

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

by
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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 (Kontzevski and others, 1968; Noble and Stanford, 1986; King, 1988). Additionally, most wells drilled since the previous work were done were completed in the deep alluvial and bedrock units.

Data from more than 60 wells visited in the mid-1990s 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.

Geologic Unit	Geologic Unit Codes	Inventoried Wells	Median Depth (ft)	Total Wells
Holocene sand and gravel	H11ALVM	82	29	2,136
Pleistocene outwash	P120TSH	92	50	4,555
Pleistocene stratified drift	P112DRFT	133	115	1,706
Pleistocene lake silt and clay	P112LCC	3	162	120
Pleistocene lacustrine deposits of Glacial Lake Missoula	P112ALVM	114	114	421
Pleistocene deep alluvium	P112ALVM, P112ALNE	269	208	4,515
Tertiary rocks	T20SDMS, T24KSNV	28	12	77
Precambrian Belt Supergroup	400BELT, 400MSSL, 400RVLV, 400MCRB, 400PRCH	286	257	3,285
unknown		7		1,817
Totals		984		15,285

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 (Kontzevski and others, 1968; Boettcher, 1982; Slagle, 1988; Kenady and Trench, 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 (H11ALVM and P120TSH), glacial-lake deposits (P120LCC), deep alluvium (P112ALVM), sedimentary rocks (T20SDMS and T24KSNV), and Belt Supergroup rocks (400-series rocks). The alluvial and glacial deposits represent deposition during one or more glacial advances 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 (H11ALVM and P120TSH), lake-deposited sediments of Glacial Lake Missoula and minor till (P112KML and P112TLL), and deep alluvium and the Lonepine alluvial aquifer (P112ALVM and P112ALNE).

Holocene sand and gravel (H11ALVM) – Sandy and gravely alluvium along most river valleys (including the Evergreen aquifer between the Flathead and Whitefish Rivers).

Pleistocene outwash (P120TSH) – Mostly gravel and some sand at or near the surface, deposited by glacial meltwater streams.

Pleistocene stratified drift (P112DRFT) – Water-transported and washed sand and gravel derived from glaciers and encased above and below by confining units, till (P112TLL) and glacial silt and clay (P120LCC).

Pleistocene lake-deposited deposits of Glacial Lake Missoula (P112KML) – 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 Mladenich, 1995).

Pleistocene till (P112TLL) – Poorly sorted mixture of gravel, sand, silt, and clay transported and deposited by glacial ice; includes few debris-flows deposited on alluvial fans near river margins.

Pleistocene glacial lake silt and clay (P120LCC) – Accumulations of laminated silt and clay, few sand beds, and minor gravel; deposited in glacial lakes that were north of the Pleistocene glacial moraine.

Pleistocene deep alluvium (P112ALVM) – Sandy and gravely alluvium containing minor silt, mostly buried by confining units of till and glacial-lake silt and clay; deposited as stratified drift, outwash alluvium, and pre- or interglacial alluvium.

Pleistocene Lonepine alluvial aquifer (P112ALNE) – Alluvium above bedrock and below glacial-lake confining unit in the Little Bitterroot valley, generally and lithologically similar to P112ALVM.

Tertiary sedimentary and volcanic rocks (T20SDMS, T24KSNV) – Sandstones, siltstones, and minor volcanic rocks in the lower portions of Little Bitterroot River valley, Canaan Prairie Basin, and White Earth Creek area (T20SDMS); siltstones, sandstones, and few conglomerates and coals of the Kishenehn Formation in the valleys of the North, South, and Middle Forks of the Flathead River.

Belt Supergroup rocks (400BELT, 400MSSL, 400RVLV, 400MCRB, 400PRCH) – Metamorphosed limestone, dolomite, siltstone, and sandstone; bedded rocks of the Missoula, Ravalli, Middle Belt carbonate, and Prichard 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://mbmgwgs.mtech.edu>) and ownership, hydrography, public land survey, and road data were obtained from the Natural Resources Information System, Helena (<http://nris.state.mt.us/>).

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Table 2. Well inventory data. Data are arranged in ascending township, range, and section order. Blank lines separate townships and gray lines separate ranges within townships; GWIC ID = Ground-Water Information Center identification number; Tr = township; R = range; Sec = section; T = tract; Alt = land-surface altitude (ft); TD = total depth (ft); SWI = static water level altitude (ft); Temp °C = water temperature (centigrade); SC = specific conductivity (micro-mhos); pH = acidity of water; Geologic Unit = geologic-unit code for well completion; Water Quality = type of analysis (blank = sample not collected).

GWIC ID	Tr	R	Sec	Alt	TD	SWI	Temp °C	SC	pH	Geologic Unit	Water Quality
12846	18N	18W	11	5114.0	11.0	5114.0	11.0	11.0	11.0	H11ALVM	full analysis
12847	18N	18W	11	5114.0	11.0	5114.0	11.0	11.0	11.0	H11ALVM	full analysis
12848	18N	18W	11	5114.0	11.0	5114.0	11.0	11.0	11.0	H11ALVM	full analysis
12849	18N	18W	11	5114.0	11.0	5114.0	11.0	11.0	11.0	H11ALVM	full analysis
12850	18N	18W	11	5114.0	11.0	5114.0	11.0	11.0	11.0	H11ALVM	full analysis
12851	18N	18W	11	5114.0	11.0	5114.0	11.0	11.0	11.0	H11ALVM	full analysis
12852	18N	18W	11	5114.0	11.0	5114.0	11.0	11.0	11.0	H11ALVM	full analysis
12853	18N	18W	11	5114.0	11.0	5114.0	11.0	11.0	11.0	H11ALVM	full analysis
12854	18N	18W	11	5114.0	11.0	5114.0	11.0	11.0	11.0	H11ALVM	full analysis
12855	18N	18W	11	5114.0	11.0	5114.0	11.0	11.0	11.0	H11ALVM	full analysis
12856	18N	18W	11	5114.0	11.0	5114.0	11.0	11.0	11.0	H11ALVM	full analysis
12857	18N	18W	11	5114.0	11.0	5114.0	11.0	11.0	11.0	H11ALVM	full analysis
12858	18N	18W	11	5114.0	11.0	5114.0	11.0	11.0	11.0	H11ALVM	full analysis
12859	18N	18W	11	5114.0	11.0	5114.0	11.0	11.0	11.0	H11ALVM	full analysis
12860	18N	18W	11	5114.0	11.0	5114.0	11.0	11.0	11.0	H11ALVM	full analysis
12861	18N	18W	11	5114.0	11.0	5114.0	11.0	11.0	11.0	H11ALVM	full analysis
12862	18N	18W	11	5114.0	11.0	5114.0	11.0	11.0	11.0	H11ALVM	full analysis
12863	18N	18W	11	5114.0	11.0	5114.0	11.0	11.0	11.0	H11ALVM	full analysis
12864	18N	18W	11	5114.0	11.0	5114.0	11.0	11.0	11.0	H11ALVM	full analysis
12865	18N	18W	11	5114.0	11.0	5114.0	11.0	11.0	11.0	H11ALVM	full analysis
12866	18N	18W	11	5114.0	11.0	5114.0	11.0	11.0	11.0	H11ALVM	full analysis
12867	18N	18W	11	5114.0	11.0	5114.0	11.0	11.0	11.0	H11ALVM	full analysis
12868	18N	18W	11	5114.0	11.0	5114.0	11.0	11.0	11.0	H11ALVM	full analysis
12869	18N	18W	11	5114.0	11.0	5114.0	11.0	11.0	11.0	H11ALVM	full analysis
12870	18N	18W	11	5114.0	11.0	5114.0	11.0	11.0	11.0	H11ALVM	full analysis
12871	18N	18W	11	5114.0	11.0	5114.0	11.0	11.0	11.0	H11ALVM	full analysis
12872	18N	18W	11	5114.0	11.0	5114.0	11.0	11.0	11.0	H11ALVM	full analysis
12873	18N	18W	11	5114.0	11.0	5114.0	11.0	11.0	11.0	H11ALVM	full analysis
12874	18N	18W	11	5114.0	11.0	5114.0	11.0	11.0	11.0	H11ALVM	full analysis
12875	18N	18W	11	5114.0	11.0	5114.0	11.0	11.0	11.0	H11ALVM	full analysis
12876	18N	18W	11	5114.0	11.0	5114.0	11.0	11.0	11.0	H11ALVM	full analysis
12877	18N	18W	11	5114.0	11.0	5114.0	11.0	11.0	11.0	H11ALVM	full analysis
12878	18N	18W	11	5114.0	11.0	5114.0	11.0	11.0	11.0	H11ALVM	full analysis
12879	18N	18W	11	5114.0	11.0	5114.0	11.0	11.0	11.0	H11ALVM	full analysis
12880	18N	18W	11	5114.0	11.0	5114.0	11.0	11.0	11.0	H11ALVM	full analysis
12881	18N	18W	11	5114.0	11.0	5114.0	11.0	11.0	11.0	H11ALVM	full analysis
12882	18N	18W	11	5114.0	11.0	5114.0	11.0	11.0	11.0	H11ALVM	full analysis
12883	18N	18W	11	5114.0	11.0	5114.0	11.0	11.0	11.0	H11ALVM	full analysis
12884	18N	18W	11	5114.0	11.0	5114.0	11.0	11.0	11.0	H11ALVM	full analysis
12885	18N	18W	11	5114.0	11.0	5114.0	11.0	11.0	11.0	H11ALVM	full analysis
12886	18N	18W	11	5114.0	11.0	5114.0	11.0	11.0	11.0	H11ALVM	full analysis
12887	18N	18W	11	5114.0	11.0	5114.0	11.0	11.0	11.0	H11ALVM	full analysis
12888	18N	18W	11	5114.0	11.0	5114.0	11.0	11.0	11.0	H11ALVM	full analysis
12889	18N	18W	11	5114.0	11.0	5114.0	11.0	11.0	11.0	H11ALVM	full analysis
12890	18N	18W	11	5114.0	11.0	5114.0	11.0	11.0	11.0	H11ALVM	full analysis
12891	18N	18W	11	5114.0	11.0	5114.0	11.0	11.0	11.0	H11ALVM	full analysis
12892	18N	18W	11	5114.0	11.0	5114.0	11.0	11.0	11.0	H11ALVM	full analysis
12893	18N	18W	11	5114.0	11.0	5114.0	11.0	11.0	11.0	H11ALVM	full analysis
12894	18N	18W	11	5114.0	11.0	5114.0	11.0	11.0	11.0	H11ALVM	full analysis
12895	18N	18W	11	5114.0	11.0	5114.0	11.0	11.0	11.0	H11ALVM	full analysis
12896	18N	18W	11	5114.0	11.0	5114.0	11.0	11.0	11.0	H11ALVM	full analysis
12897	18N	18W	11	5114.0	11.0	5114.0	11.0	11.0	11.0	H11ALVM	full analysis
12898	18N	18W	11	5114.0	11.0	5114.0	11.0	11.0	11.0	H11ALVM	full analysis
12899	18N	18W	11	5114.0	11.0	5114.0	11.0	11.0	11.0	H11ALVM	full analysis
12900	18N	18W	11	5114.0	11.0	5114.0	11.0	11.0	11.0	H11ALVM	full analysis
12901	18N	18W	11	5114.0	11.0	5114.0	11.0	11.0	11.0	H11ALVM	full analysis
12902	18N	18W	11	5114.0	11.0	5114.0	11.0	11.0	11.0	H11ALVM	full analysis
12903	18N	18W	11	5114.0	11.0	5114.0	11.0	11.0	11.0	H11ALVM	full analysis
12904	18N	18W	11	5114.0	11.0	5114.0	11.0	11.0	11.0	H11ALVM	full analysis
12905	18N	18W	11	5114.0	11.0	5114.0	11.0	11.0	11.0	H11ALVM	full analysis
12906	18N	18W	11	5114.0	11.0	5114.0	11.0	11.0	11.0	H11ALVM	full analysis
12907	18N	18W	11	5114.0	11.0	5114.0	11.0	11.0	11.0	H11ALVM	full analysis
12908	18N	18W	11	5114.0	11.0	5114.0	11.0	11.0	11.0	H11ALVM	full analysis
12909	18N	18W	11	5114.0	11.0	5114.0	11.0	11.0	11.0	H11ALVM	full analysis
12910	18N	18W	11	5114.0	11.0	5114.0	11.0	11.0	11.0	H11ALVM	full analysis
12911	18N	18W	11	5114.0	11.0	5114.0	11.0	11.0	11.0	H11ALVM	full analysis
12912	18N	18W	11	5114.0	11.0	5114.0	11.0	11.0	11.0	H11ALVM	full analysis
12913	18N	18W	11	5114.0	11.0	5114.0	11.0	11.0	11.0	H11ALVM	full analysis
12914	18N	18W	11	5114.0	11.0	5114.0	11.0	11.0	11.0	H11ALVM	full analysis
12915	18N	18W	11	5114.0	11.0	5114.0	11.0	11.0	11.0	H11ALVM	full analysis
12916	18N</										