Ground Water in the Methow Valley
Mazama to Winthrop

by

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in cooperation with Okanogan County
for
The Okanogan County Planning Department

Introduction

The area of this study extends from approximately Mazama southeast 12 miles to Winthrop along the Methow Valley in Okanogan County, Washington. The valley between Mazama and Winthrop is a northwest-southeast trending u-shaped trough which lies some 1,000 to 2,500 feet below the adjacent mountains. The valley in this area has been glaciated and is partially filled with thick deposits of glacial debris. The resultant landform is a rather steep-sided, broad, flat-bottomed valley approximately 1 mile wide. The valley sides are covered with talus slopes, alluvial fans, and glacial terraces. The alluvial fans and glacial terraces are composed for the most part of sands and gravels.

Purpose

The purpose of this study was to develop a ground-water contour map of the Methow Valley approximately between Mazama and Winthrop. In addition, potential aggregate sources were delineated. The major concern expressed regarding the aggregate sources was that they should lie above the ground-water table and the thickness and horizontal extent be enough to allow economic and efficient operation without extending into or below the ground-water table.

The interpretive map shows:

1. Depth to free ground-water table - showing by use of contours the approximate elevation at which ground water could be expected to occur based upon results obtained in May, 1975.

2. Potential aggregate sources – showing areas of probable major sand and gravel deposits which meet the concerns expressed in the paragraph above.

Field Study

The field study was conducted during the month of May, 1975 utilizing a total of 17 man days. The field study consisted of a visual geological reconnaissance as well as a detailed geophysical investigation. The geophysical investigation was conducted using a portable seismograph and resistivity meter. Twenty four traverses were conducted. The results of these traverses are included in Table 1. Thirty six resistivity traverses were conducted. The approximate resistivity was calculated and plotted and the depth of the approximate break which could indicate the ground-water table was entered on the map beside the traverse location. Air photo interpretations and the calculation, interpretation, and correlation of field data was conducted in the Olympia office of the Division of Geology and Earth Resources.

Discussion

Ground-water table as used in this paper is the upper surface of the zone saturated by free ground water. Ground water will rise roughly to the water table and not above it in a shallow well penetrating a free ground-water system. The fact is known that the standing level in a well may register (1) the water table, (2) the pressure surface of a body of confined water, or (3) the highest modified pressure surface of several horizons of confined water. In the Methow Valley few wells are extended below a depth of 90 feet. Existing well logs indicate a probable free ground-water system; therefore, water levels in existing shallow wells probably represent the ground-water table.

A ground-water table contour map is a map of the upper surface of the saturated zone. The ground-water table contours show the elevation of the ground-water table and the direction of movement of ground water at right angles to the contours. Measurement of the free ground-water table is accomplished by extending boreholes down to, and a little below, the saturated zone, or from direct measurements of depth to water in shallow wells which do not extend very much below the saturated zone, or by geophysical methods. It must be pointed out that seasonal fluctuations of the ground-water table may be considerable; therefore, it should be kept in mind that Plate 1 of this report is based on data collected during May, 1975. Key wells have been noted and the actual date and measurement tabulated on Table 2. Measurements of the ground-water table in these wells should be taken throughout the year to obtain an idea of the yearly ground-water table fluctuations.

Geophysical methods may furnish direct or indirect information regarding the location of the ground-water table. If ground water is contained in pervious sand and gravel and resistivity measurements are not affected by moist clay layers above the ground-water table, the depth of the water table can be determined. Most curves indicating change in geophysical properties due to saturation are smooth, and, therefore, the zone of saturation is not indicated by a sharp peak (figure 1); thus, the depth to the ground-water table is not indicated with the accuracy obtained from shallow boreholes. The Bison 2350 Resistivity Meter which was used in this survey has an accuracy rating of about ± 10 to 15%; therefore, in shallow measurements the results can be assumed to be fairly close to the actual depth. For instance, if the result of a resistivity sounding indicates the ground-water table at a depth of 10 feet, the actual depth may vary from 8.5 to 11.5 feet, but for the purposes of this survey has been assumed to be accurate at about 10 feet.

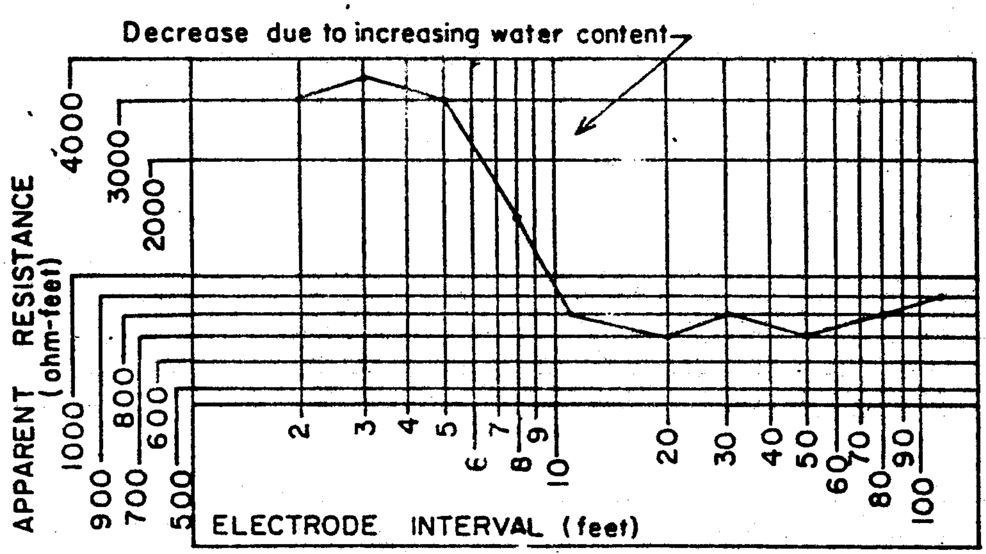

Figure 1: Example of a resistivity curve.

The depth of any point is approximately 1/3 of the electrode interval distance. In this example the change occurs between the intervals of 5 and 12 feet; therefore, the apparent ground-water table occurs approximately between the depths of about 2 to 4 feet. Using a conservative approach a depth to the ground-water table of 4 feet will be plotted.

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Legend

105 Qal — Qal Valley fill - mostly sand and gravel with some silts overlying glacial debris.

106 Qsw — Qsw Talus deposits - mostly angular blocks of rock with finer disintegration particles - located along base of steeper valley sides.

108 Qaf — Qaf Alluvial fan deposits - fanglomerate-like material - mostly sand and gravel.

109 Qrt — Qrt Older river and glacial terrace deposits - mostly sands and gravel with large percentages of finer particles.

189 — u Undifferentiated Pleistocene and pre-Pleistocene deposits - mostly bedrock.

— — — Approximate location of a geologic contact.

⊗ 6'3" 5-19-75 — Approximate water well location used as key wells. Depth to water table and measurement shown.

TR-5 10' — Approximate location of resistivity traverse - approximate depth to resistivity break shown.

T-1 → Approximate location and direction of seismic traverse.

—2030— Ground-water table contour - based on datum mean sea level (1947), and field data collected in May (1974).

TABLE 1: Results of Seismic Traverses

Seismic Traverse Number	Seismic Velocity (fps)	Depth	Comments
T-1	900	0-3½'	dry, loose earth material
	2400	3½-41'	sands and gravels
	4900	41'+	?
T-2	850	0'-5'	dry, loose earth material
	3400	5'+	sands and gravels
T-3	800	0'-3½'	dry, loose earth material
	3000	3½'-55'	sands and gravels
T-4	1100	0'-3½'	dry, loose earth material
	3300	3½'-100'+	sands and gravels
T-5	1200	0'-6'	dry(?),loose earth material
	2600	6'-30'	sands and gravels
	5800	30'+	?
T-6	800	0'-5'	dry, loose earth material
	2400	5'-47'	sands and gravels
	7000	47'+	?
T-7	1200	0'-7'	dry(?), loose earth material
	2500	7'-56'	sands and gravels
	10,000	56'+	bedrock
T-8	1200	0'-14'	loose earth material
	2000	14'-58'	sands and gravels
	15,000	58'+	bedrock
T-9	1200	0'-3½'	dry(?), loose earth material
	3600	3½'+	sands and gravels
T-10	1000	0'-4½'	dry, loose earth material
	2400	4½'-48'	sands and gravels
	7000	48'+	?
T-11	1100	0'-6½'	dry(?), loose earth material
	3900	6½'+	sands and gravels
T-12	1000	0'-7'	dry(?), loose earth material
	3000	7'-41'	sands and gravels
	8000	41'+	?

Seismic Traverse Number	Seismic Velocity (fps)	Depth	Comments
T-13	800	0'-2'	dry, loose earth material
	3000	2'-100'+	sands and gravels
T-14	1100	0'-5'	dry(?), loose earth material
	2500	5'-29'	sands and gravels
	6500	29'+	?
T-15	1000	0'-6½'	dry(?), loose earth material
	2400	6'-60'	sands and gravels
	8000	60'+	?
T-16	1200	0'-10'	dry(?), loose earth material
	3500	10'-62'	sands and gravels
	10,000	62'+	bedrock
T-17	1200	0'-20'	loose earth material
	2500	20'-68'	sands and gravels
	15,000	68'+	bedrock
T-18	1200	0'-3½'	dry, loose earth material
	3600	3½'+	sands and gravels
T-19	1000	0'-5'	dry, loose earth material
	3000	5'-30'	sands and gravels
	3600	30'+	?
T-20	1100	0'-6'	dry, loose earth material
	3200	6'+	sands and gravels
T-21	1200	0'-3'	dry, loose earth material
	2400	3'-47'	sands and gravels
	6000	47'+	?
T-22	1000	0'-5'	dry, loose earth material
	3300	5'-29'	sands and gravels
	4800	29'+	?
T-23	1100	0'-6'	dry(?), loose earth material
	2400	6'-30'	sands and gravels
	5800	30'+	?
T-24	800	0'-2'	dry, loose earth material
	2400	2'-100'+	sands and gravels

TABLE 2: Location of key wells, depth to water table and date of measurement

Sheet Number	Map Location (by coordinates)*	Depth	Date
1	570,720 N 2,111,720 E	85'	5-19-75
2	567,200 N 2,120,600 E	6'3"	5-20-75
2	565,670 N 2,120,120 E	7'6"	5-19-75
2	564,660 N 2,120,400 E	7'	5-19-75
3	545,940 N 2,139,700 E	10'9"	5-21-75
4	542,400 N 2,149,600 E	9"	5-21-75

*Washington Coordinate System
North Zone

Findings

Ground Water

The results of the visual geological investigation as well as the geophysical investigation indicate that the ground-water conditions in the Methow Valley between Mazama and Winthrop are not unlike those of other valleys with similar geologic histories and settings. The ground-water table during May, 1975 was at a high stage and was, in effect, "feeding" water to the Methow River. From verbal communications with residents of the valley, the Methow River in late summer and fall very nearly dries up and at that time "feeds" water to the ground-water system.

The ground-water contours run at approximately 90 degree angles to the axis of the valley and form a subshadow of the existing ground surface contours. The ground-water contours form a uniform slope downstream, except where the river cuts across the valley and intercepts the ground-water table. It was noted that Goat Canyon, Wolf Canyon, and several other tributary drainages apparently form ground-water "highs" near their confluence with the Methow Valley. The result is that, instead of the ground-water contours running almost perpendicular to the axis of the valley, on the influenced side of the valley the ground-water contour bends down valley. Actual depths to the ground-water table are dependent upon surface elevations; however, the interpretation is rather straight forward. To estimate depth to the ground-water table locate a point on the map and obtain the approximate ground surface elevation, for instance, 2,085 feet. Next obtain the approximate ground-water contour elevation, for instance, 2,030 feet. Subtract 2,030 feet from 2,085 feet to obtain the approximate depth of 55 feet to the ground-water table.

Sand and Gravel

Four Quaternary units were mapped: valley fill (Qal), talus deposits (Qsw), alluvial fan deposits (Qaf), and older river and glacial terrace deposits (Qt). All of these units are composed of various percentages and forms of aggregate materials.

The valley fill (Qal) is composed of river sand and gravel deposits with some silt layers. Units such as this generally contain, and are generally utilized as, excellent local deposits of sand and gravel; however, in the Methow Valley the shallow ground-water table would usually cause this unit to be excluded as a potential source of aggregate. This exclusion is based on the concerns stated in the purpose of this specific investigation.

Talus deposits (Qsw) generally contain a high percentage of oversize material, which would require extensive crushing and washing of the material; however, these types of deposits are sometimes utilized as rip-rap sources.

The two types of deposits which come the closest to meeting the concerns expressed in the purpose of this report are the alluvial fan deposits (Qaf) and the older river and glacial terrace deposits (Qt). These deposits generally lie well above the ground water table, and the thickness and horizontal extent should be enough to allow for an economical and efficient mining operation. It should be pointed out that no sampling or testing of the material was performed for this investigation. These opinions are based on the visual geological reconnaissance and the geophysical investigation.

Limitations

The use of this report and map in the evaluation of ground-water conditions is limited by the state of the art, available information in literature, and a practical geological and geophysical field investigation.

The conclusions, data, and opinions made in this report are based on conditions present in May of 1975 and are made for land use preplanning purposes only. This report is not intended to be, nor should it be used as, a geologic or ground-water report for any given site. In all cases, a geologic ground-water report by private consultants is recommended for individual site evaluations and investigations.

Field work for this report has been limited to visual inspections and a geophysical survey conducted during May of 1975. No subsurface exploration by drilling was made.

SHEET 1

DATE OF PHOTOGRAPHY 9-3-64

WASHINGTON STATE HIGHWAY COMMISSION
DEPARTMENT OF HIGHWAYS
OLYMPIA, WASHINGTON

OKANOGAN COUNTY
PRIMARY STATE HIGHWAY NO. 16
(SR-20)
MAZAMA TO WINTHROP
TOPOGRAPHIC MAP NO. B-56

CONSULTANT FALCON AIR MAPS DIVISION THE KEN R. WHITE COMPANY — AGREEMENT NO. Y-862

SCALE 1"=200 — CONTOUR INTERVAL 5 FEET

DATUM MEAN SEA LEVEL 1947 SUPPLEMENTAL ADJUSTMENT

DATE: 2-8-66 — SHEET 1 OF 7 SHEETS

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OLYMPIA, WASHINGTON

OKANOGAN COUNTY
PRIMARY STATE HIGHWAY NO. 16
(SR – 20)
MAZAMA TO WINTHROP
TOPOGRAPHIC MAP NO B-56

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SCALE 1" = 200 CONTOUR INTERVAL 5 FEET

DATUM MEAN SEA LEVEL 1947 SUPPLEMENTAL ADJUSTMENT

DATE OF PHOTOGRAPHY 9-3-64

DATE: 2-25-66 SHEET 2 OF 7 SHEETS

FAM ACCT NO. 6202