OF 55-15

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
WATER RESOURCES DIVISION

RECONNAISSANCE OF THE GEOLOGY AND GROUND-WATER RESOURCES OF THE COKEVILLE AREA, LINCOLN COUNTY, WYOMING

By Delmar W. Berry

Open-File Report 55-15

Prepared in cooperation with the
Wyoming Natural Resource Board

March 1955

Open-file report
Not reviewed for conformance
with editorial standards of
the Geological Survey

CONTENTS

ILLUSTRATIONS

TABLE

RECONNAISSANCE OF THE GEOLOGY AND GROUND-WATER RESOURCES OF THE COKEVILLE AREA, LINCOLN COUNTY, WYOMING

By Delmar W. Berry

INTRODUCTION

Purpose and Scope of the Investigation

Expanding industry and the ever-increasing demand by agriculture on water resources have brought about a need for ground-water investigations to determine the quantity and quality of ground water available.

The United States Geological Survey in cooperation with the Wyoming Natural Resource Board made a reconnaissance study in February 1955 of the geology and ground-water resources of the Cokeville area, Lincoln County, Wyo., to determine if adequate ground water is available for industrial and irrigation development and if the area would warrant additional geologic and hydrologic study. Studies were concentrated along the valley of the Bear River, where it was deemed most likely that wells of large discharge could be developed. During the course of the investigation data relative to wells and to the character, extent, and thickness of material most likely to yield large quantities of water were gathered by the author. The well data presented in this report were obtained by interviewing well owners and drillers. The geology was compiled by use of the Wyoming State geologic map and by aid of aerial photographs, and is presented on a map (fig. 1) adapted from a base map prepared by the Wyoming Highway Department. Included in the report are records of wells, drillers' logs of samples collected in the drilling of wells, and pumping-test data.

Location of Area

The area studied lies along the valley of the Bear River in Lincoln County, Wyo. The area, about 60 square miles, extends from about 8 miles south to approximately 4 miles north and from about 2.5 miles east to approximately 2.5 miles west of Cokeville and lies between latitude 41°58' and 42°08' and longitude 110°54' and 111°00'. The location of the area within the State is shown on figure 2.

Geography

The area studied includes a valley whose floor is underlain by Quaternary alluvium, flanked on either side by older rocks. The broad, flat valley floor, which ranges from 1 to 2 miles in width, is flanked on the southwest by composite alluvial fans, shown on figure 1 as Qaf; and on the east by small terrace remnants, not shown on figure 1. Drainage within the area is by numerous creeks which flow directly into the Bear River or lose themselves in the alluvial fans or terrace deposits adjacent to the river.

The following data relative to climate are based on records at Border, Wyo., about 11 miles north of Cokeville. The area is marked by extremes of temperature; the range in 1953 was from 90°F to -20°F. The normal annual temperature is about 38°. Precipitation is rather light, the normal annual precipitation being approximately 13 inches.

The major industry in the area is agriculture, primarily grazing and hay growing; however, there are phosphate deposits in adjacent areas that have development possibilities.

The Union Pacific Railroad traverses the area from north to south, and U. S. Highway 30N approximately parallels the railroad through the area.

General Geology

As a result of the Laramide disturbance, which occurred at the close of Cretaceous time, the older rocks of the area were uplifted and faulted. Subsequent erosion has exposed the older formations at the surface along both sides of the river. The rocks exposed in the report area range in age from Mississippian to Quaternary.

All strata deposited through Cretaceous time (fig. 1) resulted from alternate advance and retreat of seas. After the retreat of the last sea, erosion, and deposition of continental sediments, have dominated. It was under these conditions that the younger deposits of Tertiary (Wasatch formation) and Quaternary (alluvial deposits) age were laid down.

During one of the erosional cycles the present Bear River began to develop along the line of least resistance in the area, which presumably was an uplifted and faulted zone. Continued downcutting formed a channel a few miles in width cut into the older deposits along the apex of the uplift. Eventually the surface runoff along the flanks of the major stream eroded the bedrock and formed a drainage pattern comparable to the existing one. As a result of a succession of later cycles of erosion and deposition the valley was filled with a rather thick section of alluvium consisting of silt, sand and gravel. These deposits are an accumulation of detrital material derived from older formations upstream. As the present valley became filled, outwash from hills began to accumulate along the margin of the present valley, forming alluvial fans consisting of locally derived sand and gravel. On the west these deposits reach a considerable thickness and in part overlie the river alluvium.

GROUND WATER

Relationship to Geology

Ground water can be obtained from several geologic sources within the report area. The alluvium, which constitutes the greatest potential aquifer of the area, can be expected to yield large quantities of water to wells. Alluvial-fan deposits can be expected to yield large quantities of water where they overlie the alluvium, but the amount may be expected to decrease gradually away from the river as the saturated thickness decreases. Several of the older formations that underlie the area--namely, the Madison limestone, Amsden formation, Tensleep sandstone, Bear River formation, and Wasatch formation--can be expected to yield moderate quantities of water to wells. Water from these formations generally is under artesian head, and wells located on low ground down dip from the outcrop areas may flow. The Madison limestone and Tensleep sandstone are generally good aquifers and in many areas have been known to yield more than 100 gallons of water a minute to wells. It is believed that these formations would yield comparable quantities of water in the area under study.

Although the older deposits can be expected to yield moderate quantities of water, the yields would be small compared to those that could be obtained from the unconsolidated deposits of the alluvium and alluvial fans; consequently, the following discussion will deal only with the unconsolidated deposits.

Alluvium

The alluvium consists of beds of well-sorted silt, sand, gravel and cobbles, the major thickness consisting of gravel.

The deposits of alluvium, which are 1 to 2 miles wide, underlie approximately one-fourth of the area mapped. Test holes and wells indicate that the maximum thickness of the alluvium is at least 154 feet. A well drilled on the L. W. Roberts farm in the SW¼ sec. 5, T. 24 N., R. 119 W., penetrated that thickness of alluvium. Following is a driller's log of the formation samples taken from Mr. Roberts' well. Other data relative to the well are given in table 1.

Driller's log of well drilled on the L. W. Roberts farm in the SW¼ sec. 5, T. 24 N., R. 119 W.

Character of material	From (feet)	To (feet)	Thickness (feet)
Alluvium			
Soil and silt	0	6	6
Gravel and silt	6	35	29
Gravel	35	52	17
Gravel, silty	52	86	34
Gravel	86	123	37
Clay	123	126	3
Gravel	126	137	11
Clay	137	142	5
Gravel	142	143	1
Clay	143	154	11

Alluvial-Fan Deposits

Alluvial-fan deposits of silt, sand, and gravel are adjacent to and extend along the western side of the valley in the area (fig. 1). These deposits are not as well sorted and are more angular than the alluvium, indicating that they are locally derived. The deposits, which extend about two-thirds of the length of the area mapped, may reach a thickness of 75 feet locally.

Wells penetrating the alluvial-fan deposits will yield less water than wells penetrating the alluvium, except where they overlie the alluvium. The flow of streams draining the area to the west disappears

into the fan deposits, thus supplying considerable recharge to the area. Water entering these deposits percolates downward and eventually reaches the water table, and then flows down gradient toward the river where it either feeds the river or is discharged by evapotranspiration.

Two wells have been drilled into the alluvial-fan deposits where they are underlain by the alluvium. These wells penetrated 142 feet and 107 feet respectively, of unconsolidated material, of which the lower part was alluvium of the river. Drillers' logs of formation samples are given below and other data relative to the type of well, casing, discharge, and drawdown are given in table 1.

Driller's log of well drilled on the Doyle Knouse farm in the NW¼ NW¼ sec. 18, T. 23 N., R. 119 W.

Character of material	From (feet)	To (feet)	Thickness (feet)
Alluvial-fan deposits and alluvium			
Gravel and silt	0	35	35
Clay	35	60	25
Gravel	60	64	4
Gravel, silty	64	101	37
Clay	101	106	5
Gravel, clean	106	121	15
Gravel	121	127	6
Gravel, clean	127	142	15

Driller's log of well drilled on the Claude Knouse farm in the SW¼ NE¼ SW¼ sec. 7, T. 23 N., R. 119 W.

Character of material	From (feet)	To (feet)	Thickness (feet)
Alluvial-fan deposits and alluvium			
Gravel and silt	0	10	10
Gravel and loose clay	10	18	8
Clay	18	43	25
Gravel	43	47	4
Clay	47	50	3
Gravel	50	56	6
Clay	56	60	4
Gravel	60	69	9
Clay	69	86	17
Gravel	86	107	21

Availability

General Conditions

The availability of ground water is dependent on many factors, including recharge conditions, storage capacity of the ground-water reservoir, ability of the aquifer to transmit water, and saturated thickness of the aquifer. Recharge for the alluvial fans is derived principally from infiltration of surface runoff; the recharge of the valley alluvium is derived both from the alluvial fans and from underflow along Bear River. The storage reservoir extends over an area of several square miles and has a thickness of 150 feet or more, of which all but about the top 20 feet is saturated. Water-bearing materials within the storage reservoir are sufficiently permeable to allow comparatively rapid movement of water into wells, thereby allowing large quantities of water to be pumped.

Specific Capacity of Wells

The specific capacity of a well, or yield per unit of drawdown, is expressed as the number of gallons a minute that a well yields for each foot of drawdown of the water level in the well. Under water-table conditions, this relation is approximately constant only when the drawdown is but a small fraction of the saturated thickness of the aquifer. The drawdown depends also upon differences in the construction and development of wells. However, a comparison of specific capacities is useful in estimating the permeability of aquifers and the relative efficiency of wells. The discharge and drawdown of three of the wells are given in table 1.

The highest specific capacity recorded is for a well (no. 1) drilled in the alluvium at Cokeville. The specific capacity of this well is about 50 gpm for each foot of drawdown. Two other wells drilled about 8 miles south penetrate the alluvial-fan deposits and part of the underlying alluvium and have specific capacities of 17 and 19 gpm per foot, respectively. Yields of as much as 2,000 gpm could be expected from properly constructed wells penetrating the entire thickness of the deposits.

Large-scale development of ground water for industrial, agricultural, or other uses should be accompanied by additional detailed investigations to determine, more accurately than is now possible, the maximum feasible ground-water yield of the area.

Table 1.--Record of wells in the Cokeville area, Lincoln County, Wyo.

ell no.	Location	Owner	Year drilled (19--)	Depth of well (feet)	Diameter of well (inches)	Geologic source	Reported distance to water level below land surface (feet)	Date of measurement	Remarks (Yield given in gallons a minute; drawdown in feet)
	T. 23 N., R. 119 W.								
3	SW¼ NE¼ SW¼ sec. 7	Claude Knouse	54	107	12	Alluvial-fan deposits and alluvium	8	12- 7-54	Yield 500, drawdown 29.
2	NW¼ NW¼ sec. 18	Doyle Knouse	54	142	12	Do	44	12-31-54	Yield 400, drawdown 21.
	T. 24 N., R. 119 W.								
1	SW¼ SW¼ sec. 5	L. W. Roberts	55	154	18	Alluvium	20	1-31-55	Yield 1,125, drawdown 20.
5	NW¼ NW¼ sec. 20	Mr. Thompson	--	90	6	Alluvial-fan deposits and alluvium	60	2-11-55	
4	SE¼ SE¼ sec. 28	Sam Bennion	--	79	--	Alluvium	20	2-10-55	

All wells are drilled and cased with steel pipe.