Montana Bureau of Mines and Geology
DRAFT
Table of Contents for Final Report to Water Policy Interim Committee (60th Legislature)
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Introduction
Section 23 of House Bill 831 (60th Legislature) provides for the Montana Bureau of Mines and Geology (MBMG) to conduct a case study within closed basins of Montana. A final report is to be submitted to the Water Policy Interim Committee (WPIC) established by House Bill 304 (60th Legislature) In a work plan approved by the WPIC, the MBMG conducted a case study with three phases:

1) site investigations,
2) site-scale and basin-scale assessments of impacts, and
3) evaluation/development of criteria for hydrogeologic assessments for permit applications.

1) Site Investigations: Past or pending permit applications in closed basins were evaluated with respect to the various hydrogeologic conditions that occur in closed basins, including:

a) near stream shallow alluvial aquifers;
b) deep basin, confined or semi confined aquifers;
c) intrabasin or interbasin aquifers below the basin-fill aquifers; and
d) basin margin / bedrock (fault controlled).

The objective of the investigations was to describe these hydrogeologic settings particularly where ground water is likely to be developed and describe the range of potential impacts to ground water and surface water under each setting.

2) Site-scale and Basin-scale Assessments: The results of the site investigations in phase 1 were used to construct generic conceptual and computer-based models of the range of hydrogeologic conditions evaluated in the site investigations. In addition to pumping, each hydrogeologic condition, or combination of hydrogeologic conditions, were modeled to examine the effects of such variable stresses as recharge (natural and artificial; aquifer storage recovery), and cumulative pumping (irrigation and domestic).

3) Evaluation/development of Criteria: The site investigations and the modeling were used to evaluate the adequacy of the existing hydrogeologic assessments and minimum standards. The MBMG has reviewed the current permit process with respect to the data collected, the evaluation methods used, and makes recommendations as to additional information and analyses as called for in Section 23(2) of HB831. These recommendations will relate to both individual permit applications and basin-scale evaluations. *The MBMG will collaborate with the Montana Department of Natural Resources and Conservation and provide the final report under separate cover.*

The report consists of the three parts:

Part 1: Case Studies

these sections present observed conditions with respect to hydrogeology and current development (i.e. only irrigation in Lower Beaverhead sub-basin, no subdivisions)

Part 2: Hydrogeologic Conditions in closed basins in Montana

these sections take what we learned in Part 1 and evaluates the potential changes by different uses (e.g. a subdivision in the Lower Beaverhead sub-basin)

Part 3: Evaluation of the Hydrogeologic Assessment required in HB831 (collaboration with DNRC; part 3 may be under separate cover)

Part 1: Case Studies

A. Lower Beaverhead River

- objectives of this study: the great majority of the permit applications between the TU decision and the enactment of HB831 occur in the lower Beaverhead River. As many as 8 of the 19 eligible permit applications are in this area.
- background (geology, permits, general setting, previous work)
- description of observable hydrogeologic conditions as they relate to those described in the work plan
- description/discussion of the conceptual hydrogeologic model
- description/discussion of the numerical model (results, limitations)
- summary of <u>observed</u> hydrogeologic conditions in the lower Beaverhead River sub-basin

B. Lower Gallatin River

- objectives of this study: look at range of hydrogeologic conditions for comparison to other closed basins, somewhat unique to the Gallatin Valley, but based on existing information. Few permit applications were generated in the Gallatin Valley mainly because of the shift from agriculture (irrigation) to residential (exempt well) land use. The hydrogeology of Gallatin Valley is similar to other basins, but surface-water and ground-water use varies widely throughout the basin and has shown a great deal of change in recent years.
- background (geology, permits, general setting, previous work)
- description of observable hydrogeologic conditions as they relate to those described in the work plan
- description/discussion of the conceptual hydrogeologic model
- summary of hydrogeologic conditions for the Gallatin River sub-basins near Belgrade and Manhattan

C. Bitterroot River

- objectives of this study: provide a water balance and conceptual model at the basin scale
- background (geology, permits, general setting, previous work)
- description of observable hydrogeologic conditions as they relate to those described in the work plan
- description/discussion of the conceptual hydrogeologic model
- summary of hydrogeologic conditions for the Bitterroot River basin

Part 2: Hydrogeologic Conditions in closed basins in Montana

- Summary of the range of hydogeologic conditions in closed basins and land uses observed in Part 1
- The objective of Part 2 is to describe the range of hydrogeologic conditions in closed basins through modeling (conceptual and numerical). The approach was to construct a matrix of hydrogeologic conditions and stresses based on aquifer characteristics and dimensions found in closed basins. Each hydrogeologic condition was be modeled under background conditions. Then, for each hydrogeologic condition, new stresses (pumping) were added and the changes in ground-water levels, surface-water flow, and water levels in other wells were examined.
- additional modeling examines the immediate and cumulative effects of various management schemes including mitigation:
  - -flood to pivot
  - -irrigation to domestic
  - -recharge to shallow unconfined aquifers by irrigation canals
  - -conservation (surface water and ground water)
  - -aquifer storage recovery
- Each set of conditions will be presented and described

Part 3: Evaluation of the Hydrogeologic Assessment

- review of current permit applications and associated hydrogeologic assessments
- limitation of analytical methods
- numerical modeling efforts
- evaluation of production well construction (eg multiple completion)
  - effect on aquifer test results
  - limitation of information to one aquifer rather than all (especially deeper ones)
- overall limitation of one well, one applicant, one aquifer test, one result, one decision in a basin full of past and future applications (eg can cumulative effects be addressed with single applications)

as noted, Part 3 will be in collaboration with DNRC.