Larry C. Munn

Comments on Wyoming Powder River Basin FEIS

My name is Larry C. Munn and I am a Professor of Soil Science in the Department of Renewable Resources at the University of Wyoming. I have worked with Wyoming soils, landscapes and agriculture since coming to UW in 1981; prior to that I was employed at Montana State University as a research scientist. I received my Ph.D. in Soil Science from Montana State University in 1977. For the past several years, as part of my responsibilities to the University, I have developed an outreach program to help farmers, ranchers and other Wyoming citizens deal with the impacts of coal bed methane development. In response to a request by the Wyoming Outdoor Council, I have evaluated the Bureau of Land Management's Final Environmental Impact Statement and Proposed Plan for the Powder River Basin Oil and Gas Project. I have identified a number of concerns with this EIS document, which I will address below.

The problem with greatest consequence in the EIS is the use of an inappropriate water production value in the models used to determine the numbers of containment ponds, infiltration ponds and the acres required for disposal of product water. Because water disposal in the BLM's preferred Alternative 2A relies heavily on infiltration, containment and surface disposal (EIS p 2-46, Table 2-21), the use of an incorrect modeling parameter results in serious under estimation by BLM of the number of ponds that will be constructed and surface acreage that will be disturbed. The model presented by BLM (EIS p 2-27 to 2-30) uses an average rate of production for product water of 4.8 gallons per minute (EIS p 2-28). This 4.8 gpm rate is equivalent to 7.4 acre-feet of water per year for each well. Calculations using this rate then are presented to indicate that 1.6 acres per well would be disturbed for surface disposal, that a 6 acre reservoir would handle 7 wells as an infiltration impoundment and that a 50 acre, 450 acre-foot capacity reservoir would service 40 wells as an evaporation pond. The flaw in these calculations is using the average rate of production (4.8 gpm) to determine the required capacity of the systems.

It is well known that the rate of product water production varies with time, being high early on and declining with time over the productive life of the well. The rate of water production that must be used to determine the size of the systems constructed is not the average rate, but rather the rate over the first few years when production is highest. On page 2-25 of the EIS, it states: "The current average rate of water production per well, according to WOGCC, is about 10gpm." This is an average for wells in a variety of coal seams and of varying age. On page 2-25, it states: "Additionally, the U.S. Department of Energy Technology Laboratory determined from "type wells" in the PRB that more than half of the water is produced in the first 2 years (Advanced Resources International 2002)". What this means then is that the water to be disposed of in the first two years will be 26 acre-feet per well, not 14.8 acre-feet. The limiting year for system capacity will actually be the first two years and the ponds, reservoirs and surface disposal areas will have to be large enough to dispose of the water from the very first year when production will be greatest.

If for example, the rate of production for each well is 15 gpm (22 acre-feet per year), the 40 wells in the cluster to be serviced by an evaporation pond would produce not the 296 acre-feet as per the BLM calculation but rather 880 acre-feet. If the same assumption is made of a 50 acre water surface which can evaporate 4 feet of water annually, with 10% subtracted for seepage and an amount of water equivalent to the annual precipitation used for consumptive use, the pond would be required to contain 592 acre-of water which exceeds its 450 acre-foot storage capacity. Obviously, the ponds would have to be made larger, or there would have to be more of them constructed. Or both. This will result in a 2X to 3X increase in the area disturbed.

Similarly, the 7 wells collected for each infiltration pond would produce (at 15 gpm) 154 acre-feet of water, not 51.8 acre-feet. If the water is assumed to infiltrate at a rate of 4 feet per year and to also evaporate at 4 feet per year, then a 6 acre pond would have 17.7 feet of water in it at the end of the first year. Again, the result will be a much greater number of ponds, or much larger ponds to infiltrate the water produced during the first several years- another 2X to 3X increase in the area ultimately disturbed and requiring reclamation.

For surface disposal, the calculation will be that at a rate of 4 feet per acre evapo-transpired, it would require 5.5 acres to dispose of the water from each well. This will greatly increase the overall surface area disturbed (2X to 3X). In all three disposal strategies, the fact that all the wells of a field or cluster are all brought into production at the same time will require that the maximum rate of water production during the first year will be the limiting (size determining) rate that must be accommodated.

Assuming that one half of the total water produced by each well is pumped in the first two years, the water levels in the reservoirs and ponds will be much lower in the last 5 years of the well's production life and a shoreline of salt laden sediment will be exposed to wind erosion and weed invasion. Contamination and damage to soils on the landscape down wind from the reservoirs and ponds will be significant in the later years of production of the well cluster. Because the number of suitable sites for ponds is limited in a given watershed, the requirement to increase the number of ponds will in itself have negative consequences, as would the requirement to build higher dams or excavate additional earth materials.

The quality of the water (Table 3-2, p 3-12) is such that much of it will not be suitable for land application disposal or irrigation. Even the median value total dissolved solids from Table 3-2 represents a medium salinity hazard (an EC of 1.3 as per Table 4-16, p 4-147). An acre-foot of such water would contain 1.1 tons of salt. To add 4 feet of this water per acre per year for 7 years (p 2-29) would add more than 30 tons of salt per acre. The assumption of 100% water use by vegetation (no leaching through the root zone to avoid contaminating surface water) will result in significant damage to the vegetation. The use of 1.6 acres per well for land application disposal outlined on p 2-29 would require additions of more than 13 feet of water per acre during the first year of water production when the water yield was highest (15 gpm); clearly this is not tenable. Once salt has accumulated in the soils on the land application disposal site, there is no way to remove it from the soil without leaching it into the surface channels. Alteration of site growth potential and accelerated erosion resulting from salt accumulation are therefore essentially permanent.

The effects of lateral seepage and movement of water along faults resulting from the dependency upon infiltration impoundments (Table 2-21) will cause significant impairment of surface water quality, both locally and for main stems such as the Tongue and Powder Rivers. Infiltrating water only moves straight down if the substrate is uniform; this is clearly not the case for sedimentary strata such as the Ft. Union formation. In particular the negative effects of sodium which is generally higher in concentration in the northern PRB will be difficult to mitigate.

I do not see in the document a statement of minimal environmental quality that will be tolerated by BLM in support of development of the gas resource. Rather, the responsibility for developing protective standards for water quality, establishing upper limits of erosion, etc. is passed off to the states of Wyoming and Montana and to the gas companies and private surface owners. The assumed water handling methods (Table 2-21) for the preferred alternative differ from current on the ground practice. Nothing in the EIS indicates that the assumed partitioning between methods will actually be obtained where surface management is not under BLM control. Unless stipulated as part of the requirements for development of BLM administered minerals, the assumed mix of handling methods will not likely be achieved, with significant effect on the actual impacts realized. Injection is listed as a method of disposal for some part of the product water despite the fact that the BLM states elsewhere that injection is not feasible in the PRB (p 2-65; p S-36). If the assumed mix actually achieved varies significantly from those "assumed" by the BLM in Table 2-21, then the cumulative impacts of development of federal minerals may be very different than the predictions in the EIS.

Impacts to surface water quality in ephemeral streams are not adequately addressed. Intense thunder storms are irregularly distributed in the PRB in any single year, but are a common feature of local precipitation over time. Runoff from land application disposal sites, from surfaces where water was discharged after only passive treatment, and from seepage from ponds and reservoirs will all effect water quality in the ephemeral channels. Likewise snomelt may convey large volumes of salty water to channels from these sites. These effects should be modeled as the effects on perennial streams are. The statement on page 3–54 describing evaporation reservoirs that "Buildup of trace elements in the reservoir is purged during heavy runoff when the reservoir overflows." indicates that large quantities of salts are expected to be flushed into the ephemeral channels below the reservoir dams. Over time this may produce more damaging effects than the simple direct discharge of the water to the channels would produce. Was this effect modeled in estimating cumulative effects on main stem water quality?

The switch from an assumed stream channel conveyance loss of 80% in the draft EIS to 20% in the FEIS still does not address the question of variability by sub-watershed. Because of the tremendous total quantity involved, differences in only 5 to 10% in conveyance loss have a large effect on the amount of water that remains to be handled and on the impact to alluvial aquifers.

Weed control plans are accepted as if they will be effective, despite the fact that invasive weeds have proved difficult to control under conditions existing prior to disturbance. The large increase in roads and traffic will only make control much more difficult. Who will be responsible for weed control 20 years after the gas fields are shut down? Weed invasion will reinforce decreases in plant community diversity which will result from surface disturbance and water application. If salt tolerant crops are required to effectively utilize salinized soils, this will also represent loss of plant diversity.

In general, there is still over reliance on data from the Gillette area well fields and extrapolation of that data across a broad expanse of varied topography, water quality and geologic and soil substrates. Errors resulting from this wide extrapolation will be compounded in sub-watersheds with the greatest density of development (e.g. Upper Powder River, Table 2-23). Certainly differences in topography and substrates may be expected to influence choice of water disposal strategies by the gas companies.

In summation, it is my professional opinion that development of the gas resource under the preferred alternative will result in significant degradation of soils, vegetation and surface water quality in the PRB, and that the FEIS document fails to accurately describe the likely outcomes of development.