Data for Water Wells Visited during the Flathead Lake Area Ground-Water Characterization Study: Flathead, Lake, Sanders, and Missoula Counties

by

Larry Smith, John LaFave, Camela Carstarpharn, Donald Mason, and Michael Richter

Note - this map was originally published at a scale of 1:250,000 but the page sizes have been modified to fit the size of the paper in your printer. A full sized 36” X 48” colored print of this map can be ordered from the Office of Publications and Sales of the Montana Bureau of Mines and Geology, 1300 West Park Street, Butte, MT 59701.
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Author’s Note: This map is part of the Montana Bureau of Mines and Geology (MBMG) Ground-Water Assessment Atlas for the Flathead Lake Area ground-water characterization. It is intended to stand alone and describe a single hydrogeologic aspect of the study area, although many of the area’s hydrogeologic features are interrelated. For an integrated view of the hydrogeology of the Flathead Lake Area the reader is referred to Part A (descriptive overview) and Part B (maps) of the Montana Ground-Water Assessment Atlas No. 2.

INTRODUCTION

Visits to 984 water wells were completed by program staff as part of the Montana Ground-Water Characterization Program Flathead Lake Area study. The study area includes all of Flathead and Lake Counties and those parts of Sanders and Missoula Counties within the Flathead Indian Reservation. Most wells were visited between March and December 1996.

Wells to be visited were chosen from about 16,000 recorded wells to provide a representative geographic distribution across the significant aquifers. More wells completed in deeper geologic units (Pleistocene deep alluvium and stratified drift and Precambrian Belt rocks) were inventoried than were wells completed in shallow units (Holocene sand and gravel and Pleistocene outwash; Table 1) because previous work provided substantial coverage for the shallower units (Konizski and others, 1968; Noble and Stanford, 1986; King, 1988). Additionally, most wells drilled since the previous work was done were completed in the deep alluvial and bedrock units.

Data from more than 60 wells visited in the mid-1990’s in the Little Bitterroot valley are also available (Abdo, 1997) but are not shown on this map. Data are sparse for federally owned lands (green areas on map) because few or no wells are located within the national forests, national parks, and wilderness areas that make up these lands.

Table 1. Summary of geologic distribution of wells.

<table>
<thead>
<tr>
<th>Geologic Unit</th>
<th>Geologic Unit Codes</th>
<th>Inventoryed Wells</th>
<th>Median Depth (ft)</th>
<th>Total Wells</th>
</tr>
</thead>
<tbody>
<tr>
<td>Holocene sand and gravel</td>
<td>111ALVM</td>
<td>82</td>
<td>29</td>
<td>2,136</td>
</tr>
<tr>
<td>Pleistocene outwash</td>
<td>1120TSH</td>
<td>92</td>
<td>50</td>
<td>855</td>
</tr>
<tr>
<td>Pleistocene stratified drift</td>
<td>112DRFT</td>
<td>135</td>
<td>115</td>
<td>1,706</td>
</tr>
<tr>
<td>Pleistocene till</td>
<td>112TILL</td>
<td>19</td>
<td>12</td>
<td>153</td>
</tr>
<tr>
<td>Pleistocene lake silt and clay</td>
<td>112GLCC</td>
<td>3</td>
<td>162</td>
<td>120</td>
</tr>
<tr>
<td>Pleistocene lake deposits of Glacial Lake Missoula</td>
<td>121LKM</td>
<td>81</td>
<td>114</td>
<td>621</td>
</tr>
<tr>
<td>Pleistocene deep alluvium</td>
<td>112ALVM, 112LONE</td>
<td>269</td>
<td>208</td>
<td>4,515</td>
</tr>
<tr>
<td>Tertiary rocks</td>
<td>1201DMS, 124KSSN</td>
<td>12</td>
<td>158</td>
<td>77</td>
</tr>
<tr>
<td>Precambrian Belt Supergroup</td>
<td>400HELT, 400MSSL, 400RVLL, 400MCBC, 400PRCH</td>
<td>286</td>
<td>257</td>
<td>3,285</td>
</tr>
<tr>
<td>unknown</td>
<td></td>
<td>984</td>
<td></td>
<td>1,817</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td></td>
<td>15,285</td>
</tr>
</tbody>
</table>
Section 18, DACB

Well Location System: The location description begins with the township and range, followed by the section. The location of a well in a section is found by using a counterclockwise progression from largest to smallest quarters (tracts) within a section, designated by A’s, B’s, C’s, and D’s. This well is located in Township 31 N, Range 25 W, section 18, tract DACB.

Explanation
- Visited well
- Sampled well

These
- Well identification number
- National Forest, Wilderness, and National Park lands
- Study area boundary
- Township boundary
- Major road
- Principal river or stream
- Lake or reservoir
GEOLOGIC UNITS

Geologic units for the completed interval of each well (tables 1, 2) were assigned by comparing the driller’s lithologic log to a geologic framework devised for the area. The geologic framework was based on recent geologic mapping, interpretation of selected well logs, and revision of previous work (Konzinski and others, 1968; Boethiger, 1982; Stagale, 1968; Kendy and Tresh; 1996; and others cited therein). Relationships between geologic units and hydrologic units are more completely discussed on other maps in the atlas.

The sequence of geologic units in the area north of Flathead Lake generally includes (from younger/shallower to older/deeper) shallow alluvium (112OTSH and 111ALVM), glacial-lake deposits (112GLCC), till (112TILL), deep alluvium (112ALVM), sedimentary rocks (120SDMS and 124KSNN), and Belt Supergroup rocks (400-series rocks). The alluvial and glacial deposits represent deposition during one or more glacial advance and retreat cycles and during the postglacial time. South and west of Flathead Lake the basin-filling unconsolidated sediments are more heterogeneous than north of the lake. The sequence south and west of the lake includes shallow sand and gravel (111ALVM and 112OTSH), lake-deposited sediments of Glacial Lake Missoula and minor till (112LKLML and 112TILL), and deep alluvium and the Lepnealluvial alluvial aquifer (112ALVM and 112LONE).

Holocene sand and gravel (111ALVM) –
Sandy and gravelly alluvium along most river valleys (including the Evergreen aquifer between the Flathead and Whitefish Rivers).

Pleistocene outwash (112OTSH) –
Mostly gravel and some sand at or near the surface, deposited by glacial meltwater streams.

Pleistocene stratified drift (112DRPT) –
Water-transported and washed sand and gravel derived from glaciers and encased above and below by confining units, till (112TILL) and/or glacial-lake silt and clay (112GLCC).

Pleistocene lake-deposited deposits of Glacial Lake Missoula (112LKLML) –
Gravel, sand, and clay deposited in Glacial Lake Missoula south and west of the present Flathead Lake. Contains coarse-grained beds that are aquifers at many depths, and fine-grained confining units. Includes the Mud Creek aquifer in the Mission valley (Makepeace and Mladenic, 1995).

Pleistocene till (112TILL) –
Poorly sorted mixture of gravel, sand, silt, and clay transported and deposited by glacial ice; includes some debris-flows deposited on alluvial fans near valley margins.

Pleistocene glacial-lake silt and clay (112GLCC) –
Accumulation of laminated silt and clay, few sand beds, and minor gravel; deposited in glacial lakes that were north of the Polson glacial moraine.

Pleistocene deep alluvium (112ALVM) –
Sandy and gravelly alluvium containing minor silt, mostly buried by confining units of till and glacial-lake silt and clay; deposited as stratified drift, outwash, and pre- or inter-glacial alluvium.

Pleistocene Lepnealluvial alluvial aquifer (112LONE) –
Alluvium above bedrock and below glacial-lake confining unit in the Little Bitterroot River valley. Genetically and lithologically similar to 112ALVM.

Tertiary sedimentary and volcanic rocks (120SDMS, 124KSNN) –
Sandstones, siltstones, and minor volcanic rocks in the lower portions of Little Bitterroot River valley, Camas Prairie Basin, and White Earth Creek area (120SDMS); siltstones, sandstones, and few conglomerates and coals of the Kisheneh Formation in the valleys of the North, South, and Middle Forks of the Flathead River.

Belt Supergroup rocks (400BELT, 400MSSL, 400RVL, 400MCRB, 400PRCH)
Metamorphosed limestone, dolomite, siltstone, and sandstone; bedded rocks of the Missoula, Ravalli, Middle Belt carbonate, and Pichard units; these rocks have been folded, faulted, and fractured.

SITE VISITS

Visits to wells involved determining an accurate location, measuring the static water-level, pumping for about 30 minutes, and measuring the temperature, pH, and specific conductance of the water. Selected data for the visited wells are included in table 2; well locations and their Ground-Water Information Center (GWIC) identification numbers are shown on the map. Some wells could either not be pumped or access could not be gained to measure the water level, so some fields in table 2 are blank. Selected wells were sampled for full water-analyses (major ions and trace metals) or only for nitrate, as indicated in table 2.

DATA SOURCES

All inventory data and water-quality analysis results are available from the GWIC database at Montana Bureau of Mines and Geology (http://mbmgwic.mtech.edu). Land ownership, hydrography, public land survey, and road data were obtained from the Natural Resources Information System, Helena (http://mrisc.state.mt.us/).

ACKNOWLEDGMENTS

Well and property owners graciously gave permission to inventory the wells. In addition to the authors, well inventories were conducted by Carolyn Petrie, Brian Bixby, James Rose, Ginnette Abdo, and Natural Resources Department staff of the Confederated Salish and Kootenai Tribe. Reviews of the map by Tom Patton, Edmond Deal, and Wayne Van Vost are appreciated.

REFERENCES