



Hydrogeology and geothermal potential of the Radersburg Valley, Broadwater County, Montana  
by Glen Milton Wyatt

A thesis submitted in partial fulfillment of the requirements for the degree of Master of Science in  
Earth Sciences

Montana State University

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Abstract:

Two major aquifers occur in the Radersburg valley in southwest Montana. Irrigation and other wells discharge water from a Cenozoic basin-fill aquifer composed of up to 1000 feet of sand and gravel. During the 1979 growing season, irrigation wells withdrew about 300 million cubic feet of water from the aquifer. The Madison Group, composed of Mississippian-age limestone, is the other major aquifer. The yearly discharge from springs flowing from the Madison Group at Plunket Lake, in the southern part of the valley, approximately equals the total amount of water withdrawn from the basin-fill aquifer for irrigation during 1979.

Much of the irrigation water is withdrawn from an area north of Plunket Lake. This area is near the projected north-south subcrop trend of the Madison Group aquifer and suggests that the aquifer recharges the basin-fill. Ground-water temperatures and chemistry further support this idea. Ground-water temperatures in this area vary from less than 10°C to about 20°C. The highest temperatures are colinear with the Madison Group subcrop trend, implying deep circulation within the limestone aquifer before the water discharges to basin fill.

Ground-water compositions are generally dominated by calcium, sodium, bicarbonate, and sulfate ions. Sulfate to bicarbonate ratios are highest north of Plunket Lake and indicate that a sulfate-rich source of ground water is locally present. A possible source of such ground water could be remnant evaporite beds within the upper part of the Madison Group. Another indicator of Madison Group discharge to the basin fill is the ratio of strontium to total dissolved solids. High values for the ratio may indicate recharge by a carbonate or evaporite aquifer to an aquifer composed of clastic materials. The highest values for the ratio were obtained from water samples in the vicinity of the projected subcrop trend of the Madison Group.

A possible consequence of the use of an aquifer for irrigation may be the permanent depletion of the ground-water resource. This depletion from aquifer storage is indicated by a continuing drop in ground-water levels. Irrigation by ground water from the basin-fill aquifer began in the early 1960s. Since that time, water levels have generally declined by about 0.4 foot per year. The amount of water annually lost from aquifer storage as indicated by this average decline is less than one percent of the amount pumped for irrigation in 1979.

Ground water in the valley has a slight geothermal potential, as indicated by ground-water temperatures above 16°C. Water from such low-temperature thermal wells or springs may be used for space heating, greenhouses, or other low-temperature applications.

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BROADWATER COUNTY, MONTANA

by

GLEN MILTON WYATT

A thesis submitted in partial fulfillment  
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MONTANA STATE UNIVERSITY  
Bozeman, Montana

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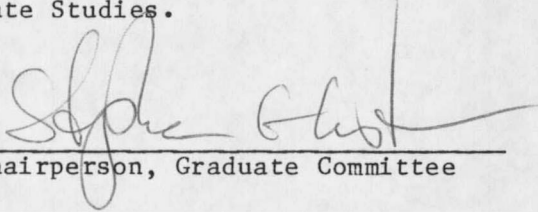
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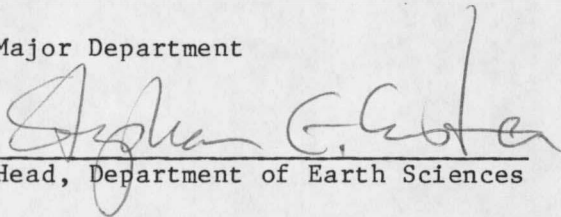
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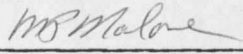
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## ABSTRACT

Two major aquifers occur in the Radersburg valley in southwest Montana. Irrigation and other wells discharge water from a Cenozoic basin-fill aquifer composed of up to 1000 feet of sand and gravel. During the 1979 growing season, irrigation wells withdrew about 300 million cubic feet of water from the aquifer. The Madison Group, composed of Mississippian-age limestone, is the other major aquifer. The yearly discharge from springs flowing from the Madison Group at Plunket Lake, in the southern part of the valley, approximately equals the total amount of water withdrawn from the basin-fill aquifer for irrigation during 1979.

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Ground water in the valley has a slight geothermal potential, as indicated by ground-water temperatures above 16°C. Water from such low-temperature thermal wells or springs may be used for space heating, greenhouses, or other low-temperature applications.

## INTRODUCTION

Shortly after the valley in the vicinity of Radersburg, Montana (Figure 1) was settled by farmers, a drought occurred. This drought lasted from about 1917 until the early 1920s and demonstrated the need for irrigation of farmlands in the area. Irrigation water was first supplied to farms by diverting water from springs and creeks. Beginning in 1941, irrigation water was supplied to the Crow Creek area by a system of canals from the Missouri River. Operation of another canal system supplying water to land south of Crow Creek began in 1955. In 1955, approximately twenty-one square miles of land were irrigated by canal systems in this area.

Irrigation water has also been supplied to part of the valley by high-capacity wells. By 1979, irrigation wells were supplying water to about seven square miles of land which had previously been irrigated by canals and to about three square miles which had been dryland farmed. Twenty-seven irrigation wells pumped from 1,000 to 3,000 gallons per minute (gpm) or 134 to 401 cubic feet per second (cfs) during the summer months and discharged over three hundred million gallons of water. Future withdrawals must be balanced by adequate recharge to the aquifer to allow irrigation by wells to continue.

The irrigation wells have been completed in basin-fill sediments which overlie older bedrock units. Many of the wells have been installed in the Warm Springs Creek area north of Plunket Lake. Plunket









































































































































































































































































































































































