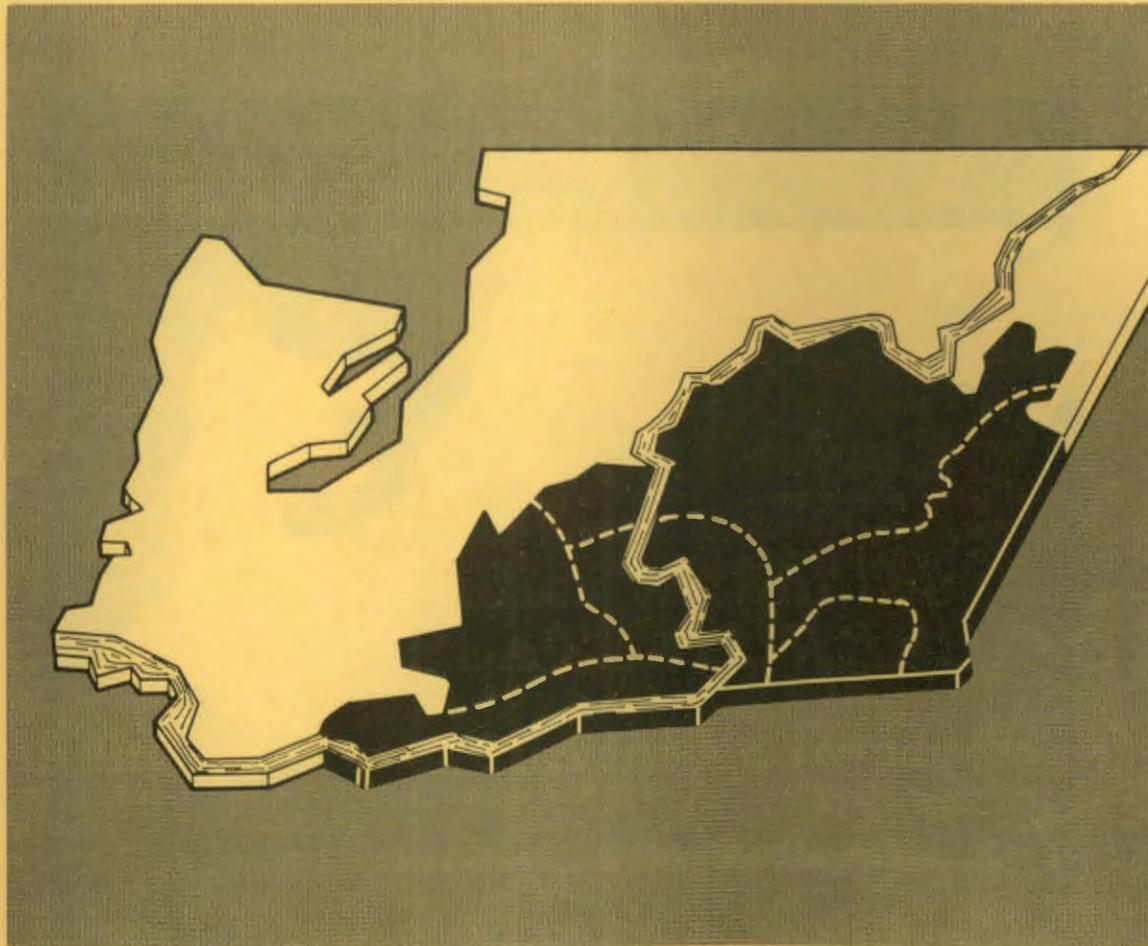


Hydrologic Studies within the COLUMBIA PLATEAU, WASHINGTON:

An Integration of Current Knowledge

Plates II-7 through II-13

Regional Hydrology



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Hydrologic Studies within the COLUMBIA PLATEAU, WASHINGTON:

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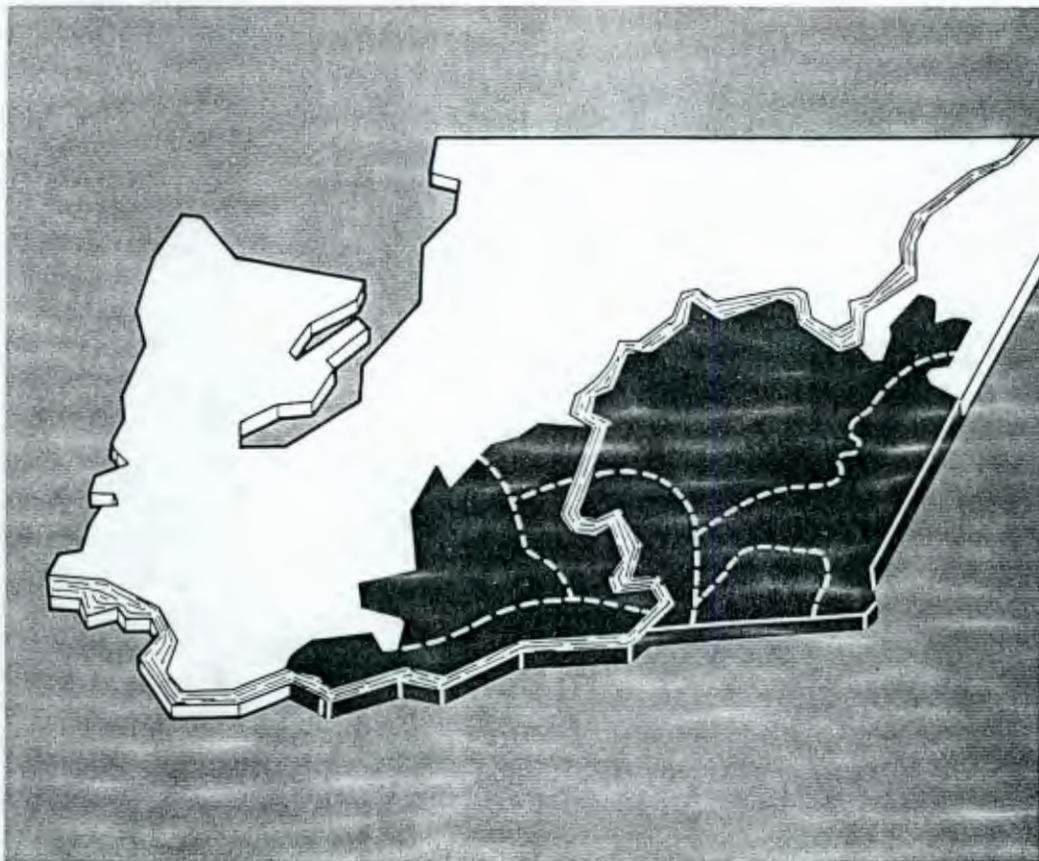


PLATE II-7

**REGIONAL CHEMICAL SAMPLING
POINTS FOR GROUNDWATER WITHIN
THE COLUMBIA RIVER BASALT GROU**

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PLATE II-8

PRINCIPAL SURFACE-WATER IRRIGATION APPLICATION AREAS AND PRE-IRRIGATION POTENTIALS WITHIN THE WANAPUM BASALT

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PLATE II-9

FEATURES OF THE COMPOSITED POTENTIAL SURFACE OF AQUIFERS WITHIN THE SADDLE MOUNTAINS BASALT

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PLATE II-10

FEATURES OF THE COMPOSITED POTENTIAL SURFACE OF AQUIFERS WITHIN THE WANAPUM BASALT

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PLATE II-11

TRANSMISSIVITY VALUES OF AQUIFERS WITHIN THE SADDLE MOUNTAINS BASALT

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PLATE II-12

TRANSMISSIVITY VALUES OF AQUIFERS WITHIN THE WANAPUM BASALT

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PLATE II-13

GEOLOGIC FEATURES OF THE WANAPUM BASALT HAVING REPORTEDLY SIGNIFICANT EFFECTS UPON GROUNDWATER FLOW

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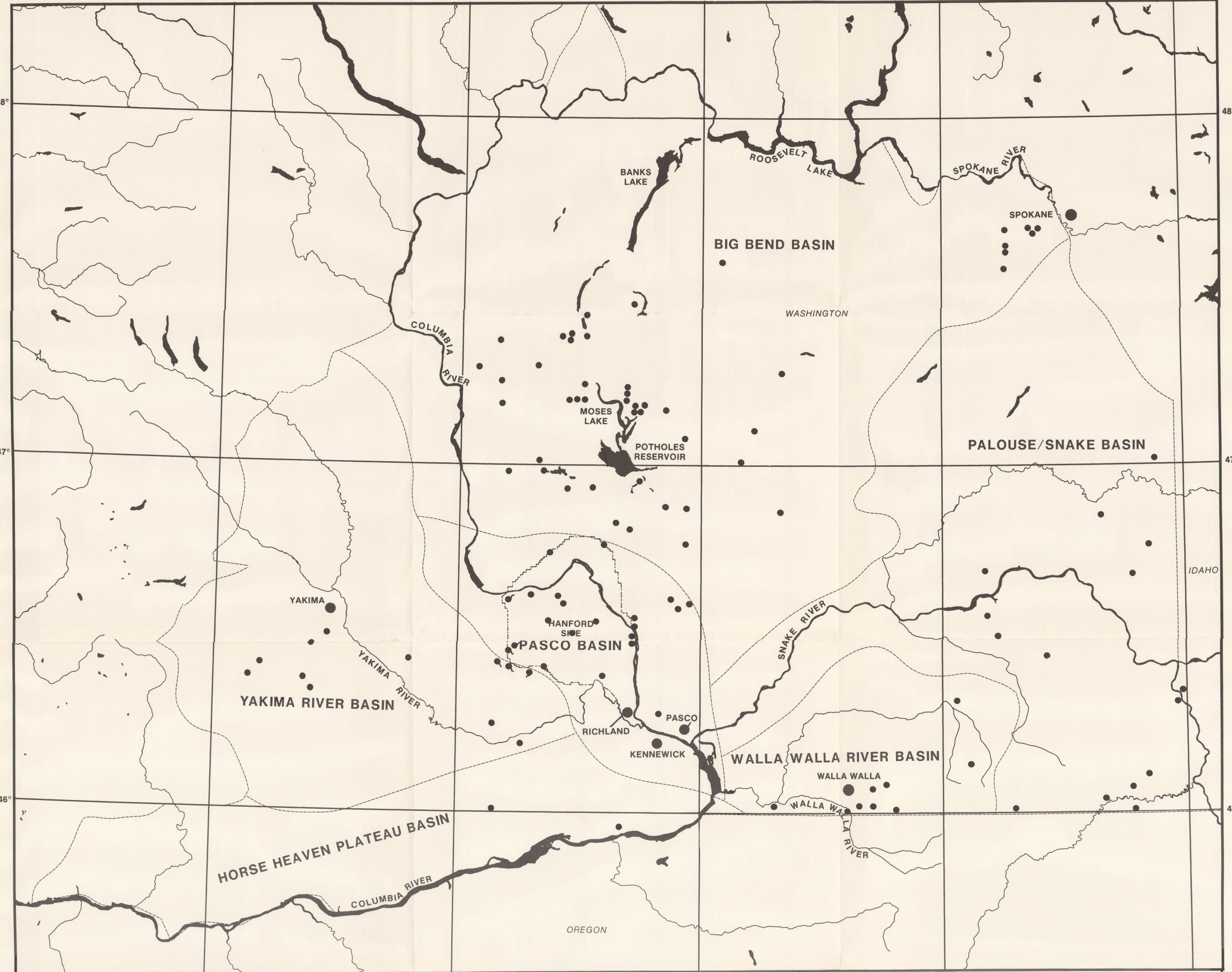


PLATE II-7

**REGIONAL CHEMICAL SAMPLING
POINTS FOR GROUNDWATER WITHIN
THE COLUMBIA RIVER BASALT GROUP**

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LEGEND

- WELL SAMPLE SITES WHICH HAVE COMPLETE MAJOR INORGANIC ANALYSES
- ⊙ SPRING SAMPLE SITES WHICH HAVE COMPLETE MAJOR INORGANIC ANALYSES
- BASIN BOUNDARY



EXPLANATION

LOCATIONS WHERE CHEMICAL DATA ARE AVAILABLE FOR GROUNDWATER WITHIN THE WASHINGTON STATE PORTION OF THE COLUMBIA PLATEAU ARE SHOWN. PARAMETERS FOR INDIVIDUAL SITES ARE VARIABLE. SOURCES OF INFORMATION INCLUDE THE U.S. GEOLOGICAL SURVEY'S GROUND-WATER SITE INVENTORY AND HANFORD TESTING DATA.



PLATE II-8

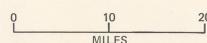
PRINCIPAL SURFACE-WATER IRRIGATION APPLICATION AREAS AND PRE-IRRIGATION POTENTIALS WITHIN THE WANAPUM BASALT

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LEGEND

-  LANDS WHICH ARE RECEIVING, ARE SCHEDULED TO RECEIVE, OR ARE UNDER INVESTIGATION TO RECEIVE IRRIGATION WATER WITHIN THE COLUMBIA BASIN IRRIGATION PROJECT AS OF JANUARY, 1978*
-  LANDS WHICH ARE RECEIVING, ARE SCHEDULED TO RECEIVE, OR ARE UNDER INVESTIGATION TO RECEIVE IRRIGATION WATER WITHIN THE YAKIMA PROJECT AS OF JANUARY, 1977*
-  PRE-IRRIGATION POTENTIALS OF WANAPUM BASALT AQUIFERS IN FEET ABOVE MEAN SEA LEVEL
-  BASIN BOUNDARY

* MOST RECENT DATA AVAILABLE



EXPLANATION

PRINCIPAL AREAS RECEIVING IMPORTED SURFACE WATERS FOR IRRIGATION ARE DEPICTED IN RELATION TO CURRENT COMPOSITE GROUNDWATER POTENTIALS OF AQUIFERS WITHIN THE WANAPUM BASALT. (METHODOLOGY EMPLOYED IN THE PREPARATION OF THE POTENTIAL MAP IS EXPLAINED ON PLATE II-10.) WITHIN A PORTION OF THE COLUMBIA BASIN IRRIGATION PROJECT, THE PRE-IRRIGATION POTENTIALS (AS INTERPRETED BY CENTURY WEST ENGINEERING FROM AVAILABLE DATA) ARE COMPARED WITH THE CURRENT POTENTIALS. REPORTEDLY SIGNIFICANT RISES IN POTENTIAL HAVE OCCURRED IN WELLS WITHIN THE PROJECT; WHEREAS IN ADJACENT AREAS OUTSIDE THE PROJECT, A COMPARISON OF PRE-IRRIGATION AND CURRENT WATER LEVELS REVEALS DECLINES (TANAKA AND OTHERS, 1974). DUE TO INSUFFICIENT POTENTIOMETRIC AND WATER-LEVEL DATA, THE PRECISE IMPACT OF THE YAKIMA IRRIGATION PROJECT ON UNDERLYING CONFINED AQUIFERS IS LARGELY UNKNOWN AT THIS TIME. PRELIMINARY DATA (U.S. ARMY CORPS OF ENGINEERS, 1978), HOWEVER, SUGGEST SIGNIFICANT WATER-LEVEL RISES WITHIN THE SHALLOW, UNCONFINED, SEDIMENTARY AQUIFERS.

REFERENCES CITED:
 TANAKA, H.H., HANSEN, A.J. JR., AND SKIVAN, J.A., 1974, DIGITAL-MODEL STUDY OF GROUNDWATER HYDROLOGY, COLUMBIA BASIN IRRIGATION PROJECT AREA, WASHINGTON: WATER SUPPLY BULLETIN 40, WASHINGTON STATE DEPARTMENT OF ECOLOGY, OLYMPIA, WASHINGTON, 60p.
 U.S. ARMY CORPS OF ENGINEERS, 1978, YAKIMA VALLEY REGIONAL WATER MANAGEMENT STUDY: GEOLOGY AND GROUNDWATER, V.A., SEATTLE DISTRICT, SEATTLE, WASHINGTON.



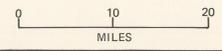
PLATE II-9
FEATURES OF THE COMPOSITED
POTENTIAL SURFACE OF AQUIFERS
WITHIN THE SADDLE MOUNTAINS
BASALT

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LEGEND

- IMAGINARY IMPERMEABLE BARRIER (CONVERGING GROUNDWATER FLOW POTENTIAL)
- 1200 POTENTIALS IN SADDLE MOUNTAINS BASALT AQUIFERS IN FEET ABOVE MEAN SEA LEVEL
- OUTCROP MARGIN OF THE SADDLE MOUNTAINS BASALT
- BASIN BOUNDARIES



EXPLANATION

A COMPOSITED POTENTIAL SURFACE FOR AQUIFERS WITHIN THE SADDLE MOUNTAINS BASALT WAS DERIVED ON THE BASIS OF DATA CONTAINED IN THE U.S. GEOLOGICAL SURVEY'S GROUND-WATER SITE INVENTORY FOR WASHINGTON AND OTHER DATA SOURCES. IT IS EMPHASIZED THAT THE RESULTING SURFACE IS PRELIMINARY AND DOES NOT NECESSARILY REPRESENT THE POTENTIAL SURFACE OF ANY SINGLE HYDROSTRATIGRAPHIC UNIT. CERTAIN PORTIONS MAY REPRESENT THE RESULTANT POTENTIALS OF TWO OR MORE HYDROSTRATIGRAPHIC UNITS. THE AREAL LIMITS OF THE SADDLE MOUNTAINS BASALT ARE SHOWN. AREAS WITHIN THESE LIMITS FOR WHICH POTENTIALS ARE NOT SHOWN DID NOT HAVE SUFFICIENT DATA CONTROL TO JUSTIFY CONTOURING. ANNOTATIONS SHOWN ARE DISCUSSED WITHIN THE TEXT.



PLATE II-10

**FEATURES OF THE COMPOSITED
POTENTIAL SURFACE OF AQUIFERS
WITHIN THE WANAPUM BASALT**

LEGEND

- POTENTIALS IN WANAPUM BASALT AQUIFERS IN FEET ABOVE MEAN SEA LEVEL
- GROUNDWATER DIVIDES (DIVERGING GROUNDWATER FLOW POTENTIAL)
- IMAGINARY IMPERMEABLE BARRIERS (CONVERGING GROUNDWATER FLOW POTENTIAL)
- AREAL LIMITS OF WANAPUM BASALT
- BASIN BOUNDARIES



EXPLANATION

A COMPOSITED POTENTIAL SURFACE FOR AQUIFERS WITHIN THE WANAPUM BASALT WAS DERIVED ON THE BASIS OF DATA CONTAINED IN THE U.S. GEOLOGICAL SURVEY'S GROUND-WATER SITE INVENTORY FOR WASHINGTON AND FROM OTHER SOURCES. IT IS EMPHASIZED THAT THE RESULTING SURFACE IS PRELIMINARY AND DOES NOT NECESSARILY REPRESENT THE POTENTIAL SURFACE OF ANY SINGLE HYDROSTRATIGRAPHIC UNIT. CERTAIN PORTIONS MAY REPRESENT THE RESULTANT POTENTIALS OF TWO OR MORE HYDROSTRATIGRAPHIC UNITS. THE AREAL LIMITS OF THE WANAPUM BASALT ARE SHOWN. AREAS WITHIN THESE LIMITS FOR WHICH POTENTIALS ARE NOT SHOWN DID NOT HAVE SUFFICIENT DATA CONTROL TO JUSTIFY CONTOURING. ANNOTATIONS SHOWN ARE DISCUSSED WITHIN THE TEXT.

REFERENCES CITED:
BROWN, J.C., 1978, DISCUSSION OF GEOLOGY AND GROUNDWATER HYDROLOGY OF THE COLUMBIA PLATEAU WITH SPECIFIC ANALYSIS OF HORSE HEAVEN, SAGEBRUSH FLATS, AND ODESSA-LIND AREAS, WASHINGTON; RESEARCH REPORT 78/14-23, THE COLLEGE OF ENGINEERING RESEARCH, WASHINGTON STATE UNIVERSITY, PULLMAN, WASHINGTON.

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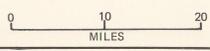




PLATE II-11

**TRANSMISSIVITY VALUES OF
AQUIFERS WITHIN THE SADDLE
MOUNTAINS BASALT**

LEGEND

- LINES OF EQUAL TRANSMISSIVITY IN GALLONS PER DAY PER FOOT X 1000
- OUTCROP MARGIN OF THE SADDLE MOUNTAINS BASALT
- BASIN BOUNDARIES



EXPLANATION

PRELIMINARY TRANSMISSIVITY DATA WERE OBTAINED FOR AQUIFERS WITHIN THE SADDLE MOUNTAINS BASALT FROM SPECIFIC CAPACITY DATA FOR INDIVIDUAL WELLS AS REPORTED WITHIN THE WASHINGTON STATE DEPARTMENT OF ECOLOGY'S WELL RECORDS. TRANSMISSIVITY VALUES WERE COMPUTED BY MULTIPLYING THE PUMP-TEST SPECIFIC CAPACITY VALUE BY 2000 AFTER METHODS DESCRIBED BY THEIS (1954). THE AREAL LIMITS OF THE SADDLE MOUNTAINS BASALT ARE SHOWN. AREAS WITHIN THESE LIMITS FOR WHICH TRANSMISSIVITY CONTOURS ARE NOT SHOWN DID NOT HAVE SUFFICIENT DATA CONTROL TO JUSTIFY CONTOURING. THE IRREGULAR CONTOUR INTERVAL TENDS TO RESULT IN A VISUAL BIAS TOWARD LOWER TRANSMISSIVITY VALUES.

REFERENCES CITED:
THEIS, C.V., 1954, ESTIMATING TRANSMISSIBILITY FROM SPECIFIC CAPACITY: U.S. GEOLOGICAL SURVEY GROUND-WATER NOTE NO. 24.

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PLATE II-12

**TRANSMISSIVITY VALUES OF
AQUIFERS WITHIN THE
WANAPUM BASALT**

RHO-BWI-ST-5

LEGEND

- 10 — LINES OF EQUAL TRANSMISSIVITY IN GALLONS PER DAY PER FOOT X 1000
- — — — — OUTCROP MARGIN OF THE WANAPUM BASALT
- - - - - BASIN BOUNDARIES



EXPLANATION

PRELIMINARY TRANSMISSIVITY DATA WERE OBTAINED FOR AQUIFERS WITHIN THE WANAPUM BASALT FROM SPECIFIC CAPACITY DATA FOR INDIVIDUAL WELLS, AS REPORTED WITHIN THE WASHINGTON STATE DEPARTMENT OF ECOLOGY'S WELL RECORDS. TRANSMISSIVITY VALUES WERE COMPUTED BY MULTIPLYING THE PUMPING-TEST SPECIFIC CAPACITY VALUE BY 2000 AFTER METHODS DESCRIBED BY THEIS (1954). THE AREAL LIMITS OF THE WANAPUM BASALT ARE SHOWN. AREAS WITHIN THESE LIMITS FOR WHICH TRANSMISSIVITY CONTOURS ARE NOT SHOWN DID NOT HAVE SUFFICIENT DATA CONTROL TO JUSTIFY CONTOURING. THE IRREGULAR CONTOUR INTERVAL TENDS TO RESULT IN A VISUAL BIAS TOWARD LOWER TRANSMISSIVITY VALUES.

REFERENCES CITED:
THEIS, C.V., 1954, ESTIMATING TRANSMISSIBILITY FROM SPECIFIC CAPACITY: U.S. GEOLOGICAL SURVEY GROUND-WATER NOTE NO. 24.





PLATE II-13

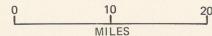
GEOLOGIC FEATURES OF THE WANAPUM BASALT HAVING REPORTEDLY SIGNIFICANT EFFECTS UPON GROUNDWATER FLOW

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LEGEND

- FAULT ZONES
- HUNTZINGER INTRACANYON FLOW
- ESQUATZEL INTRACANYON FLOW
- WAHLUKE INTRACANYON FLOW
- METAMORPHIC ROCKS
- ANTICLINE
- SYNCLINE
- MONOCLINE
- FAULT WITH BALL ON THROWN SIDE
DASHED WHERE APPROXIMATELY LOCATED
- THRUST FAULT WITH SAWTEETH IN UPPER PLATE
DASHED WHERE APPROXIMATELY LOCATED OR INFERRED
- GROUNDWATER FLOW BARRIER
- OUTCROP MARGIN OF THE WANAPUM BASALT
- BASIN BOUNDARIES



EXPLANATION

GEOLOGIC FEATURES OF THE WANAPUM BASALT WHICH HAVE AN APPARENT OR REPORTED EFFECT UPON GROUNDWATER FLOW ARE DEPICTED IN RELATION TO THE COMPOSITED POTENTIALS OF AQUIFERS WITHIN THE WANAPUM. ANNOTATIONS SHOWN ARE DISCUSSED WITHIN THE TEXT.

REFERENCES CITED:
 MADDOX, G.E., 1978, GROUNDWATER HYDROLOGY AND PROPOSED WATER MANAGEMENT AND POLICY, QUINCY AND ODESSA GROUNDWATER SUBAREAS, LINCOLN, ADAMS, AND GRANT COUNTIES, WASHINGTON: EASTERN BIG BEND RESOURCES, SPOKANE, WASHINGTON, 60p., 21 fig.
 LUZIER, J.E. AND BURT, R.J., 1974, HYDROLOGY OF BASALT AQUIFERS AND DEPLETION OF GROUNDWATER IN EAST-CENTRAL WASHINGTON: WATER SUPPLY BULLETIN 33, WASHINGTON STATE DEPARTMENT OF ECOLOGY, OLYMPIA, WASHINGTON, 53p.