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DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
WATER RESOURCES DIVISION

GROUND WATER IN THE VICINITY OF EDGERTON, WYOMING

By

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INTRODUCTION

Edgerton, an incorporated town of about 200 people most of whom are employed in the Salt Creek oil field, is in the northeast corner of Natrona County, in central Wyoming. It lies north of Salt Creek in section 29, T. 40 N., R. 78 W. Salt Creek, the principal stream of the area, rises about 20 miles to the south and flows in a northwesterly direction to empty into the Powder River. Coal Draw is its principal tributary in the Edgerton area; it drains the area to the northeast and joins Salt Creek about 2 miles northwest of Edgerton.

Adequate quantities of water for domestic and stock use can be obtained from wells in the Cody shale in the area, but this water is so highly mineralized that it is not satisfactory for drinking and most other purposes. Edgerton has a municipal water supply which because of poor quality is used only for fire fighting. Consequently, water is being piped from Casper to Midwest, a distance of about 40 miles, and trucked an additional 2 miles from Midwest to Edgerton. This report describes ground-water conditions in the vicinity of Edgerton, Wyo., and places special emphasis on the quantity and quality of water available for municipal, domestic, and stock use. The study upon which it is based was made as a part of the statewide program of ground-water investigations in cooperation with the State Engineer of Wyoming. Special thanks are due the Sinclair and Stanolind Oil Cos. and Mr. Roy Bideau, well driller, who furnished pertinent data concerning water conditions in the area.

GEOLOGIC SETTING

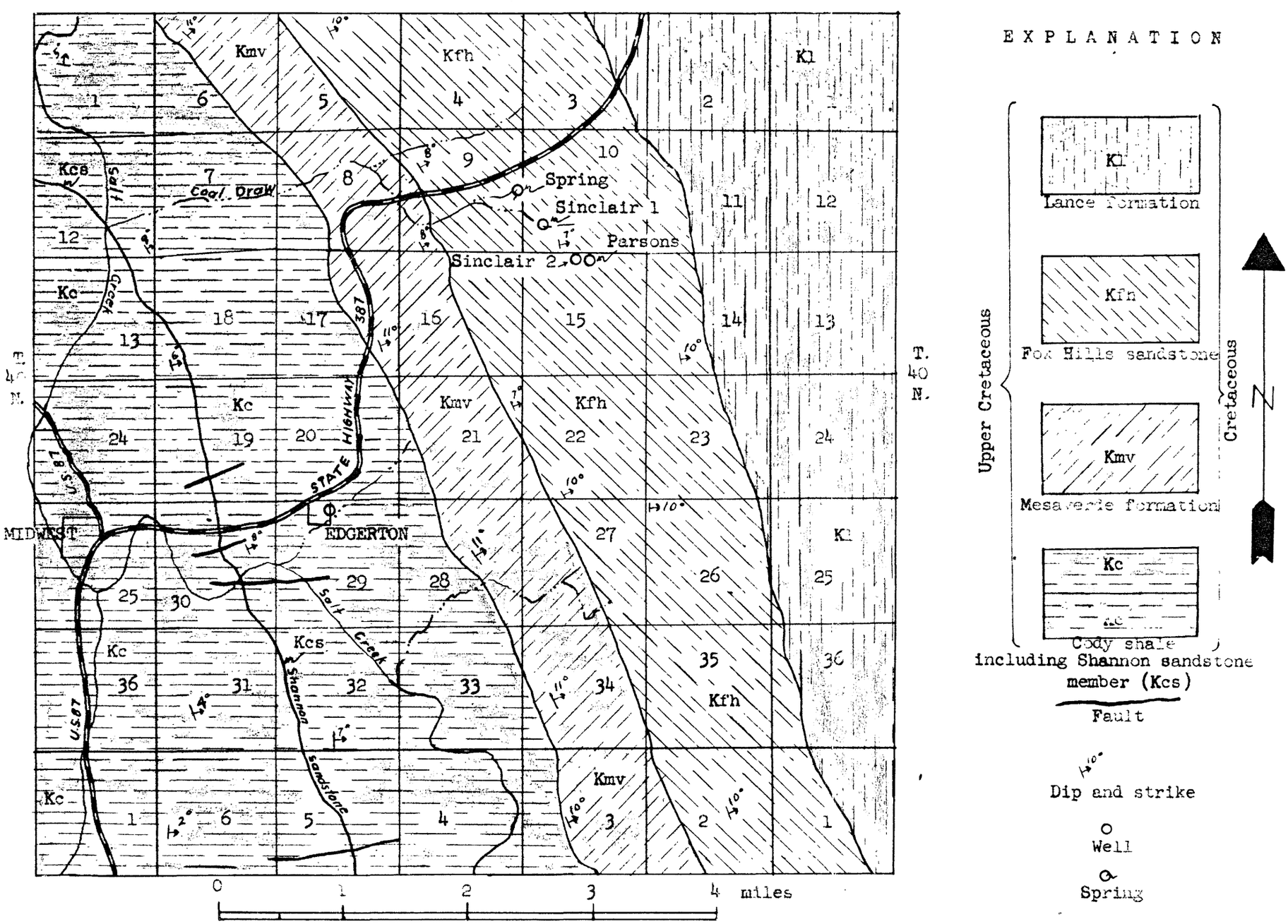
Edgerton is in the southwestern part of the Powder River structural basin. The Big Horn Mountains, which border the basin on the west, are flanked on the southeast by several anticlines which rise successively higher to the principal arch which forms the Big Horn Mountains. The easternmost of these is the Salt Creek anticline. It is an asymetrical anticline, about 30 miles long, with dips much gentler on the east limb than on the west. It is composed of three minor domes separated by two shallow saddles. Edgerton is on the east limb of the northernmost dome (the Salt Creek dome) and lies in one of the lowest of several narrow northwestward-trending strike valleys. Bounding this valley on the west is an outcrop of the Shannon sandstone member of the Cody shale (fig. 1). It once extended as a broad arch over the dome but has now been largely removed by erosion and persists as a prominent ridge that completely encircles the Salt Creek dome.

Rising rapidly to the east of Edgerton, the Parkman sandstone member of the Mesaverde formation forms a rugged escarpment which lies several hundred feet above the Shannon sandstone member. Outside the Parkman sandstone member and also encircling the dome on the east is a somewhat less conspicuous ridge formed by the Teapot sandstone member of the Mesaverde formation which, in most places, is sparsely covered by pine trees. These and several other local ridges form the divides between the valleys and indicate by their dips to the east the shape and position of the east limb of the Salt Creek dome. Numerous small normal faults occur at right angles to the strike of the formations but do not greatly affect the general shape of the structure.

FIGURE I

MAP OF THE EDGERTON AREA, WYOMING

Showing Areal Geology and Location of Water Wells



Compiled from map of Salt Creek oil field, Natrona County, Wyo., by Carroll H. Wegemann, and map of Powder River basin and adjacent areas, Wyoming, by J. D. Love and J. L. Weitz.

The foregoing is a general discussion of the geologic setting of the Edgerton area. More detailed information regarding the geology of the area can be obtained from the reports by Wegemann (1910) and by Love (1951). 1/ These reports have been consulted in the preparation of this report.

GEOLOGY AND GROUND-WATER CONDITIONS

The rocks exposed in the Edgerton area from oldest to youngest are the Cody shale, Mesaverde formation, Fox Hills sandstone, and Lance formation of Late Cretaceous age, and, along the streams, alluvium of Quaternary age. The Cretaceous rocks are shown in figure 1. Below the sequence of Cretaceous rocks exposed, and at a depth of more than 1,000 feet below the land surface at Edgerton, lies the Wall Creek sandstone member of the Frontier formation, which is the first water-bearing rock below the Shannon sandstone member. Although the Wall Creek sandstone member contains water, analyses by S. C. Dinsmore (Wegemann, 1910, pp. 42-45) indicate a high concentration of chloride and carbonate and an average of nearly 9,000 parts per million of dissolved solids. Because of this high mineralization, the Frontier formation was not studied further.

Cody Shale

The Cody shale is exposed at the crest of the Salt Creek dome and underlies the town of Edgerton. It is typically a dark-gray marine shale about 2,300 feet thick with numerous bentonite beds and some thin layers of ferruginous sandstone. The Shannon sandstone member, about 1,045 feet above its base, generally consists of two resistant beds and an intermediate mass of softer sandstone and shale. It has an average thickness of 130 feet.

The town well at Edgerton apparently penetrates this sandstone below a

1/ See references at end of report.

depth of 430 feet. The water in this well is so highly mineralized that it cannot be used for domestic purposes and is used only to supply water for fire protection. At Midwest, Wyo., six wells have been drilled into the Shannon sandstone member. Water from these wells is so highly mineralized that it must be distilled for general use. Analyses of three water samples from the Shannon sandstone member made by S. C. Dinsmore (Wegemann, 1910, pp. 42-43) indicate an average of more than 4,000 parts per million of dissolved solids and a high proportion of sulfate.

Above the Shannon sandstone member is a bed of shale about 1,100 feet thick which generally contains a 30-foot bed of sandstone about 400 feet above its base. The sandstone bed occurs below the land surface at Edgerton and is the water sand reported in many of the oil wells in the Shannon field. The water in this sandstone is very highly mineralized.

Mesaverde Formation

The Mesaverde formation, consisting of a series of beds of light-colored massive to thin-bedded sandstone, gray sandy shale, and coal, lies above the Cody shale. It is about 845 feet thick and consists of a basal sandstone, the Parkman sandstone member; an unnamed middle member of sandstone and shale; and an upper sandstone, the Teapot sandstone member. The Parkman sandstone member is about 470 feet thick and in ascending order consists of a cross-bedded buff very fine-grained basal sandstone about 170 feet thick, a series of shale, carbonaceous shale, and coal beds about 190 feet thick, and a capping white sandstone about 110 feet thick. The basal sandstone forms the prominent ridge in the Salt Creek field. The Teapot sandstone member consists of about 325 feet of shale capped by a fine-grained bluish-white sandstone about 50 feet thick. One or two beds of soft coal are associated with this sandstone. All available evidence indicates that the Mesaverde formation contains water but it is too highly mineralized for general domestic use.

Fox Hills Sandstone

Above the Teapot sandstone member of the Mesaverde formation are about 1,400 feet of light-colored sandstone and gray sandy shale which constitute the Fox Hills sandstone. The lower 600 feet consists primarily of a gray marine shale (LEWIS SHALE), which is overlain by a 100-foot bed of fine- to medium-grained sandstone. This sandstone bed, in some localities, is separated in the middle by a 6-foot bed of brown to gray carbonaceous shale. The sandstone below this shale typically is brown and weathers into knobs and pillars, whereas the sandstone overlying the shale is typically white. The 100-foot sandstone bed is the material from which water is obtained in the 130-foot Parsons well in the NE¼ sec. 15, T. 40 N., R. 78 W. This well, which encountered the sandstone at a depth of about 80 feet, penetrated only the upper 47 feet and apparently bottomed in the shale parting at the middle of the sandstone.

A pumping test was made of the Parsons well to determine the hydrologic properties of the upper part of this sandstone bed. The well was pumped at a constant rate of 10.9 gpm for 7 hours during which time the depth to water in the well was measured periodically. After the pump was shut off the rate of recovery of the water in the well was measured and the coefficient of transmissibility of the material was determined. The coefficient was computed to be about 1,600 gpd per foot by using the Theis recovery method (Theis, 1935, pp. 519-524.) The coefficient of transmissibility may be expressed as the number of gallons of water a day, at the prevailing temperature of the water, transmitted through each strip of the aquifer 1 mile wide under a hydraulic gradient of 1 foot to the mile. The coefficient of permeability was determined to be 34 gpd per foot by dividing the coefficient of transmissibility by the thickness of the aquifer, 47 feet. The specific

capacity of the well was determined to be 0.37 gpm per foot of drawdown of water in the well. Water from this well is suitable for domestic use. A partial analysis of the water, made by R. E. Sundin, Wyoming State Health Department Laboratory, indicated the following chemical constituents, in parts per million: iron (Fe), 0; fluoride (F), 0.2; dissolved solids, 388; and total hardness (as $CaCO_3$), 0.

The Sinclair well number 2 in the NW¼ sec. 15, T. 40 N., R. 76 W., which was drilled to a depth of 705 feet, penetrated the entire thickness of the sandstone, of which there was only 95 feet, and obtained a little more than 3 gpm. This well, located several hundred feet updip from the Parsons well, obtained a smaller quantity of water than the Parsons well, probably owing to a somewhat thinner saturated section of the sandstone. Sinclair well number 1 in the SW¼ sec. 10, T. 40 N., R. 76 W., is thought to obtain water from the lower part of the Fox Hills sandstone. Water from this well is of fair quality and is being used for domestic purposes. A small spring in the NE¼ sec. 9, T. 40 N., R. 76 W., issues from the lower part of the 100-foot sandstone bed. Water from this spring is potable and has been in general use for several years. A partial analysis of water from this spring indicated the following chemical constituents, in parts per million: iron (Fe), 0; fluoride (F), 0.4; dissolved solids, 886; and total hardness (as $CaCO_3$), 140.

Lance Formation

Above the Fox Hills sandstone lies a 3,200-foot sequence of alternating massive, concretionary buff sandstone, dark-colored claystone and shale, and coal beds. No information is available regarding its water-bearing qualities in this immediate area, but it is reasonable to expect that it would yield at least small quantities of water.

Alluvium

The alluvium underlying the valleys of Salt Creek and its tributaries is derived from the surrounding sandstone and shale. The alluvium is fine grained and would not readily yield water to wells. Also, the water is highly mineralized.

CONCLUSIONS

Water of good quality can be obtained in sufficient quantities for domestic, stock, and small-scale municipal use from the Fox Hills sandstone east of Edgerton. Wells capable of yielding about 10 gpm can be expected from the 100-foot sandstone that lies about 600 feet above the base of the formation, where the material is completely saturated. Wells drilled down dip, or eastward, from a line along the strike of the formation passing through the Parsons well (fig. 1.) should penetrate a completely saturated section of sandstone. West, or up dip, from this line the sandstone probably would not be completely saturated. Wells located down dip, or eastward, from the Parsons well would encounter the top of the sandstone at increasingly greater depths to the east. For example, a well drilled 300 feet down dip from the Parsons well should encounter the top of the sandstone at approximately 125 feet below the land surface and should penetrate about 50 feet more of shale than the Parsons well. The minimum safe spacing of wells is about a quarter of a mile. They would have to penetrate the entire thickness of the sandstone to develop the maximum amount of water.

Sufficient water for domestic and stock use can be obtained also from the Lance and Mesaverde formations east of Edgerton. However, the water in the Mesaverde formation is likely to be too highly mineralized for domestic use.

REFERENCES CITED

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