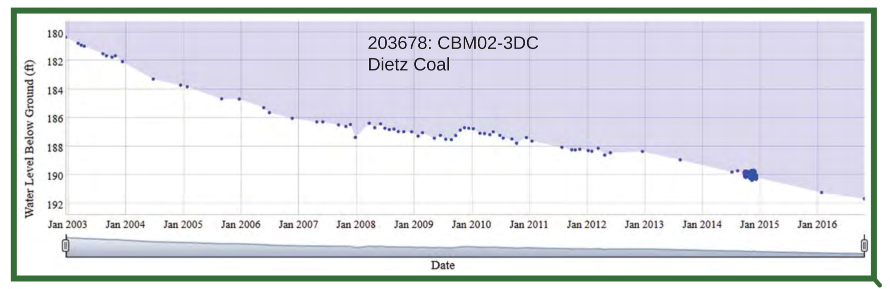
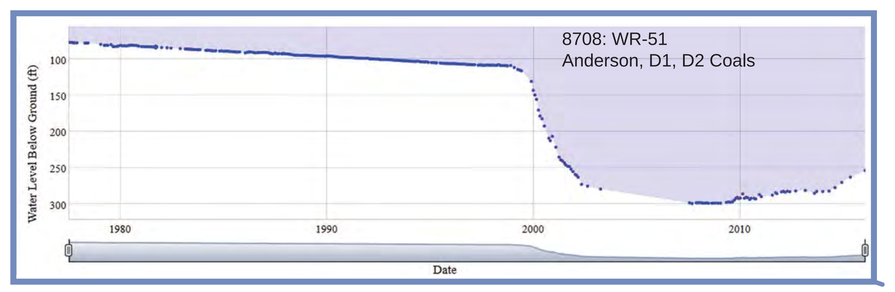
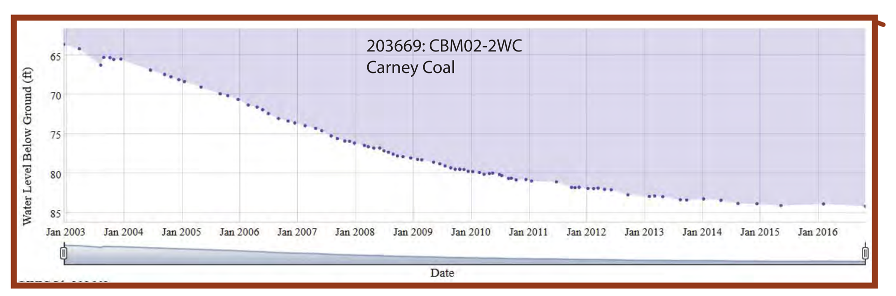
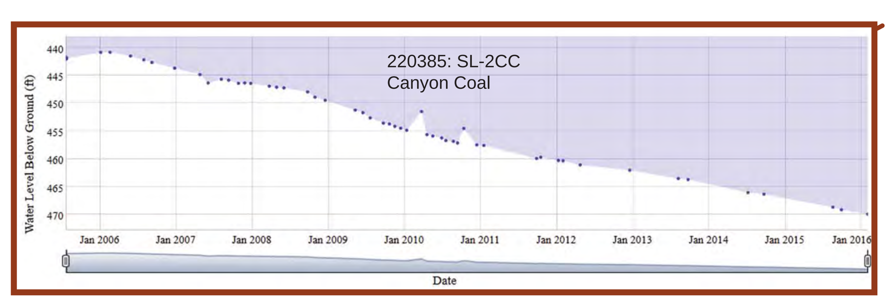
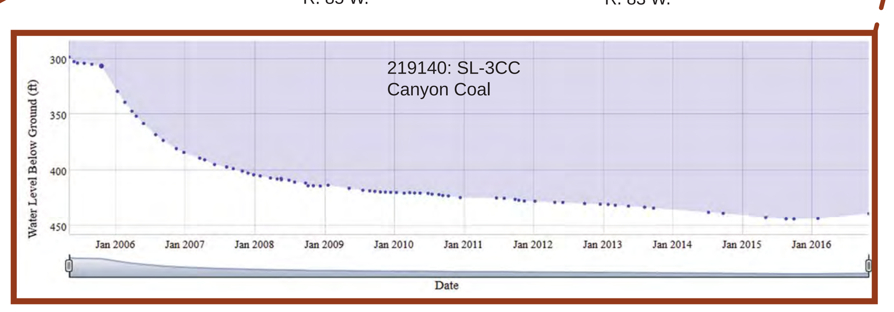
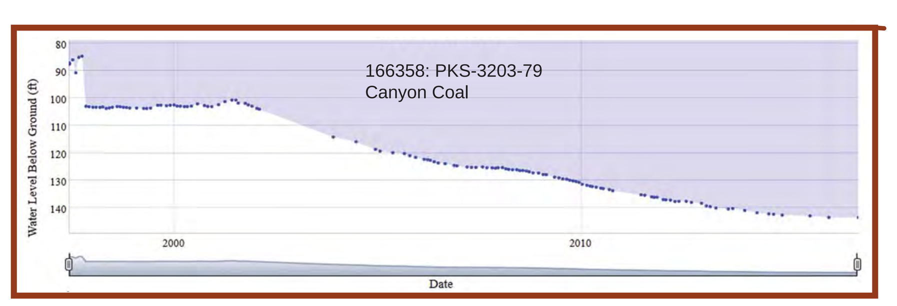


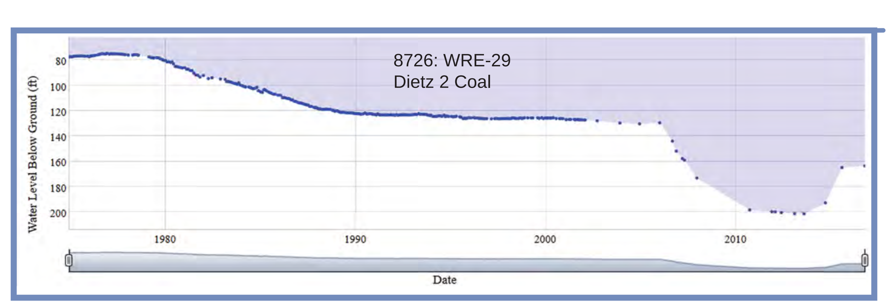


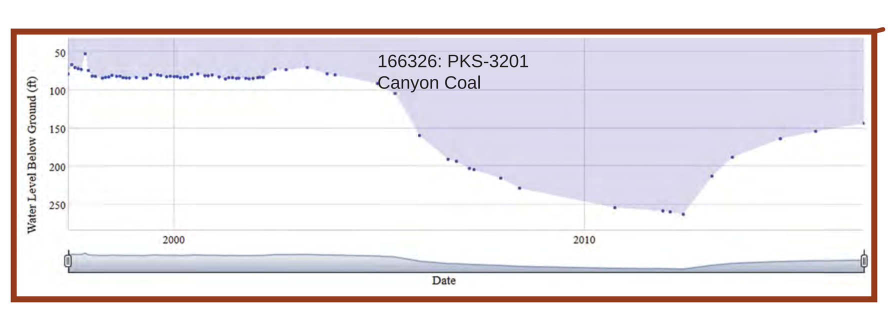








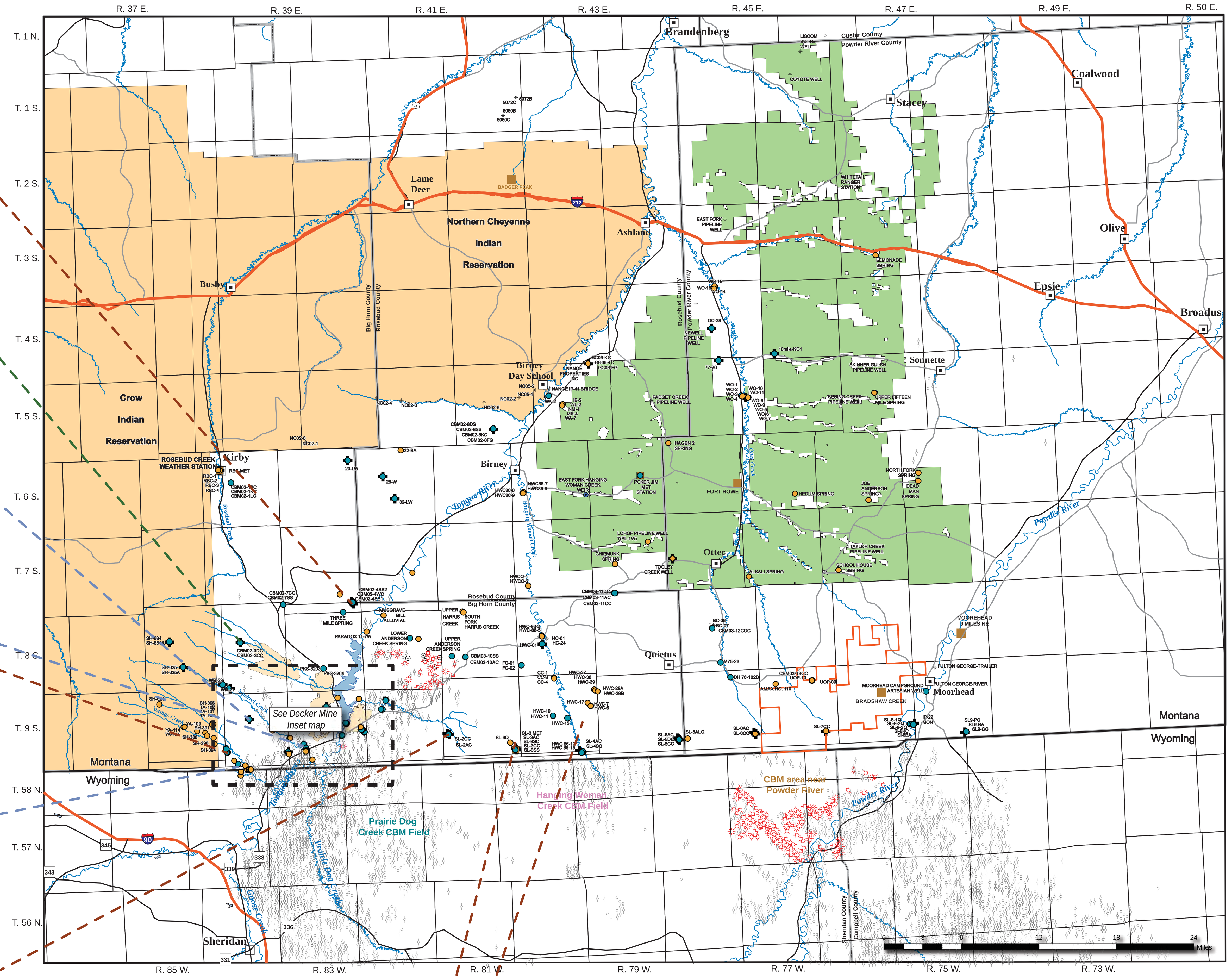




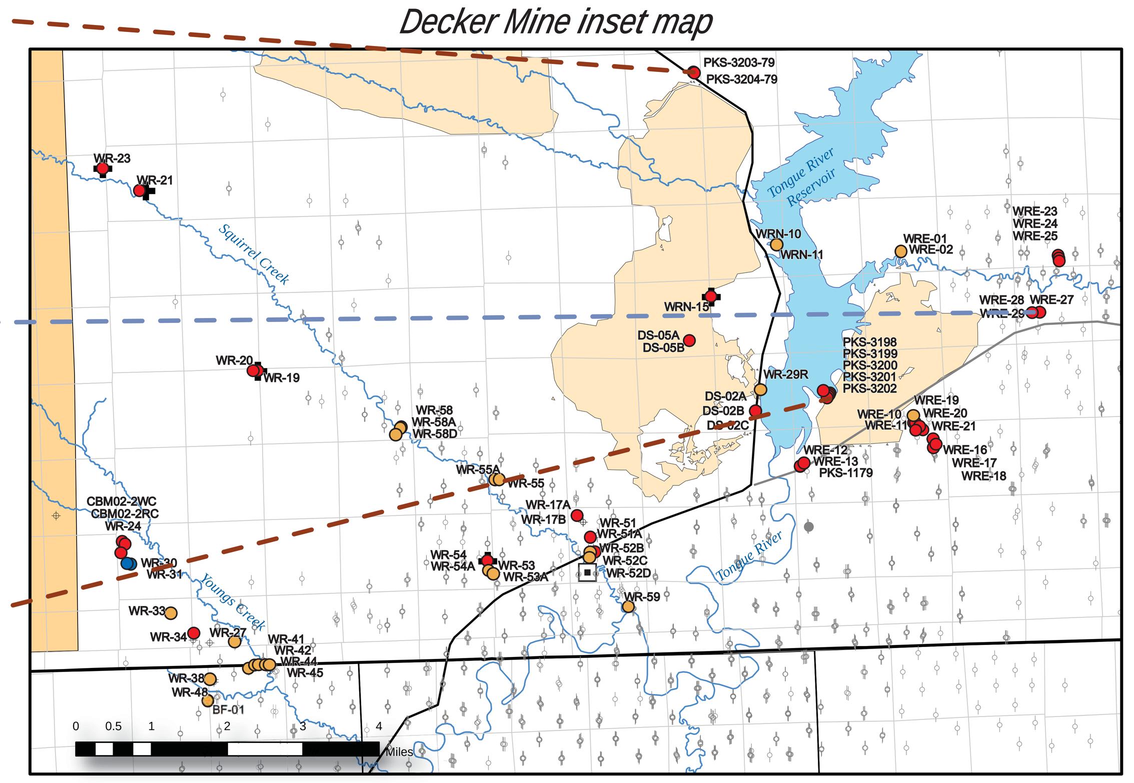
Hydrographs showing drawdown due to CBM production

Hydrographs showing drawdown due to coal mining

Hydrographs showing drawdown due to a combination of CBM production and coal mining



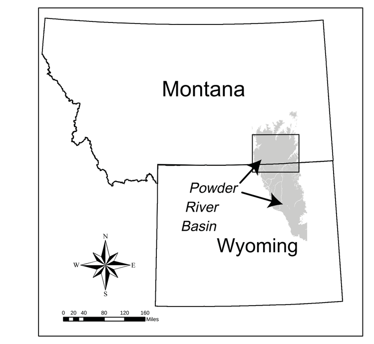
Decker Mine inset map



MBMG Open-File Report 694

2016 Annual Coalbed-Methane Regional Groundwater Monitoring Report: Powder River Basin, Montana

By Shawn Kuzara, Simon Bierbach, and Elizabeth Meredith
2017



Explanation

- CBM/Coal-impacted monitoring site
- Baseline condition monitoring site
- Inactive as of 2017
- GWAAMON program monitoring well
- Producing CBM well
- Shut-in CBM well
- CBM water injection well, Montana
- Water level data logger
- Outline of Decker Mine Inset map
- Summit proposed development
- Weather station, black border if operated by MBMG
- Custer National Forest
- Indian reservation lands
- Coal mines
- Towns
- Local roads
- Secondary roads
- US Route
- County boundary

Maps may be obtained from:
Publications Office
Montana Bureau of Mines and Geology
1300 West Park Street
Butte, Montana 59701-8997
Phone: (406) 496-4167 Fax: (406) 496-4451
http://www.mbmg.mtech.edu

Introduction

In the Powder River Basin, coalbed methane (CBM) is created by the metabolic processes of microbes. The methane is adsorbed on coal through weak bonding and water pressure. Pumping groundwater from coalbeds reduces water pressure and allows methane to desorb and be collected. Groundwater co-produced with CBM is typically pumped at a rate and scale that reduces water pressure (head) to a few feet above the top of the producing coalbed across large areas (Meredith and others, 2012).

Results and Discussion

In Montana CBM fields, the groundwater head in the Dietz coal aquifer was lowered over 200 ft within areas of production. In the Canyon coal aquifer, heads were lowered more than 600 ft. After 18 years of CBM production, the extent of the 20-ft drawdown contour beyond production area boundaries, 1 to 2 mi, has not noticeably changed since 2004 due to fewer than anticipated CBM wells, impermeable shale layers, and extensive faulting that limits drawdown. Faults in the study area tend to act as barriers to groundwater flow and, where measured in monitoring wells, drawdown rarely migrates across fault planes.

Since 2004, the MBMG has documented groundwater-level recovery due to discontinuation or reduction in CBM production near the Montana–Wyoming state line and the CX field. The full extent of drawdown and rates of recovery are controlled by the rate, intensity, and continuity of CBM development; site-specific aquifer characteristics, including the extent of faulting and proximity to recharge areas; amount, timing, and location of precipitation; and other significant groundwater withdrawals such as coal mining. The time required for water levels to recover near-baseline conditions is difficult to estimate but will likely take decades or longer.

Presented here are hydrographs (MBMG, 2016) representing a variety of groundwater-level responses to CBM and coal mine activities. In some areas, coal aquifers remain drawn down despite the reduced level of current CBM production. In areas near Decker Coal Mine and along the state line (see Decker Mine inset map), water levels are recovering. Along Youngs Creek, coal aquifer water levels in some monitoring wells have recovered to near baseline. Causes for drawdown are indicated by color: due to CBM production (red); coal mining activities (green), or both (blue).

2017 Monitoring Plan

In an effort to expand the groundwater-monitoring network in eastern Montana to address groundwater monitoring near traditional oil and gas production, the current coal and CBM network is being reduced in 2017 (see Explanation for proposed network changes). The proposed monitoring network reduces the Powder River Basin network from 225 to 124 sites.

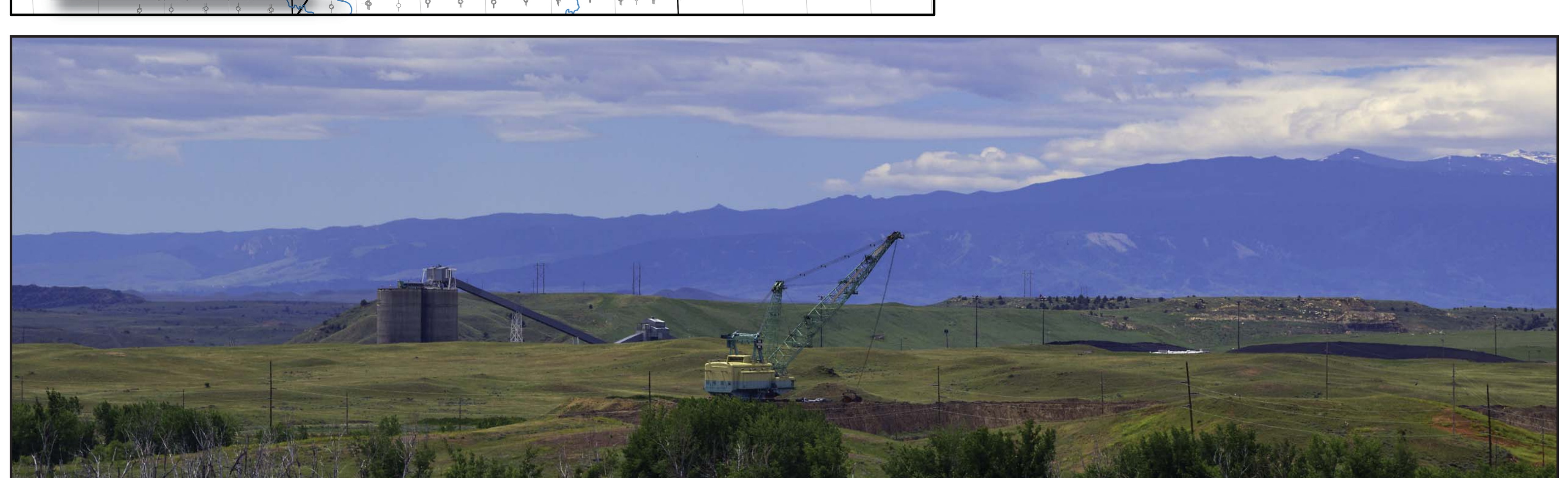
References

Kuzara, S., Meredith, E., Wheaton, J., Bierbach, S., and Sasse, D., 2016, 2015 Annual coalbed methane regional groundwater monitoring report, Powder River Basin, Montana: Montana Bureau of Mines and Geology Open-File Report 679, 96 p., 3 sheets.
Meredith, E., Wheaton, J., and Kuzara, S., 2012, Coalbed-methane basics: Ten years of lessons from the Powder River Basin, Montana. Montana Bureau of Mines and Geology Informational Pamphlet 6.
Montana Bureau of Mines and Geology (MBMG), 2016, Ground-Water Information Center (GWIC) Online data: http://mbmggwic.mtech.edu [Accessed 5/30/2017].

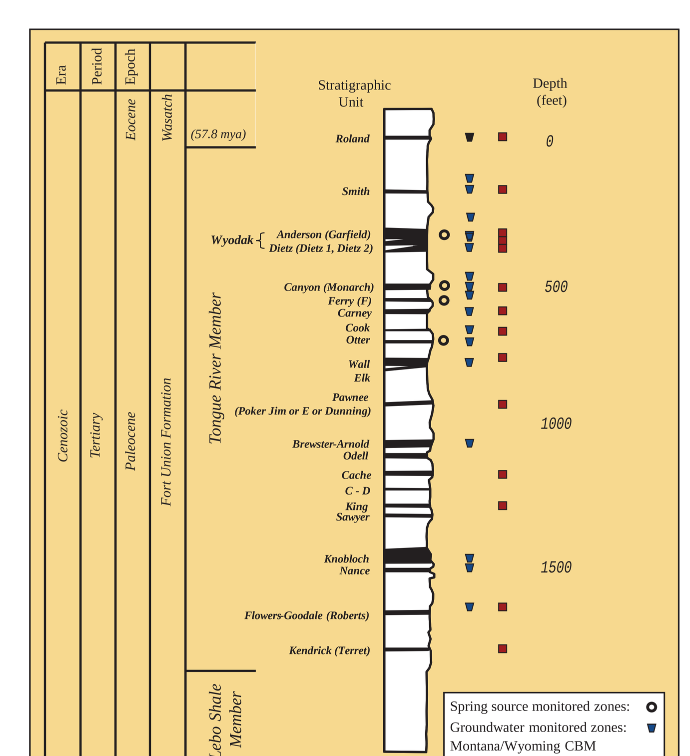
Canyon Coal outcrop at the Tongue River Dam

Knobloch Coal outcrop along the Tongue River

CBM wells with infiltration pond in the background

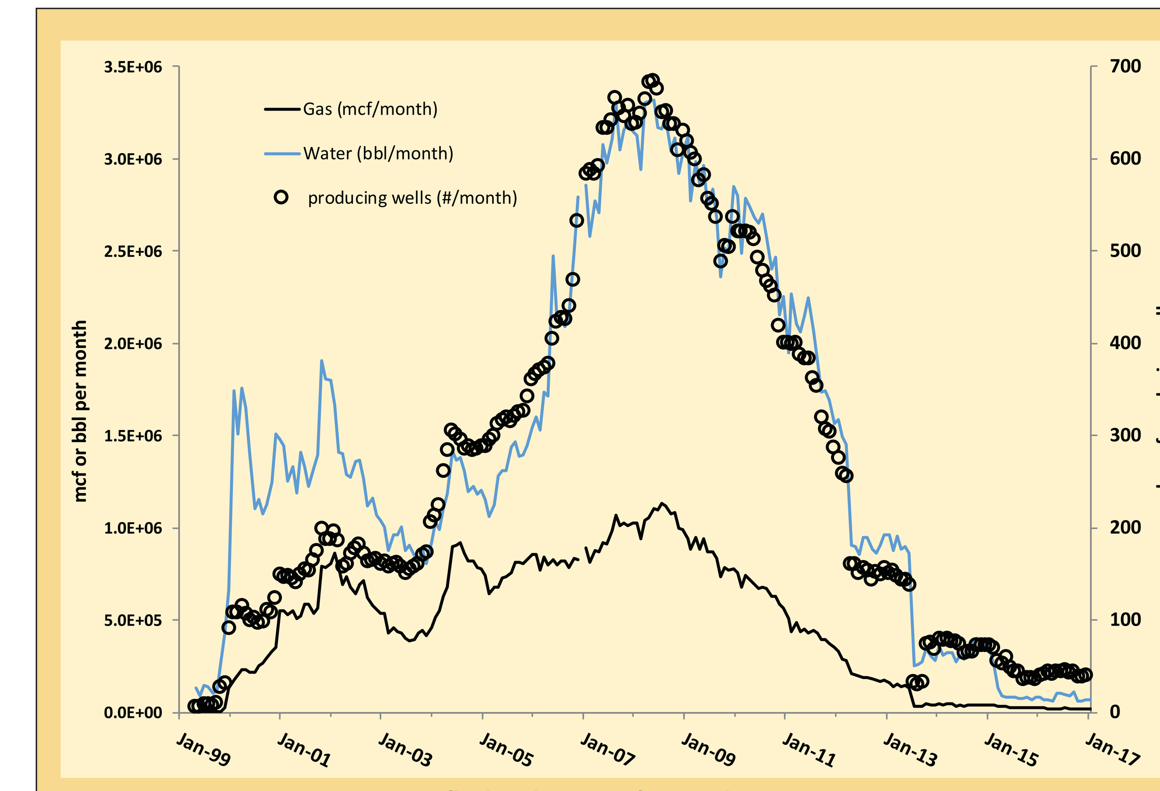


East Decker Mine with dragline in foreground



The stratigraphic column represents the relative positions of the major coalbeds mapped within the Tongue River Member of the Fort Union Formation in the Powder River Basin. Not all coalbeds shown are present across the entire basin and the interburden thickness varies considerably. The indicated depths are approximate.

Source: Kuzara and others, 2016



Coalbed Methane Development in Montana

Gas and water production from Montana CBM wells peaked in 2009. Production rates and number of CBM wells decreased consistently through 2013. Currently there are 77 producing wells in Montana, a decrease of 13 since 2015. Total gas produced during water year 2016 was 271,400 mcf and produced water was 1,016,900 bbl.