MBMG
Montana Bureau of Mines and Geology

Data for Water Wells Visited during the Park–Sweet Grass Ground Water Characterization Study

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Author's Note: This map is part of the Montana Bureau of Mines and Geology (MBMG) Groundwater Assessment Atlas for the Park–Sweet Grass Area groundwater 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 Park–Sweet Grass Area, the reader is referred to the other maps of Montana Groundwater Assessment Atlas 9. (https://mbmggwic.mtech.edu).

INTRODUCTION

The Montana Bureau of Mines and Geology (MBMG) Ground Water Characterization Program staff visited 526 groundwater and surface-water sites, including 470 water wells, 47 springs, and 9 streams between 2012 and 2018 as part of the Park–Sweet Grass Ground Water Characterization Study (fig. 1). The sites were chosen from 8,500 recorded wells in Park and Sweet Grass Counties, excluding Yellowstone National Park. Visited sites were selected to obtain representative data from all aquifers. Monthly groundwater levels were measured from a subset of 73 wells between 2012 and 2018 to understand seasonal groundwater fluctuations; 25 of those wells are part of the statewide monitoring network (GWAAMON), which continue to be monitored.

GEOLOGIC UNITS

Geologic units for each well and spring were assigned by comparing the completion interval and lithologic information from the well log to geologic maps (Berg and others, 1999, 2000; Kellogg and Williams, 2006; Lopez, 2000, 2001; McDonald and others, 2005; Wilde and Porter, 2001). The geology of the study area varies between the bedrock and basin-fill of the upper Yellowstone Valley (Paradise Valley) and the bedrock dominated plateaus and mountain ranges of the Shields and Middle Yellowstone River Valleys (table 1). Of the 526 inventoried wells, 351 (67%) are completed in the bedrock units with ages ranging from Tertiary to Proterozoic.

SELECTED REFERENCES

Berg, R.B., Lonn, J.D., and Locke, W.W., 1999, Geologic map of the Gardiner 30′ x 60′ quadrangle, south-central Montana: Montana Bureau of Mines and Geology Open-File Report 387, 11 p., 1 sheet, scale 1:100,000.

Berg, R.B., Lopez, D.A., and Lonn, J.D., 2000, Geologic map of the Livingston 30′ x 60′ quadrangle, south-central Montana: Montana Bureau of Mines and Geology Open-File Report 406, 21 p., 1 sheet, scale 1:100,000.

Kellogg, K.S., and Williams, V.S., 2006, Geologic map of the Ennis 30′ x 60′ quadrangle, Madison and Gallatin counties, Montana, and Park County, Wyoming: Montana Bureau of Mines and Geology Open-File Report 529, 27 p., 1 sheet, scale 1:100,000.

Lopez, D.A., 2000, Geologic map of the Big Timber 30′ x 60′ quadrangle, south-central Montana: Montana Bureau of Mines and Geology Open-File Report 405, 17 p., 1 sheet, scale 1:100,000.

Lopez, D.A., 2001, Preliminary geologic map of the Red Lodge 30′ x 60′ quadrangle, south-central Montana: Montana Bureau of Mines and Geology Open-File Report 423, 17 p., 1 sheet, scale 1:100,000.

McDonald, C., Lopez, D.A., Berg, R.B., and Gibson, R.I., 2005, Preliminary geologic map of the Ringling 30′ x 60′ quadrangle, central Montana: Montana Bureau of Mines and Geology Open-File Report 511, 27 p., 1 sheet, scale 1:100,000.

Wilde, E.M., and Porter, K.W., 2001, Geologic map of the Harlowton 30′ x 60′ quadrangle, central Montana: Montana Bureau of Mines and Geology Open-File Report 434, 20 p., 2 sheets, scale 1:100,000.

SITE VISITS

Visited sites were selected to provide baseline data for alluvial and bedrock aquifers. Coordinates for each visited site were determined using a hand held global positioning system receiver and USGS 1:24,000 topographic maps. Where possible, data collected included the static-water level, temperature, pH, and specific conductance of the water. The water-quality parameters represent stabilized readings attained after an average 30-min pumping duration. Samples (147) were collected from selected wells, springs, and streams after field parameters stabilized and/or three well volumes of water were discharged. Samples were analyzed at the MBMG Analytical Lab and include major ions, trace metals, and nitrate. Some wells could not either be pumped to measure field parameters or accessed to measure water levels. Field data for the inventoried sites and sampling status are included in the appendix; complete analytical results (major ions, trace metals, and nitrate) are available from the Ground Water Information Center (GWIC) database (https://mbmggwic.mtech.edu/).

DATA SOURCES

All data and water-quality analysis results are available from the GWIC database (https://mbmggwic.mtech.edu). Land ownership, hydrography, public land survey, and road data were obtained from the Natural Resource Information System, Helena (https://nris.msl.mt.gov/).

ACKNOWLEDGMENTS

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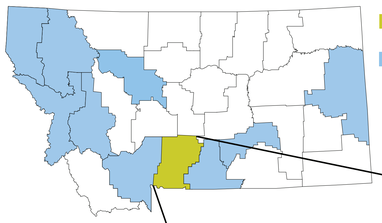
Table 1. The 526 visited wells, springs, and streams are completed in 33 geologic units. The geologic units were consolidated into 9 hydrogeologic codes, used to represent aquifers in the study area.

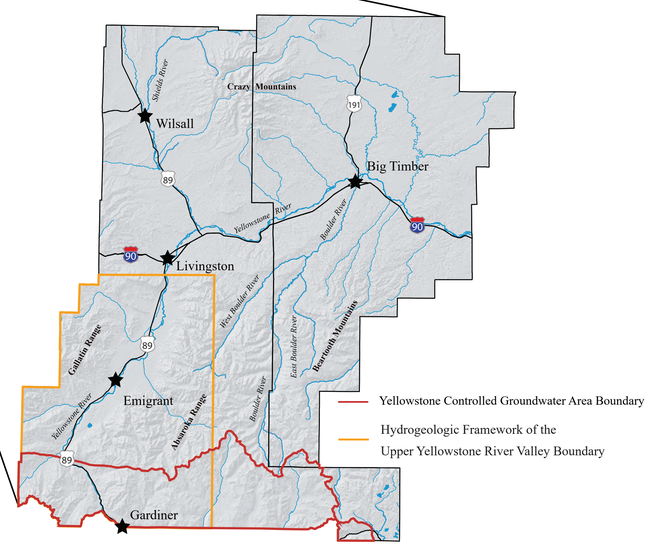
	Era	Period/Age	Geologic Code	Hydrogeologic Code	No. of Sites Visited	No. of Sampled Sites	Aquifer Description
Basin-Fill	CENOZOIC	Quaternary 1.8 Ma	110ALVM 111ALVM 112ALVM	Qal	123	27	Quaternary alluvial deposits consisting of clay, silt, sand and gravel; unconfined to semi-confined.
			112DRFT 112OTSH 112SDMS	Qg/Qgo	43	15	Quaternary (Pleistocene) glacial outwash, drift, and till (silt, clay, sand, gravel, and cobbles deposited by, or near to, glaciers); unconfined to semi-confined.
Bedrock		Tertiary 65 Ma	120PLNC 124ABSK	TKig/Tav	24	11	Tertiary Absaroka volcanic and plutonic rocks consisting of dacitic or andesitic flows, dikes, sills, porphyries, and breccias. Creataceous volcanic rocks located in the Paradise Valley, known as the Sliderock Volcanics (211VLCC), are included in the hydrogeologic code TKig. Fractured rock aquifer.
			125TGRV 125LEBO 125TLCK	Tfu	137	41	Tertiary Fort Union Formation; consists of tan to yellowish gray sandstone, sandy claystone, shale, and coalbeds. Confined to unconfined.
	MESOZOIC	Cretaceous 144 Ma	211VLCG, 211VLCC, 211HSDAN, 211HLCK, 211HPRS, 211BMCK, 211MRCK, 211CKDL, 211BRPW	Khc and Kb	106	23	Cretaceous Livingston Group and Time equivalent sedimentary deposits; Hell Creek and Bear Paw Shale. Consists of alternating sandstone, siltstone, mudstone, claystone, and shale. Cretaceous Sliderock volcanics (211VLCC) consist mostly of andesite breccias. The Sliderock Volcanics are included in the hydrogeologic code TKig (above).
			211EGLE, 211JREL	Kjrel	25	5	Cretaceous sandstones of the Judith River and Eagle Formations.
			211CLRD, 211TPCK, 211CODY, 211FRNR, 217MWRY	Kseds	24	6	Undifferentiated Cretaceous sedimentary rocks: Telegraph Creek, Cody Shale, Frontier Formation, and the Mowry Shale. Consists of alternating sandstone, siltstone, mudstone, claystone, and shale.
	PALEOZOIC	Pennsylvanian Mississippian Devonian Ordovician Cambrian 543 Ma	320AMSD 330MDSX 361BGRN 371PLGM	J-P Seds Mm	13	9	Paleozoic lithology conisists of sandstone, mudstone, interbedded shales, and limestone. Includes Amsden Formation (Pennsylvanian and Mississippian); Madison Limestone (Mississippian); Big Horn Formations (Devonian/Ordovician); and Pilgrim Formations (Cambrian).
	PRECAMBRIAN	Proterozoic Archean 4.6 Ga	500GNSC	pCIb	22	4	Precambrian metamorphic rock that forms an aquifer where sufficiently fractured. Lithology consists of mylonite, granite–gneiss, biotite–schist, amphibolite, quartzite, and marble.
		Totals			517	141	

Ground Water Characterization Study Areas



Park and Sweet Grass Counties are the 9th Ground-Water Characterization Study Area (GWCP09)

Data and/or maps available



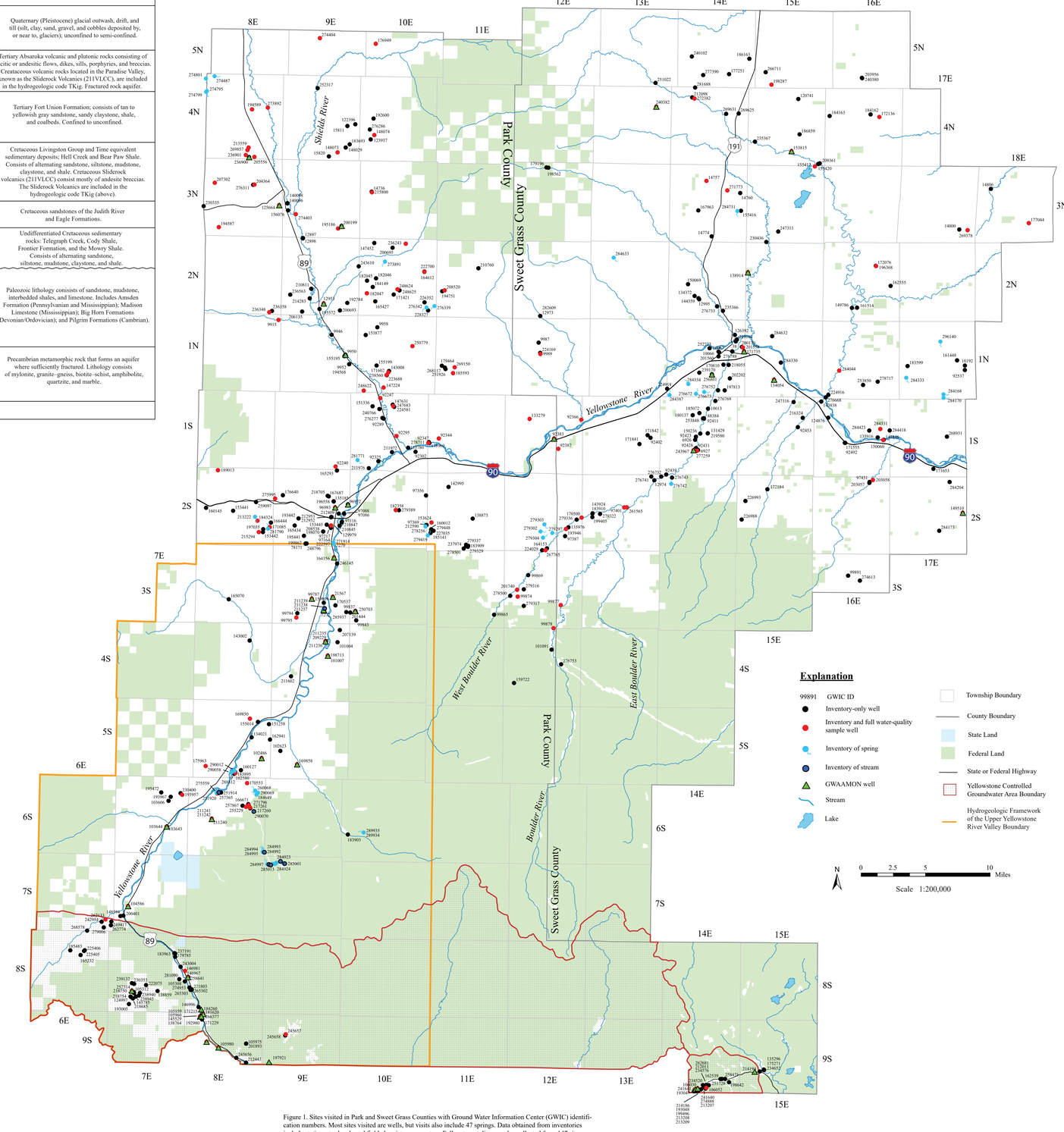


Figure 1. Sites visited in Park and Sweet Grass Counties with Ground Water Information Center (GWIC) identification numbers. Most sites visited are wells, but visits also include 47 springs. Data obtained from inventories include static water levels and field chemistry parameters. Full water-quality samples collected from 147 sites were analyzed for major ions, trace metals, and nitrate. Site information, field data, and full water-quality analyses can be obtained from the GWIC database using GWIC Project Code GWCP09 (https://mbmggwic.mtech.edu). Site information is also available in appendix A.

Maps may be obtained from:
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