

20: P. Justus / M. Weber 5,75 62355
From: COOK, NRC JMBT

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WM Project 10
Docket No.

PDR

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Distribution: Linehan Hildenbrand

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CENTER

Office of Civilian Radioactive Waste Management Program

Presentation
of the

Basalt Waste Isolation Project

to the

Joint Interim Committee on Hazardous Materials
Oregon State Legislature

at

Salem, Oregon
March 14, 1986

by

Dr. D.H. Dahlem, Chief
Geoscience & Technology Branch
Basalt Waste Isolation Division
Richland, Washington

8608110059 860314
PDR WASTE
WM-10 PDR

See packet 11
for envelope

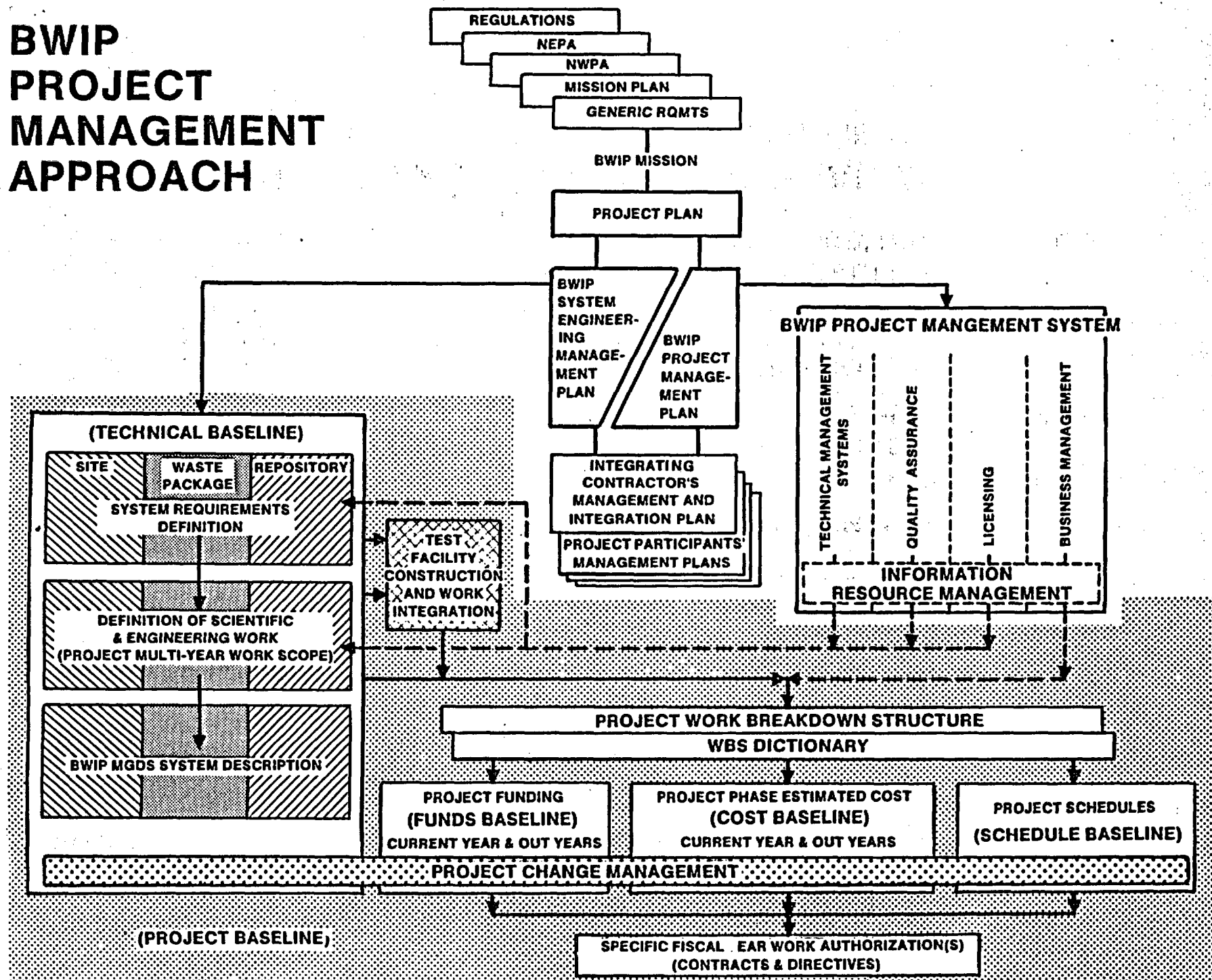
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BASALT WASTE ISOLATION PROJECT AT HANFORD

- **GEOLOGY**
- **PERFORMANCE ASSESSMENT**
- **GEOHYDROLOGY/HYDROLOGY**

*See end sheet
in OCLM program
3/14/86 101*

BWIP PROJECT MANAGEMENT APPROACH



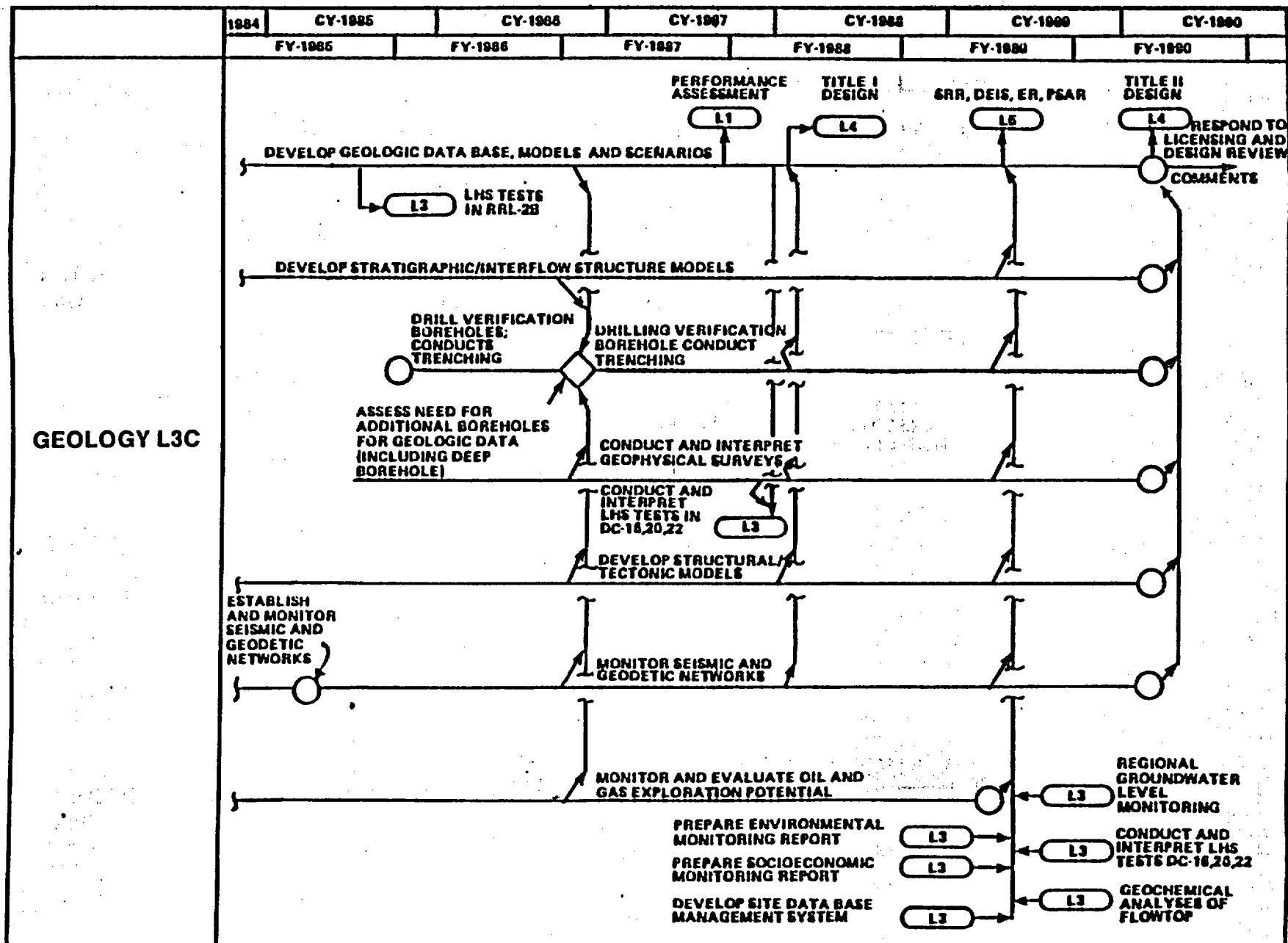
BASALT WASTE ISOLATION PROJECT TECHNICAL AND PEER REVIEWS

- **MEETINGS, WORKSHOPS, DATA REVIEWS, TOURS, BRIEFINGS, ETC., HELD WITH NRC CONCERNING GEOLOGY, HYDROLOGY, PERFORMANCE ASSESSMENT, ENGINEERING, QUALITY ASSURANCE, WASTE PACKAGE/GEOCHEMISTRY, TECTONICS/SEISMICITY, DATA MANAGEMENT, ETC.**
- **MEETINGS, WORKSHOPS, DATA REVIEWS, TOURS BRIEFINGS, ETC., HELD WITH THE USGS COVERING GEOLOGY, HYDROLOGY, TECTONICS/SEISMICITY, WASTE PACKAGE/GEOCHEMISTRY, ETC.**
- **REVIEWS HELD WITH THE WASTE ISOLATION PANEL - NAS.**
- **REVIEWS HELD WITH THE ADVISORY COMMITTEE FOR REACTOR SAFEGUARDS.**
- **MEETINGS, WORKSHOPS, DATA REVIEWS, TOURS, BRIEFINGS, ETC., HELD WITH THE STATE OF WASHINGTON, STATE OF OREGON, YAKIMA INDIAN NATIONS, UMATILLA CONFEDERATED TRIBES, NEZ PERCE TRIBE, AND MANY OTHER INSTITUTIONS.**
- **CONTINUING TECHNICAL REVIEWS HELD WITH THE DOE TECHNICAL REVIEW GROUP**
- **OTHERS**

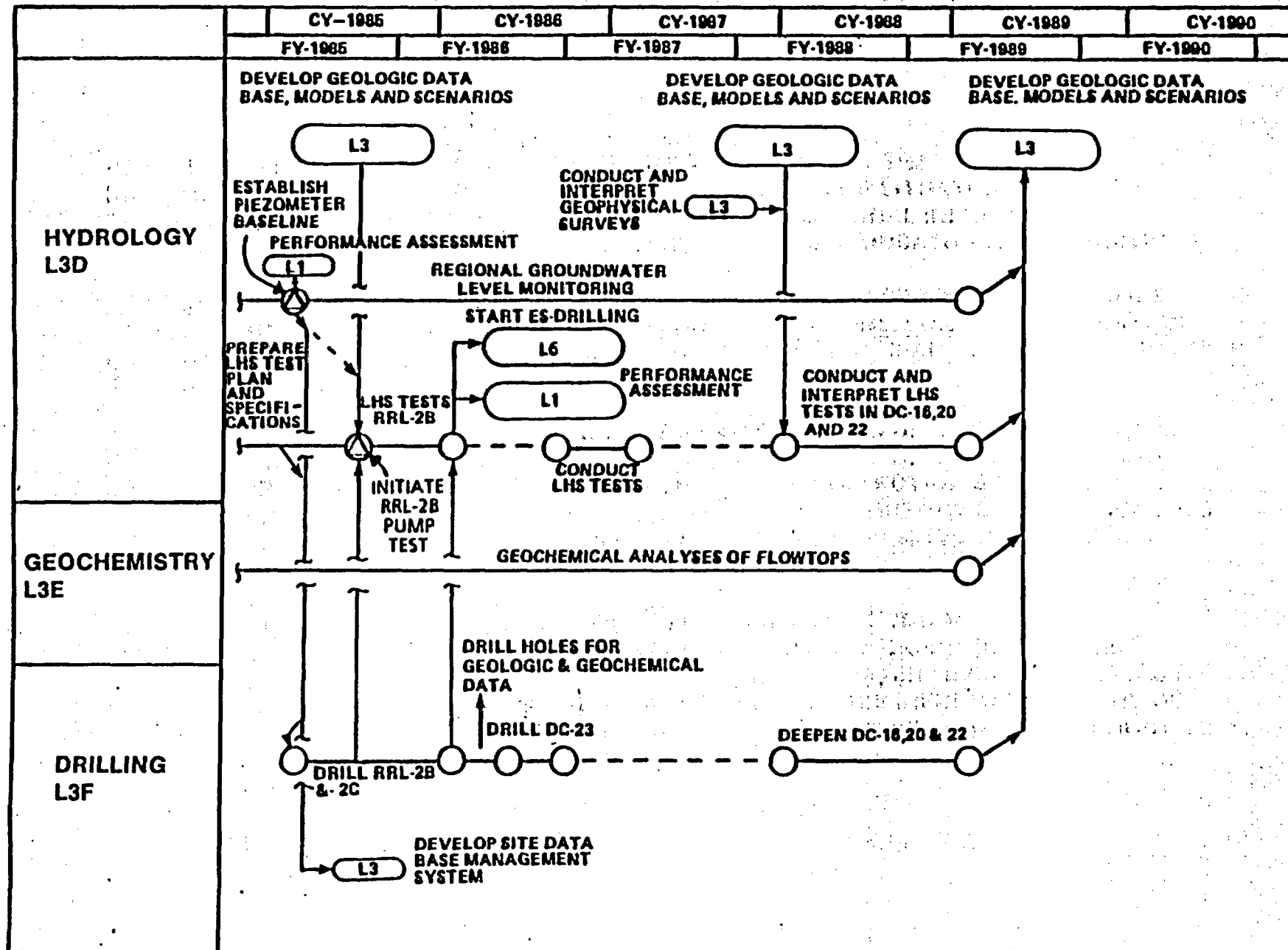
BASALT WASTE ISOLATION PROJECT CONSTRUCTION SCHEDULE

- **SELECT SITE FOR FIRST REPOSITORY (PRESIDENTIAL DECISION) - 1991**
- **SUBMIT LICENSING DOCUMENTATION FOR FIRST REPOSITORY TO NRC - 1991**
- **INITIATE CONSTRUCTION - 1994**
- **LIMITED REPOSITORY OPERATIONS - (400MT/YR) - 1998**
- **FULL REPOSITORY OPERATION - (3000MT/YR) - 2002**

1.3 SITE KEYPOINT LOGIC



1.3 SITE KEYPOINT LOGIC



U.S. NUCLEAR REGULATORY COMMISSION GUIDELINE REQUIREMENTS SITE HYDROGEOLOGIC SYSTEM

DESCRIBE THE SITE HYDROGEOLOGIC SYSTEMS TO THE EXTENT THAT AVAILABLE INFORMATION WILL PERMIT. THIS SECTION IS STRUCTURED FOR SITUATIONS WHERE SATURATED FLOW CONDITIONS DOMINATE. HOWEVER, ADDITIONAL INFORMATION REQUIREMENTS ARE SPECIFIED FOR THOSE SITES LOCATED IN UNSATURATED CONDITIONS.

3.9.1 BASELINE MONITORING. PROVIDE INFORMATION GATHERED FROM THE BASELINE MONITORING* PROGRAM THAT INCLUDES SEASONAL VARIATIONS, LONG-TERM TRENDS IN POTENTIOMETRIC LEVELS, AND HYDROCHEMISTRY OF THE PRINCIPAL HYDROGEOLOGIC UNITS, IF AVAILABLE.

3.9.1.1 MONITORING NETWORK. PROVIDE SPECIFICATIONS AND DESIGN (I.e., LOCATIONS, ELEVATIONS OF SCREENS AND MEASURING POINTS, ELEVATIONS OF SEALS), SELECTION PROCESS FOR CHOOSING LOCATION AND DEPTH OF DATA COLLECTION SYSTEMS, HYDROGEOLOGIC UNITS BEING MONITORED, METHOD AND FREQUENCY OF MEASUREMENTS, AND METHOD OF HYDROCHEMICAL SAMPLING FOR THE MONITORING NETWORK USED IN ESTABLISHING THE BASELINE MONITORING PROGRAM.

3.9.1.2 POTENTIOMETRIC LEVELS. PROVIDE REPRESENTATIVE HYDROGRAPHS AND POTENTIOMETRIC SURFACE MAPS FOR EACH PRINCIPAL HYDROGEOLOGIC UNIT. THE HYDROGRAPHS SHOULD INCLUDE PRECIPITATION, SURFACE-WATER LEVELS, AND RATES OF GROUNDWATER PUMPAGE WHERE APPROPRIATE. BASED ON THIS INFORMATION, PROVIDE COMPLETED ASSESSMENT FOR THE POTENTIAL FOR LONG-TERM OR SIGNIFICANT SHORT-TERM CHANGES IN THE WATER LEVELS, AND INDICATE THEM ON HYDROGRAPHS AND POTENTIOMETRIC MAPS.

***NRC GUIDE 4.17**

**U.S. NUCLEAR REGULATORY
COMMISSION GUIDELINE REQUIREMENTS**

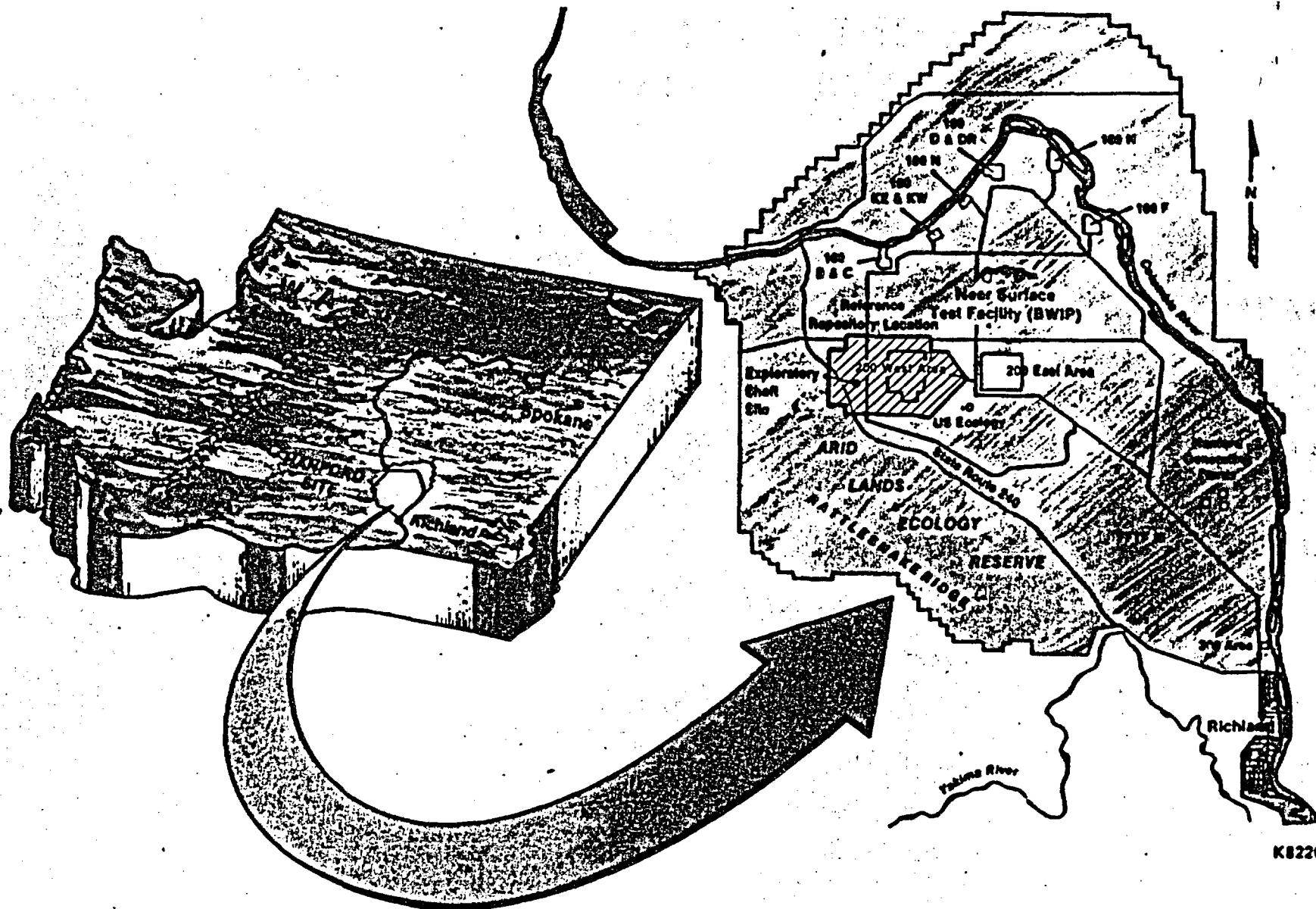
**3.6 REGIONAL HYDROLOGIC RECONNAISSANCE
OF CANDIDATE AREA & SITE***

3.6.2 RELATIONSHIPS AMONG HYDROGEOLOGIC UNITS. DESCRIBE THE RELATIONSHIPS AMONG THE REGIONAL HYDROGEOLOGIC UNITS. THE PRINCIPAL RELATIONSHIPS SOUGHT ARE POTENTIOMETRIC LEVELS, RECHARGE-DISCHARGE AND LEAKAGE, HYDROCHEMICAL FACIES, HYDROLOGIC INTERCONNECTION BETWEEN UNITS (FRACTURES, FAULTS, ETC.) AND GROUND-WATER RESIDENCE TIMES. REFERENCES SHOULD BE MADE TO THE HYDROGEOLOGIC MAP AND TO THE CROSS SECTIONS PRESENTED IN SECTION 3.6.1.

3.6.3 POTENTIOMETRIC LEVEL. DEFINE THE TIME HISTORY AND AREAL DISTRIBUTION OF MEASURED POTENTIOMETRIC LEVELS OF EACH PRINCIPAL HYDROGEOLOGIC UNIT. THE METHOD OF PRESENTING THE DATA CAN INCLUDE HYDROGRAPHS, POTENTIOMETRIC CONTOUR MAPS, AND GRAPHS TO IDENTIFY THE CHARACTERISTIC FLUCTUATIONS RESULTING FROM THE VARIOUS TYPES OF RECHARGE-DISCHARGE (I.e., SEASONAL PRECIPITATION AND SEASONAL PUMPING VARIATIONS, SEASONAL RESPONSE TO SURFACE-WATER BODIES, ETC.). POTENTIOMETRIC SURFACE MAPS SHOULD INCLUDE SUCH INFORMATION AS THE LOCATION OF THE MONITORING WELLS, HYDROGEOLOGIC UNIT IDENTIFICATION, SURFACE-WATER BODIES, AND SPECIFIC WELL INFORMATION (I.e., PERFORATION LOGS, SURFACE ELEVATIONS, TOTAL DEPTH HISTORY, CASING, METHOD OF WELL COMPLETION,

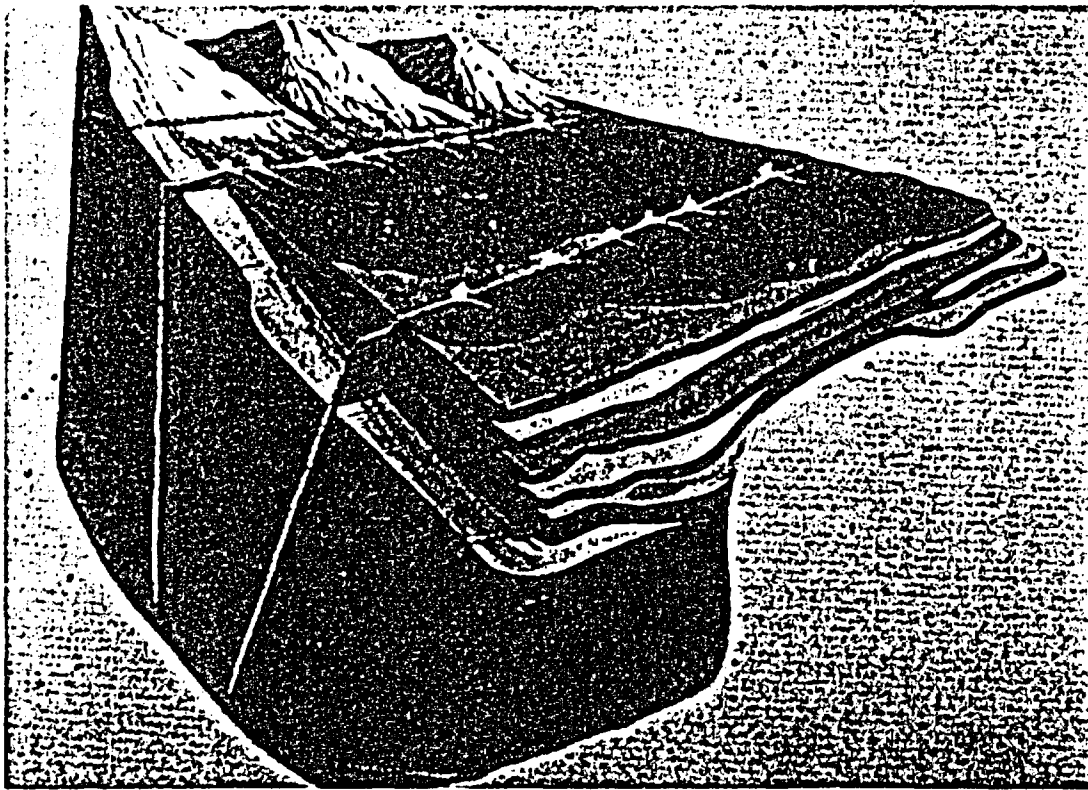
GEOLOGY

THE HANFORD SITE



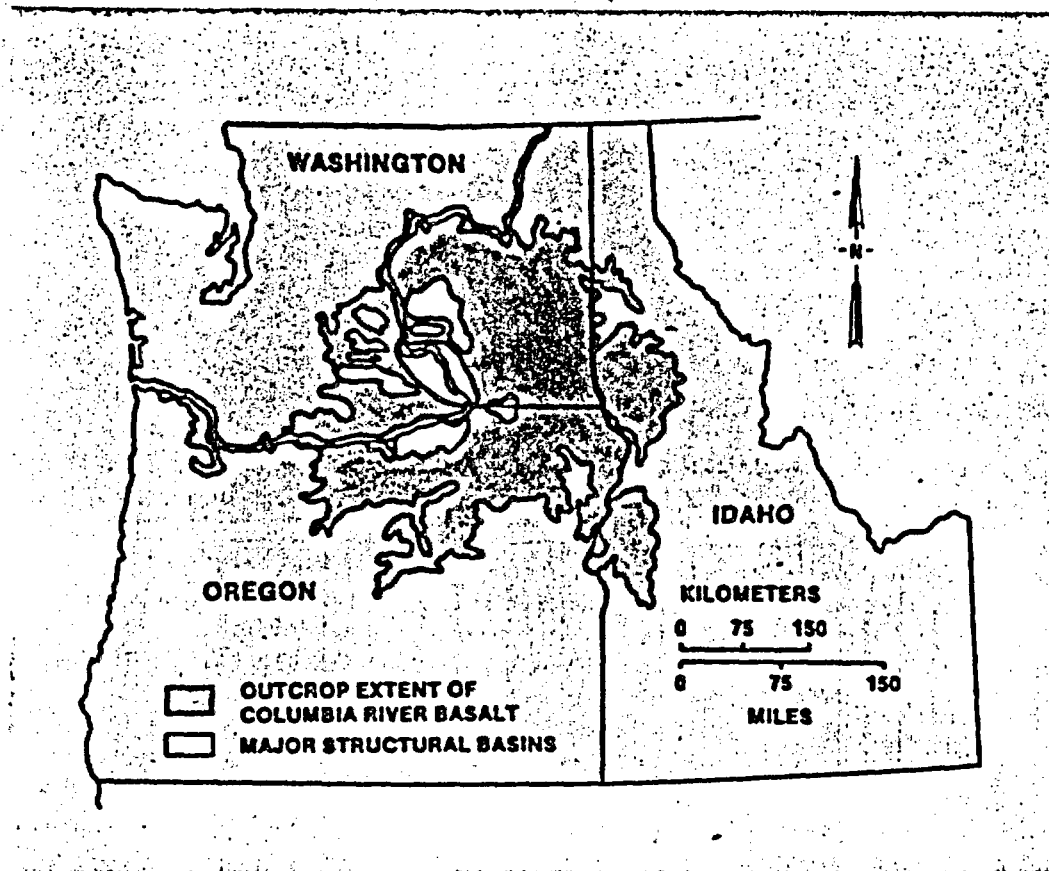
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BASALTS ORIGINATED BY GIANT SEQUENTIAL LAVA FLOWS

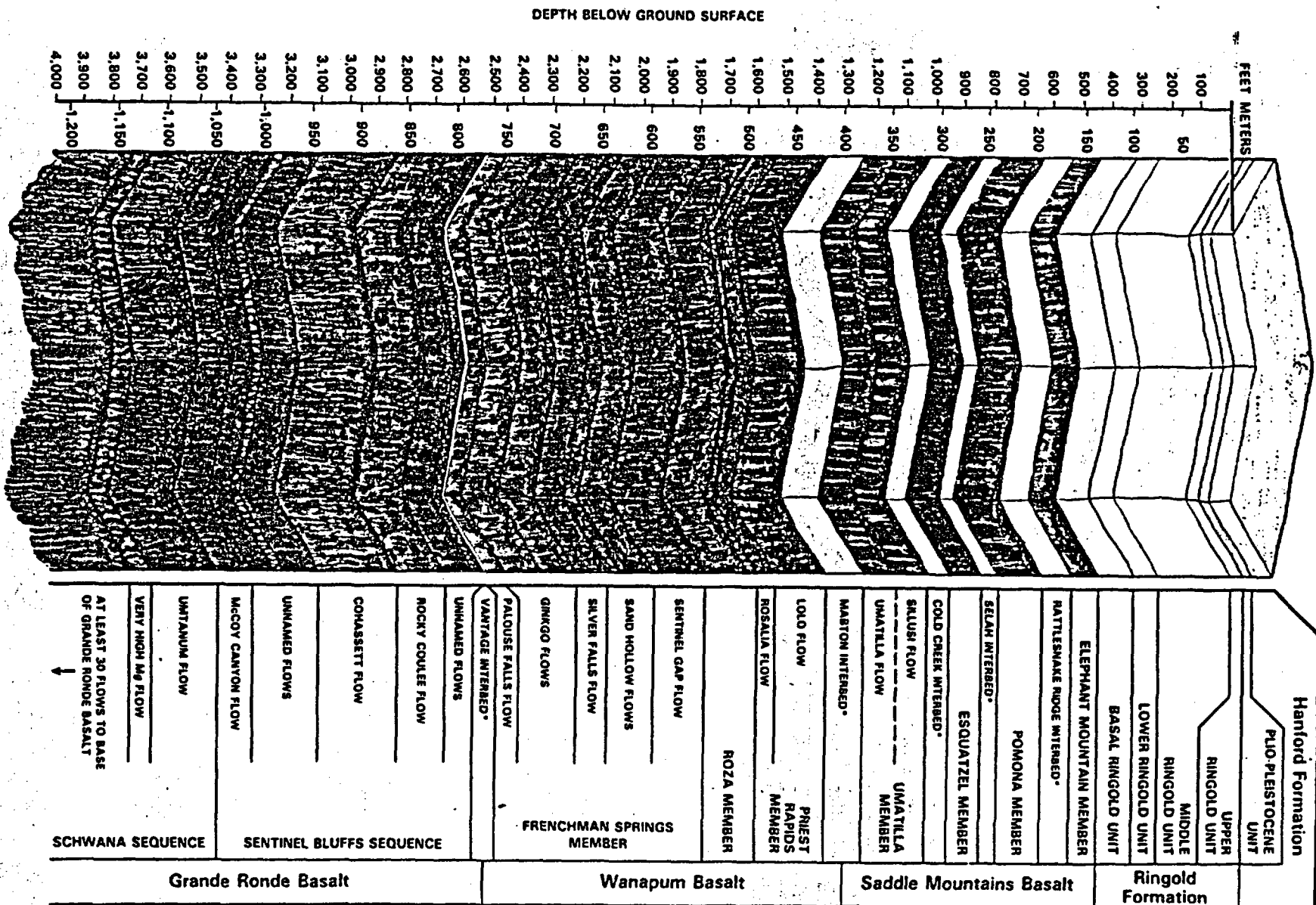


- **MORE THAN 70 SEPARATE FLOWS IDENTIFIED**
- **17 TO 6 MILLION YEARS AGO**
- **FLOWS GO TO MORE THAN 10,000 FEET IN DEPTH**

COLUMBIA RIVER BASALTS UNDERLIE PORTIONS OF THREE STATES

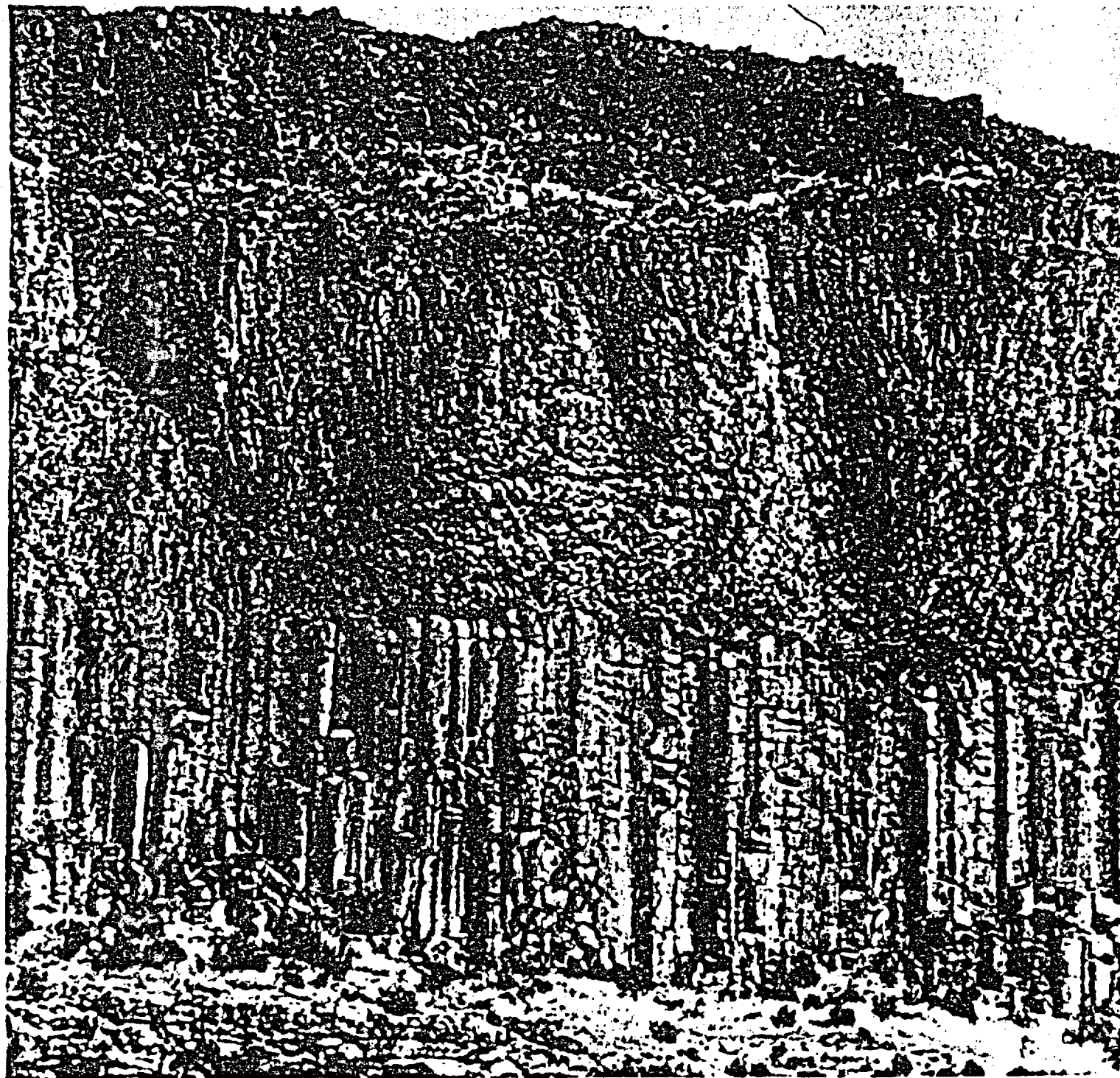


- 78,000 CUBIC MILES
- SECOND LARGEST IN THE WORLD
- THERE ARE SEVERAL STRUCTURAL GEOLOGIC BASINS WITHIN THE COLUMBIA PLATEAU



*INTERBEDS ARE STRATIGRAPHICALLY CONTAINED IN THE ELLENSBURG FORMATION

OUTCROP EXPOSURE OF A TYPICAL COLUMBIA RIVER BASALT FLOW



PARTIALLY
ERODED FLOW
TOP

ENTABLATURE

COLONNADE

BOTTOM OF FLOW

GEOLOGY: ISSUES/NEEDS

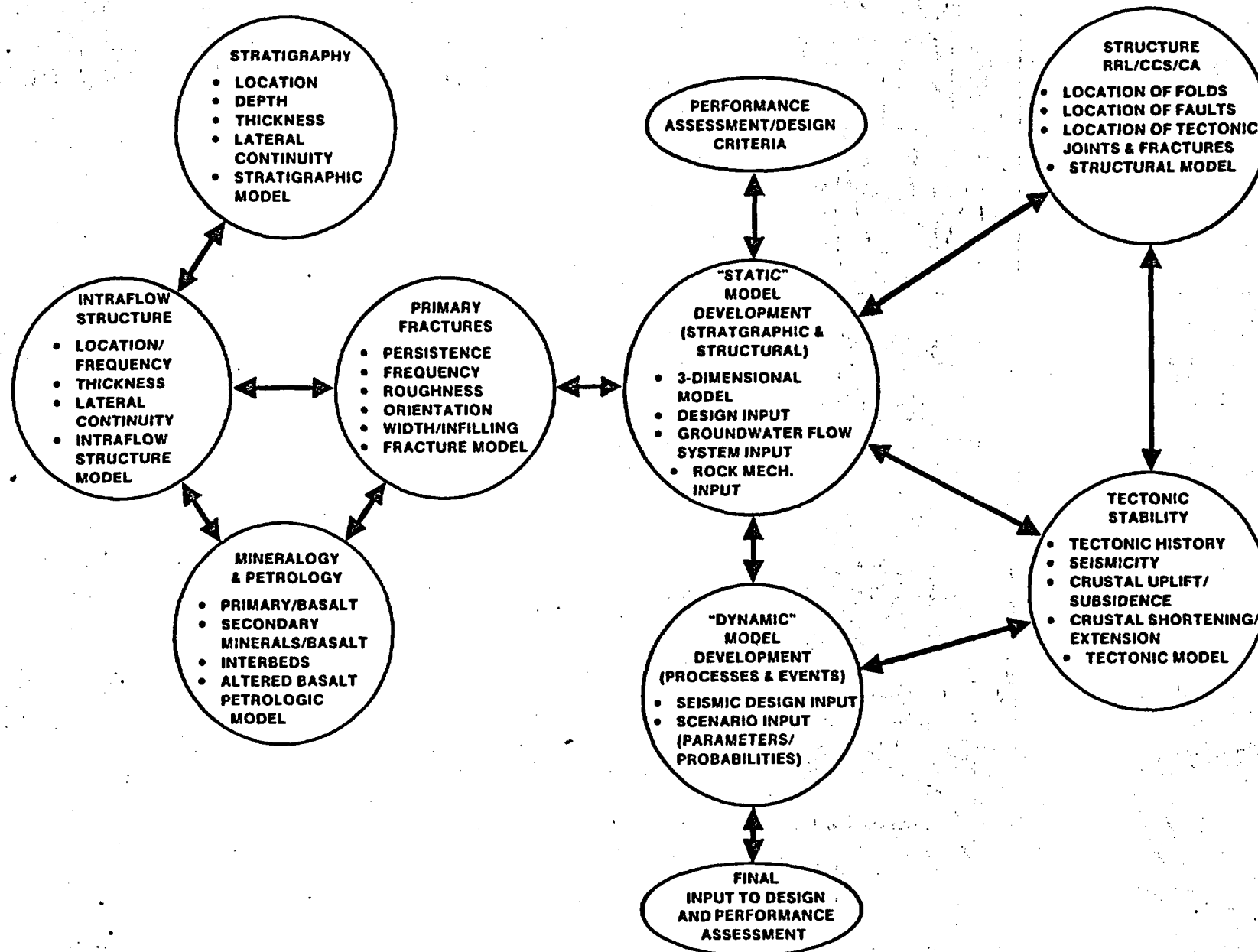
- **WHAT IS THE INFLUENCE OF ROCK PROPERTIES ON REPOSITORY CONSTRUCTION AND PERFORMANCE (PARTICULARLY GROUNDWATER TRANSPORT OF RADIONUCLIDES)?**
 - **WHAT IS THE PREDICTABILITY OF THICKNESS OF THE DENSE FLOW INTERIORS FOR THE CANDIDATE REPOSITORY HORIZONS?**
 - **ARE FRACTURE DATA, BASED ON UNORIENTED CORE OBTAINED FROM VERTICAL BOREHOLES, REPRESENTATIVE?**
 - **WHAT ARE THE CHARACTERISTICS OF INTERBED MATERIALS AND SECONDARY MINERALS IN FLOW TOPS AND WHAT EFFECT DO THEY HAVE ON GROUNDWATER TRANSPORT OF RADIONUCLIDES?**
 - **WHAT IS THE POSSIBILITY THAT GEOPHYSICAL ANOMALIES WITHIN AND IN THE VICINITY OF THE REFERENCE REPOSITORY LOCATION ARE STRUCTURES THAT MAY INFLUENCE GROUNDWATER TRAVELTIMES?**
 - **WHAT ARE THE PREVAILING GEOCHEMICAL CONDITIONS AT DEPTH?**
- **WHAT IS THE INFLUENCE OF TECTONIC PROCESSES ON THE PRECLOSURE AND POSTCLOSURE PERFORMANCE OF A REPOSITORY?**
 - **WHAT IS THE POSSIBILITY OF UNDETECTED STRUCTURES WITHIN THE REFERENCE REPOSITORY LOCATION?**
 - **WHAT IS THE IMPACT OF SEISMICITY ON REPOSITORY DESIGN AND OPERATIONS?**
 - **WHAT TECTONIC MODELS DO THE GEOLOGIC DATA SUPPORT AND WHAT IS THE IMPACT OF THESE MODELS ON LONG-TERM REPOSITORY PERFORMANCE?**

ROLE OF PERFORMANCE EVALUATION GEOLOGIC CHARACTERIZATION PLAN

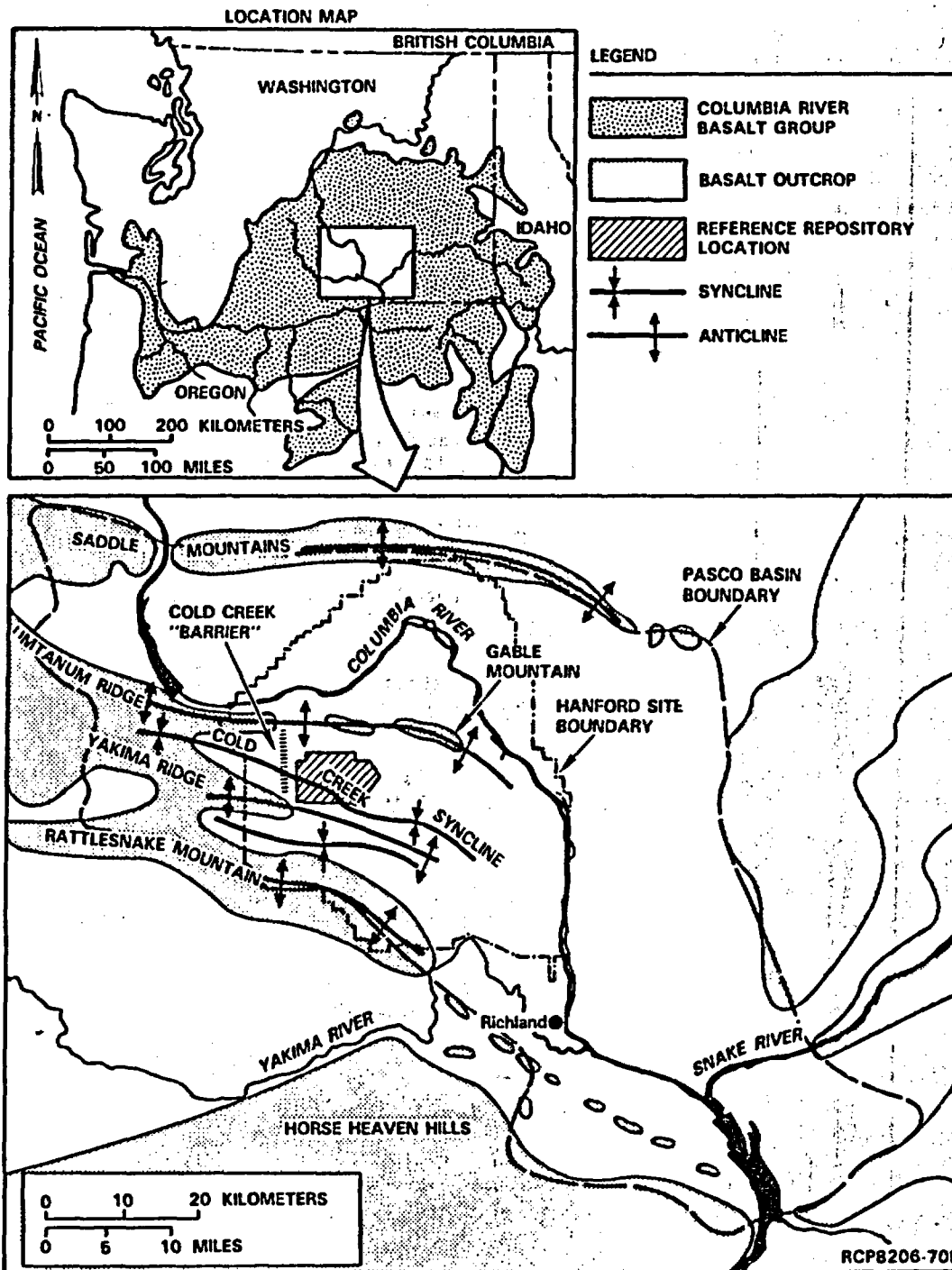
LITHOLOGIC CHARACTERIZATION

GEOLOGIC INTEGRATION

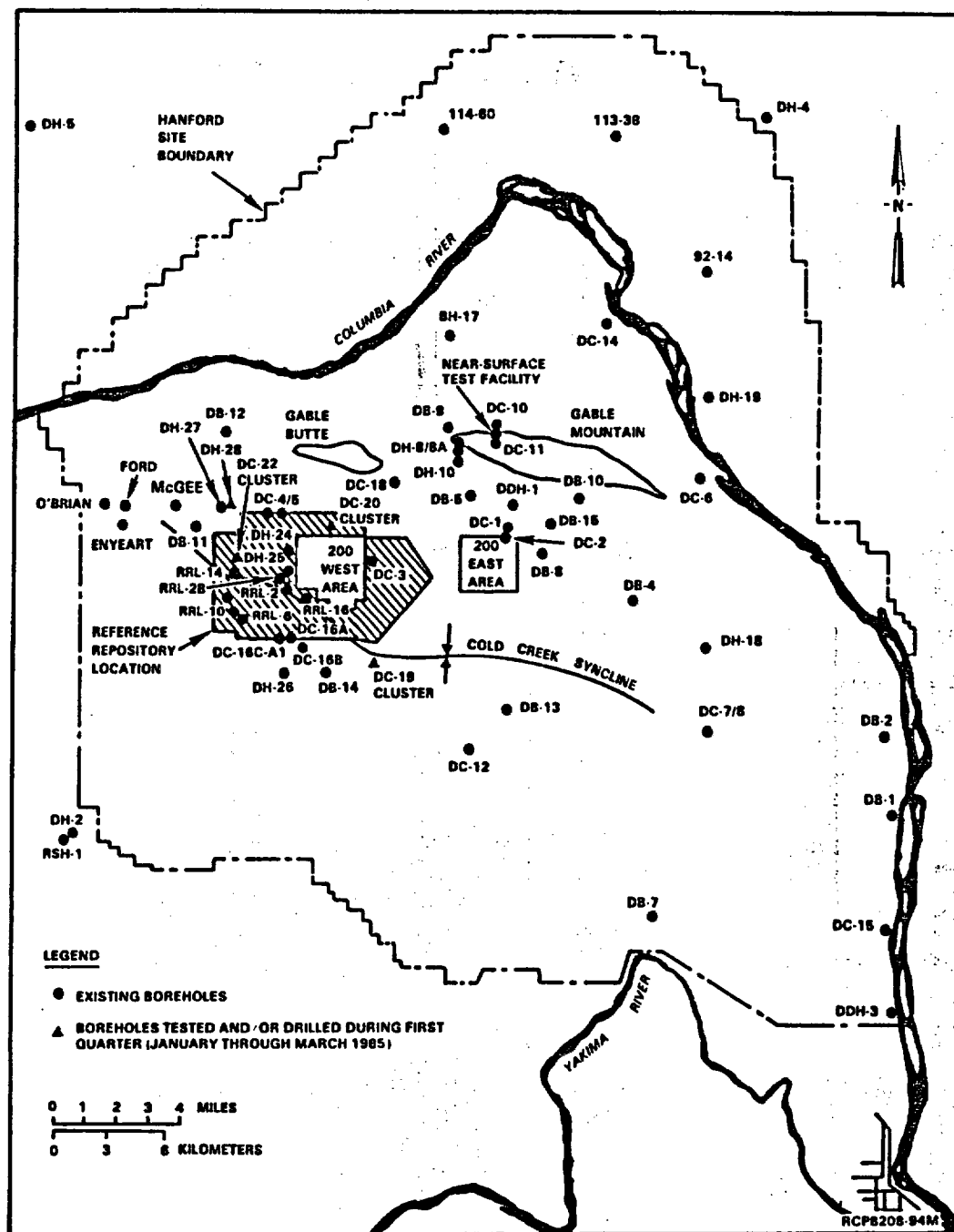
TECTONIC CHARACTERIZATION



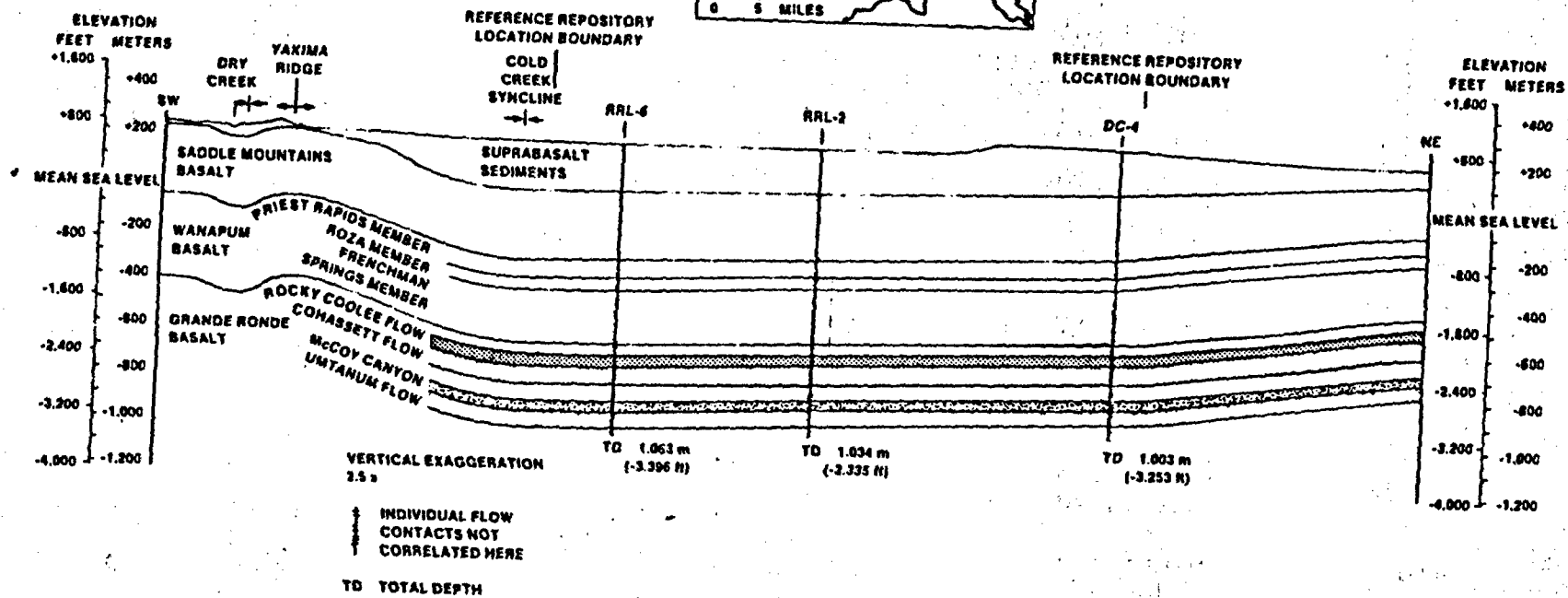
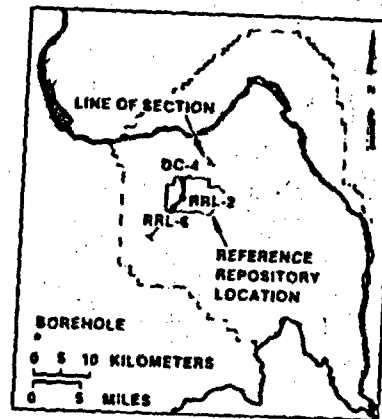
EXTENT OF THE COLUMBIA RIVER BASALT GROUP, THE PASCO BASIN, AND THE PROPOSED SITE FOR A REPOSITORY IN BASALT



LOCATION OF EXISTING BOREHOLES

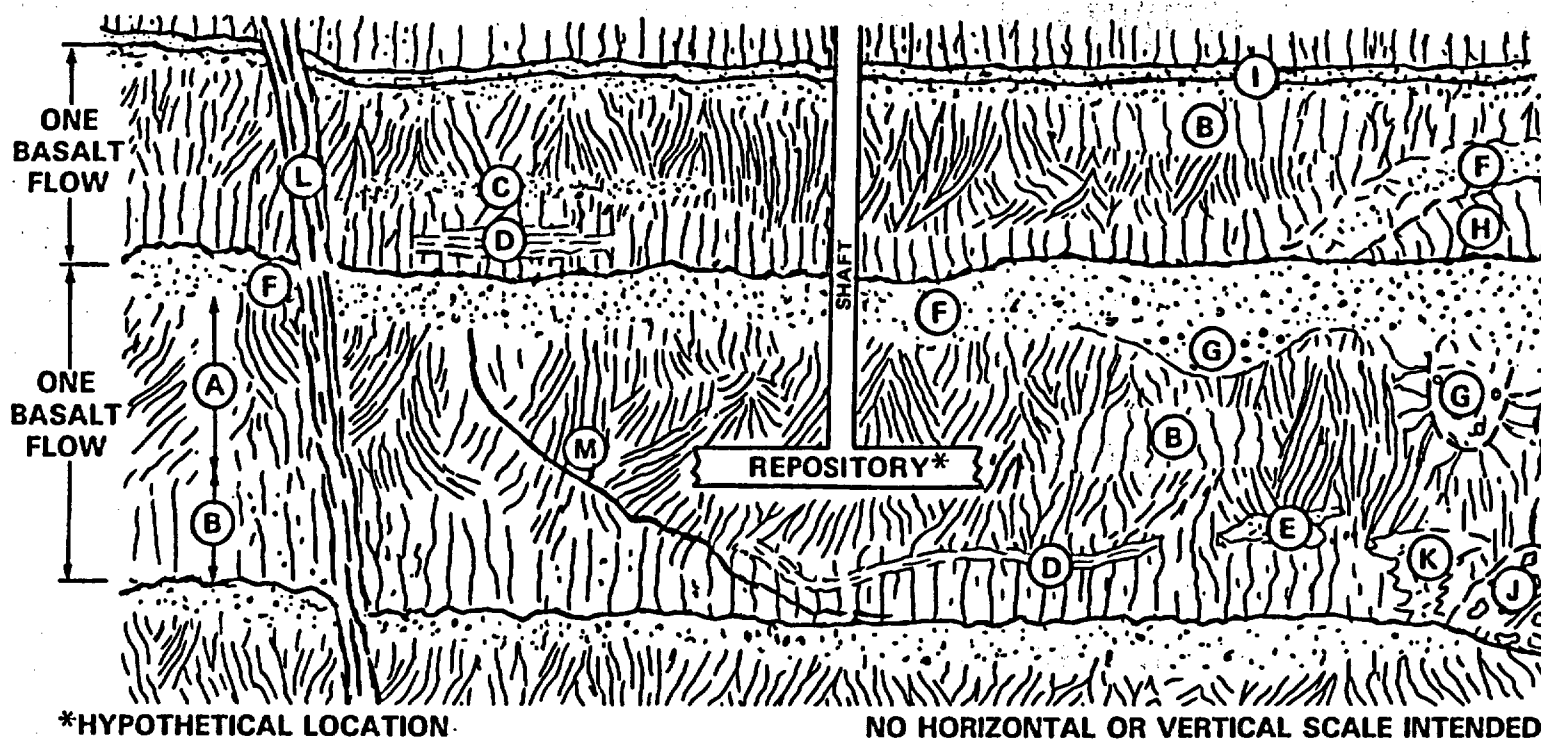


GEOLOGIC CROSS SECTION THROUGH THE REFERENCE REPOSITORY LOCATION



RCPS211-148A

HYPOTHETICAL COMPOSITE CROSS SECTION OF POSSIBLE GEOLOGIC FEATURES IN A LAYERED BASALT SEQUENCE (AFTER GEPHART ET AL., 1983)



FLOW INTERIOR DISCONTINUITIES

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

FLOW CONTACT

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

BEDROCK STRUCTURAL DISCONTINUITIES

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

BASALT WASTE ISOLATION PROJECT GEOLOGY ACCOMPLISHMENTS

- **CHARACTERIZATION OF SITE AND PASCO BASIN STRATIGRAPHY FOR BASALT AND OVERLYING SEDIMENTS**
- **CHARACTERIZATION OF INTRAFLOW STRUCTURES TYPICAL OF THE COLUMBIA RIVER BASALTS**
- **IMPROVED UNDERSTANDING OF THE NATURE OF MAJOR GEOLOGIC STRUCTURES AND THE STYLES OF DEFORMATION OF THE COLUMBIA PLATEAU**
- **DETECTION OF THE YAKIMA BARRICADE STRUCTURE BY THE USE OF GEOPHYSICAL TECHNIQUES**
- **REFINEMENT OF GEOPHYSICAL TECHNIQUES FOR USE IN CHARACTERIZATION OF SUBSURFACE STRUCTURES AND STRATIGRAPHY AS APPLICABLE TO THE COLUMBIA PLATEAU**

PERFORMANCE ASSESSMENT

PERFORMANCE ASSESSMENT

DEFINITION

- THE PROCESS OF DETERMINING HOW WELL THE VARIOUS FEATURES OF THE SITE AND REPOSITORY PERFORM WITH RESPECT TO THE APPLICABLE REGULATIONS (10 CFR 60) AND STANDARDS (40 CFR 191)

PERFORMANCE ASSESSMENT CRITERIA

POST-CLOSURE

- **LIMIT CUMULATIVE RADIONUCLIDE RELEASE TO THE ASSESSIBLE ENVIRONMENT TO LESS THAN EPA LIMITS (40CFR191)**
- **ENSURE A TRAVEL TIME OF GREATER THAN 1,000 YEARS FROM THE EDGE OF THE REPOSITORY TO THE ACCESSIBLE ENVIRONMENT (10CFR60)**
- **ENSURE RADIONUCLIDE RELEASE FROM THE ENGINEERED BARRIER SYSTEM (EBS) OF LESS THAN 1 PART IN 100,000 PER YEAR OF THE 1,000 - YEAR INVENTORY (10CFR60)**
- **MAINTAIN CONTAINMENT WITHIN THE EBS FOR 1,000 YEARS (10CFR60)**

PRE-CLOSURE

- **MAINTAIN PUBLIC SAFETY (10CFR60) (RELEASES LESS THAN 500 MREM)**
- **MAINTAIN OPERATOR SAFETY (10CFR20) (MHSA)**

PLANS

- **DEVELOP BWIP ASSESSMENT STRATEGY TO REASONABLY ASSURE THE ABILITY OF THE SITE TO BE SAFELY AND PROVIDE SUFFICIENT ISOLATION**
- **DEVELOP MODELS OF THE BWIP SAFETY AND ISOLATION FEATURES USING THEORY AND DATA TO SHOW COMPLIANCE**
- **PROVIDE GUIDANCE TO THE DATA COLLECTION AND TESTING PROGRAM**
- **EVALUATE THE PERFORMANCE OF THE DESIGN OF THE REPOSITORY SYSTEM**

ACCOMPLISHMENTS

POST-CLOSURE

- **PRELIMINARY ASSESSMENT OF THE PERFORMANCE OF THE BWIP SITE**
- **DEVELOPED FUNCTIONAL RELATIONSHIPS OF THE ISOLATION SYSTEM**
- **DEVELOPMENT OF A PROPOSED METHODOLOGY FOR DISRUPTIVE SCENARIO ANALYSIS**

PRE-CLOSURE

- **DEVELOPMENT OF A PRELIMINARY SAFETY ASSESSMENT METHODOLOGY**

STATUS

THE DEVELOPMENT OF:

- **PROJECT SPECIFIC ISSUES AND SOLUTION STRATEGIES ARE ON THE CRITICAL PATH TO PRODUCE THE SITE CHARACTERIZATION PLAN (SCP)**
- **MODEL DEVELOPMENT IN MOST CASES IS AHEAD OF DATA COLLECTION EFFORT**
- **JUST BEGINNING THE INTERACTIVE EVALUATION OF THE PROPOSED REPOSITORY SEAL SYSTEM**

GROUNDWATER

- **CONFINED**
- **UNCONFINED**

HYDROLOGY ISSUES

- **THE CONCEPTUAL HYDROLOGIC MODEL OF THE HANFORD SITE IS NEEDED; INCLUDING THE NATURE OF WATER MOVEMENT AND VELOCITY AND CHEMISTRY**
- **THE PREDICTABILITY OF THE LOCAL AND REGIONAL HYDROLOGY SURROUNDING A POTENTIAL REPOSITORY SITE NEEDS ASSESSMENT**
- **AFFECT OF GEOLOGIC DISCONTINUITIES ON THE HYDROLOGY**
- **EFFECT OF SITE CHARACTERIZATION ACTIVITIES ON GROUNDWATER CIRCULATION AND MONITORING**
- **THE GEOCHEMICAL DISPERSION IN THE GROUNDWATER SYSTEMS, CHEMICAL MIXING, AND AGE OF THE GROUNDWATER**

MAJOR ISSUES DRIVING RECOMMENDED HYDROLOGIC CHARACTERIZATION PLAN

BWIP KEY ISSUE 1

WILL THE GEOLOGIC REPOSITORY AT THE REFERENCE REPOSITORY LOCATION, INCLUDING MULTIPLE NATURAL AND ENGINEERED BARRIERS, ISOLATE THE RADIOACTIVE WASTE FROM THE ACCESSIBLE ENVIRONMENT AFTER CLOSURE IN ACCORDANCE WITH THE REQUIREMENTS SET FORTH IN 10 CFR PART 60 AND 40 CFR PART 191?

<u>ISSUE</u>	<u>INFORMATION REQUIRED</u>	<u>METHODS TO OBTAIN INFORMATION</u>
BWIP CHARACTERIZATION ISSUE 1.1 WHAT ARE THE PRESENT AND EXPECTED CHARACTERISTICS OF THE GEO-HYDROLOGICAL SETTING THAT MUST BE KNOWN TO DETERMINE COMPATIBILITY WITH CONTAINMENT AND ISOLATION?	UNDERSTANDING OF PRESENT AND FUTURE GROUNDWATER FLOW SYSTEM	<ul style="list-style-type: none">• GEOMETRY FROM GEOLOGIC STUDIES• HYDRAULIC PROPERTIES OF CONTROLLED ZONE FROM HYDROLOGIC TESTS• BOUNDARY CONDITIONS FOR CONTROLLED ZONE FROM REGIONAL MODELING• GRADIENT AND DIRECTION OF GROUNDWATER MOVEMENT IN CONTROLLED ZONE FROM PIEZOMETRY• POTENTIAL CHANGE FROM CLIMATIC MODELING, TECTONIC MODELING, AND WATER USE SCENARIOS.
BWIP CHARACTERIZATION ISSUE 1.2 WHAT ARE PRESENT AND EXPECTED GEOCHEMICAL CHARACTERISTICS THAT MUST BE KNOWN TO DETERMINE COMPATIBILITY WITH CONTAINMENT AND ISOLATION?	BASALT FLOW INTERIOR CHEMISTRY, FLOW TOP CHEMISTRY, WATER CHEMISTRY, CHEMICAL REACTIONS	<ul style="list-style-type: none">• CORE ANALYSES• GROUNDWATER SAMPLES• GEOCHEMICAL MODELING

MAJOR ISSUES DRIVING RECOMMENDED HYDROLOGIC CHARACTERIZATION PLAN (CONT.)

<u>ISSUE</u>	<u>INFORMATION REQUIRED</u>	<u>METHODS TO OBTAIN INFORMATION</u>
BWIP CHARACTERIZATION ISSUE 1.4 WHAT ARE THE FUTURE CLIMATIC CONDITIONS THAT MUST BE KNOWN TO DETERMINE IF RADIONUCLIDE RELEASES WILL BE GREATER THAN THOSE ALLOWED BY REGULATIONS?	RANGE OF POSSIBLE GROUNDWATER RECHARGE OVER THE NEXT 100,000 YEARS	<ul style="list-style-type: none"> • CLIMATIC MODELING • MODEL CALIBRATED TO PALEOCLIMATE DATA
BWIP CHARACTERIZATION ISSUE 1.8 WHAT ARE THE NATURAL RESOURCES AT OR NEAR THE SITE THAT COULD CAUSE HUMAN INTERFERENCE ACTIVITIES THAT COULD LEAD TO RADIONUCLIDE RELEASES GREATER THAN THOSE ALLOWED BY REGULATIONS?	POSSIBLE CHANGES IN BOUNDARY CONDITIONS FOR CONTROLLED ZONE DUE TO GROUNDWATER USE	<ul style="list-style-type: none"> • REGIONAL MODEL TO DETERMINE OCCURRENCE OF GROUNDWATER • WATER QUALITY DATA • WATER USE SCENARIOS • SIMULATE SCENARIOS WITH REGIONAL MODEL
BWIP PERFORMANCE ISSUE 1.15 IS THE PRE-WASTE-EMPLACEMENT GROUNDWATER TRAVEL TIME AT LEAST 1,000 YEARS ALONG THE FASTEST PATH OF LIKELY RADIONUCLIDE TRAVEL FROM THE DISTURBED ZONE TO THE ACCESSIBLE ENVIRONMENT?	LIKELY FLOW PATHS AND WATER PARTICLE VELOCITY ALONG THE FLOW PATHS	<ul style="list-style-type: none"> • HYDRAULIC PROPERTIES OF CONTROLLED ZONE FROM HYDRAULIC TESTS • GRADIENT AND DIRECTION OF GROUNDWATER MOVEMENT IN CONTROLLED ZONE FROM PIEZOMETRY • GROUNDWATER AGE DATA ALONG A FLOW PATH

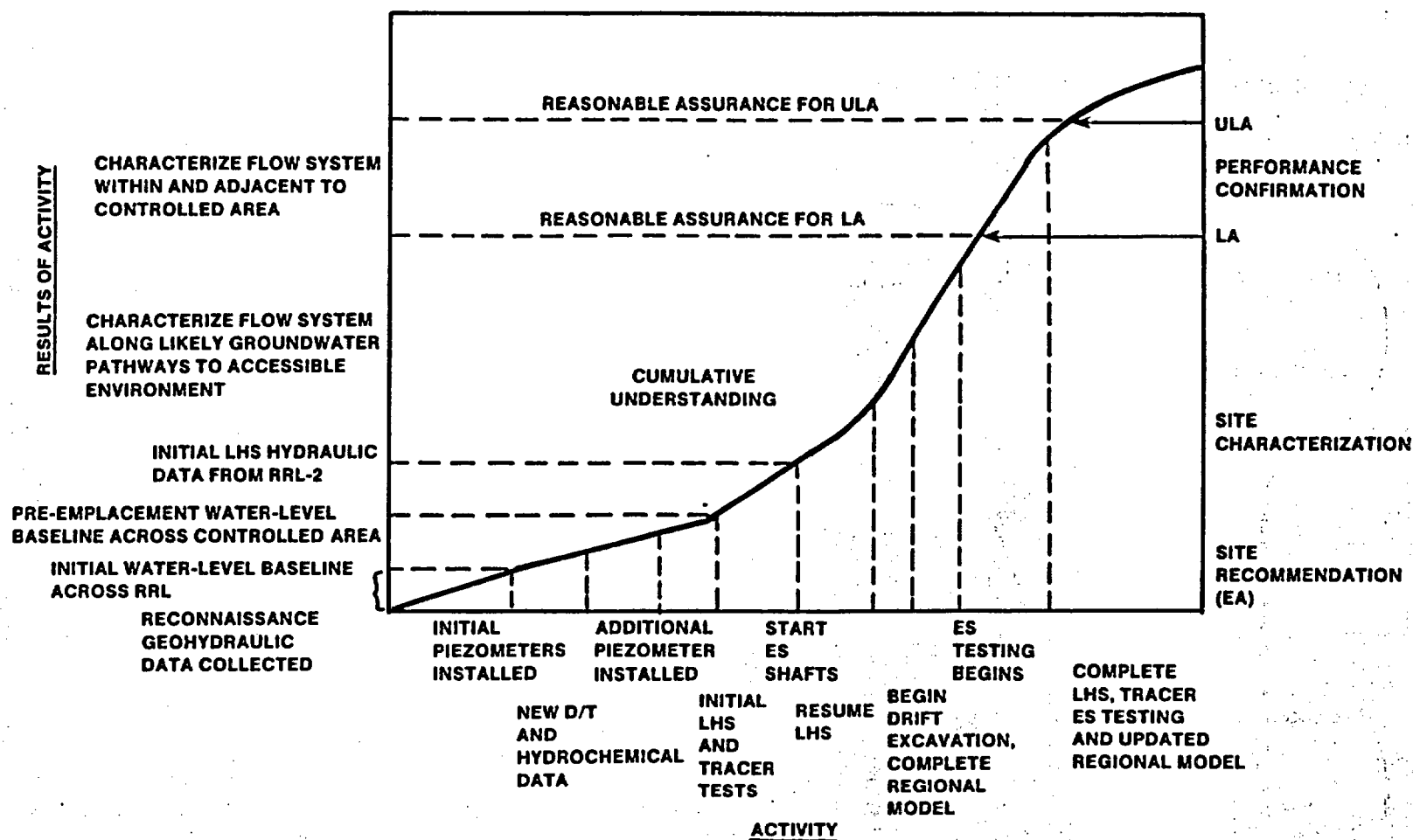
REGULATORY CRITERIA AND GUIDANCE

IN SITU HYDROLOGIC PARAMETERS	TYPE OF REGULATORY REQUIREMENT		MEASUREMENT METHOD
	INFORMATION	PERFORMANCE	
HYDRAULIC HEAD	10 CFR 960.4, 960.5 10 CFR 60.21, 60.31	10 CFR 960.4, 960.5 40 CFR 191.13, 191.14 10 CFR 60.21, 60.31, 60.112	PIEZOMETER
HYDRAULIC CONDUCTIVITY	10 CFR 960.4, 960.5 10 CFR 60.21, 60.31	10 CFR 960.4, 960.5 40 CFR 191.13, 191.14 10 CFR 60.21, 60.31, 60.112	PUMPING TEST GEOPHYSICAL WELL LOG
EFFECTIVE POROSITY	10 CFR 960.4 10 CFR 60.21, 60.31	10 CFR 960.4 40 CFR 191.13, 191.14 10 CFR 60.21, 60.31, 60.112	TRACER TEST
SPECIFIC STORAGE	10 CFR 960.4, 960.5 10 CFR 60.21, 60.31	10 CFR 960.4, 960.5 40 CFR 191.13, 191.14 10 CFR 60.21, 60.31, 60.112	PUMPING TEST

REGULATORY CRITERIA AND GUIDANCE (CONT.)

IN SITU HYDROLOGIC PARAMETERS	TYPE OF REGULATORY REQUIREMENT		MEASUREMENT METHOD
	INFORMATION	PERFORMANCE	
DISPERSIVITY/DIFFUSION	10 CFR 960.4 10 CFR 60.21, 60.31	10 CFR 960.4 40 CFR 191.13, 191.14 10 CFR 60.21, 60.31, 60.112	TRACER TEST
GEOCHEMISTRY	10 CFR 960.4 40 CFR 191.14 F 10 CFR 60.21, 60.31	10 CFR 960.4 40 CFR 191.13, 191.14 10 CFR 60.21, 60.31, 60.112	FORMATION FLUID SAMPLES ANALYSIS OF CORE AND CHIP SAMPLES
HYDROCHEMISTRY	10 CFR 960.4, 960.5 10 CFR 60.21, 60.31	10 CFR 960.4 40 CFR 191.13, 191.14 10 CFR 60.21, 60.31, 60.112	FORMATION FLUID SAMPLES
ADSORPTION/RETARDATION	10 CFR 960.4 10 CFR 60.21, 60.31	10 CFR 960.4 40 CFR 191.13, 191.14 10 CFR 60.21, 60.31, 60.112	TRACER TEST LABORATORY TESTS
ALTERATION/SOLUBILITY	10 CFR 960.4 10 CFR 60.21, 60.31	10 CFR 960.4 40 CFR 191.13, 191.14 10 CFR 60.21, 60.31, 60.112	TRACER TEST LABORATORY TESTS

STRATEGY SEQUENCE FOR DEVELOPING AN UNDERSTANDING OF THE CONTROLLED AREA HYDROLOGY



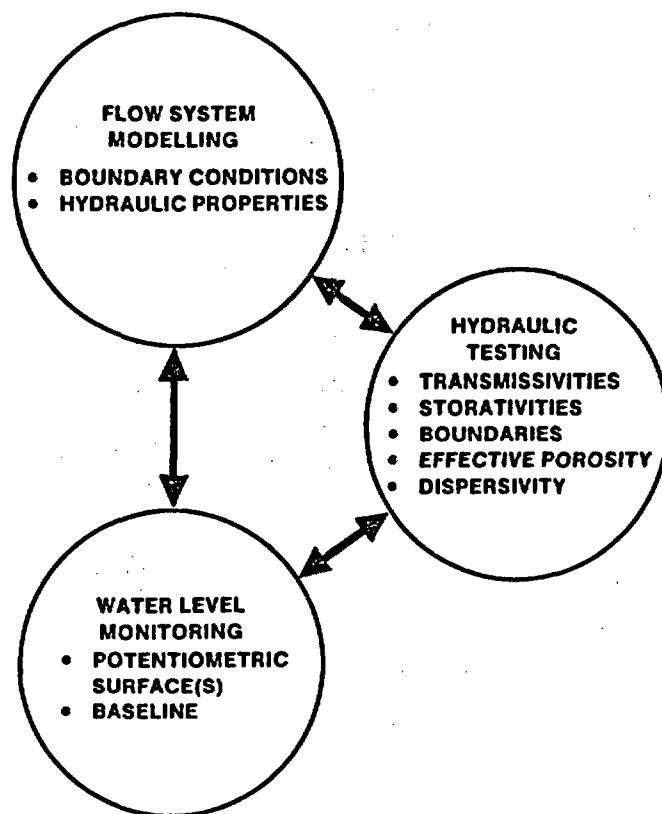
LEGEND:

LA = LICENSE APPLICATION
 ULA = UPDATED LICENSE APPLICATIONS
 D/T = DRILL AND TEST
 LHS = LARGE SCALE HYDRAULIC STRESS TEST

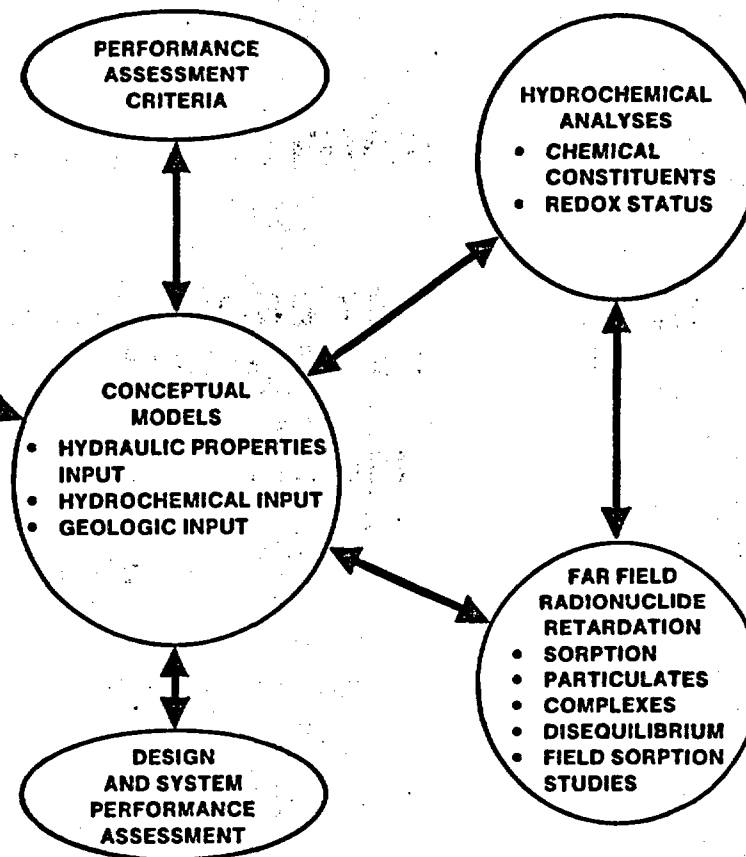
ES = EXPLORATORY SHAFT
 RRL = REFERENCE REPOSITORY LOCATION
 EA = ENVIRONMENTAL ASSESSMENT

ROLE OF PERFORMANCE EVALUATION HYDROLOGIC CHARACTERIZATION PLAN

PHYSICAL HYDROLOGY



HYDROCHEMISTRY



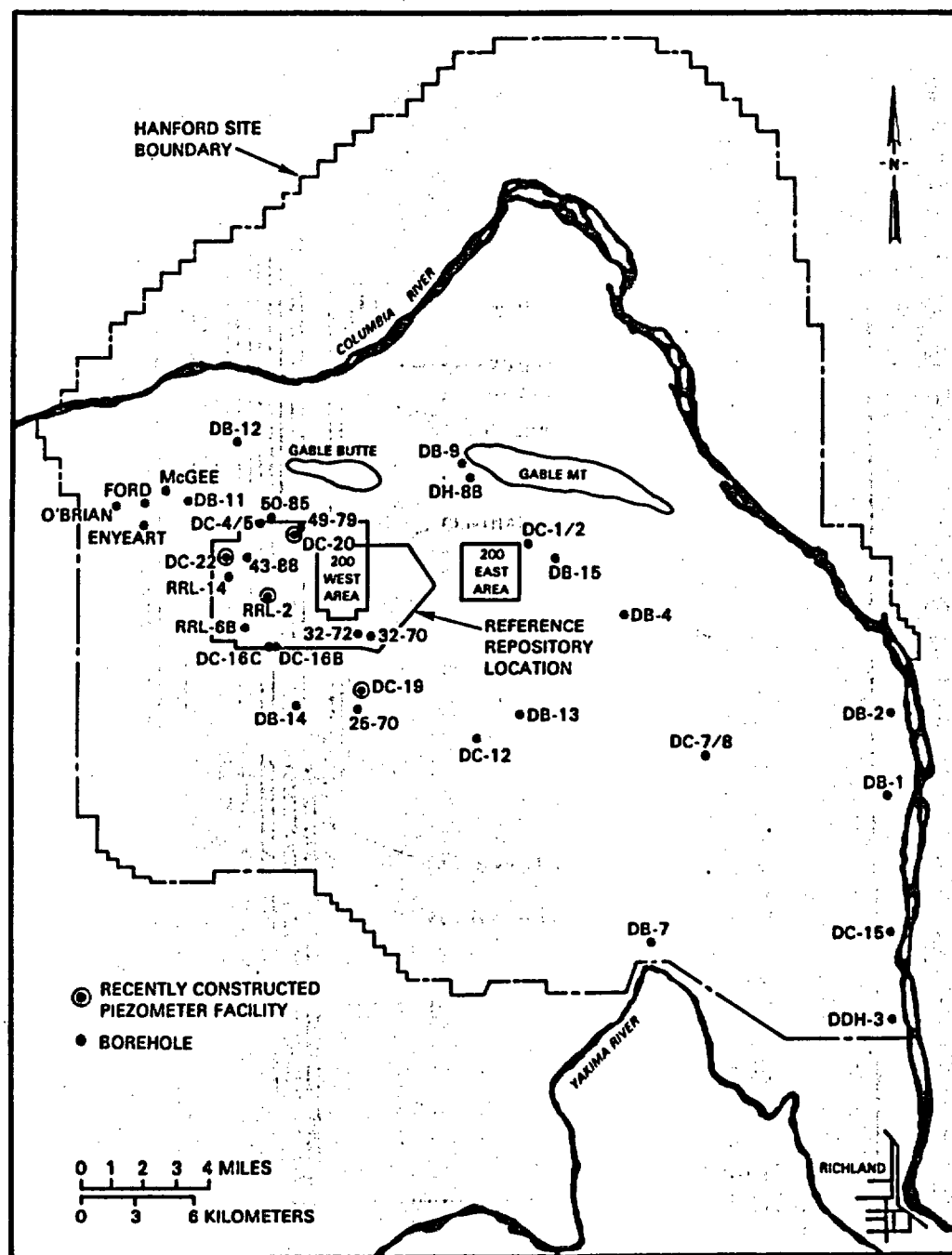
HYDROLOGY TEST OBJECTIVES

- **INTERROGATE FLOW TOPS AND INTERIORS TO DETERMINE HYDRAULIC PARAMETERS FOR PERFORMANCE MODELS**
- **PROVIDE INPUT TO CONCEPTUAL FLOW MODEL**
- **EVALUATE HYDRAULIC CONTINUITY**

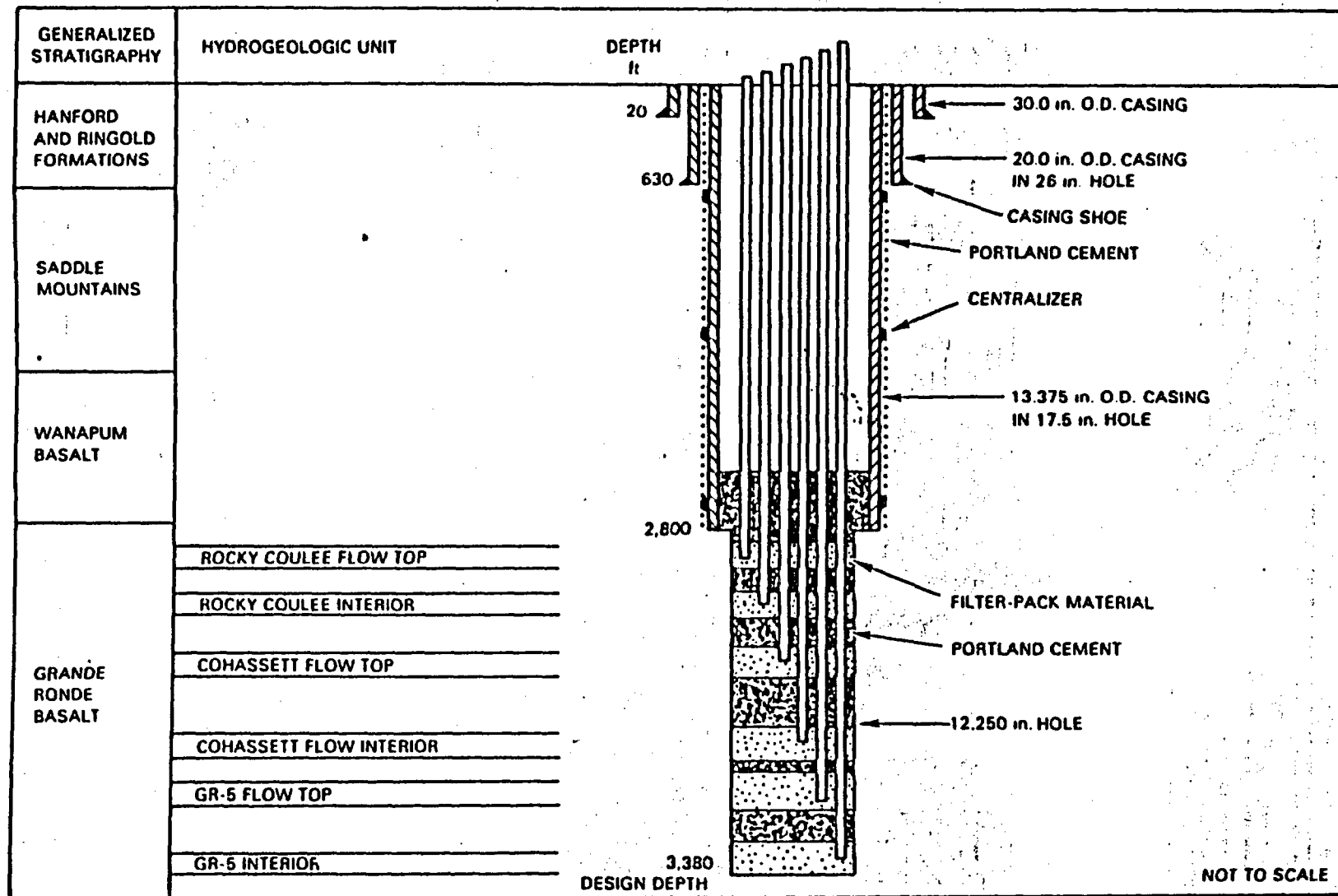
STAGES OF INVESTIGATION (HYDROLOGY)


- **GROUNDWATER-LEVEL BASELINE MONITORING PROGRAM**
- **MULTIPLE-WELL, LARGE-SCALE HYDRAULIC STRESS TESTING AT RRL-2**
- **MULTIPLE-WELL, LARGE-SCALE HYDRAULIC STRESS TESTING AT DC-16, DC-20, AND DC-22 (NO TEST ORDER IMPLIED)**
- **ADDITIONAL TESTS, BOTH LARGE- AND SMALL-SCALE AS REQUIRED**

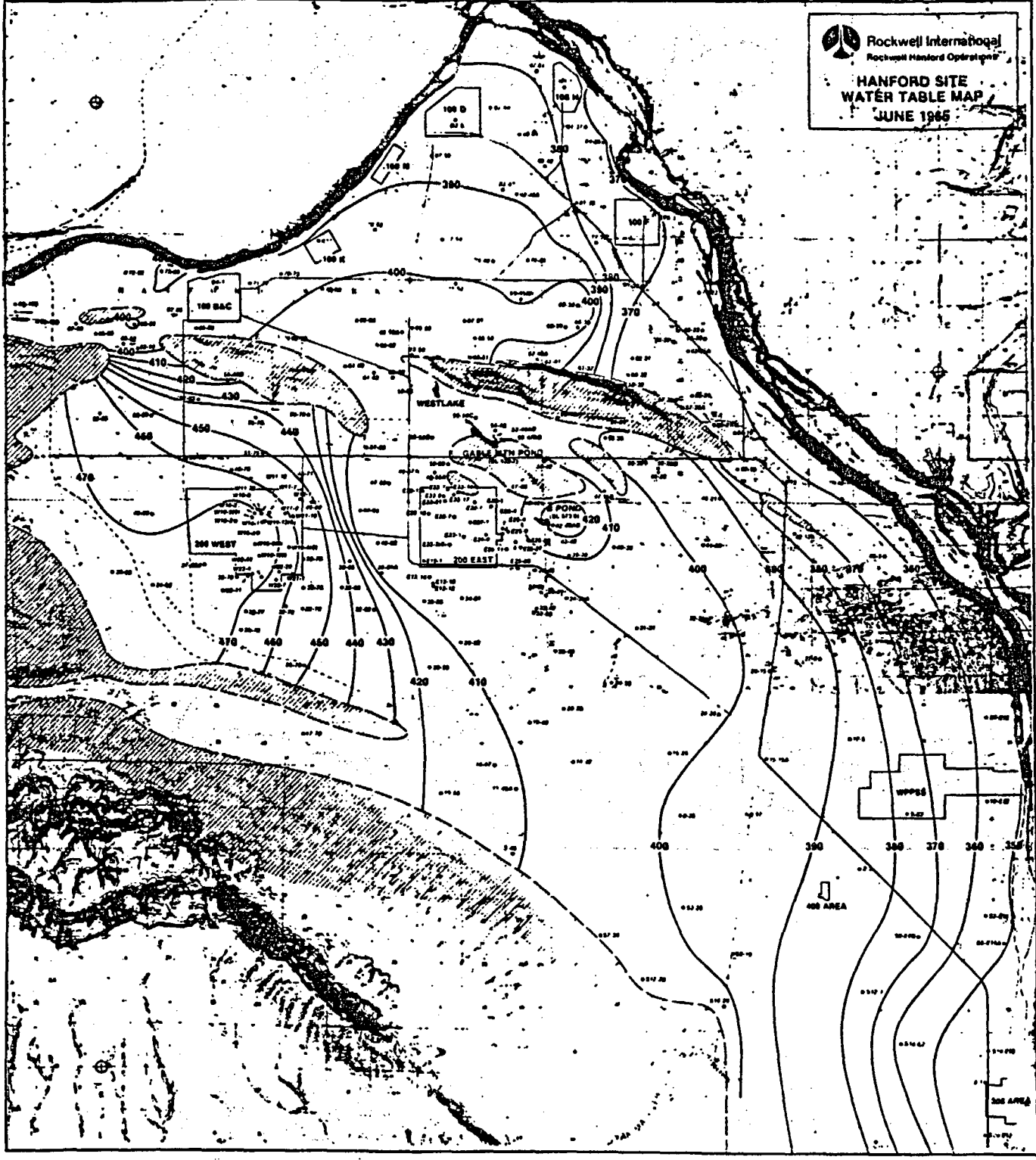
LOCATION MAP OF THE HANFORD SITE MONITORING NETWORK BOREHOLES AND THE DC-19, DC-20 AND DC-22 PIEZOMETER FACILITIES



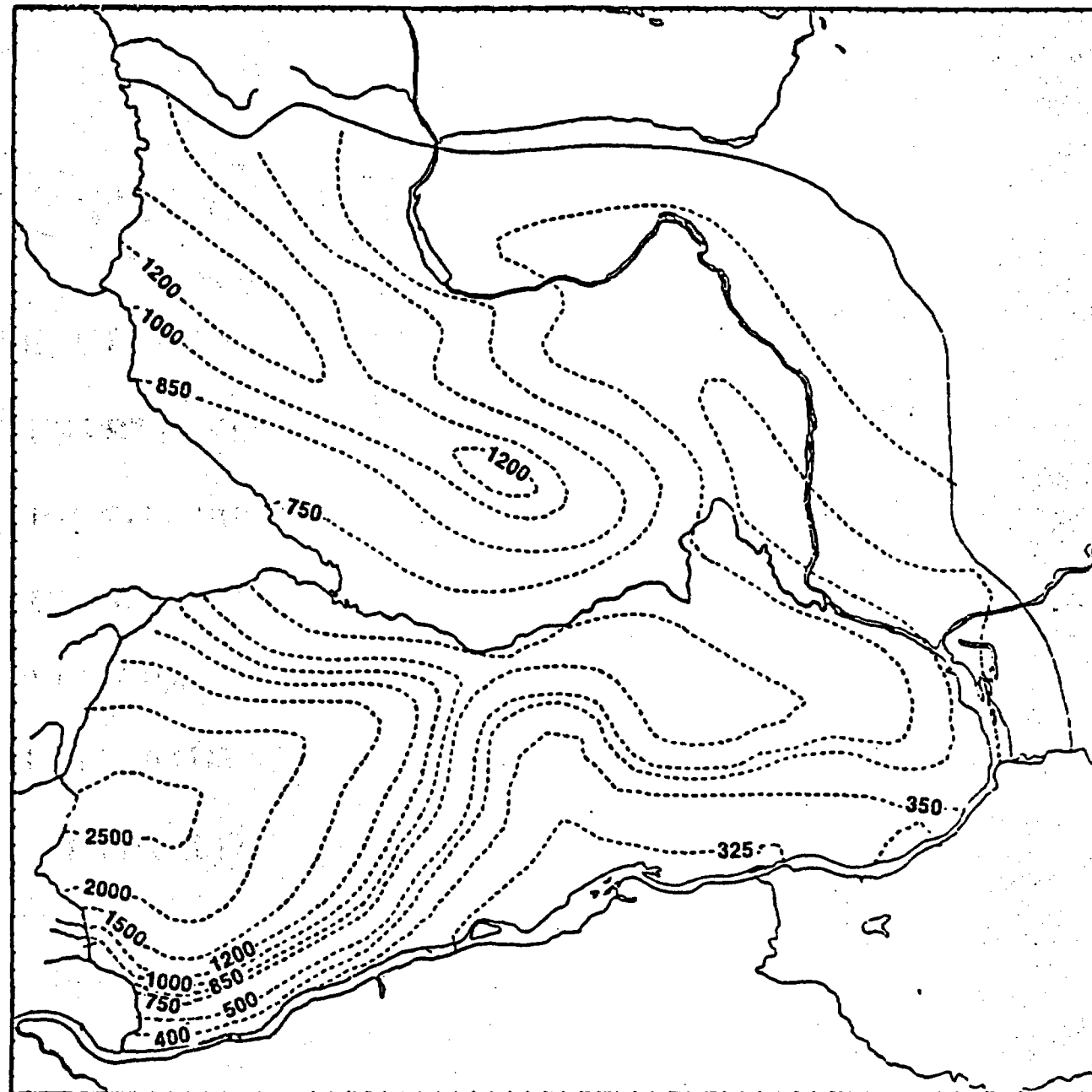
TYPICAL PIEZOMETER INSTALLATION



 Rockwell International
Rockwell Hanford Operations
**HANFORD SITE
WATER TABLE MAP
JUNE 1965**



**HAND
INTERPRETED
GRANDE RONDE
POTENTIAL
SURFACE**



GEOHYDROLOGY STATUS

- **PIEZOMETERIC SURFACE BASELINE**
- **"TESTS" (HYDRAULIC PROPERTIES)**
- **CURRENT ISSUES**
 - **BOUNDARIES**
 - **DIRECTION OF FLOW**
 - **FLOW PATHS**
- **BEST FACILITIES/ACTIVITIES**