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Those on Attached List

Gentlemen:

BWIP HYDROLOGIC WORKING GROUP INFORMATION MEETING - MINUTES AND HANDOUTS

Enclosed for your information and file is a copy of the meeting minutes and handouts which cover the subject meeting held at Richland, Washington, on November 17, 1983.

If you have any questions regarding the enclosure, please call D. J. Squires of my staff, telephone (509) 376-7240.

Very truly yours,

O. L. Olson

O. L. Olson, Project Manager
Basalt Waste Isolation Project Office

BWI:DJS

Enclosure

8402010066 840113
PDR WASTE
WM-10 PDR

00657

Distribution for letter, BWIP Hydrologic Working Group Information Meeting - Minutes and Handouts, dated: JAN 9 1984

Robert J. Wright, Nuclear Regulatory Commission
W. Meyer, U. S. Geological Survey
Michael J. Farrow, Umatilla Confederated Tribes
James B. Hovis, Representative of Yakima Indian Nation
D. Provost, State of Washington Department of Ecology
D. W. Stevens, State of Washington Department of Ecology

MEETING MINUTES

SUBJECT: Interagency Hydrology Working Group Public Information Meeting

TO:		BUILDING		
Attendees		Peoples Bank Building		
FROM:		CHAIRMAN		
S. M. Baker				
DEPARTMENT-OPERATION-COMPONENT	AREA	SHIFT	DATE OF MEETING	NUMBER ATTENDING
Site/BWIP	1100		November 17, 1983	24

See attached report.

Internal Distribution
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J. H. LaRue
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U. S. Department of Energy
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O. L. Olson (2)
R. P. Saget
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S. Whitfield

State of Washington
D. Provost
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Pacific Northwest Laboratory
R. Bond
C. Cole
S. Snyder
D. A. Zimmerman

Nuclear Regulatory Commission
F. R. Cook /R. J. Wright

Morrison-Knudsen
L. L. Mink

U. S. Geological Survey
W. Meyer

Department of Natural Resources
Umatilla Confederated Tribes
M. J. Farrow

Yakima Indian Nation
P. O. Box 487
Yakima, Washington 98907
J. B. Hovis

MINUTES OF THE INTERAGENCY HYDROLOGY WORKING GROUP
PRESENTATION TO THE STATE OF WASHINGTON AND AFFECTED INDIAN TRIBES

November 17, 1983

The purpose of this meeting was to present the history and current status of the Interagency Hydrology Working Group (also known as the Modeling Task Force) to representatives of the State of Washington, the Yakima Indian Nation, and the Umatille Tribe. The agenda included the history of the Modeling Task Force, issues being considered by the Working Group, facilities and data collection to resolve the issues, and the present status of model development. The agenda and list of speakers is presented in Appendix A. In attendance at the meeting were representatives from the State of Washington, the Umatilla and Yakima Indian tribes, the U.S. Geological Survey (USGS), U.S. Department of Energy (DOE), Nuclear Regulatory Commission (NRC), Pacific Northwest Laboratory (PNL) and Rockwell Hanford Operations (Rockwell). The list of attendees and their affiliation is included in Appendix B.

OPENING REMARKS

D. J. Squires, DOE-Basalt Waste Isolation Project Office, opened the meeting by making introductions, welcoming the participants and giving an overview of the purpose of the meeting. G. S. Hunt then commented that the minutes of the last two meetings of the Modeling Task Force are being assembled and would be made available at a later date. He also mentioned that he and S. M. Price have been given the responsibility for external communication in the areas of hydrology and geology, respectively, and may be contacted on questions in those areas.

1. History and Issues of the Modeling Task Force

A review of the history of the Modeling Task Force was presented by W. Meyer, USGS (viewgraphs in Appendix C).

The group is composed of representatives from Rockwell, USGS, and PNL. It was formed in January 1982 in recognition of differences between the USGS, PNL, and Rockwell conceptual models of the Pasco

Basin as they relate to groundwater flow. Since that time nine meetings have been held to study the differences (see Appendix C).

The two objectives of the Modeling Task Force presented by W. Meyer are:

1. Provide a technical forum for identifying and resolving differences in numerical modeling results for groundwater movement in the Pasco Basin

2. Provide a technical peer group to develop an understanding of groundwater movement in the Pasco Basin.

The approach used acknowledged that extensive drilling was not a feasible way to resolve the model differences. The alternative approach decided upon was to expand the area of interest outside the Pasco Basin, numerically model it, and obtain head data from existing wells to calibrate the model. It was found there were more data available in some areas than in others, with some data of only a preliminary nature. Numerical parameters will be determined as additional data become available. Disputed areas will be evaluated as new and more reliable data are input in the model.

2. <u>The Following are Issues Identified by the Modeling Task Force</u>

<u>Boundary Conditions</u>: The question of the Basin boundary conditions are of major concern. Model boundaries have been extended to include more area both west and south of the reference repository location (RRL) (see figure in Appendix C). This should help to determine the disputed boundary conditions. Members at the Working Group decided they would all have to share data within this boundary for input into respective models.

<u>Vertical Groundwater Movement</u>: Data on the vertical component of groundwater flow for the site are limited, but can be inferred from the model until more testing is conducted and evaluated.

<u>Hydraulic Transients</u>: Rockwell's method involved collection of data over a period of 1-2 years for individual wells. Each zone was sealed and monitored for approximately 2 weeks. The USGS has a concern that over a period of years the information gathered can't

be compared because over a two year period conditions may change. W. Meyer said that data should be collected at all points at the same time as described in a letter from the Director of the USGS to R. Morgan of DOE-Headquarters which described a groundwater monitoring program which would map changes over time. W. Meyer said that adequate transient monitoring must be conducted to determine appropriate model input parameters.

S. M. Baker commented that groundwater monitoring is currently one of the highest priorities at the Basalt Waste Isolation Project (BWIP). S. M. Baker also went on to discuss a groundwater mound that has formed beneath the 200 West Area as a result of infiltration of water discharged into a pond. A brief discussion relating to the groundwater mound then ensued.

Head Measurement Techniques: The Modeling Task Force is working to develop a "pre-development" or "pre-man" model. The approach is to identify all available geotechnical information known (geometry, etc.) and let the model determine the pre-development groundwater flow system. The present model being used is not a predictive tool for repository performance. Its purpose is to assist ongoing work and to establish parameters for other models.

Discussions as to the availability of information relating to the model and data gathering techniques followed. The concept of the Working Group meetings will provide the mechanism for dissemination of the information along with G. S. Hunt and S. M. Price being available for specific questions at any time.

S. M. Baker commented that lots of other people will and have been reviewing our techniques and invited the USGS, Indians, and others to go out in the field and look over the monitoring techniques.

Lateral Hydraulic Conductivity: W. Meyer said techniques used by Rockwell were questionable. Drilling techniques involved the use of drilling muds which are added to the fluid to bring up cuttings. Air, water, and foam are alternatives. If mud is used, it goes into the formation, and there is no guarantee it can be extracted.

It isn't known to what degree the permeability of the formation is affected. Hydraulic conductivity values reported by Rockwell are not accepted by the USGS as indicative of the natural flow system since the USGS values were 20 times higher than Rockwell's. Reasons for differences in values may be that due to differences in sampling localities, borehole differences, or mud used in drilling may be affecting the formation. W. Meyer said Rockwell is presently addressing the use of mud and its effect on the wellbore and formation.

Interpretation of Geochemical Data: W. Meyer stated that Rockwell and USGS were originally directly opposed on the issue of chemical mixing. The USGS interpreted the chemical data to show the flow having a dominant upward component. S. M. Baker commented that Rockwell agrees that the chemical data indicate vertical mixing.

Water Balance: W. Meyer stated there is a need to understand what man has done and is doing (in the Pasco Basin) and how it affects the system. This information doesn't currently exist.

Discussion then followed relating to baseline monitoring and the interpretation of the baseline data with respect to the study area boundaries and possible hydrologic barriers.

3. Model Development

D. A. Zimmerman, PNL, was introduced to discuss the expanded Pasco Basin groundwater flow model. The objective of the expanded Pasco Basin groundwater flow is to characterize pre-development and current flow system.

The methodology for formulating the model included the following:

- document sources for existing models
- interpret data and formulate conceptual model
- run model with nominal data and look for problems, and revise conceptual model if necessary
- compare model results to measured heads and adjust model accordingly
- perform sensitivity analyses
- select baseline; make transient runs
- perform special studies.

The approach was to first "nail down" what is known and then "tune" for what isn't known. Input parameters include both geologic and hydrologic information.

Discussion followed concerning the type of code being used, amount of data needed for model calibration and the use of the model in measuring the pertinent questions relating to groundwater flow.

4. New Facilities and Data Collection (Viewgraphs in Appendix D)

S. M. Baker, Rockwell, was introduced to discuss new facilities and status of the data collection. S. M. Baker stated that the reconnaissance phase is complete and activity in the area of hydrologic characterization has increased significantly. The hydrological characterization involves five activities.

- conceptual flow system model
- conceptual hydrochemical system model
- site data base
- borehole drilling
- hydrologic testing.

S. M. Baker followed with a discussion concerning the need for regional data as well as site data and the status of data needs as seen by the USGS and NRC. Site data needs include getting an adequate baseline to calibrate the model to current transient conditions, and will involve conducting large scale stress tests to adequately determine horizontal and vertical conductivity over the RRL. To do this, three sets of "cluster" wells are being drilled. Each cluster will consist of four wells of which three will be monitor wells and one will be a pumping well (except that one cluster does not have a pump well planned at this time) (see diagram in Appendix D). The "C" well of each set will be completed with several 2 1/16 OD piezometer tubes, each tube designed to monitor a specific horizon.

These monitoring wells and piezometers will be used initially to gather the baseline data and then be used as monitoring wells for the large scale testing.

Several recent developments have occurred from the drilling of the "C" series wells. To eliminate the mud damage problem the wells were drilled with air-mist. This has resulted in lifting considerable amounts of water out of the borehole. This has caused drawdown in several wells across the site. This well interference will be very helpful in designing the large scale tests. Also, upon logging the wells with a downhole television camera, gas bubbles were seen discharging from two flow tops in the Frenchman Springs. This could be escaping air which was trapped from the drilling or in situ gas in the formation. Also a textural change was observed in the geophysical signature in DC-19C borehole log. Testing is being conducted to determine the hydrologic significance of this observation.

S. M. Baker then opened the meeting to questions. Discussion centered around the gas seen in the Frenchman Springs formation and the possible source of hydrocarbons in the Pasco Basin or surrounding area.

M. Farrell, the Director of the Department of National Resources of the Umatilla Tribes, commented that the Umatillas are involved in data collection regionally, and are concerned about putting a model together describing pre-1965 conditions. To date the Tribe has found well construction standards to be very poor in the Umatilla Basin. The three major problems are:

1) wells poorly constructed
2) well interference because of well spaced too close
3) slow recharge.

Another major issue is transportation. Mr. Farrell discussed "Cabbage Hill" where there are many trucking accidents at the 6-7 mile 9% downgrade. He said that they are concerned about traffic on the I-82 corridor. The Umatilla Tribe is affected by the BWIP on the grounds of potential groundwater and transportation problems.

APPENDIX A

AGENDA AND ATTENDEES

AGENDA

ACTIVITY STATUS OF HYDROLOGIC WORKING GROUP
BASALT WASTE ISOLATION PROJECT

Richland, Washington
November 17, 1983

Thursday, November 17, 1983
PBB, 5th Floor Conference Room

9:00 a.m.	Welcome	Pierre Saget	DOE
9:10 a.m.	Introductions and Meeting Agenda	Gail Hunt	Rockwell
9:20 a.m.	Discussion covering the history of the Working Group and issues which the Group is evaluating	Bill Meyer	USGS
9:45 a.m.	Discussion covering new facilities and data collection	Steve Baker	Rockwell
10:35 a.m.	Model development	Tony Zimmerman	PNL
11:15 a.m.	Discussion	All	
12:00 p.m.	Adjourn		

BASALT WASTE ISOLATION PROJECT
INTERAGENCY HYDROLOGY WORKING GROUP
STATUS MEETING
RICHLAND, WASHINGTON

November 17, 1983

ATTENDEES

Name	Organization	Phone
D. J. Squires	US DOE-BWIPO	509-376-7240
D. W. Stevens	State of Washington	206-459-6504
D. Provost	State of Washington	206-459-6023
T. Zimmerman	PNL	509-376-8333
G. S. Hunt	Rockwell-BWIP	509-376-6786
S. P. Reidel	Rockwell-BWIP	509-376-6771
T. Rutz	Rockwell-BWIP	509-376-7905
D. Forgette	Rockwell-BWIP	509-376-2554
J. H. LaRue	Rockwell-BWIP	509-376-8506
S. Snyder	PNL	509-376-8321
A. Lassila	US DOE	509-376-6158
R. C. Arnett	Rockwell-BWIP	509-376-7716
J. B. Hovis	Yakima Indian Nation P.O. Box 487 Yakima, WA 98907	509-575-1500
R. P. Saget	US DOE	509-376-7250
S. M. Baker	Rockwell-BWIP	509-376-7981
R. Bond	PNL	509-376-8449
F. R. Cook	NRC (BWIP Site)	509-376-1701
S. Whitfield	DOE/RL/BWIP	509-376-2048
L. Mink	M-K (BWIP)	509-376-7981
R. D. Landon	Rockwell-BWIP	509-376-8988
M. Farrow	Department of Natural Resources Umatilla Confed. Tribes	503-276-8221
C. Cole	PNL	509-376-8451
J. Bazemore	Rockwell-BWIP	509-376-9188
W. Meyer	USGS-Tacoma	206-593-6510 FTS-390-6510

APPENDIX B

HISTORY AND ISSUES

Viewgraphs used by W. Meyer (USGS)

INTERAGENCY HYDROLOGY WORKING GROUP

PARTICIPANTS

* ROCKWELL HANFORD OPERATIONS
* U.S. GEOLOGICAL SURVEY
* PACIFIC NORTHWEST LABORATORY

INTERAGENCY HYDROLOGY WORKING GROUP

OBJECTIVES

* PROVIDE TECHNICAL FORUM FOR IDENTIFYING AND RESOLVING DIFFERENCES BETWEEN NUMERICAL MODELING RESULTS FOR GROUNDWATER MOVEMENT WITHIN THE PASCO BASIN

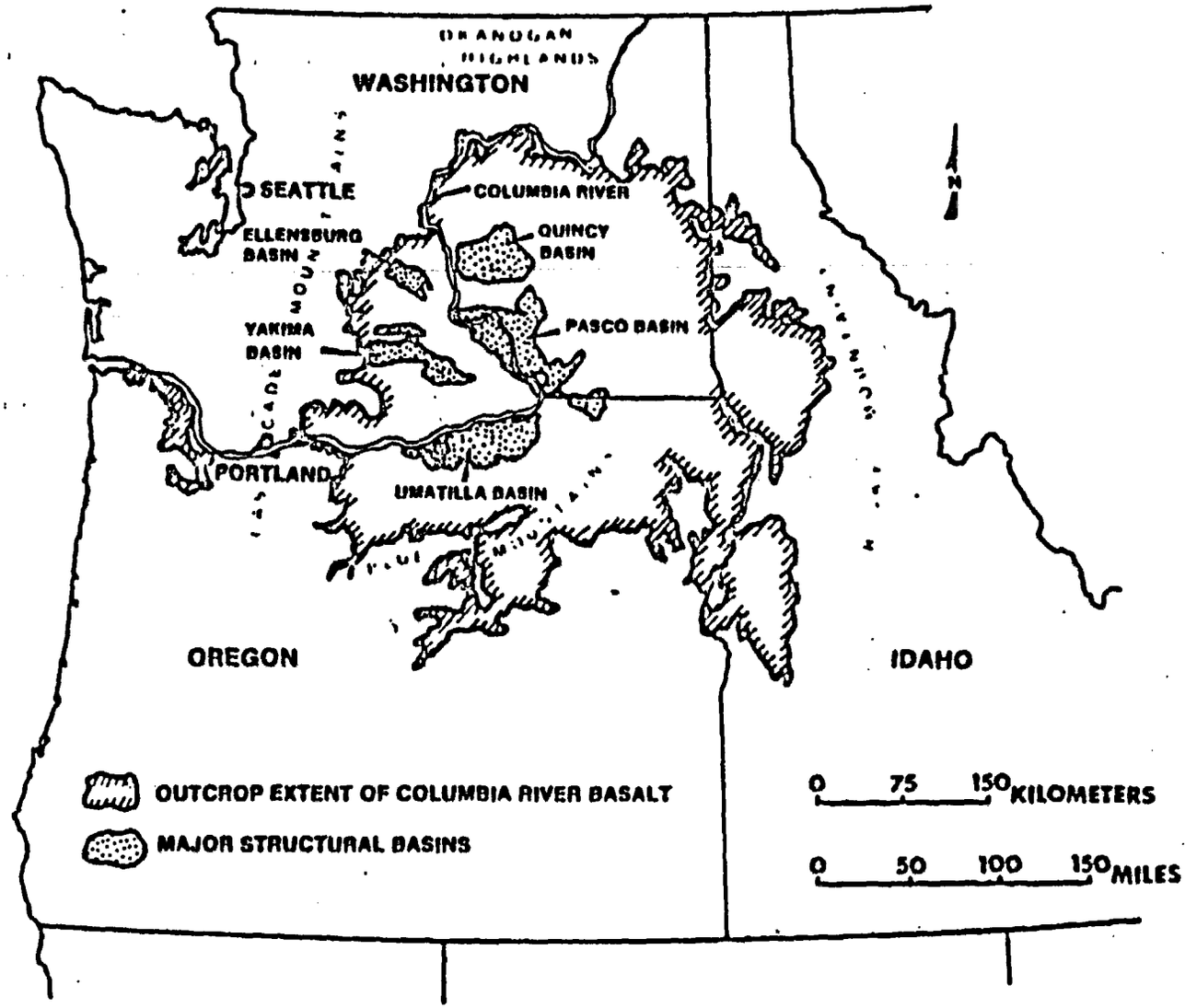
* PROVIDE TECHNICAL PEER GROUP FOR DEVELOPING AN UNDERSTANDING OF GROUNDWATER MOVEMENT WITHIN THE PASCO BASIN

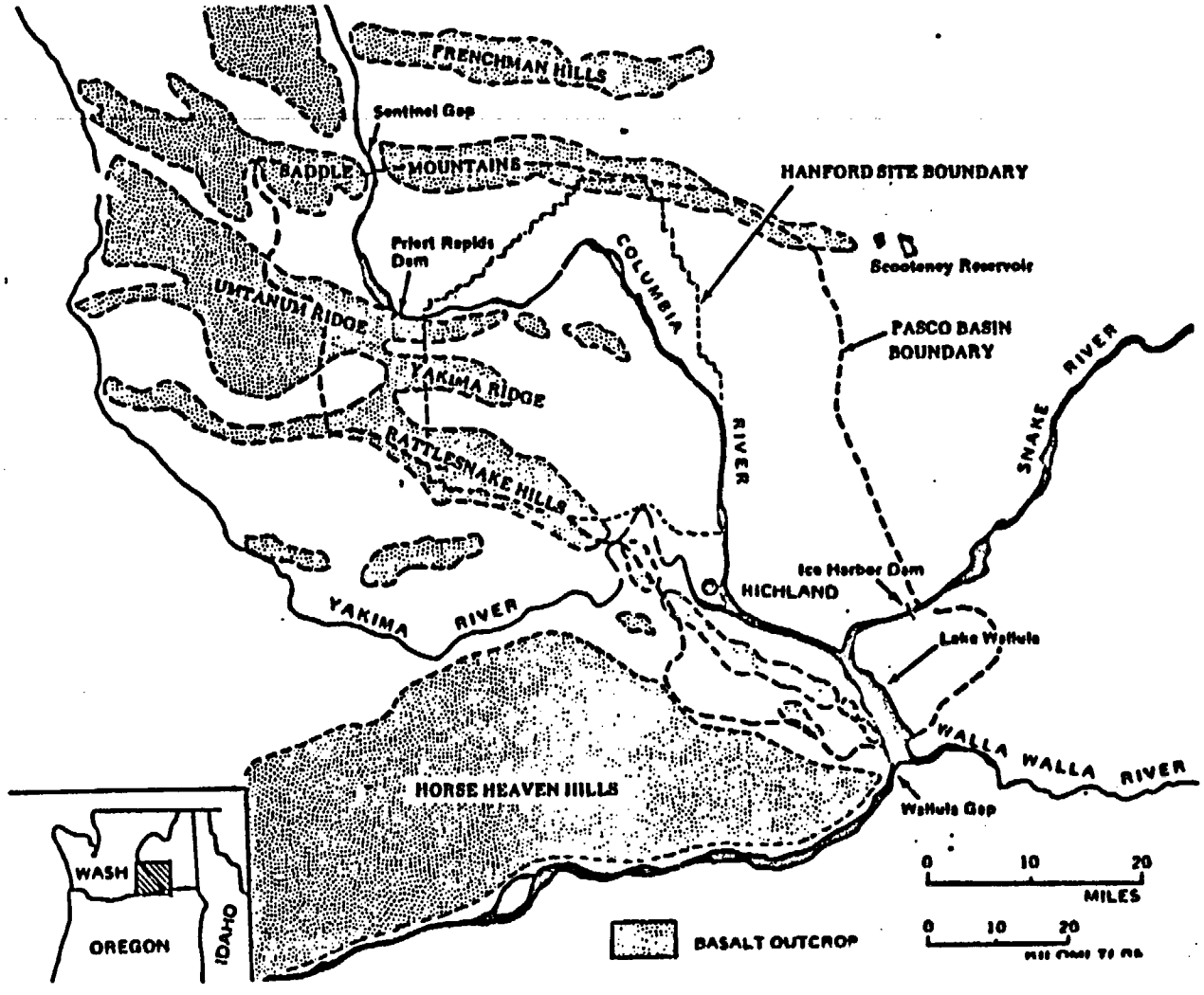
WORKING GROUP MEETINGS

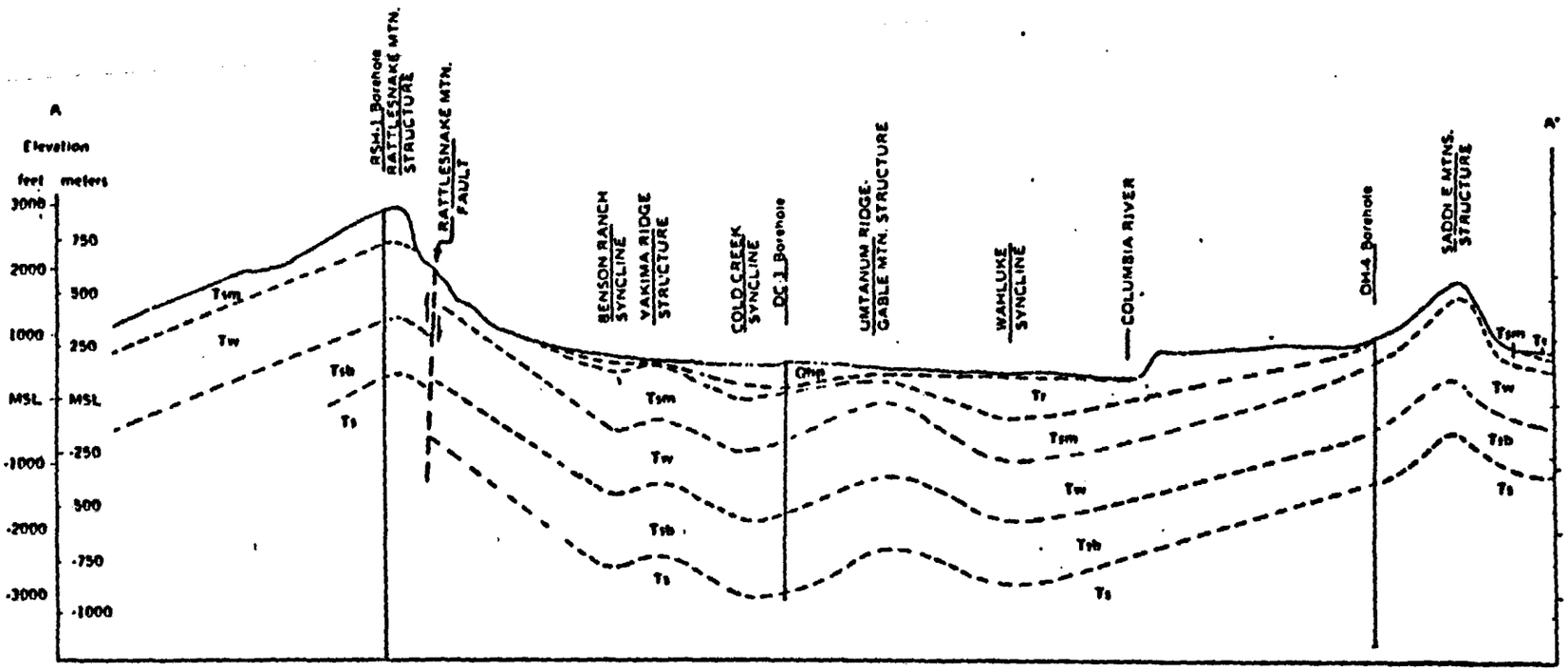
1.	FEB. 17-18-19, 1982	ORGANIZATIONAL AND INITIAL TECHNICAL DISCUSSIONS.
2.	MAY 13-14, 1982	DISCUSS PLANS FOR RESOLVING DIFFERENCES.
3.	JULY 28-29, 1982	DISCUSS RESPONSES TO DATA BASE QUESTIONNAIRE. REVIEW HYDROLOGIC TEST DATA.
4.	SEP. 27-28, 1982	SUMMARIZE FY-82 ACTIVITIES AND DISCUSS FY-83 PLANS. AGREE TO DEVELOP EXTENDED PASCO BASIN MODEL. USGS PRESENTS LIST OF MAJOR ISSUES.
5.	JAN. 17-18-19, 1983	ROCKWELL PRESENTS PLANS AND PROGRAMS TO RESOLVE MAJOR ISSUES. START DATA BASE FOR EXTENDED MODEL.
6.	JUNE 2-3, 1983	REVIEW INITIAL EXTENDED MODEL RESULTS. REVISE INITIAL DATA BASE. ROCKWELL PRESENTS UPDATE ON PLANS AND PROGRAMS.
7.	JULY 8, 1983	REVIEW EXTENDED MODEL RESULTS AND REVISE DATA BASE.
8.	OCT. 6-7, 1983	REVIEW RECHARGE CALCULATION RESULTS. DISCUSS FY-84 PLANS.
9.	NOV. 7, 1983	REVIEW EXTENDED MODEL DATA BASE. REVIEW RECENT FIELD TEST RESULTS.

PRINCIPAL ISSUES IDENTIFIED BY THE WORKING GROUP

* BOUNDARY CONDITIONS
* VERTICAL GROUNDWATER MOVEMENT
* HYDRAULIC TRANSIENTS
* HEAD MEASUREMENT TECHNIQUES
* LATERAL HYDRAULIC CONDUCTIVITY VALUES
* INTERPRETATION OF GEOCHEMICAL DATA
* WATER BALANCE
* EXTENT OF GEOLOGIC STRUCTURES


OKANOGAN HIGHLANDS
WASHINGTON
SEATTLE
COLUMBIA RIVER
ELLENSBURG BASIN
QUINCY BASIN
YAKIMA BASIN
PASCO BASIN
PORTLAND
UMATILLA BASIN
OREGON
IDAHO
N
OUTCROP EXTENT OF COLUMBIA RIVER BASALT
MAJOR STRUCTURAL BASINS
0 75 150 KILOMETERS
0 50 100 150 MILES


FRENCHMAN HILLS
Sentinel Gap
SADDLE
MOUNTAINS
HANFORD SITE BOUNDARY
Priest Rapids Dam
Scooteney Reservoir
COLUMBIA
URTANUM RIDGE
PASCO BASIN BOUNDARY
YAKIMA RIDGE
SNAKE RIVER
RIVER
RATTLESNAKE HILLS
Ice Harbor Dam
HICHLAND
YAKIMA RIVER
Lake Wallula
WALLA WALLA RIVER
HORSE HEAVEN HILLS
Wallula Gap
WASH
OREGON
IDAHO
0 10 20
MILES
BASALT OUTCROP

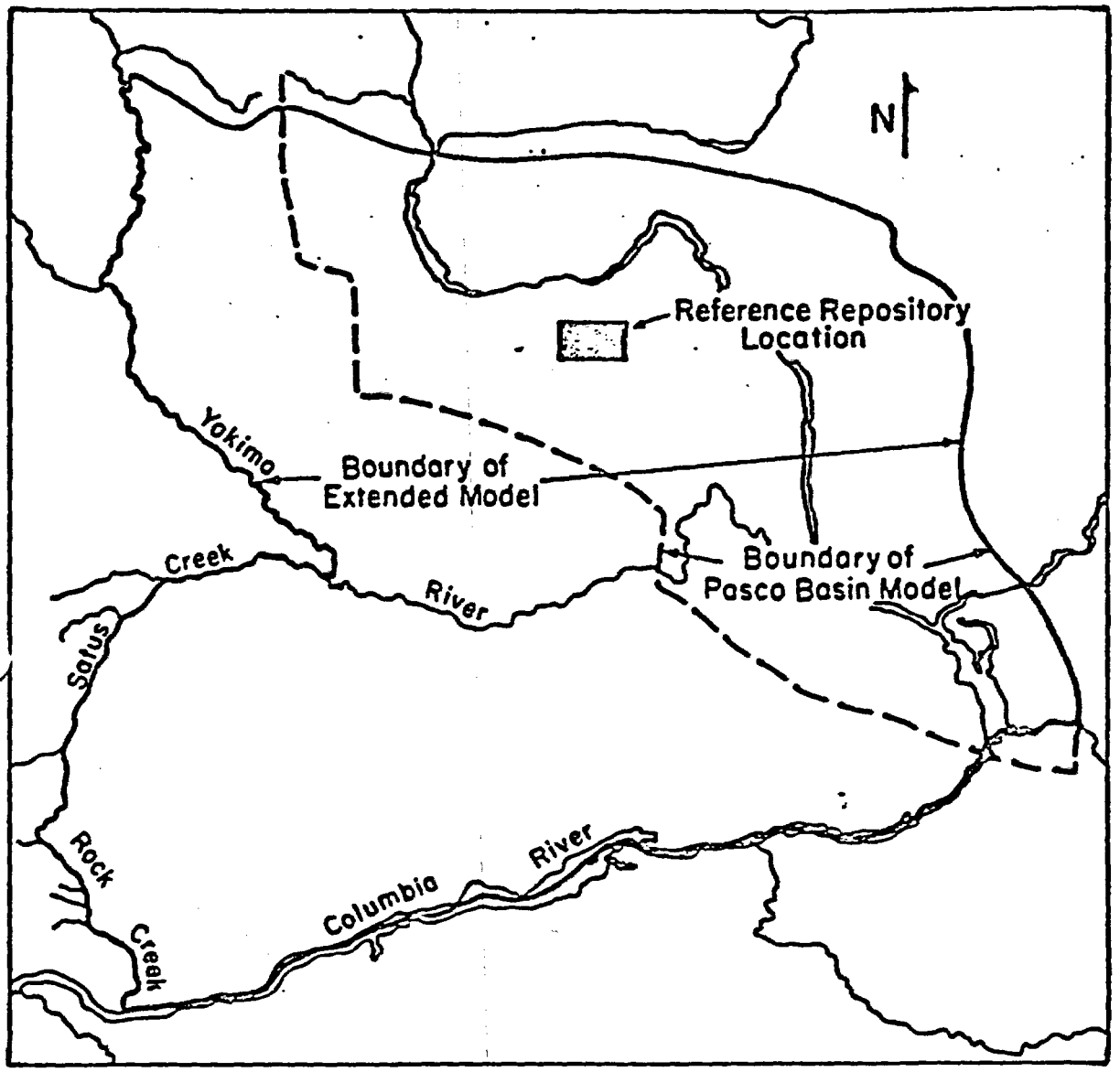


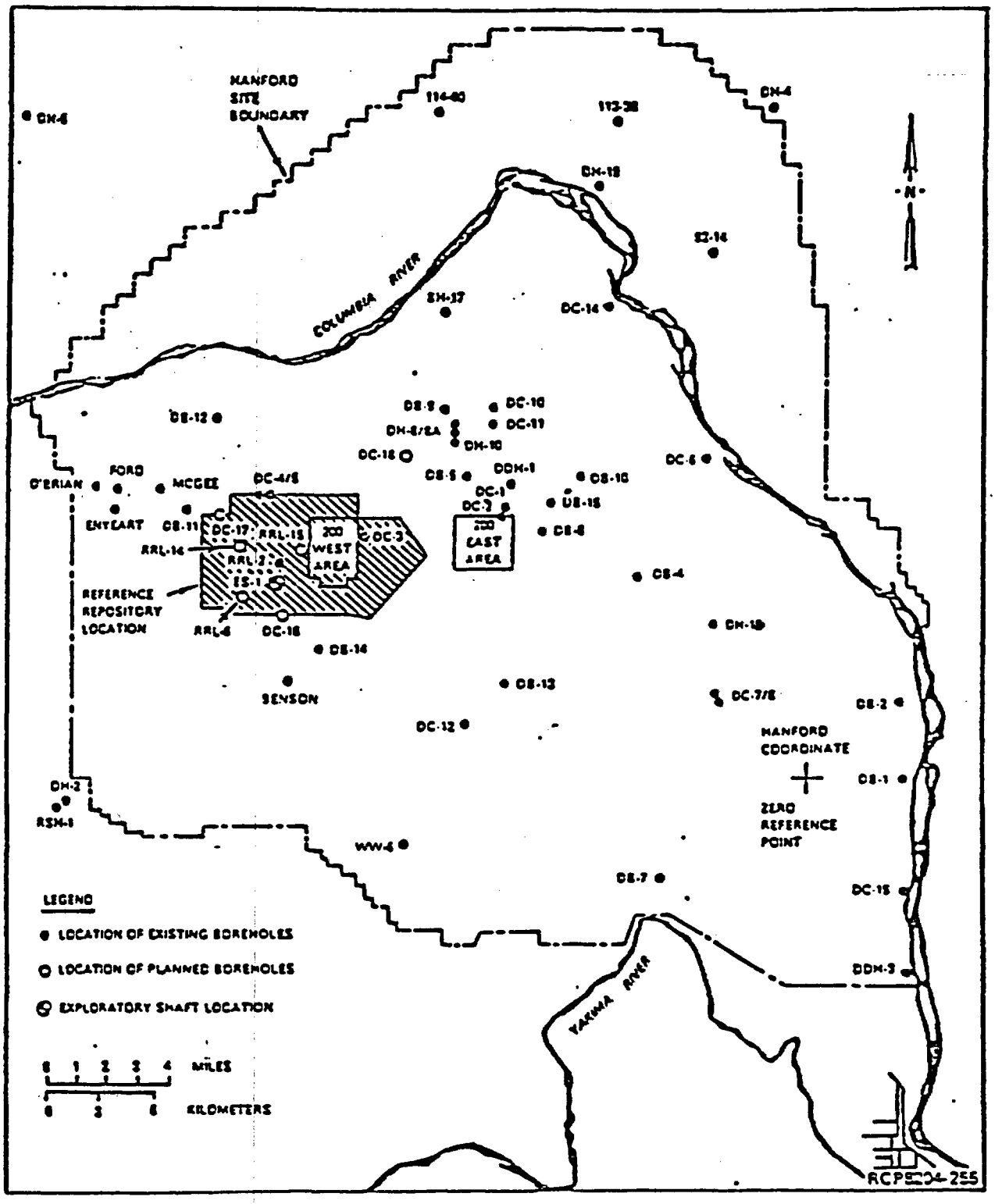
MILES

KILOMETERS

VERTICAL EXAGGERATION = 125X

Qhp - Hanford-Pasco gravels
Tr - Ringold Formation
Tsm - Saddle Mountains Basalt
Tw - Wanapum Basalt
Tsb - Sentinel Bluffs Sequence } Grande Ronde Basalt
Ts - Schwana Sequence


N
Reference Repository Location
Yokimo
Boundary of Extended Model
Boundary of Pasco Basin Model
Creek
River
Satus
Rock
Creek
Columbia
River


HANFORD SITE BOUNDARY
COLUMBIA RIVER
YAKIMA RIVER
200 WEST AREA
200 EAST AREA
REFERENCE REPOSITORY LOCATION
HANFORD COORDINATE
ZERO REFERENCE POINT
O'BRIAN
FORD
MCGEE
ENYEART
SENSON
LEGEND
LOCATION OF EXISTING BOREHOLES
LOCATION OF PLANNED BOREHOLES
EXPLORATORY SHAFT LOCATION
MILES
KILOMETERS
RCPE04-255

APPENDIX C

MODEL DEVELOPMENT

Viewgraphs used by Tony Zimmerman (PNL)

– OBJECTIVES –

Expanded Pasco Basin Groundwater Flow Model

"Characterize The Pre-development And Current Regional Pasco Basin Groundwater Flow System"

* Compile Reference Data Base
* Determine the nature of the flow conditions under Rattlesnake Hills
* Quantify Vertical Permeabilities
* Characterize Vertical Groundwater Movement
* Determine The Effect Of Hydraulic Transients

— METHODOLOGY —

For Accomplishing Modeling Objectives:

1. Document Data Sources For Existing Models
2. Interpret Data And Formulate Conceptual Model
3. Run Model With Nominal Data – Look For Problems And Revise Conceptual Model If Necessary
4. Compare Model Results To Measured Heads And Adjust Inputs to improve predictions
5. Perform Sensitivity Analyses
6. Select Pre–development Baseline Data Set And Make Transient Runs
7. Special Studies (eg. Recharge)

— MODELING APPROACH —

SITUATION:

Large Geographical Region

Complex Hydrogeology

Limited Data Base

Hierarchy of Confidence in Input Data:

Recharge	Most
Geology	
Lateral Permeability	
Storage Coefficient	
Vertical Permeability	Least

APPROACH:

"Nail Down" those parameters which we have the most knowledge of (ie. recharge, geology)

"Tune" the model by varying the parameter with the most uncertainty (vertical permeability)

— STATUS OF MODEL DEVELOPMENT —

1. Document Data Sources ✓ FY83
2. Formulate Conceptual Model ✓ FY83
3. Run Model With Nominal Data ✓ FY83
4. Special Studies ✓ FY83

FY84 Modleing Activities:

1. Recalculate Recharge
2. Reexamine Structural Data And Revise
3. Transfer Model To USGS Modular Code
4. Run New Model With Nominal Data Set And Compare Results To Measured Heads
5. Perform Sensitivity Analyses
6. Compile Aquifer Stress Data And Initiate Transient Model Runs

EXTENDED PASCO BASIN MODEL

MODEL INPUT CHECKLIST

* BOUNDARIES AND BOUNDARY CONDITIONS
  - LOCATION
  - FLOW/NO-FLOW
* STRUCTURAL FEATURES
  - AREAL DISTRIBUTION – BASALT OUTCROPS
* HYDRAULIC CHARACTERISTICS
  - TRANSMISSIVITY – HORIZONTAL AND VERTICAL K'S
  - POTENTIALS – SATURATED EXTENT
* RECHARGE

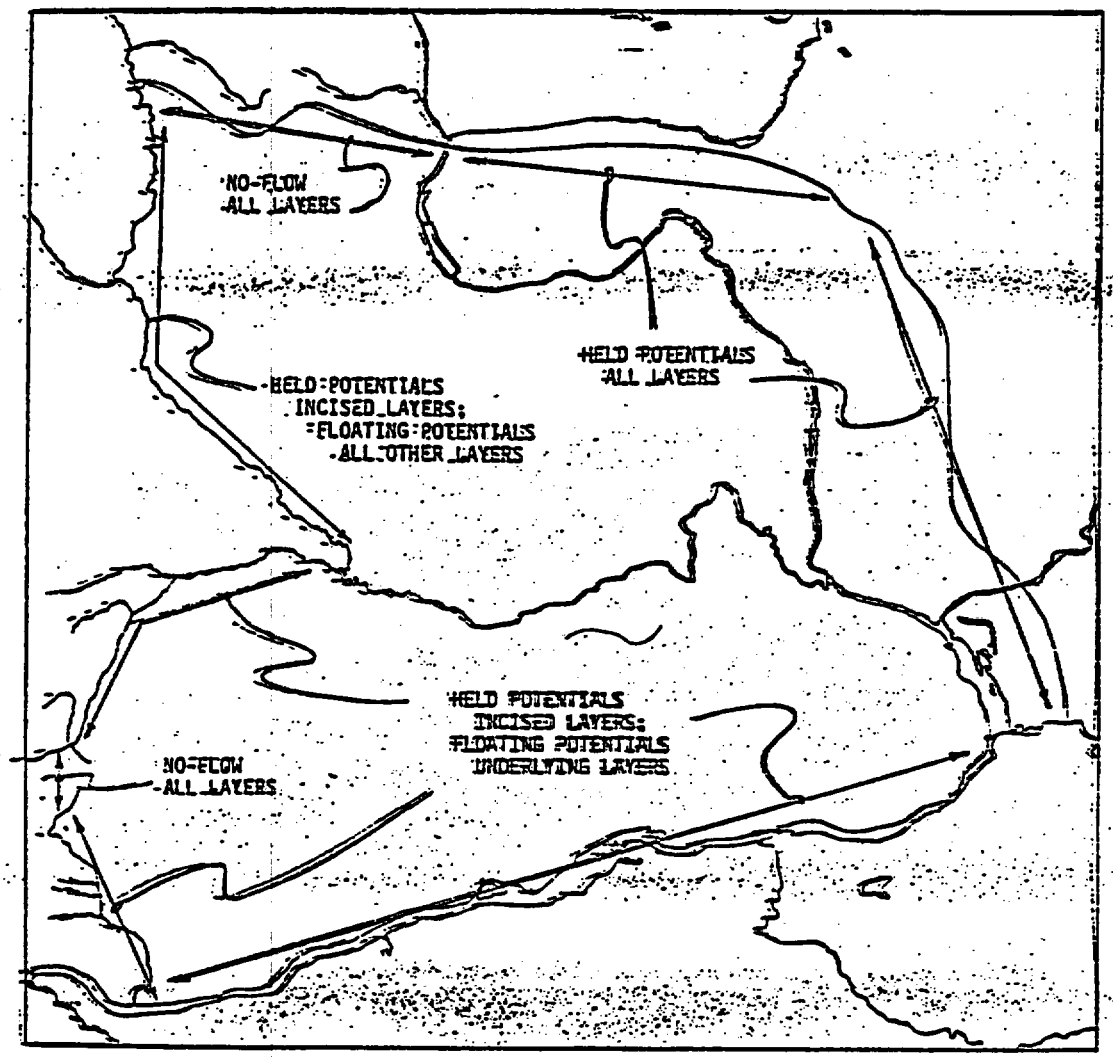


FIGURE 2. Boundary Conditions

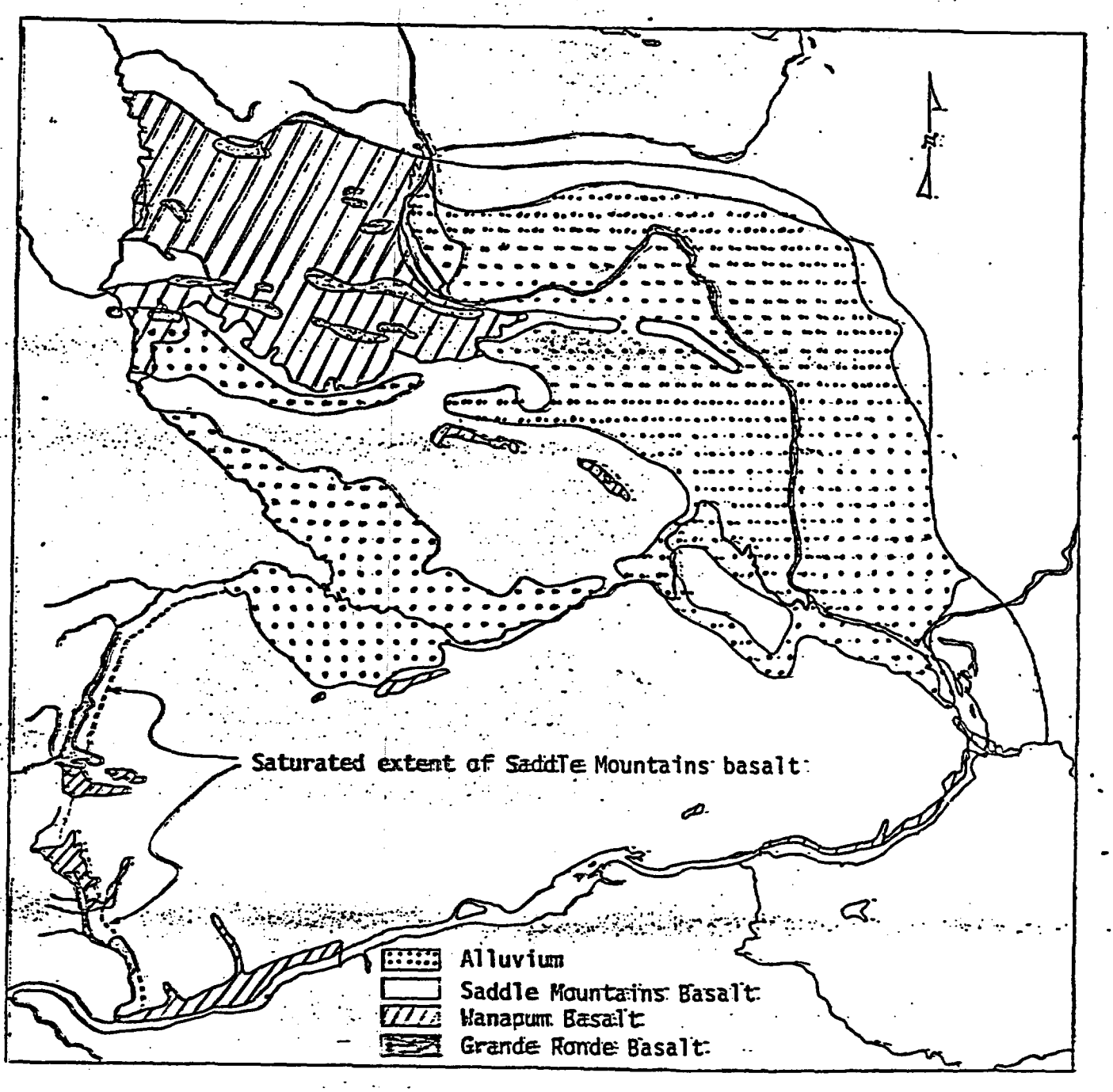
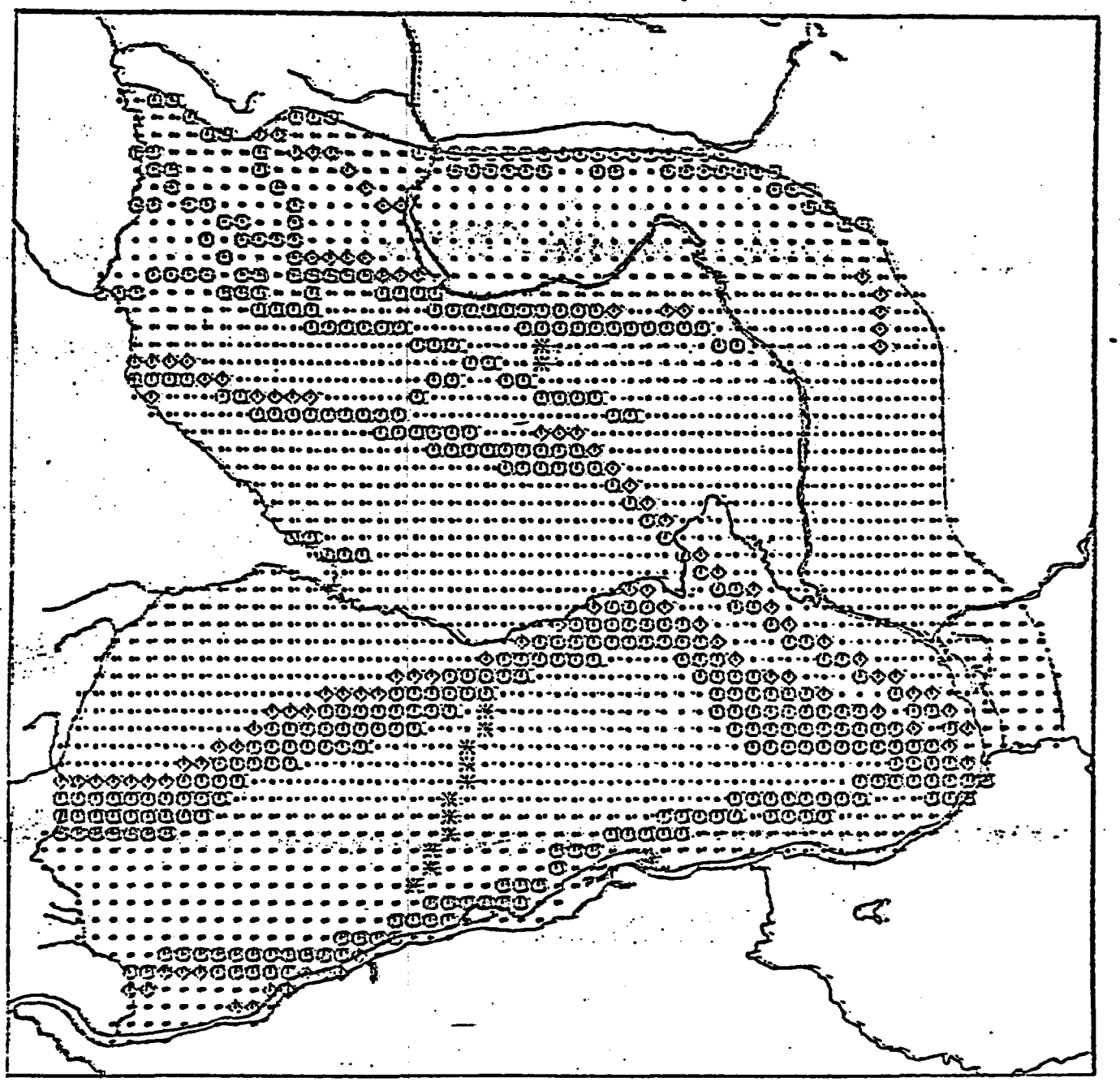


FIGURE 1. Areal Extent of Alluvium and Basalt Outcrops.



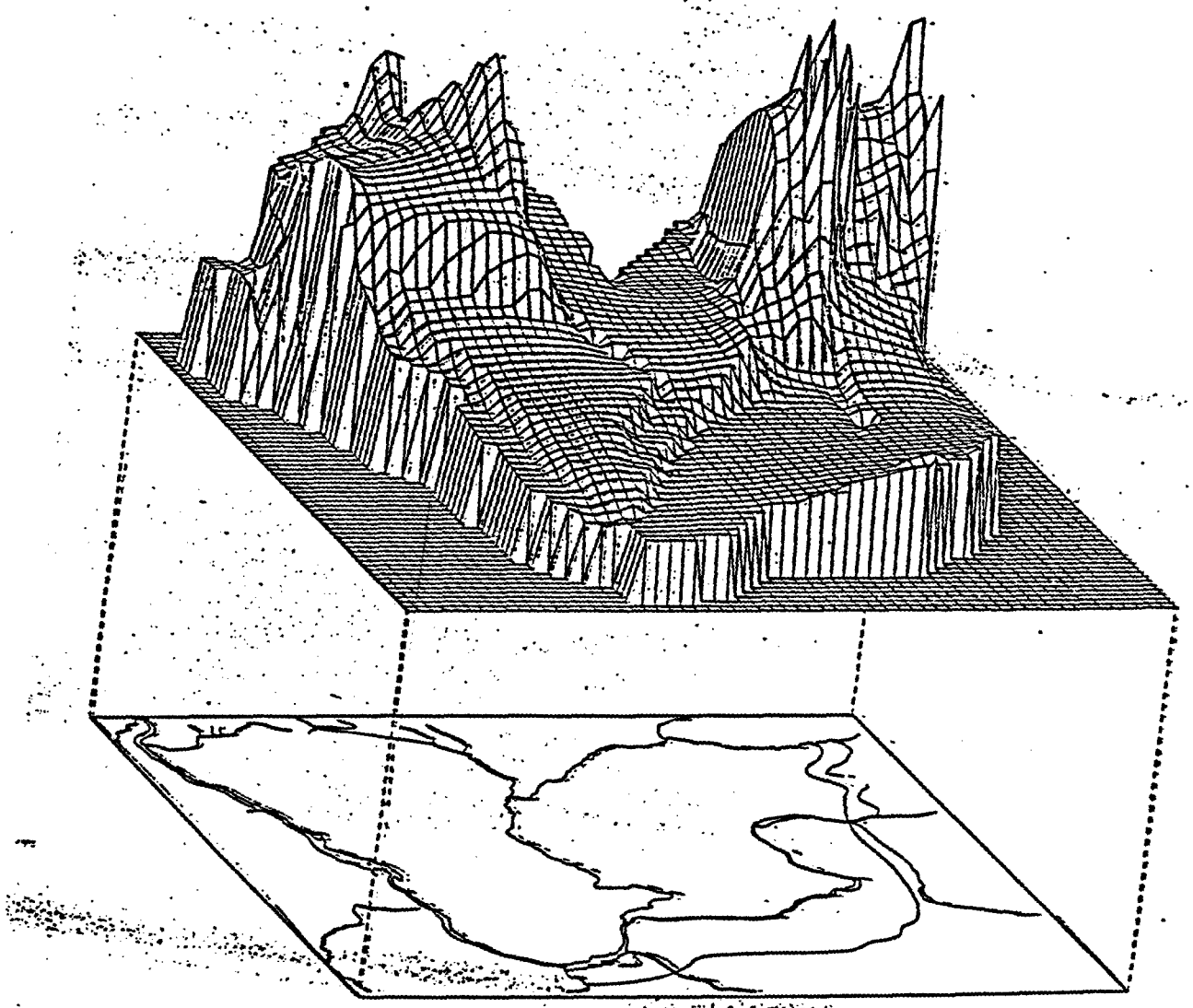
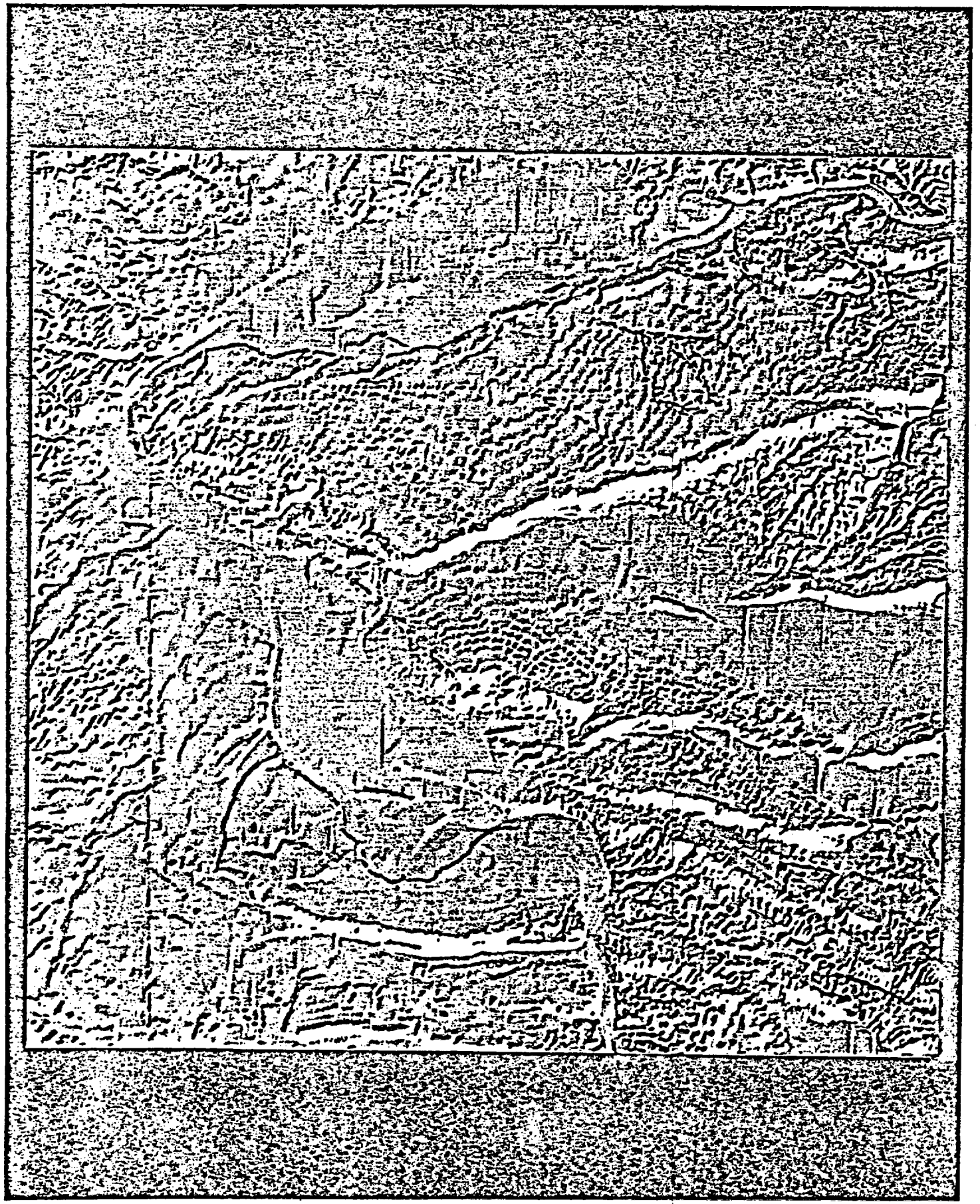


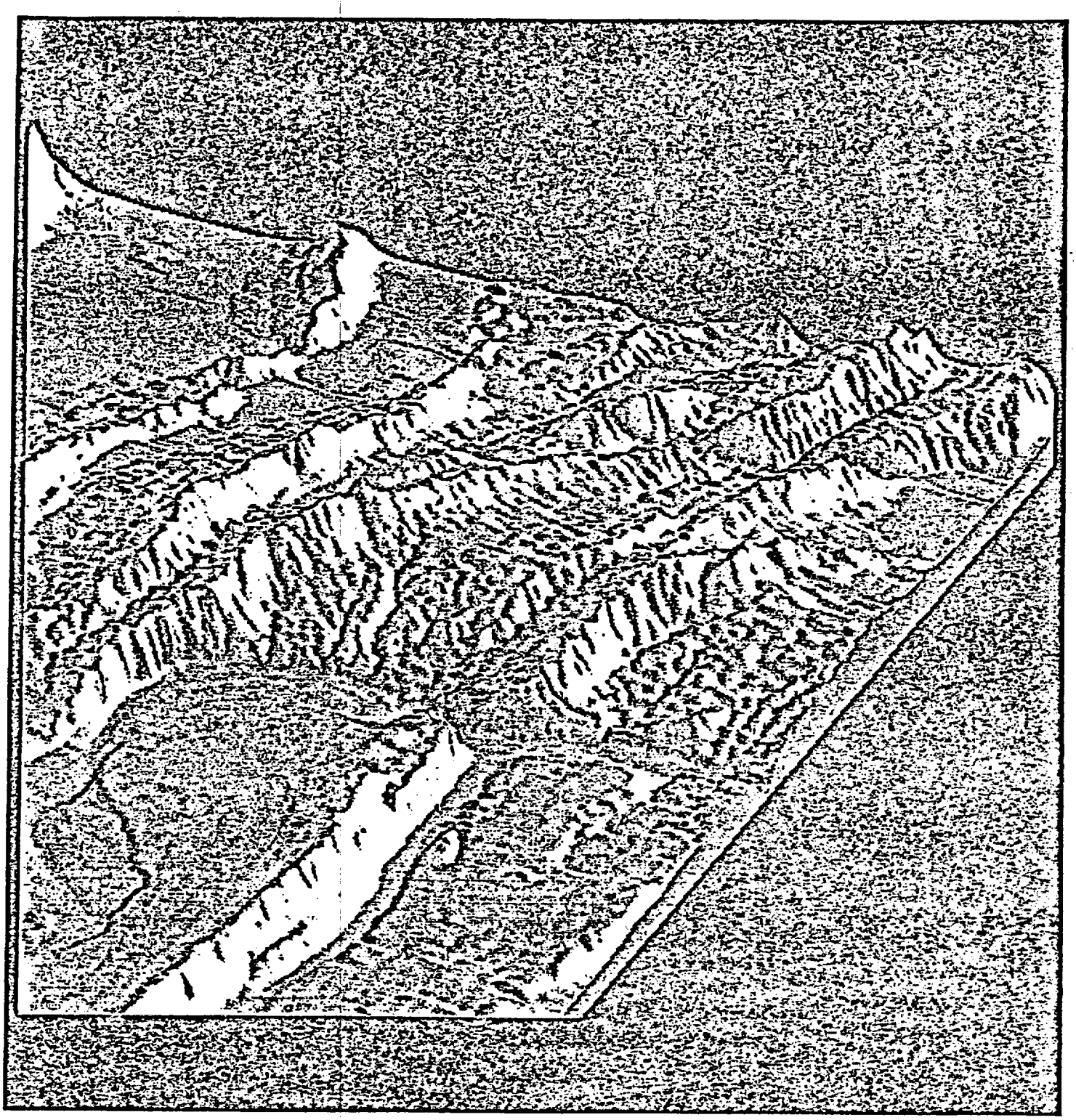
FIGURE 11. Base Case Lower Grande Ronde Potentials Displayed in Three Dimensions (not to scale).

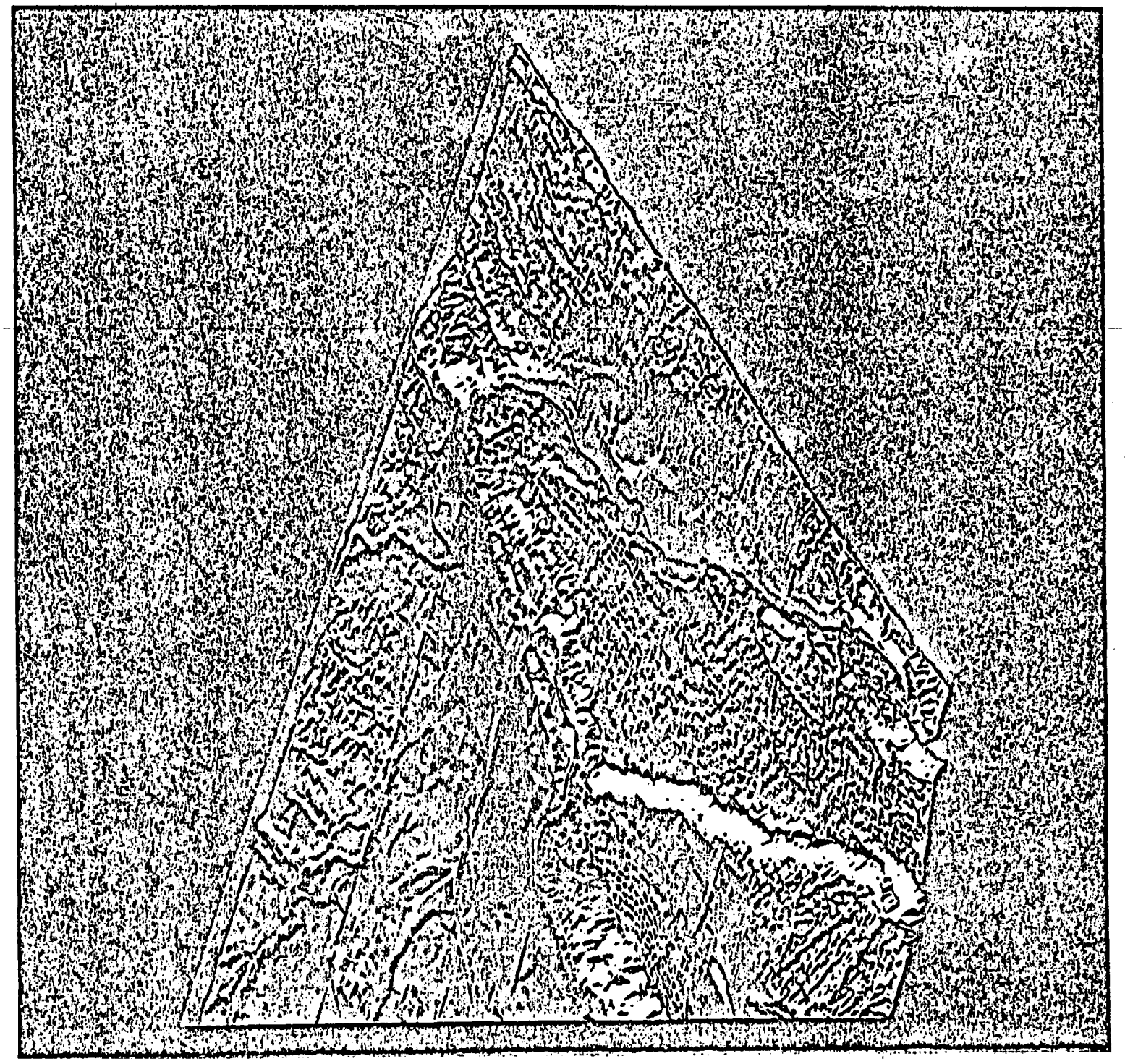
– RECHARGE CALCULATIONS –

1. Interpolate Spatial Distribution Of Rainfall (USGS)
2. Develop Computer Code For Calculating AET (USGS)
3. Aggregate Soil Properties; AWC And Depth (PNL)
4. Calibrate Runoff To Stream Gage Data (PNL)

   (Convert To Pre-development Conditions)







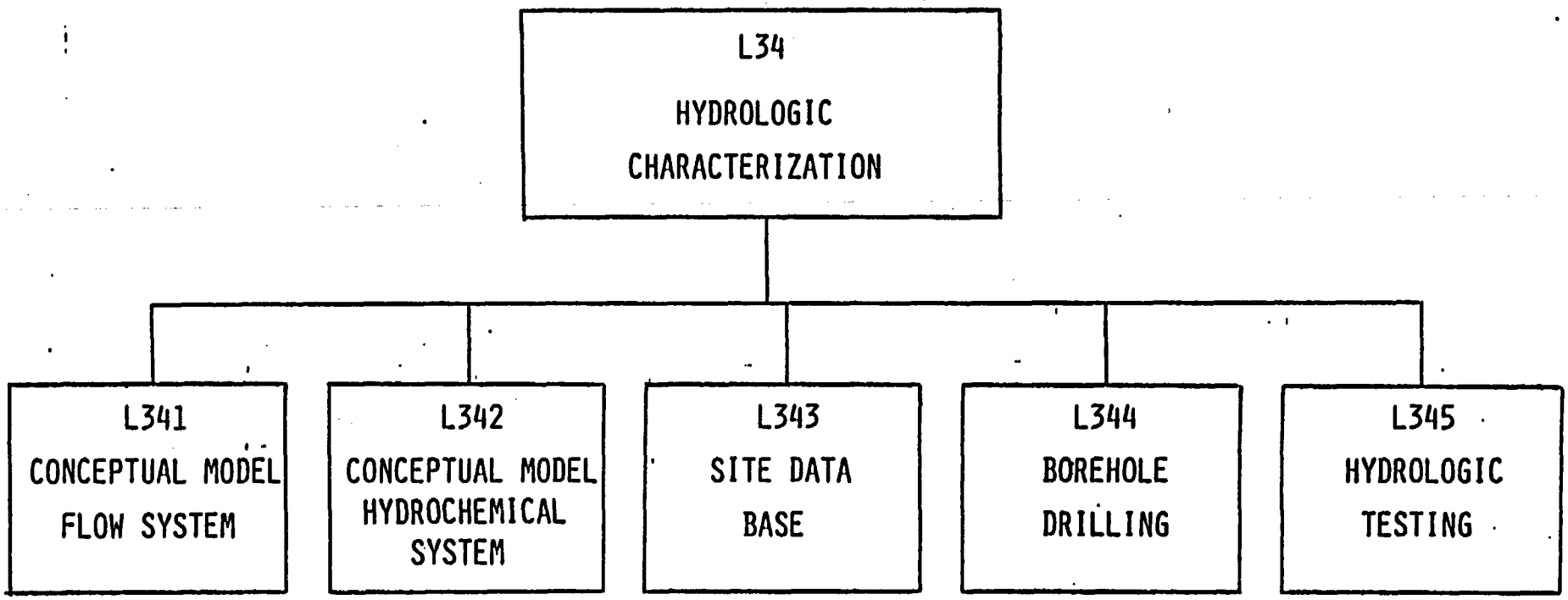
APPENDIX D

NEW FACILITIES AND DATA COLLECTION

Viewgraphs used by Steve Baker (Rockwell)

BWIP HYDROLOGIC CHARACTERIZATION STATUS

- "RECONNAISSANCE" PHASE COMPLETED
- PLANNING TO COMPLETE HYDROLOGIC CHARACTERIZATION IN PROGRESS
- HYDROLOGIC CHARACTERIZATION ACTIVITY HAS INCREASED SIGNIFICANTLY RECENTLY
- HYDROLOGIC CHARACTERIZATION IS AN EXCITING CHALLENGE

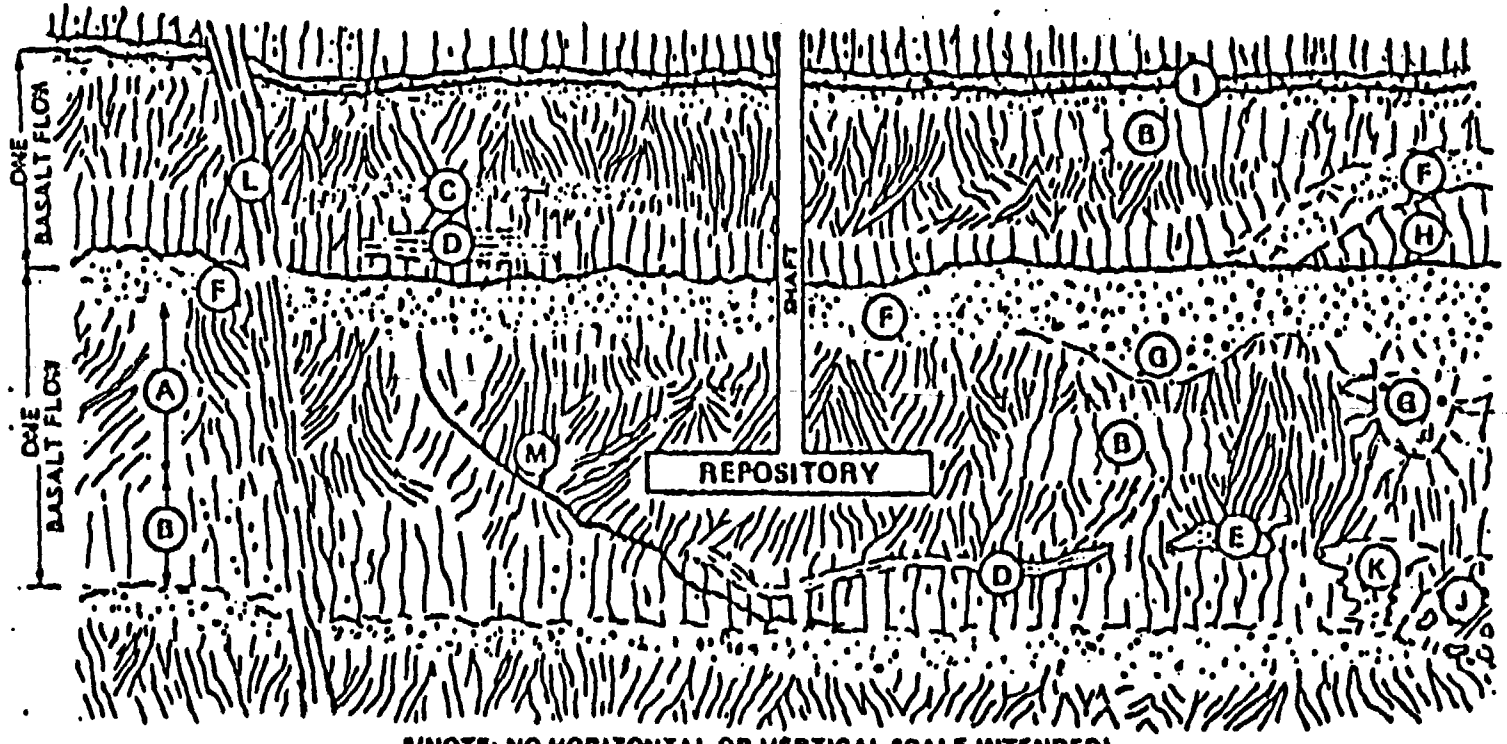

L34
HYDROLOGIC
CHARACTERIZATION
L341
CONCEPTUAL MODEL
FLOW SYSTEM
L342
CONCEPTUAL MODEL
HYDROCHEMICAL
SYSTEM
L343
SITE DATA
BASE
L344
BOREHOLE
DRILLING
L345
HYDROLOGIC
TESTING

GROUNDWATER FLOW CHARACTERIZATION ASPECTS

- UNDERSTAND REGIONAL FLOW SYSTEM
  - REGULATORY REQUIREMENT
  - BOUNDARY CONDITIONS FOR PERFORMANCE MODELS
  - INTERAGENCY COOPERATION
- SITE DATA COLLECTION
  - SUPPLEMENT REGIONAL DATA
  - INPUT FOR PERFORMANCE MODEL

PLANNING STATUS FOR HYDROLOGIC CHARACTERIZATION

- AGREEMENT ON "APPROACH" FOR SITE (HANFORD) DATA COLLECTION REACHED WITH NRC
- "REGIONAL" DATA REQUIREMENTS BEING ESTABLISHED WITH USGS



*(NOTE: NO HORIZONTAL OR VERTICAL SCALE INTENDED)

EXPLANATION

FLOW INTERIOR

- A ENTABLATURE
- B COLONNADE
- C VESICULAR ZONE
- D PLATY ZONE
- E ANOMALOUSLY FRACTURED ZONE

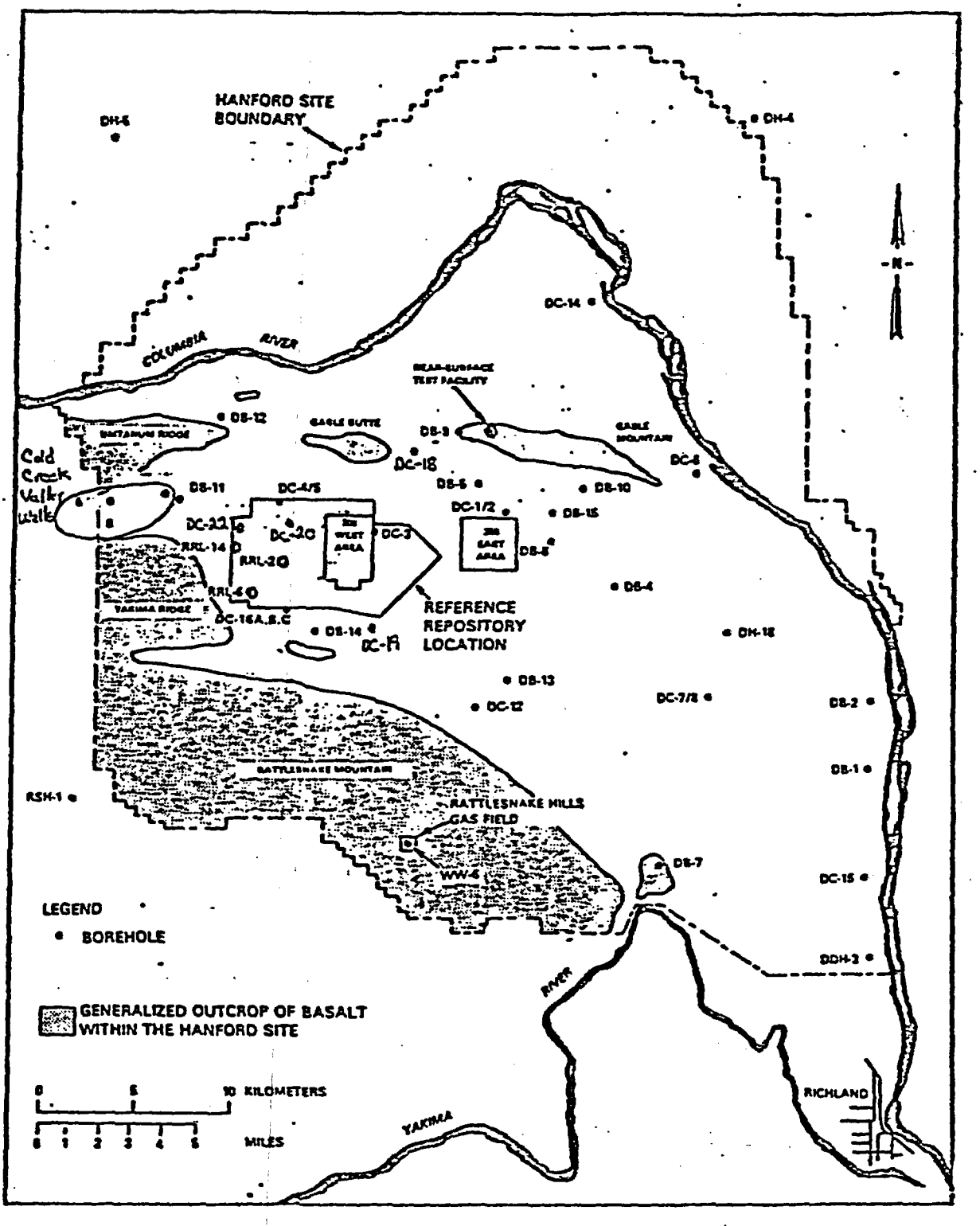
FLOW CONTACT

- F FLOW TOP
- G LOCAL THICKENING OF FLOW TOP BRECCIA
- H FLOW TERMINATION
- I SEDIMENTARY INTERBED
- J PILLOW BRECCIA
- K SPIRICLE OR SPIRICLE-LIKE FEATURE

BEDROCK STRUCTURE

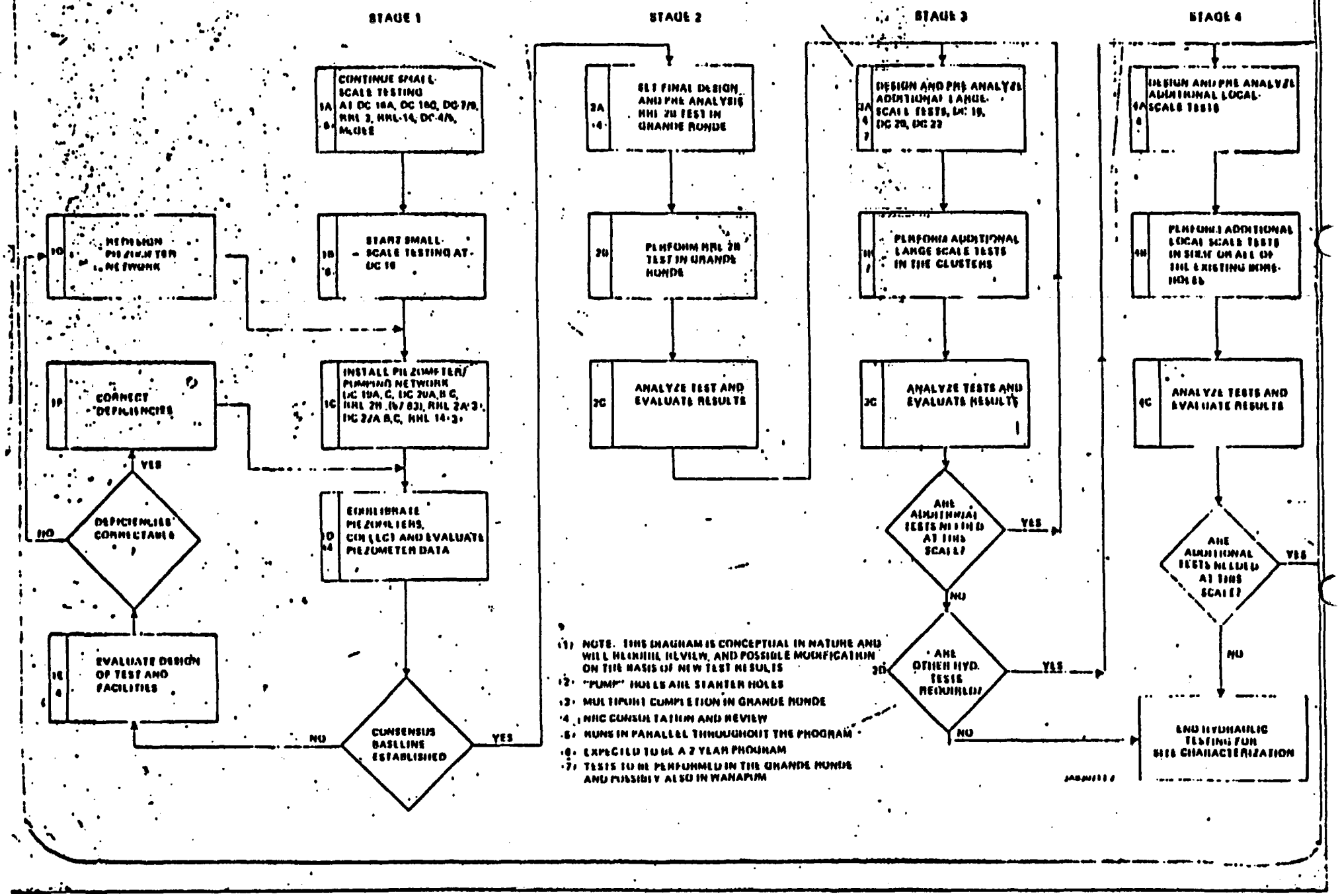
- L FAULT OR FRACTURE ZONE, HINGE OF FOLD, OR SHEAR ZONE
- M LOCALIZED TECTONIC FRACTURE

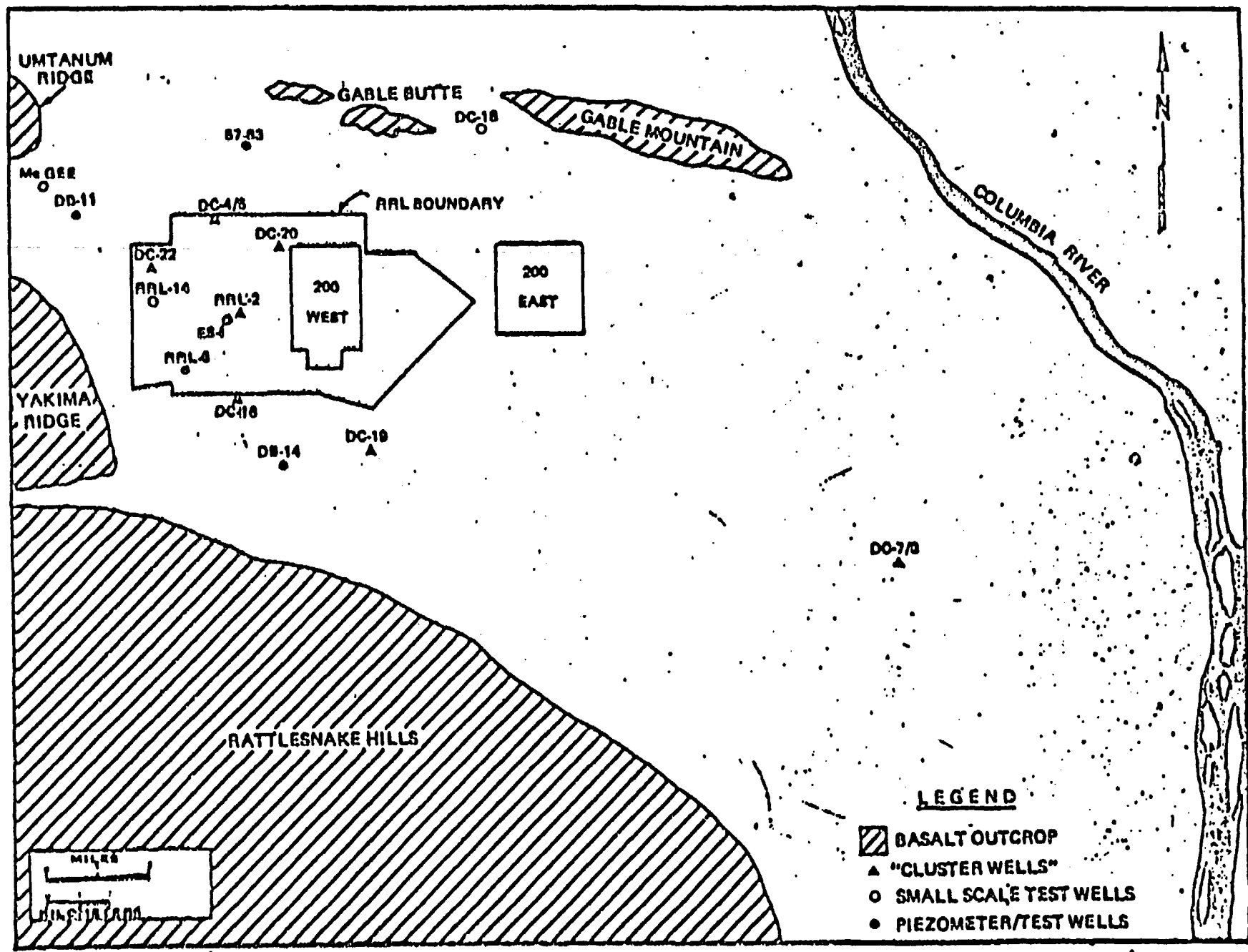
FIGURE 3. COMPOSITE, HYPOTHETICAL CROSS-SECTION OF GEOLOGIC FEATURES* POTENTIALLY AFFECTING GROUNDWATER FLOW PATHS.



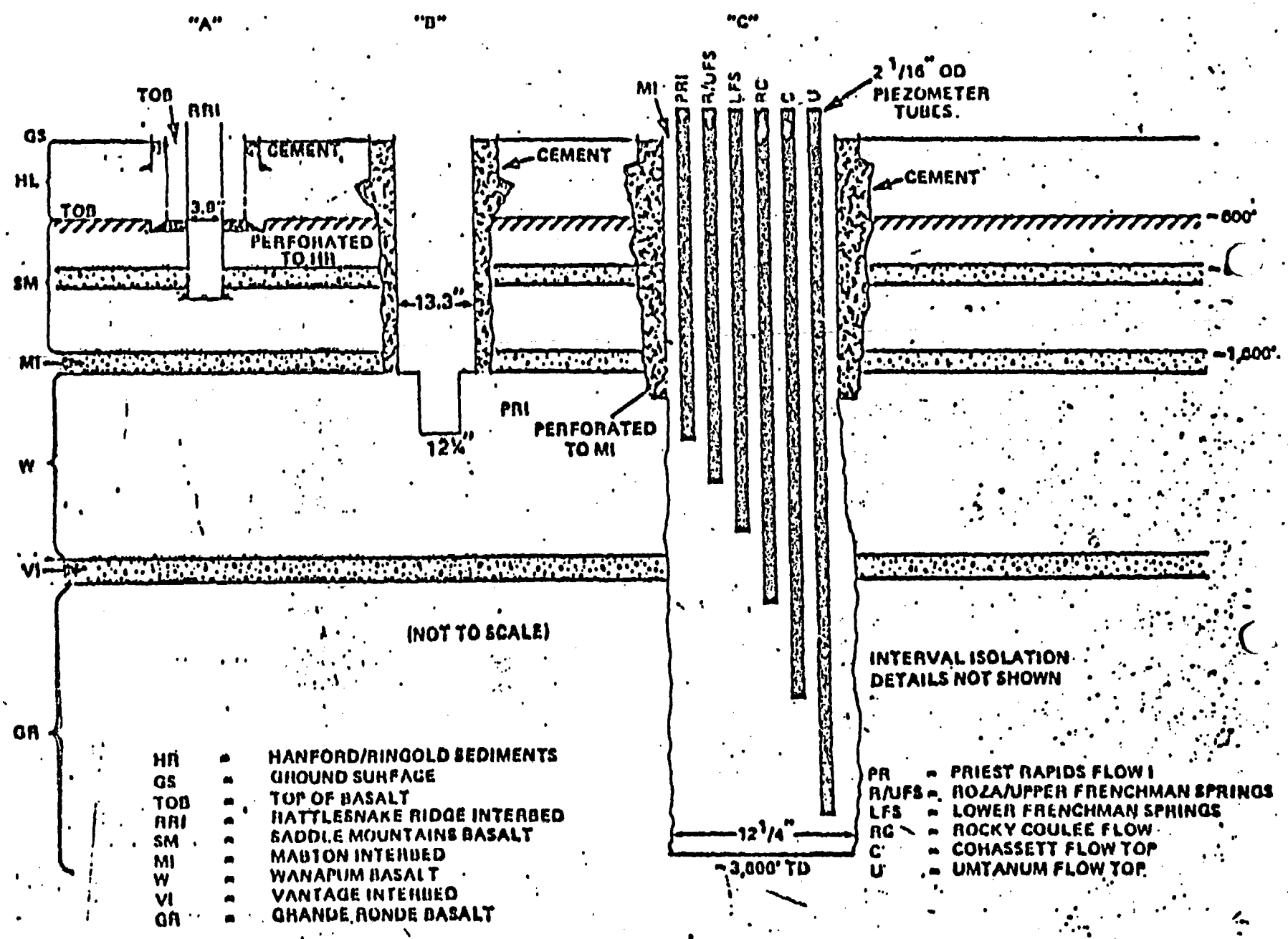
Location Map for Key Boreholes

LOGIC DIAGRAM FOR BWIP BOREHOLE: HYDROLOGIC TEST STRATEGY

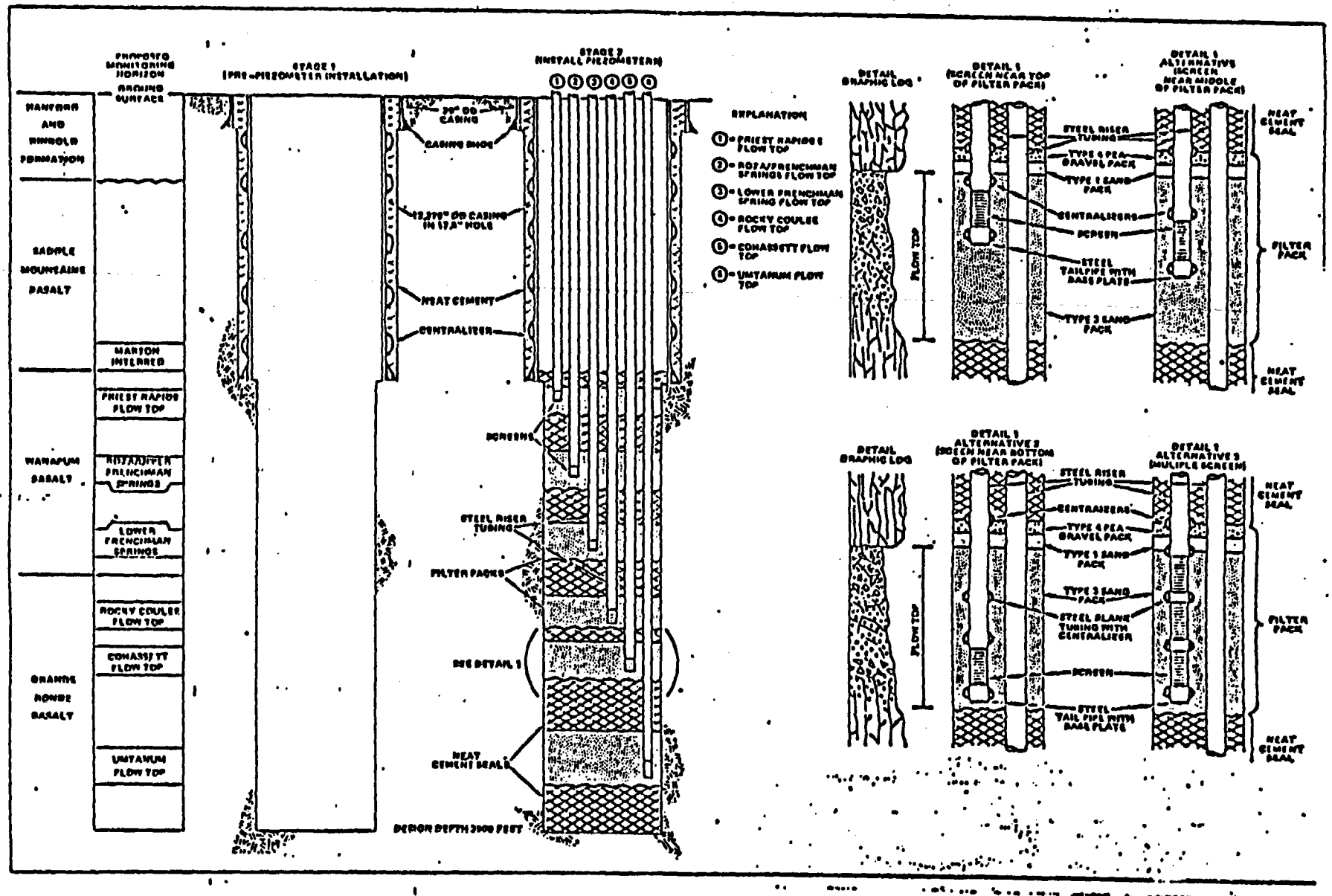


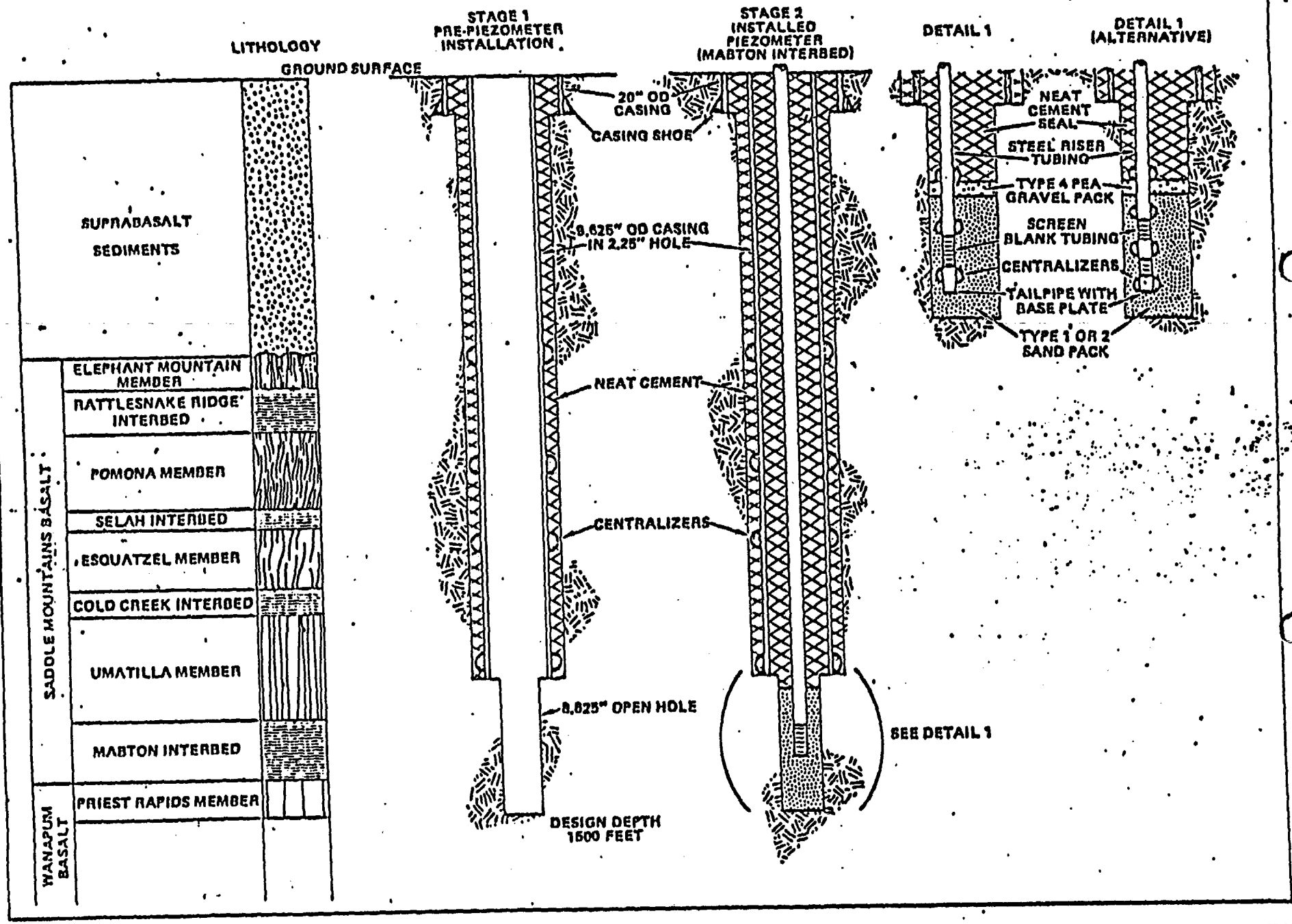


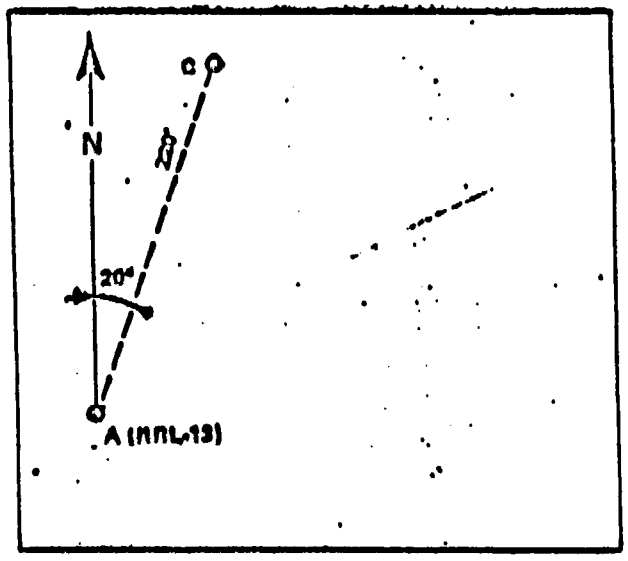
ACTIVE AND PLANNED WELL LOCATIONS



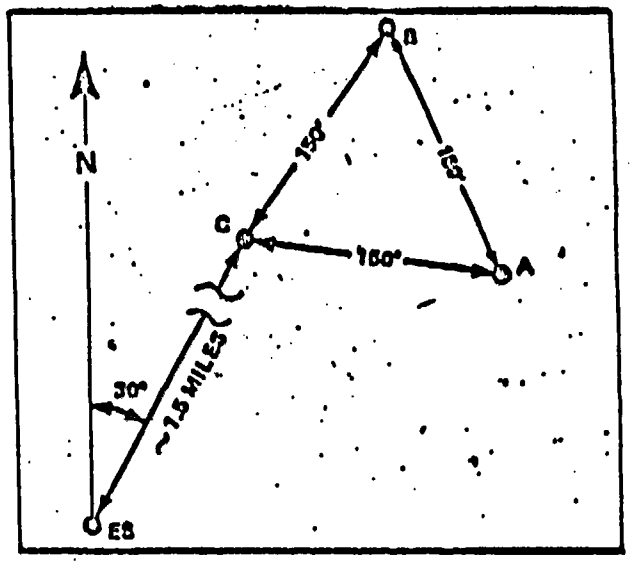
SCHEMATIC OF PROPOSED PIEZOMETER CLUSTER DESIGN.
(PRELIMINARY)
FIGURE 3


PROPOSED MONITORING HORIZON
GROUND SURFACE
HANFORD AND RINGOLD FORMATION
SADDLE MOUNTAINS BASALT
WANAPUM BASALT
GRANDE RONDE BASALT
MARTIN INTERBED
PRIEST RAPIDS FLOW TOP
ROTA/FRENCHMAN SPRINGS
LOWER FRENCHMAN SPRINGS
ROCKY COULEE FLOW TOP
COHASSETT FLOW TOP
UMTANUM FLOW TOP
STAGE 1 (PRE-PIEZOMETER INSTALLATION)
20" OD CASING
CASING SHOE
12.375" OD CASING IN 17.5" HOLE
HEAT CEMENT
CENTRALIZER
STAGE 2 INSTALL PIEZOMETERS
SCREENS
STEEL RISER TUBING
FILTER PACKS
SEE DETAIL 1
HEAT CEMENT SEAL
DESIGN DEPTH 2000 FEET
EXPLANATION
1 = PRIEST RAPIDS FLOW TOP
2 = ROTA/FRENCHMAN SPRINGS FLOW TOP
3 = LOWER FRENCHMAN SPRING FLOW TOP
4 = ROCKY COULEE FLOW TOP
5 = COHASSETT FLOW TOP
6 = UMTANUM FLOW TOP
DETAIL GRAPHIC LOG
FLOW TOP
DETAIL 1 (SCREEN NEAR TOP OF FILTER PACK)
STEEL RISER TUBING
TYPE 4 PEA GRAVEL PACK
TYPE 1 SAND PACK
CENTRALIZERS
SCREEN
STEEL TAILPIPE WITH BASE PLATE
TYPE 3 SAND PACK
DETAIL 1 ALTERNATIVE (SCREEN NEAR MIDDLE OF FILTER PACK)
HEAT CEMENT SEAL
FILTER PACK
HEAT CEMENT SEAL
DETAIL GRAPHIC LOG
FLOW TOP
DETAIL 1 ALTERNATIVE 2 (SCREEN NEAR BOTTOM OF FILTER PACK)
STEEL RISER TUBING
CENTRALIZERS
TYPE 4 PEA GRAVEL PACK
TYPE 1 SAND PACK
TYPE 3 SAND PACK
STEEL BLANK TUBING WITH CENTRALIZER
SCREEN
STEEL TAIL PIPE WITH BASE PLATE
DETAIL 1 ALTERNATIVE 3 (MULTIPLE SCREEN)
HEAT CEMENT SEAL
FILTER PACK
HEAT CEMENT SEAL

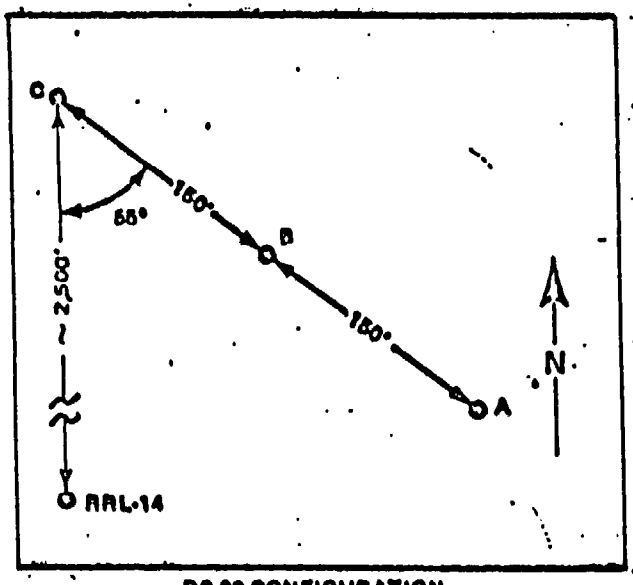

LITHOLOGY
GROUND SURFACE
SUPRABASALT SEDIMENTS
SADDLE MOUNTAINS BASALT
ELEPHANT MOUNTAIN MEMBER
RATTLESNAKE RIDGE INTERBED
POMONA MEMBER
SELAH INTERBED
ESQUATZEL MEMBER
COLD CREEK INTERBED
UMATILLA MEMBER
MABTON INTERBED
WANAPUM BASALT
PRIEST RAPIDS MEMBER
STAGE 1
PRE-PIEZOMETER INSTALLATION
20" OD CASING
CASING SHOE
8.625" OD CASING IN 2.25" HOLE
NEAT CEMENT
CENTRALIZERS
8.625" OPEN HOLE
DESIGN DEPTH 1500 FEET
STAGE 2
INSTALLED PIEZOMETER (MABTON INTERBED)
SEE DETAIL 1
DETAIL 1
DETAIL 1 (ALTERNATIVE)
NEAT CEMENT SEAL
STEEL RISER TUBING
TYPE 4 PEA GRAVEL PACK
SCREEN
BLANK TUBING
CENTRALIZERS
TAILPIPE WITH BASE PLATE
TYPE 1 OR 2 SAND PACK



DC-19 CONFIGURATION



DC-20 CONFIGURATION



DC-22 CONFIGURATION

FIGURE 2. Plan View Illustrating the Relationships of Boreholes at Each Cluster Site.

TWO APPROACHES FOR UNDERSTANDING THE REGIONAL FLOW SYSTEM

- PRE-DISTURBANCE
  - INITIAL CONDITION
  - HISTORICAL CHANGES
  - RUN TRANSIENT TO GET PRESENT CONDITIONS
  - PREDICTIVE CAPABILITY
- CURRENT TRANSIENT
  - ESTABLISH TRANSIENT BASELINE
  - CALIBRATE TO CURRENT TRANSIENT CONDITIONS
  - PREDICTIVE CAPABILITY

PRE-DISTURBANCE APPROACH

- REGIONAL MODEL WITH BOUNDARIES FAR FROM REGION OF INTEREST
- ACCURATE RECHARGE INPUT NECESSARY
- MUST ACCOMMODATE STRUCTURAL CONTROL OF GROUNDWATER FLOW
- UNDISTURBED STATE ESTIMATED FROM HISTORICAL DATA, CALCULATIONS BASED UPON CROP CHANGES AND PRESENT DATA
- HISTORY OF HYDRAULIC STRESSES REQUIRED

RECENT DEVELOPMENTS

- AIR MIST DRILLING PUMPED ABOUT 800-1000 GPM FROM DC-19 AND DC-20C
  - DRAWDOWN OBSERVED ACROSS THE SITE (PR AND COHASSETT)
  - DRAWDOWN OBSERVATIONS WILL HELP DESIGN LARGE SCALE TESTS
- DOWNHOLE CAMERA USED AT DC-19C
  - GAS EVOLVING FROM WANAPUM FLOW TOP
  - MIGHT BE IN SITU GAS OR RESIDUAL FROM DRILLING
  - WILL BE TESTED
- DC-19C GEOPHYSICAL SIGNATURE INDICATES TEXTURAL CHANGE (APPROXIMATELY 44 FEET)
  - HIGHER POROSITY
  - HYDRAULIC TESTING IN PROGRESS
  - INITIAL RESULTS INDICATED LOW TRANSMISSIVITY