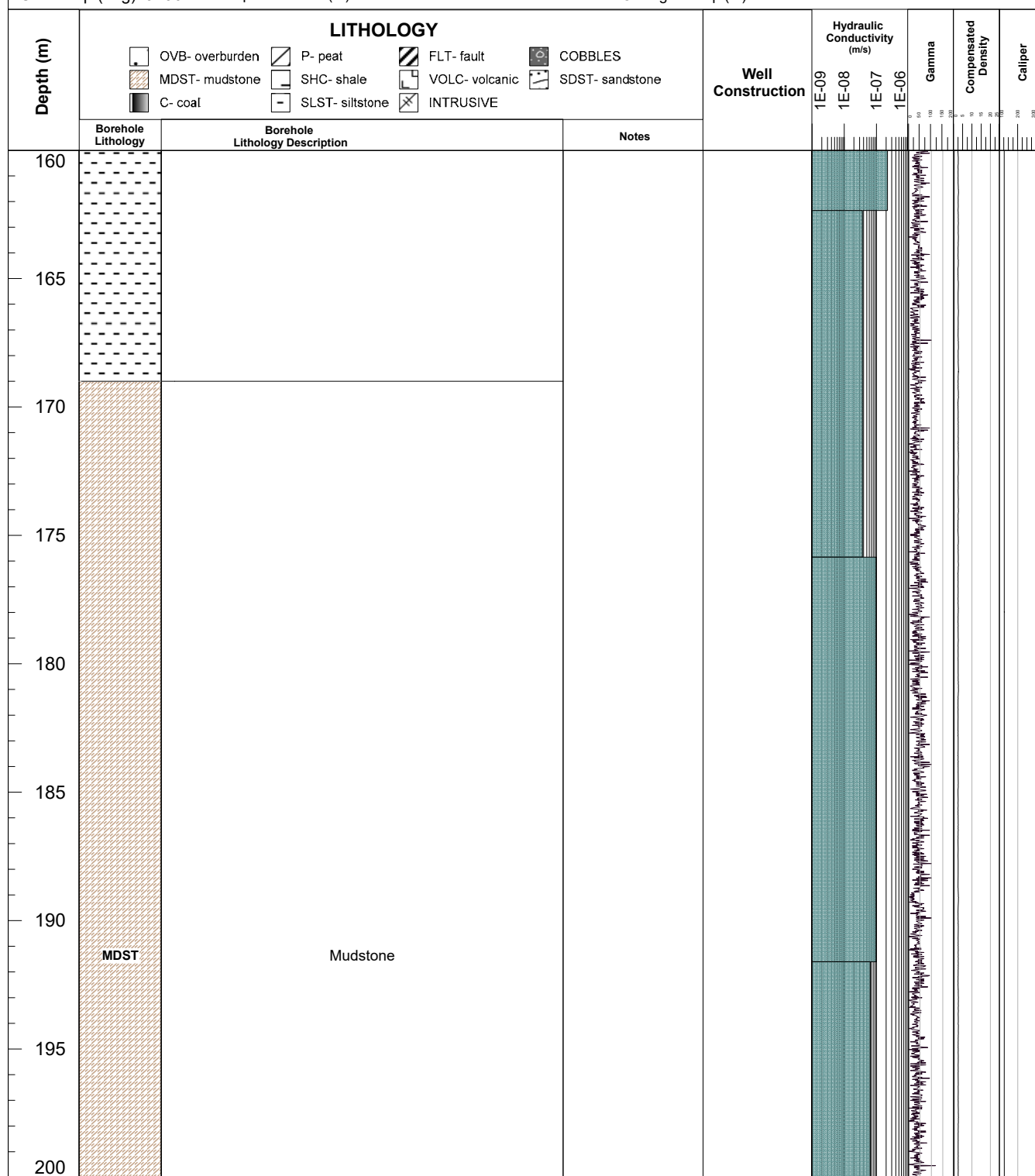
Installation Legend

 Bento Chips
  Coated Pellets
  Sand
  Cave
  PVC
  Screen
  Monument

Project No.: **1CT027.002**Client: **Telkwa Coal Limited**Project: **Telkwa Coal**Drilling Contractor: **Driftwood**Drilling Equipment: **Diamond Drill**Logged By: **RP**Depth to Rock(m): **6.90**Final Depth(m): **213.7**Start Date: **2/25/2018**End Date: **2/26/2018**Borehole Coordinates: **E: 617,318 (m) N: 6,052,051 (m)**Ground Elevation (m): **864.16**EOH Elevation (m): **650.46**Collar Dip (deg): **0/-90**Depth to Water (m): **N/A**Casing Stickup (m): **N/A**

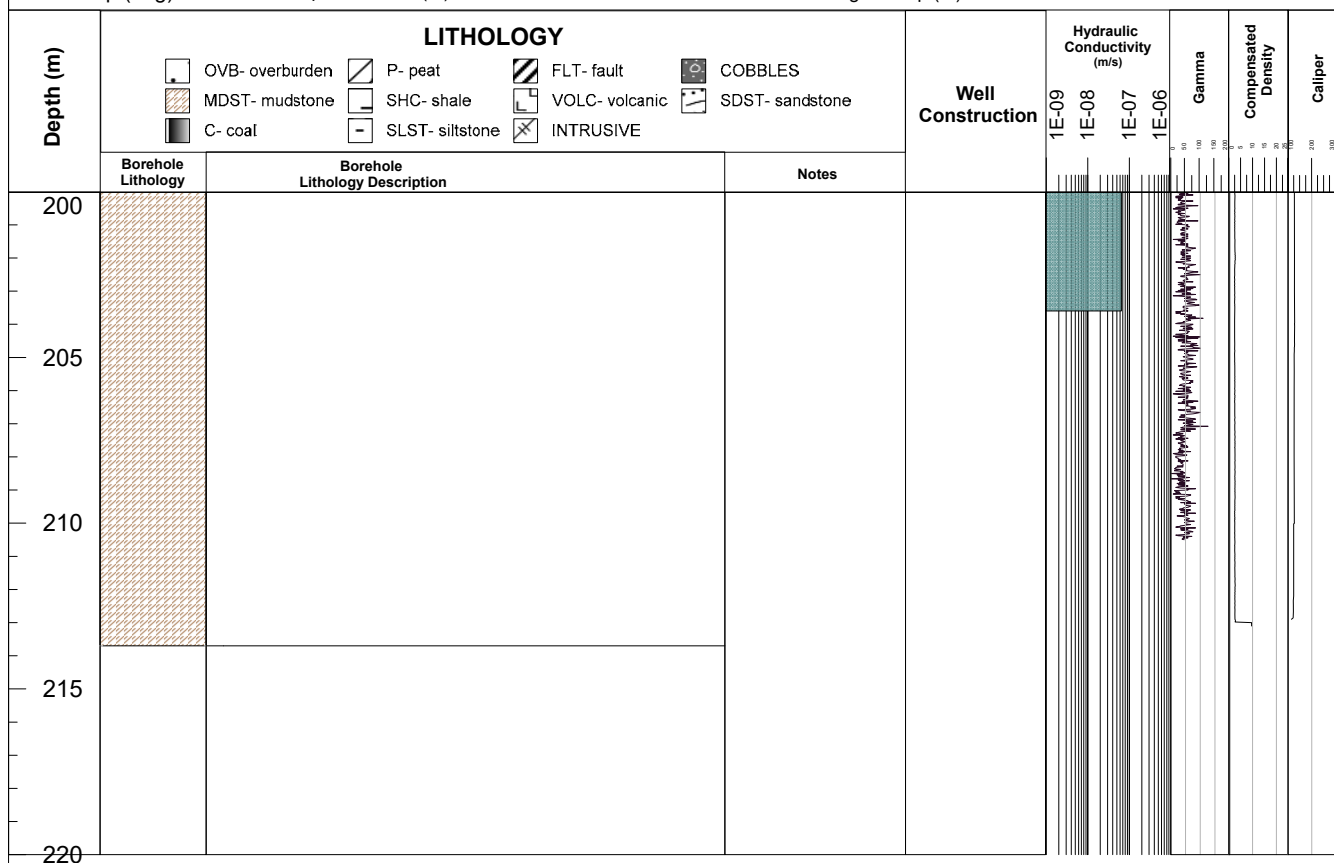
Installation Legend

 Bento Chips
  Coated Pellets
  Sand
  Cave
  PVC
  Screen
  Monument

Project No.: **1CT027.002**Client: **Telkwa Coal Limited**Project: **Telkwa Coal**Drilling Contractor: **Driftwood**Drilling Equipment: **Diamond Drill**Logged By: **RP**Depth to Rock(m): **6.90**Final Depth(m): **213.7**Start Date: **2/25/2018**End Date: **2/26/2018**Borehole Coordinates: **E: 617,318 (m) N: 6,052,051 (m)**Ground Elevation (m): **864.16**EOH Elevation (m): **650.46**Collar Dip (deg): **0/-90**Depth to Water (m): **N/A**Casing Stickup (m): **N/A**

Installation Legend

 Bento Chips
  Coated Pellets
  Sand
  Cave
  PVC
  Screen
  Monument

Project No.: **1CT027.002**Client: **Telkwa Coal Limited**Project: **Telkwa Coal**Drilling Contractor: **Driftwood**Drilling Equipment: **Diamond Drill**Logged By: **RP**Depth to Rock(m): **6.90**Final Depth(m): **213.7**Start Date: **2/25/2018**End Date: **2/26/2018**Borehole Coordinates: **E: 617,318 (m) N: 6,052,051 (m)**Ground Elevation (m): **864.16**EOH Elevation (m): **650.46**Collar Dip (deg): **0/-90**Depth to Water (m): **N/A**Casing Stickup (m): **N/A**

Installation Legend

Bento Chips
 Coated Pellets
 Sand
 Cave
 PVC
 Screen
 Monument

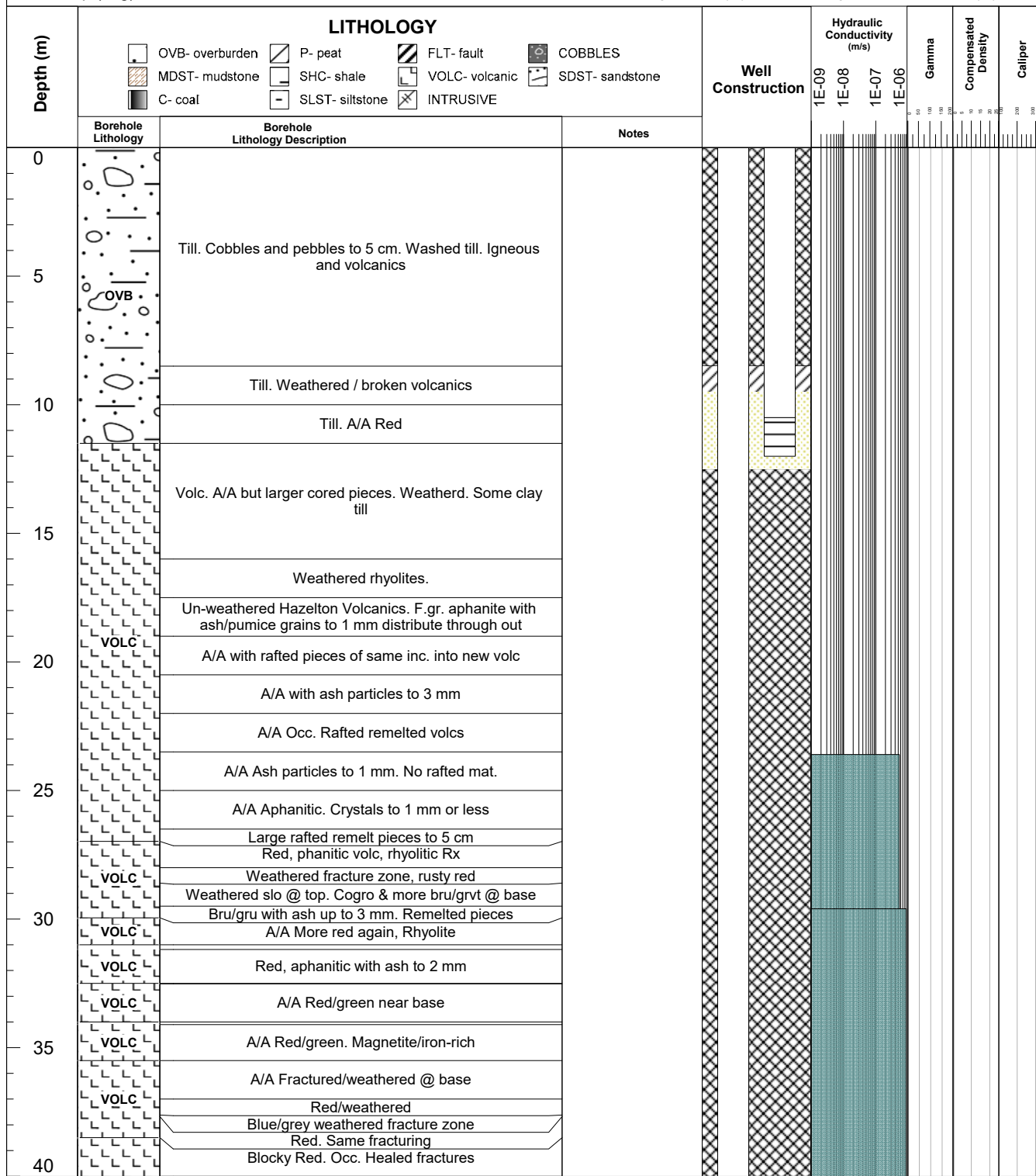
Borehole Number: **W1 (T18-04D)**
 Location: **Tenas Project**



Project No.: 1CT027.002	Drilling Contractor: Driftwood	Depth to Rock(m): 11.50	Start Date: 2/4/2018
Client: Telkwa Coal Limited	Drilling Equipment: Diamond Drill/Sonic	Final Depth(m): 70.0	End Date: 2/7/2018
Project: Telkwa Coal	Logged By: AW/RP		

Borehole Coordinates: **E: 615,955 (m) N: 6,051,115 (m)** Ground Elevation (m): **938.84** EOH Elevation (m): **868.84**

Collar Dip (deg): **0/-90** Depth to Water (m): **-0.30** Casing Stickup (m): **1.47** Casing Stickup Deep Well (m): **1.73**



Installation Legend

Bento Chips
 Coated Pellets
 Sand
 Cave
 PVC
 Screen
 Monument

Project No.: 1CT027.002	Drilling Contractor: Driftwood	Depth to Rock(m): 11.50	Start Date: 2/4/2018
Client: Telkwa Coal Limited	Drilling Equipment: Diamond Drill/Sonic	Final Depth(m): 70.0	End Date: 2/7/2018
Project: Telkwa Coal	Logged By: AW/RP		

Borehole Coordinates: **E: 615,955 (m) N: 6,051,115 (m)** Ground Elevation (m): **938.84** EOH Elevation (m): **868.84**

Collar Dip (deg): **0/-90** Depth to Water (m): **-0.30** Casing Stickup (m): **1.47** Casing Stickup Deep Well (m): **1.73**

Depth (m)	LITHOLOGY			Well Construction	Hydraulic Conductivity (m/s)	Gamma	Compensated Density	Caliper
	Borehole Lithology	Borehole Lithology Description	Notes					
					1E-09 1E-08 1E-07 1E-06	10 100 1000	10 15 20	100 200 300
40	L VOLC.	A/A No fractures any more through						
		Grey/green. Vertical fractures near base						
	VOLC	A/A Fractured, Magnetite-rich						
		Softer, easily eroded. Coarse grained						
45	L VOLC.	Very fractured						
	VOLC.	A/A but less fractured. Vertical fracturing						
	L VOLC.	Very fractured @ top						
		Very fractured esp near base; Vertical fracturing						
50	VOLC	A/A Very fractured						
	VOLC	A/A Few fractured						
	VOLC	Red/brown aphanitic rhyolite						
		Light red/brown. Common vertical fractures						
		A/A but less fracturing						
55	VOLC	Red/brown rhyolite. Ash blebs to 1mm						
	VOLC	Crushed A/A						
	VOLC	Very broken. A/A						
	VOLC	Fractured @ top but A/A						
60	VOLC	Red/brown rhyolite						
	VOLC	A/A						
	VOLC	A/A Ash blebs to 2 mm						
65	VOLC	A/A						
		A/A Rel abrupt lwr contact						
		Transition zone with underlying						
	INTRUSIVE	Aphanitic. Light grey. Some bedding (ash) @ top						
	VOLC	Intrusive alike						
	VOLC	Cogr. Soft. Transition zone						
70		Dark grey volc. Rhyolite with abundant ash blebs.						
		A/A but less ash blebs & finer gr. @ base						

Installation Legend

Bento Chips
 Coated Pellets
 Sand
 Cave
 PVC
 Screen
 Monument

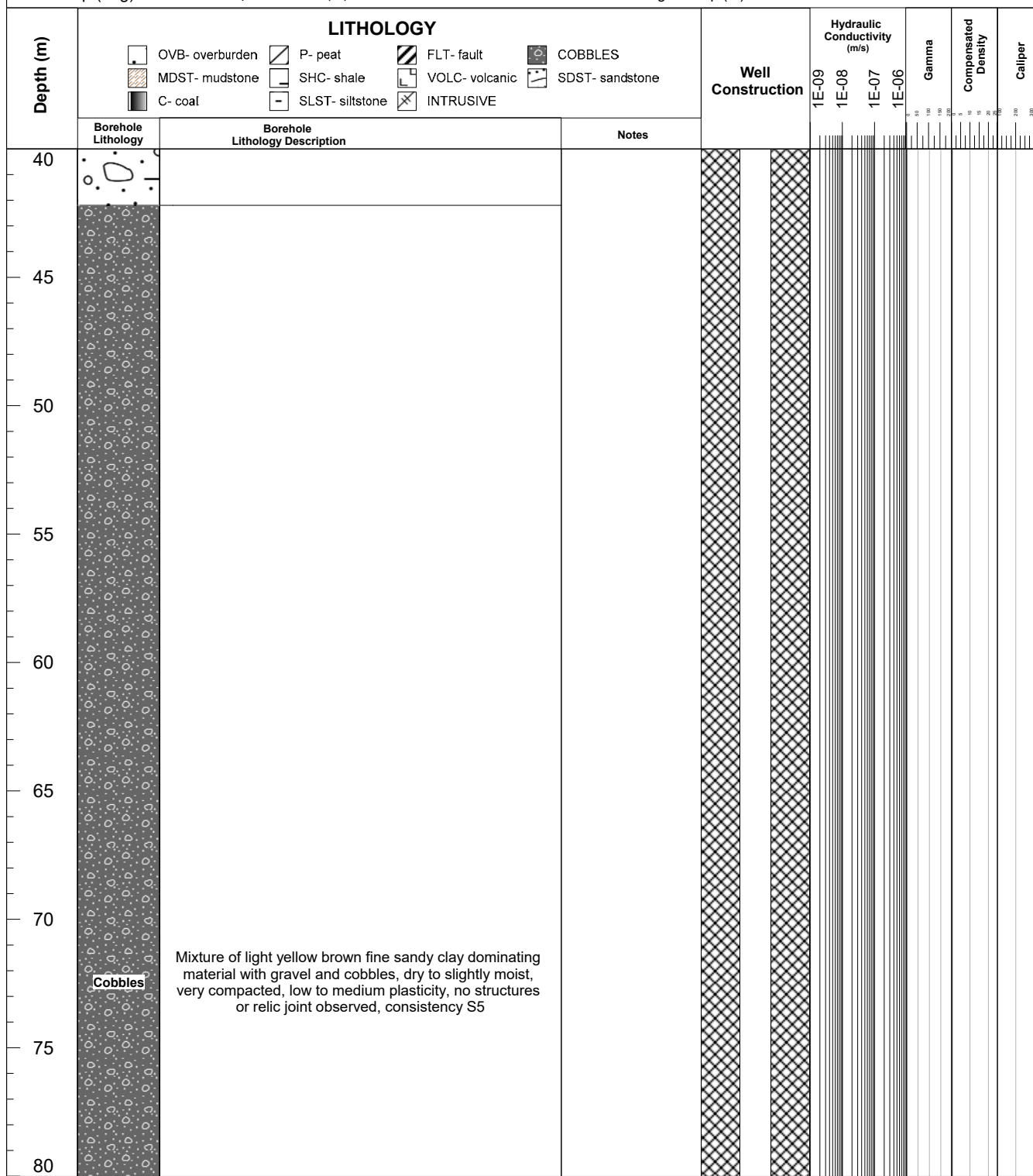
Borehole Number: **W2 (T18-06D)**
 Location: **Tenas Project**



Project No.: 1CT027.002	Drilling Contractor: Driftwood	Depth to Rock(m): 42.20	Start Date: 2/12/2018
Client: Telkwa Coal Limited	Drilling Equipment: Diamond Drill	Final Depth(m): 131.3	End Date: 2/17/2018
Project: Telkwa Coal	Logged By: JJ/RP		

Borehole Coordinates: **E: 616,245 (m) N: 6,052,647 (m)** Ground Elevation (m): **852.5** EOH Elevation (m): **721.2**

Collar Dip (deg): **0/-90** Depth to Water (m): **N/A** Casing Stickup (m): **0.8**



Installation Legend

Bento Chips
 Coated Pellets
 Sand
 Cave
 PVC
 Screen
 Monument

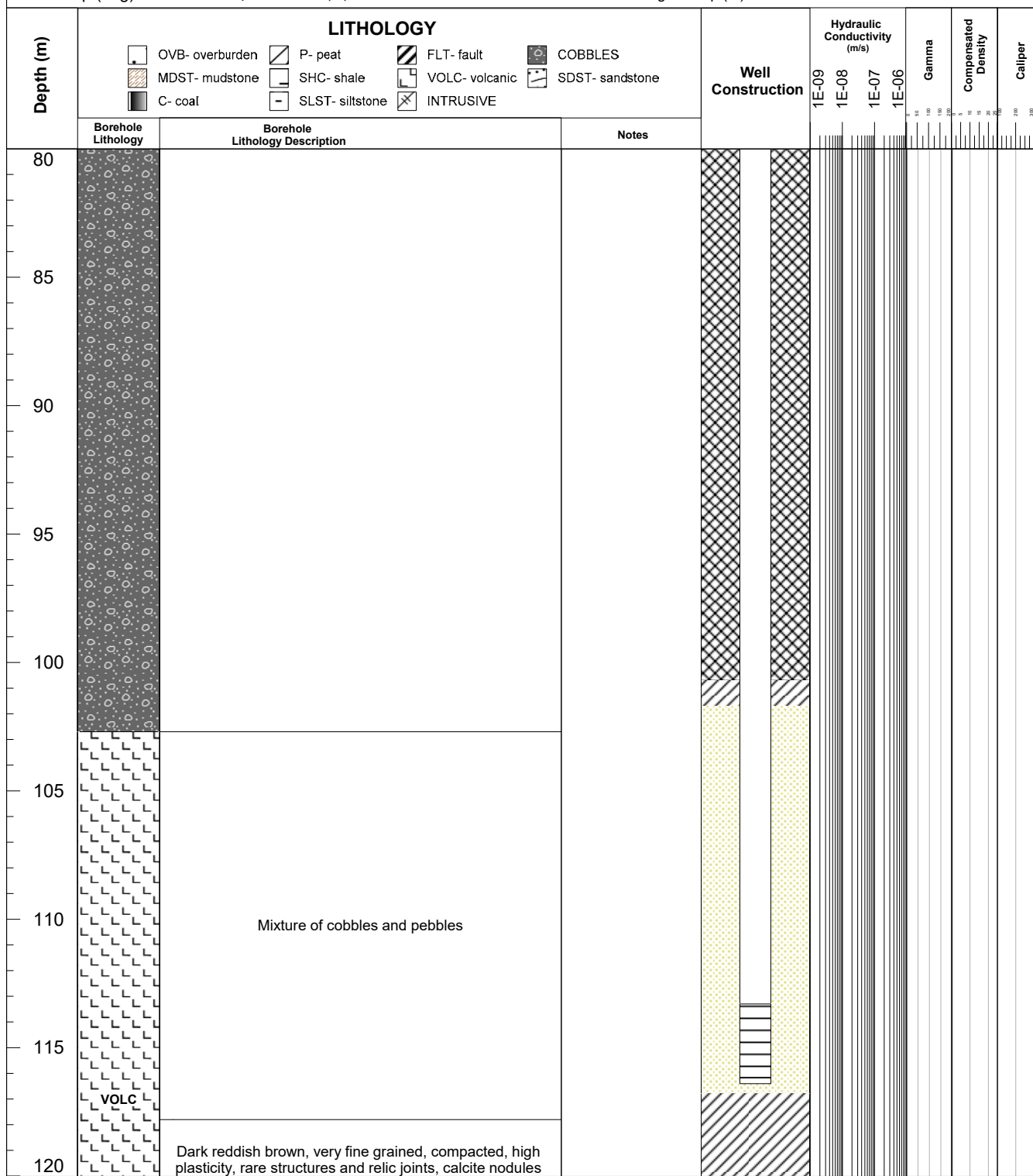
Borehole Number: **W2 (T18-06D)**
 Location: **Tenas Project**



Project No.: 1CT027.002	Drilling Contractor: Driftwood	Depth to Rock(m): 42.20	Start Date: 2/12/2018
Client: Telkwa Coal Limited	Drilling Equipment: Diamond Drill	Final Depth(m): 131.3	End Date: 2/17/2018
Project: Telkwa Coal	Logged By: JJ/RP		

Borehole Coordinates: **E: 616,245 (m) N: 6,052,647 (m)** Ground Elevation (m): **852.5** EOH Elevation (m): **721.2**

Collar Dip (deg): **0/-90** Depth to Water (m): **N/A** Casing Stickup (m): **0.8**



Installation Legend

Bento Chips
 Coated Pellets
 Sand
 Cave
 PVC
 Screen
 Monument

Borehole Number: **W2 (T18-06D)**
 Location: **Tenas Project**



Project No.: 1CT027.002	Drilling Contractor: Driftwood	Depth to Rock(m): 42.20	Start Date: 2/12/2018
Client: Telkwa Coal Limited	Drilling Equipment: Diamond Drill	Final Depth(m): 131.3	End Date: 2/17/2018
Project: Telkwa Coal	Logged By: JJ/RP		

Borehole Coordinates: **E: 616,245 (m) N: 6,052,647 (m)** Ground Elevation (m): **852.5** EOH Elevation (m): **721.2**

Collar Dip (deg): **0/-90** Depth to Water (m): **N/A** Casing Stickup (m): **0.8**

Depth (m)	LITHOLOGY			Well Construction	Hydraulic Conductivity (m/s)				Gamma	Compensated Density	Caliper
	Borehole Lithology	Borehole Lithology Description	Notes		1E-09	1E-08	1E-07	1E-06			
120		and veinlets									
		Dark red brown, fine grain, competent rock, calcite nodules and									
125		Dark redish brown, ver fine grained, comparcted, high plasticity, rare structures and relic joints, calcite nodules and veinlets									
130											
135											
140											

Installation Legend

Bento Chips
 Coated Pellets
 Sand
 Cave
 PVC
 Screen
 Monument

Borehole Number: **W3 (T18-08D)**
 Location: **Tenas Project**



Project No.: 1CT027.002	Drilling Contractor: Driftwood	Depth to Rock(m): 44.20	Start Date: 2/22/2018
Client: Telkwa Coal Limited	Drilling Equipment: Diamond Drill	Final Depth(m): 53.2	End Date: 2/24/2018
Project: Telkwa Coal	Logged By: CC/RP		

Borehole Coordinates: **E: 618,515 (m) N: 6,053,379 (m)** Ground Elevation (m): **804.52** EOH Elevation (m): **751.32**

Collar Dip (deg): **0/-90** Depth to Water (m): **23.79** Casing Stickup (m): **1** Casing Stickup Deep Well (m): **1**

Depth (m)	LITHOLOGY			Well Construction	Hydraulic Conductivity (m/s)				Gamma	Compensated Density	Caliper
	Borehole Lithology	Borehole Lithology Description	Notes		1E-09	1E-08	1E-07	1E-06			
0		Topsoil Gravelly SAND (fine to medium grained), some silt, dry, brown	Soil observed from the wall of the cuttings pit. Soil also frozen.								
5		Glacial Till - matrix comprised of fine sand, silt and clay, grey. Poor recovery from 1.5 to 15.7 m - abundant gravel (all size ranges), trace cobbles. From 14.2 -18.7 m the clay content of the Till has increased, trace to some silt, pods of brown fine sa									
10											
15											
20		SILT, trace clay, low percentage of gravel. Fine sand percentage increases around 22 m. SAND layer (dark brown) from 20 to 20.2 m.									
25		Glacial Till? - matrix comprised of silty fine sand, trace to some gravel, dark brown. Gravel content increases after 27.7 m.	Driller foreman reports that the drillers were losing plenty of water but the exact depth is unknown								
30		Looks like Glacial Till although there is very poor recovery. Abundant subrounded gravel and cobbles.									
35											
40		Glacial Till - matrix predominantly silt and fine sand, trace to some gravel clasts, dry, grey. Mostly good core									

Installation Legend

Bento Chips Coated Pellets Sand Cave PVC Screen Monument

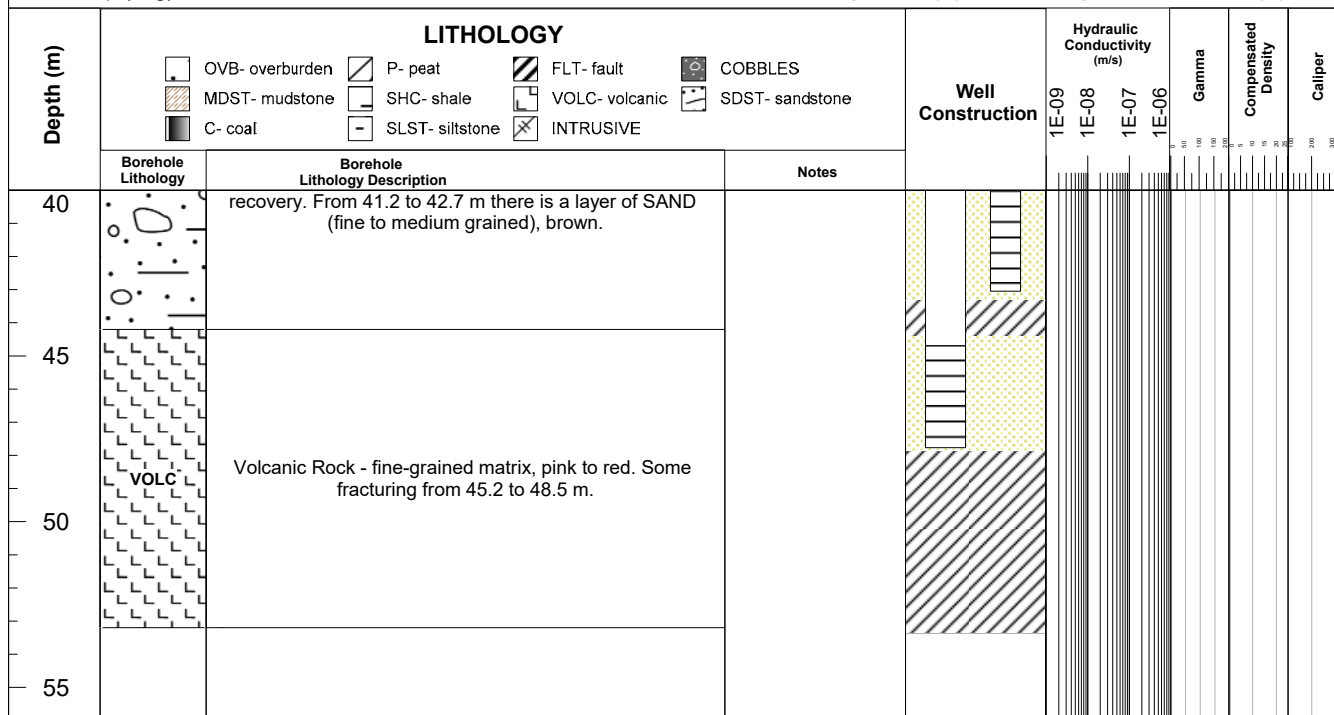
Borehole Number: **W3 (T18-08D)**
 Location: **Tenas Project**



Project No.: 1CT027.002	Drilling Contractor: Driftwood	Depth to Rock(m): 44.20	Start Date: 2/22/2018
Client: Telkwa Coal Limited	Drilling Equipment: Diamond Drill	Final Depth(m): 53.2	End Date: 2/24/2018
Project: Telkwa Coal	Logged By: CC/RP		

Borehole Coordinates: **E: 618,515 (m) N: 6,053,379 (m)** Ground Elevation (m): **804.52** EOH Elevation (m): **751.32**

Collar Dip (deg): **0/-90** Depth to Water (m): **23.79** Casing Stickup (m): **1** Casing Stickup Deep Well (m): **1**



Installation Legend

Bento Chips
 Coated Pellets
 Sand
 Cave
 PVC
 Screen
 Monument

Appendix 5-C Well Development Details, Tenas Project, 2018

Appendix 5-C. Well Development Details, 2018

Well ID	Well Installation Date ¹	Well Development Date	Amount of Water Removed (L)	Method of Water Removal	Turbidity (Qualitative)	Notes
New Bedrock Wells						
W1 Shallow	2/7/2018	4/23/2018	40.0	Manual Inertial Pumping	Turbid, brown	Throughout the well development process the well was bailed close to dry and then allowed to recover before removing more water. Slow recovery rate. Well is artesian.
		4/23/2018	15.0	Bailing	Turbid, brown	
		4/24/2018	65.0	Bailing	Turbid, brown	
		4/25/2018	65.0	Bailing	Turbid, brown	Water was clear upon arrival before development.
		Total	185.0			Groundwater sample was collected on April 27th, 2018. Slightly turbid sample. Approximately 6 well volumes removed.
W1 Deep	2/7/2018	4/23/2018	80.0	Manual Inertial Pumping	Semi-turbid, pink	Well is artesian. This well had water circulating with the drill for around 6 hours before packer testing and was still slightly turbid and pink.
		4/24/2018	95.0	Submersible Pump	Turbid, pink	
		4/25/2018	205.0	Hydro-lift Inertial Pumping	Turbid, pink	
		4/27/2018	135.0	Hydro-lift Inertial Pumping	Turbid, pink	Slow recharge rate. Groundwater sample was collected on April 28th, 2018. Slightly turbid sample. Approximately 5 well volumes removed.
		4/27/2018	15.0	Bailing	Turbid, pink	
		4/28/2018	75.0	Submersible Pump	Turbid, pink	
		Total	605.0			
W2	2/17/2018	3/27/2018	80.0	Hydro-lift Inertial Pumping	Slightly turbid, slightly yellow, some bubbles	Deep water table in this well (50.86 mbtoc). Difficult to lift water deeper than 50 meters with the Hydro-lift.
		3/28/2018	54.0	Hydro-lift Inertial Pumping	Slightly turbid, slightly yellow, some bubbles	Moderate recharge rate.
		3/30/2018	20.0	Hydro-lift Inertial Pumping	Slightly turbid, slightly yellow, some bubbles	Will use a Grundfos pump next time to purge and sample. Groundwater sample was collected on April 5th, 2018. Slightly turbid sample. Approximately 1.25 well volumes removed. Needs more well development/purging.
		4/4/2018	15.0	Hydro-lift Inertial Pumping	Slightly turbid, slightly yellow, some bubbles	
		Total	169.0			
W3 Shallow	2/24/2018	3/24/2018	3.0	Hydro-lift Inertial Pumping	Semi-turbid, yellow/brown, viscous	This well is 1.5 inches in diameter and has a slow to moderate recharge rate.
		3/27/2018	11.0	Bailing	Clear, viscous	
		3/30/2018	12.0	Bailing	Clear, viscous	
		4/2/2018	5.0	Bailing	Clear, viscous	
		4/4/2018	8.5	Bailing	Clear, less viscous than before	
		4/5/2018	7.0	Bailing	Clear, less viscous than before	
		Total	46.5			Groundwater sample was collected on April 6th, 2018. Clear sample but slightly viscous. Approximately 4.5 well volumes removed.
W3 Deep	2/24/2018	3/24/2018	18.0	Hydro-lift Inertial Pumping	Semi-turbid, slightly yellow, some bubbles, slight odor	After well development the water level was close to dry (2.6 meters of standing water). Slow recharge rate.
		3/27/2018	23.0	Bailing	Turbid with brown globules, viscous, slightly yellow/brown	Well was almost bailed dry after well development.
		3/30/2018	9.0	Bailing	Semi-turbid with brown globules, viscous, slightly yellow/brown	The static water level has changed from 37.56 mbtoc before well development to 46.25 mbtoc after the first two development events. Well was almost bailed dry after today's well development.
		4/2/2018	6.5	Bailing	Semi-turbid with brown globules, viscous, slightly yellow/brown	Well bailed dry after 6.5 liters were removed.
		4/4/2018	9.0	Bailing	Semi-turbid with brown globules, viscous, slightly yellow/brown	Well bailed dry after 9.0 liters were removed. Very slow recharge rate.
		4/5/2018	1.0	Bailing	Semi-turbid with brown globules, viscous, slightly yellow/brown	There was only 0.75 meters of standing water in the well upon arrival (bailed dry 28 hours earlier). Plenty of clay globules removed with the bailer. Bailed dry before leaving for the day.
		4/6/2018	1.0	Bailing	Semi-turbid with brown globules, viscous, slightly yellow/brown	There was only 0.30 meters of standing water in the well upon arrival (bailed dry 21 hours earlier). Plenty of clay globules removed with the bailer. Bailed dry before leaving for the day.
		4/23/2018	0.0	No development today	No development today	Water level recovered to 41.85 mbtoc since April 6th. Added 4 liters of water to the well today for the purposes of conducting a falling head test.
		4/24/2018	22.0	Bailing	Clear	Due to the extremely slow rate of water displacement we decided to bail the well dry so we could collect a sample the following day. Expecting close to 2 meters of displacement and the water was 1.35 meters from static after 22.5 hrs.
		4/25/2018	1.0	Bailing	Clear	There was 1.55 meters of standing water in the well upon arrival (bailed dry 28 hours earlier).
		Total	90.5			Groundwater sample was collected on April 25th, 2018. Sample was clear. Difficult to determine how many well volumes were removed (bailed dry 8 times).

Appendix 5-C. Well Development Details, 2018

Well ID	Well Installation Date ¹	Well Development Date	Amount of Water Removed (L)	Method of Water Removal	Turbidity (Qualitative)	Notes
New Bedrock Wells						
ARD 2	1/31/2018	3/23/2018	205.0	Hydro-lift Inertial Pumping	Semi-turbid	This is a 3 inch diameter well. Water clarity was clear during the beginning of the development process then became semi-turbid.
		3/24/2018	140.0	Hydro-lift Inertial Pumping	Semi-turbid	Water level was 9.88 mbtoc before well development on March 23rd. Water level was slightly lower at 11 mbtoc on March 24th before well development. Fairly slow pumping rate of 1.1 L/min. Used a surge block today. Could probably pump at a higher rate.
		Total	345.0			No sample collected at this well as this well may be used for a pumping test in the summer. Approximately 1.2 well volumes removed.

Notes:

¹ Installation date is the end date from well logs in Telkwa 2018 Winter Hydro Field Program memo, prepared by SRK

Appendix 5-D *Existing Monitoring Well Inspection Results,
Tenas Project, July 2017*

Appendix 5-D. Existing Monitoring Well Inspection Results, July 2017

Well ID	UTM Coordinates (zone 9N)		Geology Type	Lithology	Groundwater Surface Elevation (masl) ¹	Depth to Water (mbtoc)	Stick-up (mags)	Diameter (in)	Screen Top (mbgs) ⁴	Screen Bottom (mbgs) ⁴	Depth to Bottom (mbtoc) - Measured 2017	Date Inspection (2017)	Damaged (y/n)	Dry (y/n)	July 2017 Notes
T95R-15C	617062	6051998	BDR	Coal (seam #1)	880.20	0.45	1.08	2	48.0	63.0	62.17	July 26th	No	No	There is a crack in the upper part of the well but it is functional. There is no cap and no protective steel lid. Water level is above the ground surface.
T95R-40	6051461	618188	BDR	Coal (seam #1)	900.85	7.95	0.26	2	42.0	53.0	52.24	July 25th	No	No	The dedicated bailer fell down into the well.
T95R-64	6050597	618278	BDR	Coal (seam #1)	940.74	7.54	1.23	2	88.0	94.0	>90	July 25th	No	No	Dedicated bailer.
T96R-16-19	6050613	616954	BDR	Coal (seam #1)	1012.53	2.69	0.75	2	13.1	19.1	18.61	July 25th	No	No	No dedicated bailer, well is in good shape.
T96R-16-28	6050613	616954	BDR	Coal (seam #1)	1012.53	2.69	0.82	2	24.5	27.5	28.58	July 25th	No	No	Dedicated bailer.
T96R-34-87	6051180	617691	BDR	Coal (seam #1)	934.15	0.85	0.97	2	80.6	86.6	86.83	July 25th	No	No	No cap on the well.
TOB96-01-05	6050602	619014	OVB	Till	922.54	2.70	0.75	2	1.6	4.6	5.17	July 25th	No	No	Well looks to be in good condition. Dedicated bailer.
TOB96-02-06	6051947	618466	OVB	Till	853.46	2.93	0.38	2	3.0	6.0	6.79	July 26th	No	No	Well is in good condition and has a dedicated bailer.
TOB96-02-20	6051947	618466	OVB	Sand & gravel	853.46	n/a	0.34	2	17.0	20.0	n/a	July 26th	No	n/a	Could not get the cap off. Well has a dedicated bailer and is in good condition.
TOB96-11-04	6052818	617724	OVB	Clay	827.16	2.48	0.87	2	1.5	4.5	4.43	July 26th	No	No	Well looks to be in good condition. Had dedicated Waterra tubing with a foot valve. Screened section may be partially filled with fines.
TOB96-11-19	6052818	617724	OVB	Fine sand	827.16	dry	0.31	2	18.7	20.2	19.80	July 26th	No	Yes	Upper part of the PVC casing is cracked and broken (cap on the ground). Well is still useable. Steel protective casing looks good. Water level tape easily can get down the well. Dedicated Waterra tubing with a foot valve. Well is dry. Screened section may be partially filled with fines.
TOB97-06-21	6052496	616652	OVB	Sand	855.78	dry	0.74	2	18.0	21.0	20.38	July 26th	No	Yes	Well is in good condition. No dedicated bailer or tubing.
TOB97-07-24	6053579	617887	OVB	Sand	819.13	dry	0.90	2	21.0	24.0	23.54	July 26th	No	Yes	Well is in good condition. There is a cap. The screened section may be partially filled with fines.
T95R-39C	6050869	617336	BDR	Coal (seam #1)	n/a	n/a	n/a	2	51.2	58.4	n/a	July 25th	Yes	n/a	Upper part of the well and casing are destroyed. Fragments of the 2" PVC found along with the dedicated bailer lying in the mud.
T97R-108C-70	6052532	617380	BDR	Coal (seam #1)	n/a	<u>0.27</u>	0.42	2	61.0	70.0	1.25	July 26th	Yes	No	Well is damaged. Casing is bent and the ground around the well is depressed. Depth to bottom is very shallow.
T96R-34-67 ²	6051180	617691	BDR	Coal (upper seam)	n/a	<u>0.53</u>	0.94	2	66.2	67.5	68.67	July 25th	Yes	No	No cap on the well.
T96R-56C-83	6050370	618588	BDR	Coal (seam #1)	n/a	<u>0.75</u>	1.18	2	74.9	82.6	31.37	July 25th	Yes	No	Suspected damage. Depth to bottom is much shallower than the provided well details. The well casing looks disturbed and tilted. Moose tracks beside the well. No cap as well.
TOB96-12-04	6051377	616082	OVB	Till	n/a	n/a	0.42	2	1.0	4.0	1.47	July 26th	Yes	n/a	Well is damaged. Casing is bent over and the depth to bottom is shallower than the original depth. There is a dedicated bailer.

Appendix 5-D. Existing Monitoring Well Inspection Results, July 2017

Well ID	UTM Coordinates (zone 9N)		Geology Type	Lithology	Groundwater Surface Elevation (masl) ¹	Depth to Water (mbtoc)	Stick-up (mags)	Diameter (in)	Screen Top (mbgs) ⁴	Screen Bottom (mbgs) ⁴	Depth to Bottom (mbtoc) - Measured 2017	Date Inspection (2017)	Damaged (y/n)	Dry (y/n)	July 2017 Notes
T96TP-01-10	6050718	617276	BDR	Coal (seam C)	n/a	<u>2.14</u>	1.24	3	8.5	10.0	6.13	July 25th	Yes	No	The coordinates were off by about 26 meters. Could not find another well in the area. 3" well in some type of testing area. Well is surrounded by a fence. Depth to bottom off by 5 meters from the original depth (screened section is filled with fines?).
T96TP-02-07 ³	6050655	617201	BDR	Coal (seam #1)	n/a	3.42	1.31	3	2.0	7.0	7.65	July 25th	No	No	3" diameter well surrounded by a fence. Soft bottom and shallower than original depth.
T93R-17	6052178	617435	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	July 25th	n/a	n/a	Could not find the well. No evidence of the well.
T93R-18	6052193	617968	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	July 25th	n/a	n/a	Could not find the well. No evidence of the well.

Notes:

¹ - Ground surface elevations for all wells derived from topo model data provided by the project geologist Ron Parent, April 2019.

² - The inside casing of T96R-34-67 was found to be damaged during the August 2017 sampling event

³ - This monitoring well is not being used in the baseline program.

⁴ - Screen Top and Bottom measurements from Baseline Hydrogeological Investigations in the Tenas Pit, Waste Dumps, and Mine Pit 3, Telkwa Coal Project, prepared by Piteau Engineering Ltd., 1997

	Damaged or well not being used in baseline program.
xxxx	Depth to water may not be true due to the well being damaged
masl	meters above sea level
mbtoc	meters below top of casing
mags	meters above ground surface
mbgs	meters below ground surface

*Appendix 5-E Summary of Groundwater Monitoring Wells and
Water Levels*

Appendix 5-E. Summary of Groundwater Monitoring Wells and Water Levels, Tenas Project, 2017 to 2019

Well ID	Installation Date	UTM Zone 9U		Ground Surface Elevation (m asl)	Measured Standpipe Stickup Height (m ags)	Top of PVC Elevation (m asl)	Manual Water Level Readings				Screen		Sand Pack		PVC Casing Diameter (in)	Drilled Diameter (mm)	Lithology	Vertical Hydraulic Gradient (m/m)	Datalogger	Comments	
		Easting (m)	Northing (m)				Date	Time	Water Level Measurement (m btoc)	Water Level (m asl)	From (m bgs)	To (m bgs)	From (m bgs)	To (m bgs)							
Bedrock Wells																					
T95R-15C	7/19/1995	617061.75	6051998.35	880.20	0.9	881.10	10/26/1995	-	artesian	>881.1	48.00	63.00	48.00	63.00	2.0	143	Coal (seam #1)	n/a	2065041		
					1.96	882.16	8/23/1997	-	1.32	880.84											
					1.08	881.28	7/26/2017	-	0.45	880.83											
							9/26/2017	9:00 AM	0.24	881.28											
							1/15/2018	11:15 AM	0	881.28										Frozen to top of casing.	
							4/20/2018	1:00 PM	0.24	881.04											
							6/19/2018	9:44 AM	1.23	880.63										Additional stick up added	
					1.66	881.86	9/11/2018	1:30 PM	0.71	881.15											
							1/9/2019	2:30 PM	artesian	>881.86										Not measured as there is a sub-frost plug in the well to prevent freezing. Water level (m asl) is above ground elevation based on transducer readings.	
							4/5/2019	10:58 AM	0.63	881.23											
							6/7/2019	12:04 PM	0.66	881.20											
							8/31/2019	3:04 PM	0.82	881.04											
							11/24/2019	1:10 PM	0.58	881.28											
T95R-40	8/14/1995	618188.00	6051460.67	900.85	0.35	901.20	10/27/1995	-	7.88	893.32	48.00	53.00	42.00	53.00	2.0	143	Coal (seam #1)	n/a	n/a		
					0.26	901.11	8/23/1997	-	7.41	893.79											
							7/25/2017	-	7.95	893.17											
							8/17/2017	9:30 AM	8.16	892.96											
							9/29/2017	10:59 AM	8.03	893.08											
							1/18/2018	1:01 PM	7.95	893.16											
							4/3/2018	10:06 AM	7.91	893.20											
							6/27/2018	11:40 AM	8.11	893.00											
							9/15/2018	8:40 AM	8.17	892.94											
							1/10/2019	10:50AM	8.02	893.09											
							4/2/2019	10:02 AM	8.08	893.03											
							6/4/2019	10:50 AM	8.13	892.99											
							8/30/2019	3:45 PM	8.21	892.90											
							11/28/2019	11:19 AM	8.14	892.97											
							T95R-64	9/8/1995	618277.80	6050597.05											940.74
1.23	941.97	8/22/1997	-	7.56	934.38																
		7/25/2017	-	7.54	934.43																
		8/17/2017	1:10 PM	7.53	934.44																
		9/26/2017	12:54 PM	7.35	934.62																
		1/15/2018	12:10 PM	7.28	934.69																
		3/31/2018	10:15 AM	7.20	934.77																
		6/21/2018	10:12 AM	7.43	934.54																
		9/13/2018	10:35 AM	7.51	934.46																
		1/11/2019	11:05 AM	7.35	934.62																
		2/7/2019	2:35 PM	7.36	934.61																
		2/10/2019	1:10 PM	7.32	934.65																
		3/4/2019	2:22 PM	7.37	934.60																
		4/6/2019	10:50 AM	7.32	934.65																
		6/8/2019	10:00 AM	7.37	934.60																
8/31/2019	3:47 PM	7.36	934.61																		
11/24/2019	2:29 PM	7.23	934.74																		
T96R-16-19	Jul-96	616953.66	6050612.97	1012.53	0.65	1013.18	9/18/1996	-	2.36	1010.82	13.10	19.10	12.50	19.10	2.0	159	Coal (seam #1)	-	2060396		
					0.75	1013.28	8/22/1997	-	2.40	1010.78											
							7/25/2017	-	2.69	1010.59								0.007			
							9/27/2017	4:41 PM	2.74	1010.55								0.004			
							1/16/2018	10:10 AM	2.43	1010.85								0.005			
							3/30/2018	4:25 PM	2.47	1010.81								0.004			
							6/27/2018	9:17 AM	2.34	1010.95								0.006			
							9/6/2018	2:33 PM	3.04	1010.24								0.006			
							1/5/2019	1:50 PM	2.79	1010.50								0.005			
							4/3/2019	2:31 PM	2.7	1010.58								0.004			
							6/1/2019	1:55 PM	2.24	1011.05								0.006			
							8/31/2019	2:09 PM	2.79	1010.50								0.005			
							11/24/2019	1:54 PM	2.27	1011.01								0.005			

Appendix 5-E. Summary of Groundwater Monitoring Wells and Water Levels, Tenas Project, 2017 to 2019

Well ID	Installation Date	UTM Zone 9U		Ground Surface Elevation (m asl)	Measured Standpipe Stickup Height (m ags)	Top of PVC Elevation (m asl)	Manual Water Level Readings				Screen		Sand Pack		PVC Casing Diameter (in)	Drilled Diameter (mm)	Lithology	Vertical Hydraulic Gradient (m/m)	Datalogger	Comments																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																									
		Easting (m)	Northing (m)				Date	Time	Water Level Measurement (m btoc)	Water Level (m asl)	From (m bgs)	To (m bgs)	From (m bgs)	To (m bgs)																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																															
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T96R-16-28	Jul-96	616953.66	6050612.97	1012.53	0.74	1013.27	9/18/1996	-	2.41	1010.86	24.50	27.50	24.00	27.50	2.0	159	Unnamed lower coal seam	n/a	n/a																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																										
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T96R-34-87	7/23/1996	617691.35	6051179.99	934.15	0.86	935.01	9/18/1996	-	artesian	>935.01	80.60	86.60	80.60	86.60	2.0	159	Coal (seam #1)	n/a	n/a																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																										
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							11/28/2019	12:01 PM	0.83	934.29																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																			

Appendix 5-E. Summary of Groundwater Monitoring Wells and Water Levels, Tenas Project, 2017 to 2019

Well ID	Installation Date	UTM Zone 9U		Ground Surface Elevation (m asl)	Measured Standpipe Stickup Height (m ags)	Top of PVC Elevation (m asl)	Manual Water Level Readings				Screen		Sand Pack		PVC Casing Diameter (in)	Drilled Diameter (mm)	Lithology	Vertical Hydraulic Gradient (m/m)	Datalogger	Comments														
		Easting (m)	Northing (m)				Date	Time	Water Level Measurement (m btoc)	Water Level (m asl)	From (m bgs)	To (m bgs)	From (m bgs)	To (m bgs)																				
Bedrock Wells (cont'd)																																		
W3 Deep	2/24/2018	618515.25	6053378.95	809.11	1	810.11	4/23/2018	10:31 AM	41.85	768.26	44.70	47.77	44.41	47.77	2.0	122	Fractured volcanics	-1.58	21105305															
							6/18/2018	11:20 AM	41.93	768.18								-1.57																
							9/8/2018	9:00 AM	42.35	767.76								-1.69																
							1/4/2019	9:45 AM	41.85	768.26								-1.60																
							3/30/2019	9:48 AM	42.39	767.72								-1.67																
							5/31/2019	11:19 AM	40.70	769.42								-1.32																
							8/27/2019	10:42 AM	39.48	770.63								-1.05																
							11/20/2019	11:42 AM	43.5	766.61								-1.92																
							ARD 2	1/31/2018	617840.63	6050689.06								957.29			0.99	958.28	3/24/2018	9:23 AM	11	947.28	69.8	72.90	69.50	78.70	3.0	122	Sandstone	n/a
6/21/2018	9:40 AM	10.61	947.67																															
9/6/2018	3:04 PM	10.76	947.52																															
1/8/2019	1:45 PM	10.67	947.61																															
2/7/2019	1:25 PM	10.64	947.64																															
2/10/2019	1:20 PM	10.60	947.69																															
3/30/2019	3:40 PM	13.01	945.27																															
6/1/2019	2:20 PM	12.85	945.43																															
8/31/2019	12:22 PM	13.04	945.25																															
11/28/2019	12:43 PM	12.95	945.33																															
Overburden Wells																																		
TOB96-01-05	7/26/1996	619014.28	6050601.75	922.54	0.52	923.06	9/20/1996	-	1.45	921.61	1.60	4.60	1.30	4.60	2.0	159	Till	n/a	n/a															
					0.75	923.29	8/22/1997	-	1.12	921.94																								
							7/25/2017	1:24 PM	2.7	920.59																								
							9/28/2017	2:56 PM	3.675	919.62																								
							1/18/2018	10:20 AM	1.92	921.37																								
							3/29/2018	9:40 AM	1.37	921.92																								
							6/21/2018	8:19 AM	1.96	921.33																								
							9/13/2018	9:29 AM	4.88	918.41																								
							1/11/2019	9:50 AM	5.12	918.17																								
							4/3/2019	1:12 PM	4.7	918.59																								
							6/6/2019	3:00 PM	2.36	920.93																								
							8/31/2019	11:42 AM	4.93	918.36																								
11/28/2019	1:20 PM	1.92	921.38																															
TOB96-02-06	7/26/1996	618465.52	6051947.29	853.46	0.57	854.03	9/20/1996	-	2.02	852.01	3.41 *	6.41 *	3.11 *	6.41 *	2.0	159	Till	-	2065063															
					0.38	853.84	8/23/1997	-	1.76	852.27								-																
							7/26/2017	2:15 PM	2.93	850.91								nc																
							9/28/2017	9:50 AM	3.61	850.23								nc																
							1/16/2018	1:37 PM	2.63	851.22								nc																
							3/26/2018	12:00 PM	2.73	851.11								nc																
							6/20/2018	8:20 AM	2.01	851.83								-1.31																
							9/10/2018	2:50 PM	3.40	850.44								nc																
							1/8/2019	11:15 AM	3.96	849.88								nc																
							4/5/2019	2:09 PM	4.12	849.72								nc																
							6/6/2019	12:20 PM	3.62	850.22								nc																
							8/30/2019	1:26 PM	3.62	850.22								nc																
							11/24/2019	11:45 AM	3.84	850.00								nc																
							TOB96-02-20	7/26/1996	618465.52	6051947.29								853.46		0.52	853.98	9/20/1996	-	18.42	835.56	17.60 *	20.60 *	17.30 *	20.60 *	2.0	159	Sand & gravel	n/a	2077546
																				0.34	853.8	8/23/1997	-	19.71	834.27									
9/28/2017	9:52 AM	dry	<832.86																															
1/16/2018	1:40 PM	dry	<832.86																															
3/26/2018	12:02 PM	dry	<832.86																															
6/20/2018	8:25 AM	20.36	833.44																															
9/10/2018	2:55 PM	dry	<832.86																															
1/8/2019	11:17 AM	dry	<832.86																															
4/5/2019	2:15 PM	dry	<832.86																															
6/6/2019	12:31 PM	dry	<832.86																															
8/30/2019	1:32 PM	dry	<832.86																															
11/24/2019	11:50 AM	dry	<832.86																															

Appendix 5-E. Summary of Groundwater Monitoring Wells and Water Levels, Tenas Project, 2017 to 2019

Well ID	Installation Date	UTM Zone 9U		Ground Surface Elevation (m asl)	Measured Standpipe Stickup Height (m ags)	Top of PVC Elevation (m asl)	Manual Water Level Readings				Screen		Sand Pack		PVC Casing Diameter (in)	Drilled Diameter (mm)	Lithology	Vertical Hydraulic Gradient (m/m)	Datalogger	Comments										
		Easting (m)	Northing (m)				Date	Time	Water Level Measurement (m btoc)	Water Level (m asl)	From (m bgs)	To (m bgs)	From (m bgs)	To (m bgs)																
Overburden Wells (cont'd)																														
TOB96-11-04	9/13/1996	617724.47	6052817.77	827.16	0.72	827.88	9/20/1996	-	dry	<822.61	1.55	4.55	1.40	4.55	2.0	159	Clay	n/a	n/a											
							8/23/1997	-	2.77	825.11																				
					0.87	828.03	7/26/2017	10:30 AM	2.48	825.55											18.70	20.00	18.20	20.20	2.0	159	Fine sand	n/a	n/a	
							9/27/2017	2:35 PM	2.54	825.49																				
							1/15/2018	10:30 AM	3.20	824.83																				
							3/26/2018	1:30 PM	3.87	824.16																				
							6/21/2018	9:07 AM	3.35	824.68																				
							9/6/2018	3:55 PM	3.75	824.28																				
							1/8/2019	9:44 AM	3.89	824.14																				
							3/30/2019	3:05 PM	4.1	823.93																				
							5/30/2019	12:57 PM	3.8	824.23																				
							8/28/2019	2:54 PM	3.44	824.60																				
							11/28/2019	9:45 AM	2.90	825.13																				
TOB96-11-19	9/13/1996	617724.47	6052817.77	827.16	0.68	827.84	9/20/1996	-	dry	<807.67	18.70	20.00	18.20	20.20	2.0	159	Fine sand	n/a	n/a											
							8/23/1997	-	dry	<807.67																				
					0.31	827.47	7/26/2017	10:30 AM	dry	<807.67											18.00	21.00	17.70	21.00	2.0	152	Sand	n/a	n/a	
							9/27/2017	2:32 PM	dry	<807.67																				
							1/15/2018	10:32 AM	dry	<807.67																				
							3/26/2018	1:40 PM	dry	<807.67																				
							6/21/2018	9:26 AM	dry	<807.67																				
							9/6/2018	3:57 PM	dry	<807.67																				
							1/8/2019	9:50 AM	dry	<807.67																				
							3/30/2019	3:10 PM	dry	<807.67																				
							5/28/2019	3:10 PM	dry	<807.67																				
							8/28/2019	2:57 PM	dry	<807.67																				
							11/28/2019	9:50 AM	dry	<807.67																				
TOB97-06-21	9/24/1997	616651.84	6052495.70	855.78	0.7	856.48	8/22/1997	-	dry	<836.16	18.00	21.00	17.70	21.00	2.0	152	Sand	n/a	n/a											
							7/26/2017	3:24 PM	dry	<836.16																				
					0.74	856.52	1/19/2018	2:00 PM	dry	<836.16											21.00	24.00	20.70	24.00	2.0	159	Sand	n/a	n/a	
							6/22/2018	2:07 PM	dry	<836.16																				
							9/10/2018	10:50 AM	dry	<836.16																				
							1/5/2019	10:50 AM	dry	<836.16																				
							4/1/2019	11:01 AM	dry	<836.16																				
							6/1/2019	11:00 AM	dry	<836.16																				
							8/28/2019	2:08 PM	dry	<836.16																				
							11/22/2019	1:10 PM	dry	<836.16																				
TOB97-07-24	9/23/1997	617886.71	6053578.67	819.13	0.6	819.73	8/22/1997	-	dry	<796.47	21.00	24.00	20.70	24.00	2.0	159	Sand	n/a	n/a											
							7/26/2017	12:30 PM	dry	<796.47																				
					0.9	820.03	3/26/2018	2:50 PM	dry	<796.47											40.00	43.05	39.60	43.34	1.5	122	Sand	n/a	2110531	
							6/25/2018	11:10 AM	dry	<796.47																				
							9/8/2018	1:15 PM	dry	<796.47																				
							1/4/2019	1:43 PM	dry	<796.47																				
							4/1/2019	3:00 PM	dry	<796.47																				
							5/30/2019	11:30 AM	dry	<796.47																				
							8/28/2019	3:44 PM	dry	<796.47																				
							11/23/2019	11:40 AM	dry	<796.47																				
W3 Shallow	2/24/2018	618515.25	6053378.95	809.11	1	810.11	4/28/2018	3:37 PM	34.38	775.73	40.00	43.05	39.60	43.34	1.5	122	Sand	n/a	2110531											
							6/18/2018	11:15 AM	34.50	775.61																				
							9/8/2018	9:00 AM	34.39	775.73																				
							1/4/2019	9:50 AM	34.29	775.82																				
							2/7/2019	1:43 PM	34.51	775.60																				
							2/10/2019	12:35 PM	34.48	775.63																				
							3/30/2019	9:45 AM	34.53	775.58																				
							5/31/2019	9:14 AM	34.44	775.67																				
							8/27/2019	10:40 AM	34.44	775.67																				
							11/20/2019	11:50 AM	34.53	775.58																				

Appendix 5-E. Summary of Groundwater Monitoring Wells and Water Levels, Tenas Project, 2017 to 2019

Well ID	Installation Date	UTM Zone 9U		Ground Surface Elevation (m asl)	Measured Standpipe Stickup Height (m ags)	Top of PVC Elevation (m asl)	Manual Water Level Readings				Screen		Sand Pack		PVC Casing Diameter (in)	Drilled Diameter (mm)	Lithology	Vertical Hydraulic Gradient (m/m)	Datalogger	Comments
		Easting (m)	Northing (m)				Date	Time	Water Level Measurement (m btoc)	Water Level (m asl)	From (m bgs)	To (m bgs)	From (m bgs)	To (m bgs)						
Overburden Wells (cont'd)																				
W2	2/17/2018	616245.42	6052647.37	852.00	0.8	852.8	4/24/2018	11:30 AM	51.30	801.50	113.30	116.40	111.70	116.80	2.0	122	Sand	n/a	2110536	
							6/22/2018	10:00 AM	nm	-										Not measured; water level tape malfunction.
							9/10/2018	8:48 AM	50.80	802.00										
							1/5/2019	9:30 AM	51.23	801.58										
							4/1/2019	9:55 AM	51.61	801.19										
							6/1/2019	9:08 AM	51.36	801.44										
							8/28/2019	9:45 AM	50.94	801.86										
							11/22/2019	9:45 AM	51.02	801.78										
							GEO 11	2/2/2018	617696.50	6054253.26										800.23
6/27/2018	9:49 AM	dry	<786.17																	
9/8/2018	3:06 PM	dry	<786.17																	
1/10/2019	2:45 PM	dry	<786.17																	
4/2/2019	3:50 PM	dry	<786.17	9 cm of water in the well but we bailed out mud and water, therefore we believe this is leftover from the drilling. Well is dry.																
6/6/2019	2:10 PM	dry	<786.17	3 cm of standing water/mud at the bottom. We may not have bailed the mud completely out on April 2, 2019.																
8/30/2019	2:06 PM	dry	<786.17																	
11/28/2019	2:23 PM	dry	<786.17																	
GEO 13	2/17/2018	617808.78	6053407.77	814.45	0.87	815.32					4/2/2018	4:30 PM	dry	<797.51	14.90	17.90	14.29	18.51	2.0	
							6/25/2018	11:24 AM	dry	<797.51										
							9/8/2018	1:25 PM	dry	<797.51										
							1/4/2019	1:52 PM	dry	<797.51										
							4/1/2019	3:10 PM	dry	<797.51										
							5/30/2019	11:40 AM	dry	<797.51										
							8/28/2019	4:08 PM	dry	<797.51										
							11/23/2019	1:07 PM	dry	<797.51										
							GEO 22	2/13/2018	618920.65	6051994.78	835.75	0.75	836.5	4/3/2018						3:20 PM
6/25/2018	10:40 AM	dry	<825.25																	
9/8/2018	2:00 PM	dry	<825.25																	
1/4/2019	2:40 PM	dry	<825.25																	
1/4/2019	2:40 PM	dry	<825.25																	
4/1/2019	3:40 PM	dry	<825.25																	
5/31/2019	12:45 PM	dry	<825.25																	
8/31/2019	10:51 AM	dry	<825.25																	

Notes:

Well details for installed prior to 2018 are from Baseline Hydrogeological Investigations in the Tenas Pit, Waste Dumps, and Mine Pit 3, Telkwa Coal Project, prepared by Piteau Engineering Ltd., 1997.

Where there were discrepancies in the screen and sand intervals between Table 1 and the well logs from the 1997 Piteau baseline report, the information from the well logs was used.

2018 well construction details provided by SRK.

Ground surface elevations for all wells derived from topo model data provided by the project geologist Ron Parent, April 2019.

* - Revisions were made to these values as Piteau measurements differ from the field depth to bottom measured in 2017. The measured depth to bottom in 2017 was deeper than the bottom of the well from the Piteau reports.

nm not measured

m asl meters above sea level

m btoc meters below top of casing

m ags meters above ground surface

m bgs meters below ground surface

nc not calculated