Appendix N

Watershed Monitoring Plan

Chokecherry and Sierra Madre Wind Energy Project

Watershed Monitoring Plan

Prepared for

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1.0 INTRODUCTION

This Watershed Monitoring Plan (Plan) for Power Company of Wyoming's (PCW) Chokecherry and Sierra Madre Wind Energy Project (Project) provides an overview of methods that will be used to supplement existing data and better characterize pre-construction and post-construction watershed conditions. Efforts described in this plan will be closely coordinated with the efforts associated with the Project's Master Reclamation Plan (MRP), Stormwater Pollution Prevention Plan (SWPPP), and other ongoing monitoring efforts being completed by the Bureau of Land Management Rawlins Field Office (BLM RFO), the Saratoga-Encampment-Rawlins Conservation District (SERCD), PCW, and The Overland Trail Cattle Company (TOTCO).

The Project is located within the Upper North Platte basin (HUC 10180002) and the Muddy Creek basin (HUC 14050004) (Figure 1). The Muddy Creek Basin falls within the Upper Colorado River Basin and is a tributary to the Little Snake River. Within the Upper North Platte basin, Project activities will occur in the Sage Creek, Iron Spring Draw, and Sugar Creek watersheds. Within the Muddy Creek basin, Project activities will occur in the Upper Muddy Creek watershed. Waters potentially affected by Project activities include Sage Creek, Little Sage Creek, Hugus Draw, Smith Draw, and Iron Spring Draw in the Upper North Platte and McKinney Creek, Grove Creek, and Stoney Creek in the Muddy Creek basin. Several unnamed tributaries to these waters will also be affected by project activities.

The Project is located on private lands, federal lands administered by the BLM ("public lands") and state lands under the management of the Wyoming State Board of Land Commissioners, as well as lands under the administration of the Wyoming Game and Fish Commission (collectively referred to as "state lands"). This Plan is designed to better define current watershed conditions and monitor future conditions of the watersheds. Final monitoring sites may be placed on private, state, or public lands and will monitor channel characteristics and water quality.

2.0 PREVIOUS AND ONGOING SURVEYING EFFORTS

Substantial surveying and watershed enhancement efforts have occurred in the watersheds draining the Project area. These surveying efforts help establish baseline conditions in the Project area and will be used as the basis of future monitoring efforts. Past and ongoing surveying efforts are described in the sections below.

Sage Creek, in the Upper North Platte basin, was removed from Wyoming's 303(d) list in 2008 (WDEQ 2008). Because of naturally high sediment loads originating from highly erodible shale formations and soils, Sage Creek has been identified as a substantial contributor of sediment to the upper North Platte River. In 1997, the SERCD, in cooperation with landowners and other agencies, received a Section 319 Grant from the Environmental Protection Agency (EPA) to address sedimentation issues in Sage Creek and the Upper North Platte River. The grant funded projects to improve water quality in Sage Creek. Projects included rotational grazing management, upland water development, cross fencing, riprap, irrigation structures, culverts, and road reshaping (BLM 2002b; WDEQ 2008, SERCD 2007).

The projects have been implemented and land management Best Management Practices (BMPs) are still in effect. The BMPs consist of a combination of short duration grazing, riparian fences, and drift fencing (WDEQ 2008). Data collected following implementation of projects and BMPs showed reduced sediment loading in the North Platte River and improved riparian and range conditions, which indicates Sage Creek is fully supporting designated water quality classifications (WDEQ 2001). In addition to surveying efforts completed by the SERCD (SERCD 2007), BLM has photo documentation points along Sage Creek and Little Sage Creek and has completed riparian Proper Functioning Condition (PFC) assessments.

Portions of McKinney Creek where Project activities will occur were removed from Wyoming's 303(d) list in 2000 as a result of Section 319 funded watershed improvement projects and BMPs that have been occurring since 1992 (WDEQ 2008). Projects in the Upper Muddy Creek watershed include upland water development, cross fencing, vegetation management, and improved grazing management. Reaches of McKinney Creek downstream of its confluence with Eagle Creek remain on Wyoming's 303(d) list. Impaired reaches are approximately 20 stream-miles downstream from all planned Project activities. Impairment of the downstream reaches of McKinney Creek occurs as a result of channel degradation and naturally high sediment yields from erosive shale formations and soils near the confluence of Eagle and Muddy creeks. Reaches of McKinney Creek adjacent to Project activities are in compliance with Wyoming water quality standards and primarily drain stable sandy to sandy-loam soils with high gravel and cobble content. In addition to and in support of past and ongoing watershed improvement efforts, BLM has multiple photo documentation points and channel surveying sites in the Upper Muddy Creek watershed downstream from planned Project activities. PFC assessments for Upper Muddy Creek have been completed by the BLM.

The BLM has numerous historic photo documentation points in the Iron Springs Draw watershed. However, many of these photo points have not been visited consistently over time and no known channel surveying or water quality data have been collected in the watershed.

Changes in watershed condition in the upper reaches of the Little Sage Creek watershed may have occurred as a result of recent hydrocarbon releases. These hydrocarbon releases are not related to any Project activities. It is believed that water quality samples have been collected to determine the effect of the hydrocarbon release. As those data become available, they will be used to help establish baseline water quality conditions upstream from and in the Project area. Future monitoring efforts to document the effects of the hydrocarbon release will occur separately from this Plan and will not be the responsibility of PCW or TOTCO.

Other future monitoring efforts are anticipated in the Upper Muddy Creek watershed as part of ongoing 303(d) sampling, the Upper Muddy/Grizzly Wildlife Habitat Management Area planning, and potential future fisheries improvement projects planned by the Wyoming Game and Fish Department. These anticipated future monitoring efforts will occur separately from this Plan and will not be the responsibility of PCW or TOTCO.

While substantial surveying, land management, and watershed improvement efforts have occurred and are planned across TOTCO and in the Muddy Creek and Upper North Platte basins, the existing and planned monitoring may not adequately characterize the current

baseline water quality and channel conditions in the watersheds draining the Project area. To remedy this, PCW and the BLM have collaborated to identify the efforts required to better establish baseline watershed conditions and monitor those conditions following Project construction and operations activities. The methods and monitoring approaches identified in this document will be closely coordinated with the MRP, SWPPP, and other compliance and monitoring efforts associated with the Project to streamline all monitoring activities and maximize the benefits of all data being collected.

3.0 WATERSHED MONITORING ACTIVITIES

Monitoring sites will be located throughout the Project area, such that the whole Project is adequately represented. Some existing monitoring sites will be used; however, the majority of sites will be newly established to bracket Project disturbances. Approximate locations of monitoring sites (Figure 1) have been determined based on possible turbine configurations and possible locations of major roads and other Project infrastructure. Final monitoring sites will be determined in coordination with the BLM hydrologist.

There are 21 proposed monitoring sites in the Project area. No additional monitoring sites are anticipated to be needed. Monitoring will be completed on an annual basis prior to construction, throughout construction and for the first three years following construction. After three years of post-construction monitoring, the frequency and type of monitoring will be reassessed. Monitoring efforts will be consistently completed during late summer/early fall baseflow conditions.

All monitoring sites will be permanently monumented using a metal stake or capped and labeled rebar. The location of monitoring sites will be recorded using GPS. Data collected during monitoring efforts will be electronically submitted to BLM for review at the earliest practicable time following field and data entry efforts. The following sections describe the proposed monitoring methods.

3.1 CHANNEL AND STREAMBED MONITORING

During each monitoring event, the physical characteristics of the streambed will be defined. Channel cross sections and a longitudinal profile will be recorded using a total station or other appropriate technology that is positioned directly over the permanent monument stake at each site. Each cross section and the upstream and downstream extents of the longitudinal profile will be monumented. Ends of cross sections will be placed at an elevation of twice the maximum bankfull depth to ensure flood prone areas are captured in surveys (Rosgen 1996). The number of cross sections collected per monitoring site will vary depending on the type of stream flow (i.e., perennial or ephemeral). Cross sections will be used to identify erosional and depositional processes, mass wasting events, and other changes in channel morphology at a site. Wolman pebble counts (Wolman 1954) will be conducted in a zig-zag pattern along the longitudinal profile of the channel to document sediment particle size at each monitoring site.

3.1.1 Perennial Streams

Three cross sections will be measured for all perennial streams. One cross section each will be measured in a pool, a riffle, and a run to document baseline characteristics and monitor future changes in channel shape in each of these major habitat types. In the event that a monitoring site does not have each of the three habitat types, cross sections will be placed in the most representative habitat types for that site.

The longitudinal profile for perennial stream monitoring sites will be measured along the thalweg through each of the three habitat types where cross sections are collected, or for two stream meanders whichever is greater in length. If these conditions do not occur at a particular site, the longitudinal profile and total site length will be capped at 40-times the length of the wetted width.

3.1.2 Ephemeral Streams

One cross section will be measured for all ephemeral streams. The location of the cross section will be in coordination with the BLM hydrologist. A longitudinal profile will be recorded for each ephemeral stream and will encompass two stream meanders. The longitudinal profile will generally follow what would be the channel thalweg if the channel were carrying water.

3.2 GREENLINE MONITORING

Monitoring of the greenline will be used to document trends and changes in riparian vegetation that may influence stream erosional and depositional processes. Where riparian vegetation is not present, greenline monitoring will record upper bank vegetation or vegetation within and adjacent to the channel as appropriate. Greenline monitoring will be completed along the length of the longitudinal profile for each site generally following the methods presented in Cagney (1993). Specific greenline monitoring methods will be determined during initial site visits in coordination with the BLM hydrologist. Greenline transects will be completed on both sides of each stream.

3.3 STREAMFLOW

At perennial stream monitoring sites, flow will be calculated from water velocity measurements (using a Marsh-McBirney flow meter or similar) and water depth measurements collected across a channel cross section. The precise location of flow measurements will vary each year and will depend on channel characteristics and flow volumes.

3.4 WATER QUALITY MONITORING

Water quality samples will be collected at perennial stream monitoring sites and sites with flowing water at the time of monitoring. Turbidity, pH, electrical conductivity, salinity, temperature, and dissolved oxygen will be measured on-site with a handheld water quality meter (Yellow Springs Instrument 556 Handheld Multiparameter Meter or similar). Grab samples will be collected and sent to a certified water quality lab for analysis of total

dissolved solids (TDS), major cations and anions, selenium, and selected other water quality constituents to be determined in coordination with the BLM, private landowners, and the state of Wyoming.

3.5 PHOTO DOCUMENTATION

Prior to monitoring at each location, a reference photograph will be taken of a dry erase board that displays the stream name, monitoring site name, date, time, and names of the data collectors. Site photos will be taken at each cross section in upstream and downstream directions as well as from either side of the cross section. Photos will also be taken for each erosional or depositional feature of each site. A graduated survey rod or other appropriate method will be used to document the scale of each photo that is taken. Site photos will also be taken in upstream and downstream directions at either end and at the center point of each greenline transect. A standard photo log will be used to record the location, direction, and description of each photo that is taken.

4.0 COORDINATED MANAGEMENT

Monitoring will be completed on an annual basis prior to construction, throughout construction and for the first three years following construction. Following the third year of post-construction monitoring, the need for future monitoring will be determined and the frequency and duration of those monitoring activities will be established as necessary. The watershed monitoring process will be integrated into the management framework for other Project monitoring, conservation, and compliance activities.

5.0 REFERENCES

Cagney, J. 1993. Riparian area management: greenline riparian-wetland monitoring. BLM Technical Reference 1737-8. U.S. Department of the Interior Bureau of Land Management, Denver, CO.

Rosgen, D. 1996 Applied River Morphology. Wildland Hydrology, Pagosa Springs, Colorado.

Wolman, M.G. 1954. A method of sampling coarse river-bed material. Transactions of the American Geophysical Union, 35:951-956.

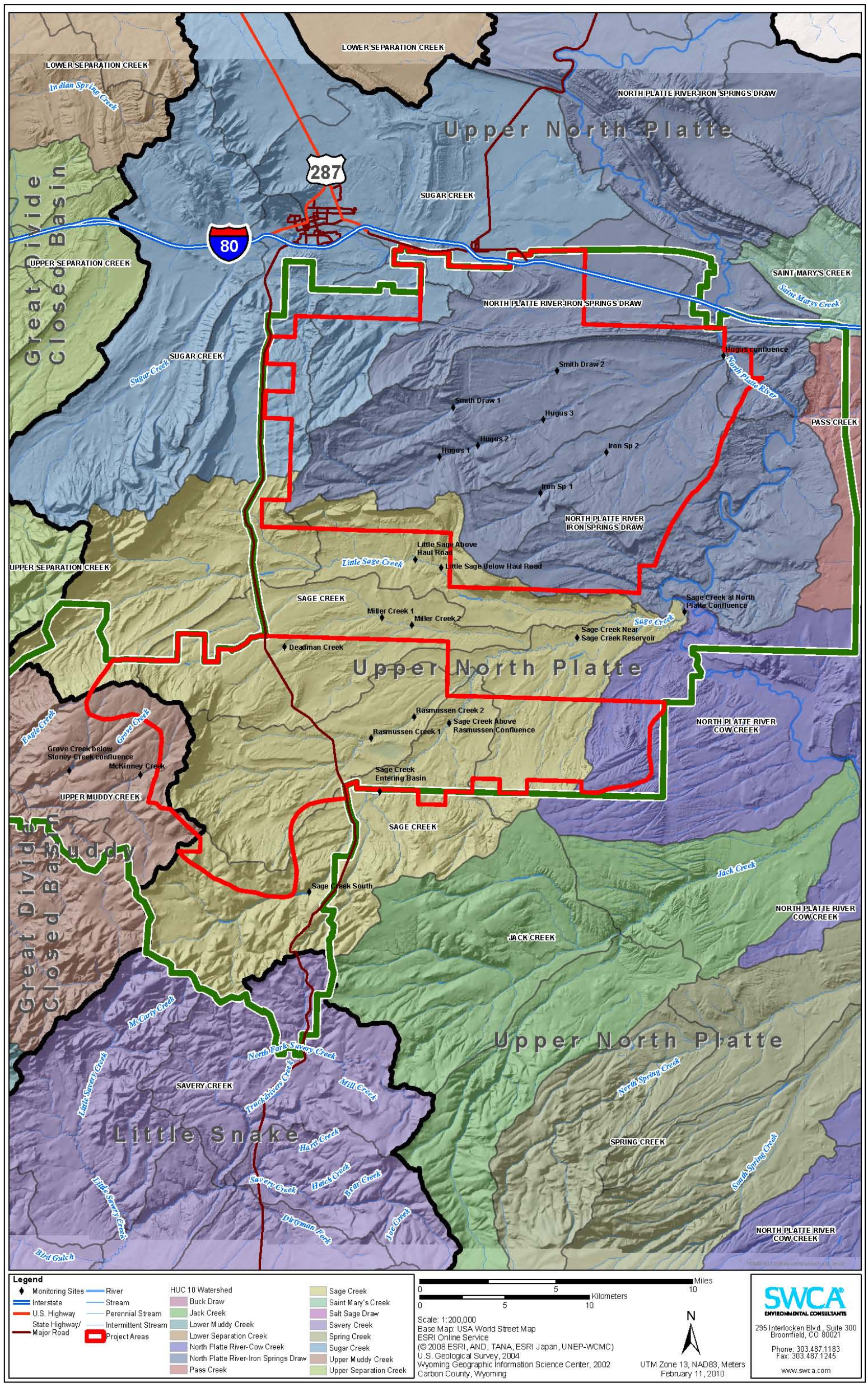

Figure 1. Watersheds and preliminary sampling points in the Project area. Final sampling points will be determined based on site conditions evaluated during the first year of data collection efforts.