RECLAMATION OF PORCUPINE CREEK RIPARIAN AND WETLAND HABITATS[1]

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Abstract. The North Antelope/Rochelle Mine Complex is located in the Eastern Powder River Basin between the towns of Gillette to the north and Douglas to the south. Elevations in the permit area range between about 4600 and 5000 feet above mean sea level. Porcupine Creek dominates the present morphology of the permit area. The entire drainage basin of Porcupine Creek is an erosional landscape with stream channels often gullied to the point where active flood plains are limited in extent. Porcupine Creek is classified as ephemeral, flowing only in response to snowmelt and rainfall in the watershed. The area receives approximately twelve inches of annual precipitation while annual potential evapotranspiration is twenty-five to thirty inches.

Following mining, the North Antelope Rochelle Mine Complex was required to restore the function of Porcupine Creek. The goals of the project were to create a creek structure and hydrology that will recharge local ground water, establish a maximum amount of wetland and riparian habitat that sustains hardy emergent and submergent obligate wetland vegetation, develop an alternating, stepped pool/riffle design and sinuous channel to simulate pre-mine conditions, and to stabilize streambanks that may erode during bank-full flows.

Porcupine Creek valley was reclaimed to follow a sinuous path within the permit area. The valley is designed to hold the 100-year flood and to be topographically suitable for flood irrigation agricultural activities. During the pre-mining surface water hydrologic studies, it was discovered that three levels of flow capacity are reflected in the pre-mining cross section of the existing Porcupine Creek channel and flood plain. The pre-mining discharges were identified as 35 cubic feet per second, 700 cfs and 6000 cfs, corresponding to the active; low flow channels and the flood plain. To encourage future agricultural activities and to discourage flood erosion of the surfaces, the low flow and flood plain channel are designed to have a large width/depth ratio. The active channel is expected to be sub-irrigated and the low flow channel should naturally flood irrigate.

Additional Key Words: wetland, riparian, sub-irrigated, alluvium, obligate wetland species, erosion, water quality, self-sustaining

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The slope of the reconstructed Porcupine Creek channel will be approximately equivalent to the pre-mining slope of 0.23 percent and is directly related to the stability of the pre-mining channel. The active channel is designed to intersect the anticipated post-mining ground water potentiometric surface which will reestablish the pre-mining area of sub-irrigated land within the area to be mined.

In order to promote sub-irrigation and hydrologic communication between the reconstructed and undisturbed portions of Porcupine Creek, a ten foot thick layer of "coarser" grained alluvial material was used to reconstruct the eighty-foot wide active and low flow channel. The coarse material for reconstruction of Porcupine Creek is at least 60% sand (no more than 40% passing the #200 sieve) and has a hydrologic conductivity of at least 100 gpd/ft2. These 'coarse grained' materials were special handled during mining and stockpiled for this specific use.

Creation of the pool riffle sequences was accomplished by excavation of pools and installing counter weirs made from four foot diameter boulders. The counter weirs serve as essential grade control and are strategically located downstream of each pool. A total of 43 pool/riffle sequences have been strategically located within 5,100 linear feet of reclaimed channel to retain flowing water within pools that will result in formation of riparian and wetland habitat.

The riparian seed mixture was used to revegetate the floodplain and was crimped with a native hay mulch. The species within the seed mix included Western wheatgrass, Green needlegrass, Streambank wheatgrass, Prairie sandreed, Blue grama, Big bluegrass, Alkali sacaton, Western yarrow, Fringed sagewort and Northern sweetvetch. Additionally, obligate wetland species, Nebraska sedge, Needleleaf sedge, Needle spikerush, Common spikerush, Soft-stem bulrush, and Common three-square bulrush were seeded in the active flow channel.

To provide initial streambank protection, one hundred seventy-five five-gallon Coyote willows were planted in the channel meanders. Twenty-five hundred ten cubic inch Coyote willows were planted throughout the entire stream length (5,100 linear feet) to provide additional protection from erosion. To enhance diversity and wildlife habitat, 25 five-gallon chokecherry trees, 20 2.75" caliper chokecherry trees, 1000 ten cubic inch and 100 five gallon Plains cottonwood were planted within the floodplain of reclaimed Porcupine Creek.

Currently, stream flow to the reclaimed creek has been from ahead-of-mining dewatering and from storm water. After-mining flow will be from native Porcupine Creek and a reclamation well drilled near the confluence of Porcupine Creek and Payne Draw. The well was drilled to a depth 900 feet and should produce 10 g.p.m. supplementing groundwater and surface water contributions.

In June of 2001 PRCC contracted InterMountain Resources to conduct wetlands inventory on reclaimed Porcupine Creek. On the reclaimed creek the criteria for hydrophtic vegetation and wetlands hydrology had been met. Hydric soils were

developing as evidence of saturation was present throughout most of the growing season. Nineteen vegetative species that were indicative of wetland development were found within the reclaimed creek. The dominant wetlands plants were saltmarsh bulrush (*Scirpus maitimus*), softstem bulrush (*Scirpus validus*), cattail (*Typha latifolia*), threesquare bulrush (*Scirpus pungens*), and redtop bentgrass (*Agrostis stolonifera*).

Sampling also revealed that macroinvertebrate colonization was superior to that of native Porcupine Creek. The reclaimed creek had 13 different taxa of organisms while the native creek had only eight. The most common of which were Dragonfly nymphs (Odonata). The second most frequently collected organisms were right and left-handed snails (Gastropoda). Waterboatman and Waterstriders (Hemiptera) were commonly collected, as were predaceous water beetles (Coleoptera). With a Pollution Tolerance Index (PTI) of 3, predaceous water beetles indicate that water quality in reclaimed Porcupine Creek is of moderate to excellent water quality. Freshwater shrimp (Amphipoda) were collected in areas with abundant aquatic vegetation. Their presence again indicates that water quality in reclaimed Porcupine Creek is moderate to excellent.

Three nongame fish species, the Plains minnow (Hybognathus placitus), the Plains killifish (Fundulus kansae), and the fathead minnow (Pimephales promelas), natives to the Porcupine Creek drainage, were collected in large numbers. One amphibian, the northern leopard frog (Rana pipens) was recorded utilizing the open water and wetland areas. An abundance of terrestrial wildlife species were observed using the site for cover, forage, watering and reproduction

Reclaimed Porcupine Creek is currently being managed to produce wetland and riparian habitats. Ahead of mining dewatering operations along with the reclamation well will continue to supply ample water to support the growth and maintenance of obligate wetland plant species. Additionally, the surplus of water available during mining will facilitate saturation of the alluvium used to construct the creek channel. Agriculture, which failed pre-mine, is now possible within the floodplain.

To restore the function of Porcupine Creek innovative techniques such as the replacement of alluvium, development of water sources and reconstruction of stream morphology were utilized to establish obligate wetland and riparian vegetation. The reclamation of Porcupine Creek has produced a self-sustaining riparian plant community and improved land use potential. Reclaimed Porcupine Creek demonstrates Powder River Coal Company's commitment to exceed the letter, spirit and intent of the Surface Mining Control and Reclamation Act of 1977 and the Wyoming Department of Environmental Quality Rules and Regulations (1977).