



Vegetation and Wetland Resources



MILLENNIUM
EMS Solutions Ltd.

6111 91 Street
Edmonton, AB T6E 6V6
tel: 780.496.9048
fax: 780.496.9049

Suite 325, 1925 18 Avenue NE
Calgary, AB T2E 7T8
tel: 403.592.6180
fax: 403.283.2647

#106, 10920 84 Avenue
Grande Prairie, AB T8X 6H2
tel: 780.357.5500
fax: 780.357.5501

10208 Centennial Drive
Fort McMurray, AB T9H 1Y5
tel: 780.743.4290
fax: 780.715.1164

toll free: 888.722.2563
www.mems.ca

Obed Mountain Mine Wastewater Release Monthly Status Report for August 2014

Prepared for:
Coal Valley Resources Inc.

Prepared by:
Millennium EMS Solutions Ltd.
6111 – 91 Street
Edmonton, Alberta
T6E 6V6

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Table of Contents

	Page
Table of Contents.....	i
List of Tables	ii
List of Figures	ii
List of Appendices	ii
1.0 CLAUSE 11: LONG TERM SAMPLING AND MONITORING PLAN	1
1.1 Vegetation and Wetlands Sampling and Monitoring Plan.....	1
1.2 Methodology: Permanent plot selection and establishment	1
1.3 Methodology: Data Collection.....	2
1.3.1 Ecosite Verification	2
1.3.2 Monitoring and reference plots.....	4
1.4 Planned Work.....	9
1.5 References	9

List of Tables

	Page
Table 1: Locations of Ecosite verification plots surveyed within the Obed LSA	3
Table 2: Data Collected from Each Plot.....	4
Table 3: Locations of monitoring and reference plots established within the Obed LSA.....	6

1.0 CLAUSE 11: LONG TERM SAMPLING AND MONITORING PLAN

1.1 Vegetation and Wetlands Sampling and Monitoring Plan

The Vegetation and Wetlands Sampling and Monitoring Plan was originally submitted to the ESRD as part of the combined Long-Term Sampling and Monitoring Plan, Impacts Assessment Plan and Wildlife Mitigation Plan on December 13, 2014. CVRI received approval of the parent plans, Long-Term Sampling and Monitoring Plan, Impacts Assessment Plan and Wildlife Mitigation Plan on April 24, 2014. The vegetation and wetlands sampling and monitoring plan was designed to address the success of both natural and assisted vegetation recovery within the three zones of the water release impact.

The setting up of permanent vegetation sampling plots and collection of monitoring data within these plots commenced in the summer of 2014. Two field surveys were undertaken during the months of June and August 2014. These field surveys achieved three main objectives:

1. **Ecosite Verification** (June 2014) – The preliminary ecosite map generated following the water release was ground-checked and mapped ecosites/wetlands verified. This work included a full vegetation inventory at all plot locations (Methodology section). Sampling plots for ecosite verification were pre-selected via stratification of ecosite areas within the Obed LSA.
2. **Monitoring Plot Set-up in Zone 1, 2 and 3** (June and August 2014) – Monitoring plot locations were selected and permanent plots established (Section 1.3). 21 permanent monitoring plots were established along the creek within the disturbance/reclamation footprint. Additionally two reference plots were established along tributaries in Zone 1 to serve as control sites.
3. **Data Collection in Zone 1 monitoring plots** (June 2014) and **re-assessment of Zone 1 monitoring Plots** (August 2014) – Zone 1 vegetation monitoring plots were re-assessed following outlined data collection methodology (Section 1.3). In addition, the survival of any planted trees and willow stakes within reclamation areas observed within the permanent vegetation monitoring plots was assessed.

1.2 Methodology: Permanent plot selection and establishment

Permanent vegetation monitoring and reference plots were set up within the three zones of impact and along the creek. Whenever possible, monitoring and reference sites were paired, with monitoring plots selected to represent changes in the vegetation community and levels of impact by the water release, and reference to represent vegetation communities of similar classification located away from the zones of impacts.

Plots were set up to avoid edge effects, transition zones and small variations in topography. In plots where polygons were large enough to avoid the above effects; 20 m by 20 m plots were established. In narrower polygons, the plot shape was adjusted to ensure that the sampled community/stand was homogenous with respect to vegetation and other site characteristics. The total area of each survey plot was 400 m². All plots were orientated parallel to the contour of the land with one edge starting at the creek bank. All permanent monitoring plots were marked with two rebar corner pins and flagging. The four corners (SE, NE, SW and NW) were marked and the start of plot clearly marked to be used a reference point for setting up shrub and forb data plots (See section 1.3.2).

1.3 Methodology: Data Collection

1.3.1 Ecosite Verification

Preliminary ecosite-phase maps (Beckingham & Archibald 1996) were developed based on recent pre-disturbance Valtus 0.5 metre color pixel orthophotography, bare earth 5 metre LiDAR, GPS locations and data on dominant tree and shrub species collected during the preliminary field assessment in November 2013. These ecosite maps, areas summaries and descriptions of dominant ecosite phases within the Obed LSA were submitted with the December preliminary impact assessment report.

In the summer of 2014 (June and August), detailed plant community identification and ecosite-phase verification was completed. Sampling plots for ecosite verification were pre-selected via stratification of ecosite areas identified in the preliminary ecosite map of the Obed LSA. A detailed vegetation and wetlands inventory was conducted on each sampling plot. Alberta Vegetation Inventory (AVI) type data was collected on 20 x 20 m plots; shrub and forb (graminoids, mosses and lichens) data was collected in 10 x 10 and 5 x 5 m plots, respectively, nested within the 20 x 20 m main plot. In each plot, a comprehensive list of vascular and non-vascular species and their percent covers was recorded.

In each plot, ecosite classifications were conducted to the plant community type level (Beckingham & Archibald 1996) at each sample site. Additional ecosite calls (Ecocall) were performed while in transit between sampling plots. Ecocall sites constitute plots that were added in the field to further improve the mapping process.

Ecosite classifications in the field were made by evaluating plant indicator species and topographic features. In areas where ecosite phases were difficult to distinguish based on this information alone, a shallow soil pit was dug to determine basic soil properties and the moisture and nutrient regime of the site. Additionally, wetland calls following the Alberta Wetland Classification System (Halsey *et al.* 2003) were made where applicable.

GPS coordinates for all permanent plots were recorded for future mapping and data analysis and are provided in Table 1.

Table 1: Locations of Ecosite verification plots surveyed within the Obed LSA			
Plot Number	Northing	Easting	Plot Type
EC012	5942202	483677	Ecocall
EC04	5944506	478039	Ecocall
EC05	5944749	478670	Ecocall
ECO01	5943833	476719	Ecocall
ECO011	5944471	483493	Ecocall
ECO02	5943561	476448	Ecocall
ECO03	5943242	476024	Ecocall
ECO06	5944808	482735	Ecocall
ECO07	5945659	482355	Ecocall
ECO08	5945463	482317	Ecocall
ECO09	5945349	482240	Ecocall
ECO10	5945634	481984	Ecocall
ECO13	5943568	482189	Ecocall
ECO14	5944202	481184	Ecocall
OB02EE	5943361	482186	Ecosite + Diversity + Rare
OB03EE	5944197	483568	Ecosite + Diversity + Rare
OB05EE	5944244	480997	Ecosite + Diversity + Rare
OB06EE	5943797	477398	Ecosite + Diversity + Rare
OB09EE	5943040	476684	Ecosite + Diversity + Rare
OB11EE	5944815	482247	Ecosite + Diversity + Rare
OB11EE	5946319	482329	Ecosite + Diversity + Rare
OB13EE	5944528	478913	Ecosite + Diversity + Rare
OB14EE	5945715	481603	Ecosite + Diversity + Rare
OB15EE	5942996	476077	Ecosite + Diversity + Rare

Table 1: Locations of Ecosite verification plots surveyed within the Obed LSA			
Plot Number	Northing	Easting	Plot Type
OB16EE	5942149	474044	Ecosite + Diversity + Rare
OB18EE	5941674	474516	Ecosite + Diversity + Rare
OB19EE	5941138	475063	Ecosite + Diversity + Rare
OB21EE	5939555	472330	Ecosite + Diversity + Rare
OB22EE	5937649	472336	Ecosite + Diversity + Rare

1.3.2 Monitoring and reference plots

A nested plot design was used to collect tree, shrub and herbaceous plant species information from each permanent plot. First, tree data were collected from the 20 m by 20 m main plot. Tree data included Alberta Vegetation Inventory (AVI) type data including canopy cover, dominant tree species and average heights on each stratum. Tree height and diameter at breast height (1.4 m) was assessed from a maximum of ten randomly selected trees of the dominant species within each 20 m x 20 m tree plot. Epiphytic lichens were documented qualitatively based on the amount of cover on woody plant species within the 20 m by 20 m main plot. Second, shrub data (species, percent cover, average height and vigor) was collected from four 4 m by 4 m subplots nested within the 20 x 20 m plot and located in each corner of the plot. Only shrub species with > 1% cover in the subplot were assessed for vigor. Third, six 1 x 1 m subplots were randomly selected within each main plot and herbaceous (forb, graminoid, bryophyte and ground lichens) plant composition and percent cover recorded. All vascular plants within each were identified to species, and species with cover greater than 1 percent assessed for vigour. Digital photographs of the main plot and each subplot were taken to assist in documenting vegetation changes over time. Table 2 below provides a summary of the three plot types, their dimensions and data collected on each plot type.

Table 2: Data Collected from Each Plot	
Plot size	Data Collected
General Site Data	Plot #; GPS Coordinates; Surveyor
	Natural Subregion
	surface shape and expression

	moisture regime
	nutrient regime
	aspect
	slope, slope position, and slope length
	Ecosite Phase
	Plant community Type
	wildlife use observations
	General observations/Notes
20 m by 20 m (Where applicable – see Table 4)	Total species canopy cover
	Height
	Average age (tree cores)
	diameter at Breast Height (DBH)
	Qualitative estimation of epiphytic lichens
4m by 4 m plots	Shrub species cover
	Average shrub species height
	Shrub species health
1m by 1m plots	Forb species cover
	Forb species health
	Graminoid species cover
	Graminoid species health
	Bryophyte species cover
	Ground lichen species cover

Vigor of all vascular species (trees, shrubs and herbaceous species) was recorded using a four-point scale:

1. Healthy (0-10% leaves dead);
2. Light to moderate decline (11-50% leaves dead);
3. Severe decline (>50% leaves dead); and
4. Dead (100% leaves dead).

Vascular and non-vascular plant species that could not be identified in the field were collected for later identification. Specimen collection followed ANPC guidelines (Alberta Native Plant Council (ANPC) 2012), which state that one sample of vascular plants can only be collected where there are at least 50 or more individuals in a population or within a localized area.

The soil nutrient regime, soil moisture regime and other soil and terrain information for each site will be collected to determine the ecosite phase of the site/polygon. Soils and terrain data was gathered by

digging a shallow soil pit. Sediment depth and/or presence of erosion were noted at all monitoring locations.

Additional information collected within sampling plots and while moving from site to site included wildlife information (nests and other incidental wildlife observations such as wildlife scat) as well as presence of tree snags.

GPS coordinates for all permanent plots were recorded and are provided in Table 3.

Table 3: Locations of monitoring and reference plots established within the Obed LSA				
Plot Number	Plot corner labels	Northing	Easting	Plot dimensions
VM001	VM001 SW STRT	5938881.457	472326.275	40X10m
	VM001 SE	5938875.269	472338.019	
	VM001 NW	5938904.280	472361.551	
	VM001 NE	5938893.564	472367.577	
VM002	VM002 SE STRT	5939202.209	472765.190	20X20m
	VM002 SW	5939224.625	472755.988	SW CORNER
	VM002 NE	5939214.384	472776.047	NW CORNER
	VM002 NW	5939234.642	472774.509	
VM004	VM004 SW STRT	5939478.445	473154.955	20X20m
	VM004 NE	5939482.992	473176.951	
	VM004 NW	5939492.758	473161.787	
	VM004 SE	5939463.003	473170.418	
VM005	VM005 SW STRT	5939885.432	473466.738	20X20m
	VM005NE	5939878.164	473492.899	
	VM005NW	5939894.955	473474.731	
	VM005SE	5939871.023	473476.780	
VM006	VM006 SE STRT	5938635.770	471036.414	20X20m
	VM006 NE	5938653.509	471046.450	
	VM006 NW	5938667.504	471032.174	
	VM006 SW	5938650.690	471016.385	

Table 3: Locations of monitoring and reference plots established within the Obed LSA				
Plot Number	Plot corner labels	Northing	Easting	Plot dimensions
VM007	VM007 NW STRT	5938557.286	471518.757	10X80m
	VM007 NE	5938551.705	471595.499	
	VM007 NW	5938553.822	471594.983	
	VM007 SE	5938558.511	471518.632	
VM009	VM009 SW STRT	5938594.778	472151.781	
	VM009 NE	5938596.159	472181.573	
	VM009 NW	5938610.479	472168.222	
	VM009 SE	5938581.554	472167.985	
VM013	VM013 SE STRT	5941543.566	474395.342	20X20
	VM013 NE	5941552.270	474411.065	
	VM013 NW	5941561.150	474394.313	
	VM013 SW	5941544.690	474372.727	
VM015	VM015 SE STRT	5942161.090	475006.346	20X20
	VM015 NE	5942170.701	475019.095	
	VM015 NW	5942185.214	474988.883	
	VM015 SW	5942166.330	474983.359	
VM016	VM016B STRT	5942378.286	475211.978	20X20
VM017	VM017 NW STRT	5942316.360	475288.366	20X20
	VM017 NE	5942309.822	475304.534	
	VM017 SE	5942294.805	475304.058	
	VM017 SW	5942294.907	475284.550	
VM018	VM018 STRT	5942334.845	475327.547	20X20m
VM019	VM019 SE STRT	5942560.480	476499.672	20X20
	VM019 NE	5942578.233	476531.436	
	VM019 NW	5942584.986	476515.863	
	VM019 SW	5942566.884	476487.205	
VM020	VM020 STRT	5943102.158	476977.390	10X40

Table 3: Locations of monitoring and reference plots established within the Obed LSA				
Plot Number	Plot corner labels	Northing	Easting	Plot dimensions
	VM020 NE	5943143.171	476985.724	
	VM020 NW	5943136.918	476967.576	
	VM020 SW	5943105.889	476965.242	
VM021	VM021 STRT	5943245.936	477732.775	10X10
VM023	VM023 NW STRT	5943834.718	478591.560	20X20
	VM023 NE	5943857.883	478610.837	
	VM023 SE	5943838.161	478617.359	
	VM023 SW	5943829.828	478615.007	
VM024	VM024 SW STRT	5943896.887	478842.530	10X40
	VM024 NE	5943933.500	478865.172	
	VM024 NW	5943946.935	478846.391	
	VM024 SE	5943889.661	478841.242	
VM025	VM025 SW STRT	5944678.405	479998.406	10X40
	VM025 NE	5944704.127	480019.402	
	VM025 NW	5944702.337	480021.642	
	VM025 SE	5944674.543	480017.095	
VM027	VM027 STRT	5944856.761	481320.285	10X40
VM028	VM028 CONTROL STRT	5942060.857	483734.405	20X20
VM0029	VM0029 CONTROL	5941938.464	483867.511	10X10
VM030	VM030 STRT SW	5940389.183	473528.921	20X20
	VM030 NE	5940383.617	473549.267	
	VM030 NW	5940402.457	473542.426	
	VM030 SE	5940372.816	473531.012	
VM031	VM031 STRT SE	5940609.910	473509.852	10X40
	VM031 NE	5940643.859	473507.000	
	VM031 SW	5940640.161	473492.028	

Table 3: Locations of monitoring and reference plots established within the Obed LSA				
Plot Number	Plot corner labels	Northing	Easting	Plot dimensions
	VM031 SW	5940604.156	473504.395	

1.4 Planned Work

All data collected in the summer of 2014 will be presented with the October 2014 quarterly report. Work planned includes:

1. Plant identification and species confirmation
2. Data entry and data QAQC
3. Data analysis and summaries
4. Post-field ecosite mapping

The long-term sampling and monitoring plan will focus on monitoring the establishment of vegetation resources. It is anticipated that once the full extent of the impact is known the plan can be adjusted. It is also expected that as remedial activities are undertaken the sampling and monitoring plan for vegetation and wetland resources will need to be adjusted to include all areas disturbed by both the incident and the remedial activities. Monitoring will continue during the summer of subsequent years until success criteria are met. Success criteria will be set as a comparison against vegetation composition and health within reference sites.

1.5 References

- Alberta Native Plant Council (ANPC). (2012). *ANPC Guidelines for Rare Vascular Plant Surveys in Alberta - 2012 Update*. Alberta Native Plant Council, Edmonton, AB. Retrieved January 24, 2014, from <http://www.anpc.ab.ca/content/resources.php>
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- Halsey, L.A., Vitt, D.H., Beilman, D., Crow, S., Mehelcic, S. & Wells, R. (2003). *Alberta Wetland Inventory Classification System Version 2.0*. Alberta Sustainable Resource Development, Edmonton, AB.