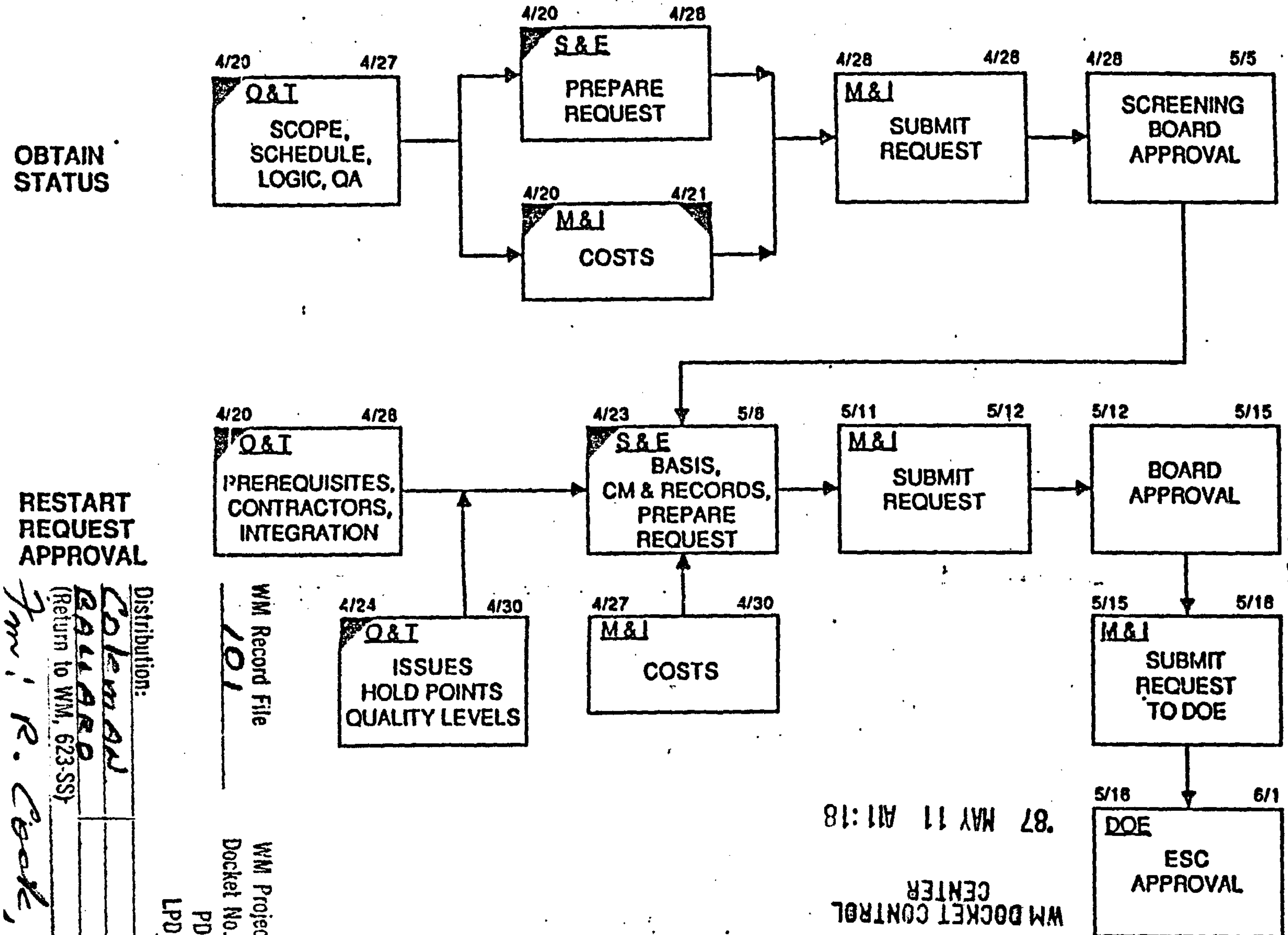
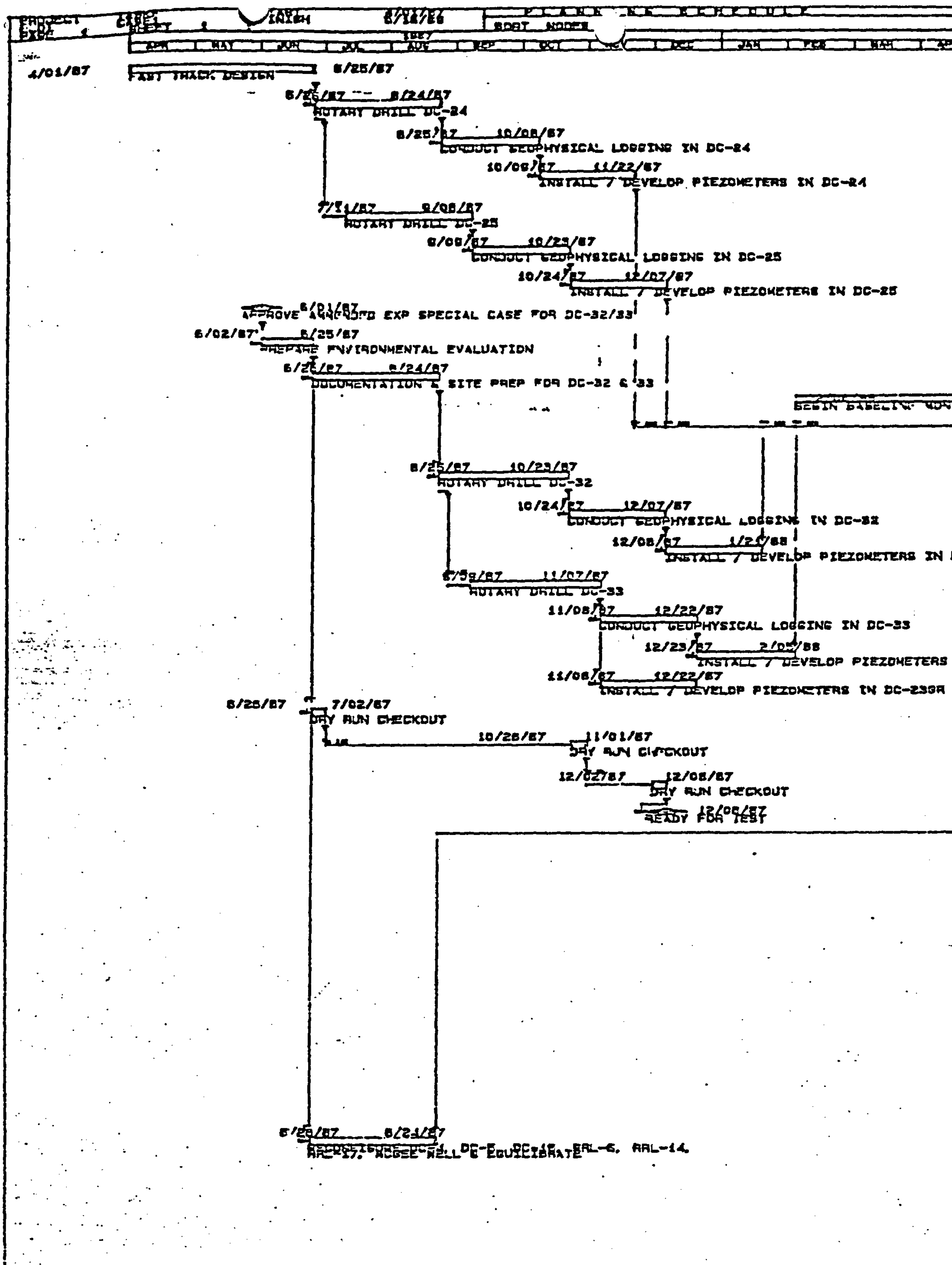
EXPEDITED SPECIAL CASE - BOREHOLE DRILLING

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ROTARY DRILL DC-24
10/08/87
CONDUCT GEOPHYSICAL LOGGING IN DC-24
11/22/87
INSTALL / DEVELOP PIEZOMETERS IN DC-24
9/08/87
10/23/87
CONDUCT GEOPHYSICAL LOGGING IN DC-25
10/24/87
12/07/87
INSTALL / DEVELOP PIEZOMETERS IN DC-25
6/01/87
EXP SPECIAL CASE FOR DC-32/33
6/02/87
6/25/87
ENVIRONMENTAL EVALUATION
8/24/87
SITE PREP FOR DC-32 & 33
10/23/87
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ROTARY DRILL DC-33
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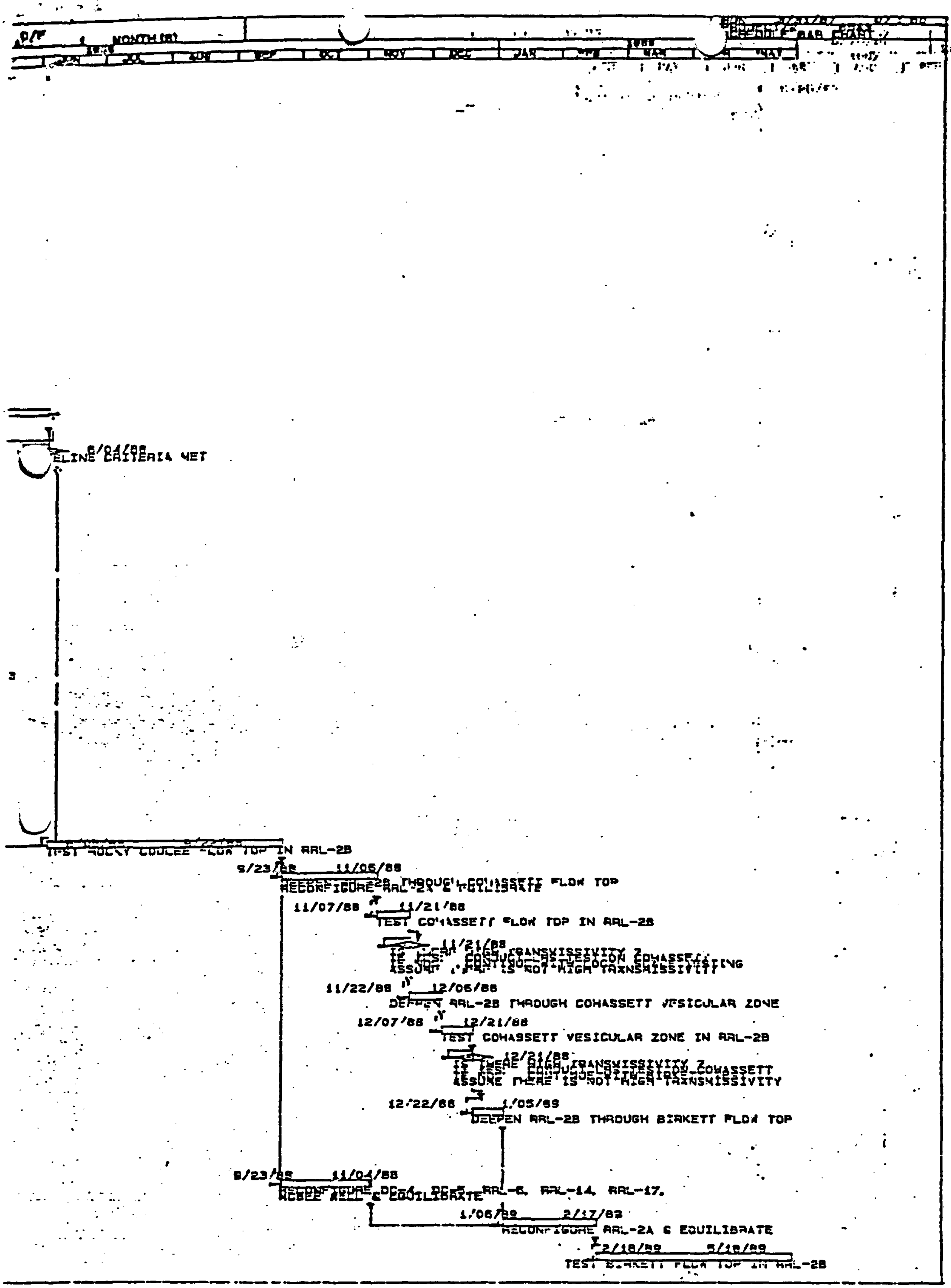
RRL-6, RRL-14,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9/23/88
11/06/88
RECONFIGURE RRL-2A & EQUILIBRATE
FLOW TOP
11/07/88
11/21/88
TEST COHASSETT FLOW TOP IN RRL-2B
11/21/88
ASSUME THERE IS NOT HIGH TRANSMISSIVITY
11/22/88
12/06/88
DEEPEN RRL-2B THROUGH COHASSETT VESICULAR ZONE
12/07/88
12/21/88
TEST COHASSETT VESICULAR ZONE IN RRL-2B
12/21/88
IS THERE HIGH TRANSMISSIVITY ?
ASSUME THERE IS NOT HIGH TRANSMISSIVITY
12/22/88
1/05/89
DEEPEN RRL-2B THROUGH BIRKETT FLOW TOP
9/23/88
11/04/88
RRL-6, RRL-14, RRL-17,
& EQUILIBRATE
1/06/89
2/17/89
RECONFIGURE RRL-2A & EQUILIBRATE
2/18/89
5/18/89
IN RRL-2B

WI 101.5 II

To: Neil Coleman

HS62355

Internal Letter

Rockwell International

Date. February 26, 1987

No. 71000-87-LC-069

TO: (Name, Organization, Internal Address)
. G. W. Jackson, Director
. Science and Engineering
. CDC-1/7/3000 Area

FROM: (Name, Organization, Internal Address, Phone)
. L. Connell, Director
. Operations and Test
. CDC-1/26/3000 Area
. 6-8795

Subject: . Interim Problem Reports

Attached are copies of three Interim Problem Reports (IPR) on integrity testing of DC-19, -20, -22, integrity testing of RRL-2C, and Westbay Instruments, Ltd. packer degradation at RRL-14 for review by Science and Engineering. I need review comments on these by March 2, 1987. Dr. S. M. Baker has previously been sent copies of these IPRs. In addition, I need one person from Science and Engineering to serve on an evaluation team for the integrity testing IPR's (IPR-SD-BWI-TC-016-001 and IPR-SD-BWI-TC-023-001).

correct

L Connell 2/25/87
L. Connell, Director
Operations and Test

LC/SRS/llk

Att.

cc: W. H. Price
S. R. Strait
BRMC (2) 3503/E903/003
LB

INTERIM PROBLEM REPORT

INTERIM PROBLEM REPORT	1. REPORT NUMBER IPR-SD-BW[illegible]-TC-016-001	PAGE ____ OF ____

2. TEST PROCEDURE NUMBER AND SEQUENCE AND SUBTIER TEST PROCEDURE NUMBER, IF APPLICABLE — Not Applicable	3. WORK AREA 600 Area (see attached)

4. EQUIPMENT Nested piezometers DC-19C, DC-20C, and DC-22C.

5. REPORTED BY (NAME/ORG.)	6. PHONE NO.	7. DATE AND TIME
F. A. Spane, Site Characterization Field Invest.	3-1180	March 1986

8. COGNIZANT ENGINEER/SCIENTIST RESPONSIBLE FOR TEST ACTIVITY (NAME/ORG.) F. A. Spane, Site Characterization Field Investigations Dept.	11. VALIDATION (INITIAL REVIEW) S. R. Strait, Manager [signature] 1/19/87

9. ITEM	10. PROBLEM DESCRIPTION
	See Attached.

12. EVALUATION TEAM REQ. YES ☐ NO ☒	13. RETEST REQUIRED YES ☐ NO ☒ ITEMS:
14. CONSTRAINTS YES ☐ NO ☒ TO:	15. CONSTRAINT SIGNATURE, DATE

16. ITEM	17. DISPOSITION/CAUSE/CORRECTIVE ACTION
	See attached.

19. ACCEPTANCE APPROVALS — Signature / Function/Phone / Date	18. OTHER REPORT REQ. YES ☐ NO ☐ TYPE ____ NUMBER ____
20. EVALUATION TEAM SIGNATURES (IF APPLICABLE)	21. FINAL CLOSEOUT ____ GROUP MANAGER ____ DATE

INTERIM PROBLEM REPORT

1. Report Number: IPR-SD-BWI-TC-016-001

2. Controlling TOP: Not Applicable

3. Work Area: 600 Area; at DC-19C, DC-20C, and DC-22C during drilling and construction of DC-23W.

4. Equipment: Nested piezometers DC-19C, DC-20C, and DC-22C.

5. Reported By: Frank A. Spane Jr., Site Characterization Field Investigations.

6. Phone Number: 373-1180.

7. Date and Time: March 1986 (as noted in document SD-BWI-TI-313).

8. Cognizant Engineer Responsible For Test Activity: Frank A. Spane, Jr., Site Characterization Field Investigations.

9. Item: #1

10. Problem Description: Review of water-level and hydrostatic pressure records obtained from nested piezometer sites DC-19C, DC-20C, and DC-22C, during drilling and construction at neighboring DC-23W (Figure 1), indicates that cross-formational responses were evident at these monitoring facilities for the Wanapum Basalt. The causative factor for the observed cross-formational response is not known.

The uncertainity as to the cause of the observed Wanapum Basalt responses raises the question as to the integrity of the nested piezometers within DC-19C, -20C, and 22C to monitor isolated zones within the Wanapum (and possibly the Grande Ronde) Basalt. Resolution as to the causative factor responsible for the observed cross-formational response at DC-19C, -20C, and -22C is needed to:

- evaluate the performance and viability of nested piezometer sites DC-19C, -20C, and -22C, and

- determine whether remedial measures are required to establish isolation integrity for individual monitoring horizons within the nested piezometer facilities.

11. Validation: (S. R. Strait signature)

12. Evaluation Team Required: No.

13. Retest Required: No.

14. Constraints: No.

15. Constraint Signature: None

16. Item: #1

17. Disposition/Cause/Corrective Action: Uncertainity exists as to the isolation integrity of individual piezometers at nested piezometer sites DC-19C, -20C, and -22C. To resolve the causative factor responsible for the observed cross-formational response and to determine whether repairs or remedial measures are required within the nested piezometer facilities (i.e., DC-19C, -20C, and -22C), several diagnostic activities are proposed. Proposed diagnostic activities include:

- o a review of available data,
- o individual piezometer tubing-string tests, and
- o short-duration hydrologic field tests.

Figure 2 shows a general logic diagram for evaluation of the observed cross-formational responses at DC-19C, -20C, and -22C. The estimated time for completion of identified diagnostic activities is presented in Table 1 and Figure 3.

A. Review of Available Data

The review of available data includes the analysis of data collected at DC-19C, -20C, and -22C during facility construction and piezometer installation (i.e., piezometer intergrity and development tests), and during construction of nearby borehole DC-23W; as well as data collected at nested piezometers within the Wanapum Basalt (DC-23W) during hydrolgic field testing of the Rosalia flow top at DC-23GR. As indicated in Figures 2 and 3, the review of available data is estimated to require 8 weeks and can be performed concurrently with proposed tubing-string testing. A general diagram of the various review data elements is shown in Figure 4.

B. Tubing-String Tests

Tubing-string integrity tests (see Figure 5) will be performed on each of the piezometers within the C-site monitoring facility at DC-19, -20, and -22. The tests will be conducted to assess whether leaks are present within the piezometer tubing or at tubing-string joint connections. If leaks are detected (i.e., above a threshold value), repairs and remedial measures may be implemented to provide isolation integrity for the monitoring installations. Estimated time for completion of tubing-string tests is 8 weeks. The time alloted for piezometer repair and remedial activities, is dependant on the presence (if any) and nature of leaks that occur. The length of time afforded for this work element, therefore, may be highly variable. For the purposes of scheduling, a period of 0 to 6 weeks is tenatively assigned.

C. Diagnostic Hydrologic Field Tests

Provided that the integrity of tubing-string installations for Wanapum Basalt piezometers has been established, diagnostic hydrologic field tests will be initiated. The main element of the hydrologic field tests will focus on a constant discharge test of the Rosalia flow top at monitoring sites DC-20 and DC-22. The test includes the pumping or withdrawal of water at a constant rate from the Rosalia flow top at the B-site installation, and observing the hydrologic response within individual piezometers at the C-site facility (Figures 6 & 7). The active pumping phase of the constant discharge test will be of short-duration, ranging from 12 to 36 hours. Because of the short test duration and the high transmissive properties of the Rosalia flow top, affects from the constant discharge test should dissipate rapidly (i.e., within one week or less). Comparison of the drawdown and recovery responses of Wanapum monitoring horizons at the C-site facility will provide data that can be analyzed using analytical and numerical methods.

The absence of a B-well site eliminates the possibility of conducting similar constant discharge pumping tests at the DC-19 site. Although small-rate, air-lift pumping tests could be conducted within the Rosalia flow top at the DC-19C facility, results from such tests are not anticipated to provide any diagnostic information. This is because of the:

- low production capability and low stress application attainable within small-diameter, nested piezometers,
- high transmissive character (and therefore low associated response characteristics) of monitored Wanapum horizons, and
- inability to make a direct comparison of transient response for the Rosalia and Sentinel Gap flow tops during drawdown and recovery phases of the air-lift pumping test.

Results from the diagnostic hydrologic field tests will be analyzed and integrated with information obtained from the previous tubing-string tests and review of available data. Results from the final integration are expected to indicate whether the observed cross-formational responses within the Wanapum Basalt are attributable to areally pervasive or borehole/site specific factors.

TABLE 1. Estimated Schedule for Completion of Identified IPR Diagnostic Activities for Evaluating Cross-Formational Piezometer Response at DC-19C, -20C, and -22C.

Work Item	Estimated Completion Time
1. IPR Issuance	(Starting Point of Schedule)
2. Pre-Diagnostic Test Documentation (e.g., Trouble-Shooting Plan, etc.)	10 weeks
3. Review of Available Data	8 weeks
4. Tubing-String Tests	8 weeks (done concurrently with Item # 3)
5. Remedial Nested Piezometer Repairs and/or Modifications	0 - 6 weeks (variable time; dependent on results of Item # 4)
6. Diagnostic Hydrologic Field Tests	
6a) Constant Discharge Test at DC-20B	1 week
6b) Preliminary Analysis of DC-20B, Constant Discharge Test	1.5 weeks
6c) Constant Discharge Test at DC-22B	1 week
6d) Preliminary Analysis of DC-22B, Constant Discharge Test	1.5 weeks
7. Final Integration and Analysis of Field Te ts Results, and IPR Disposition	3 weeks

TOTAL ESTIMATED TIME = 26 - 32 weeks

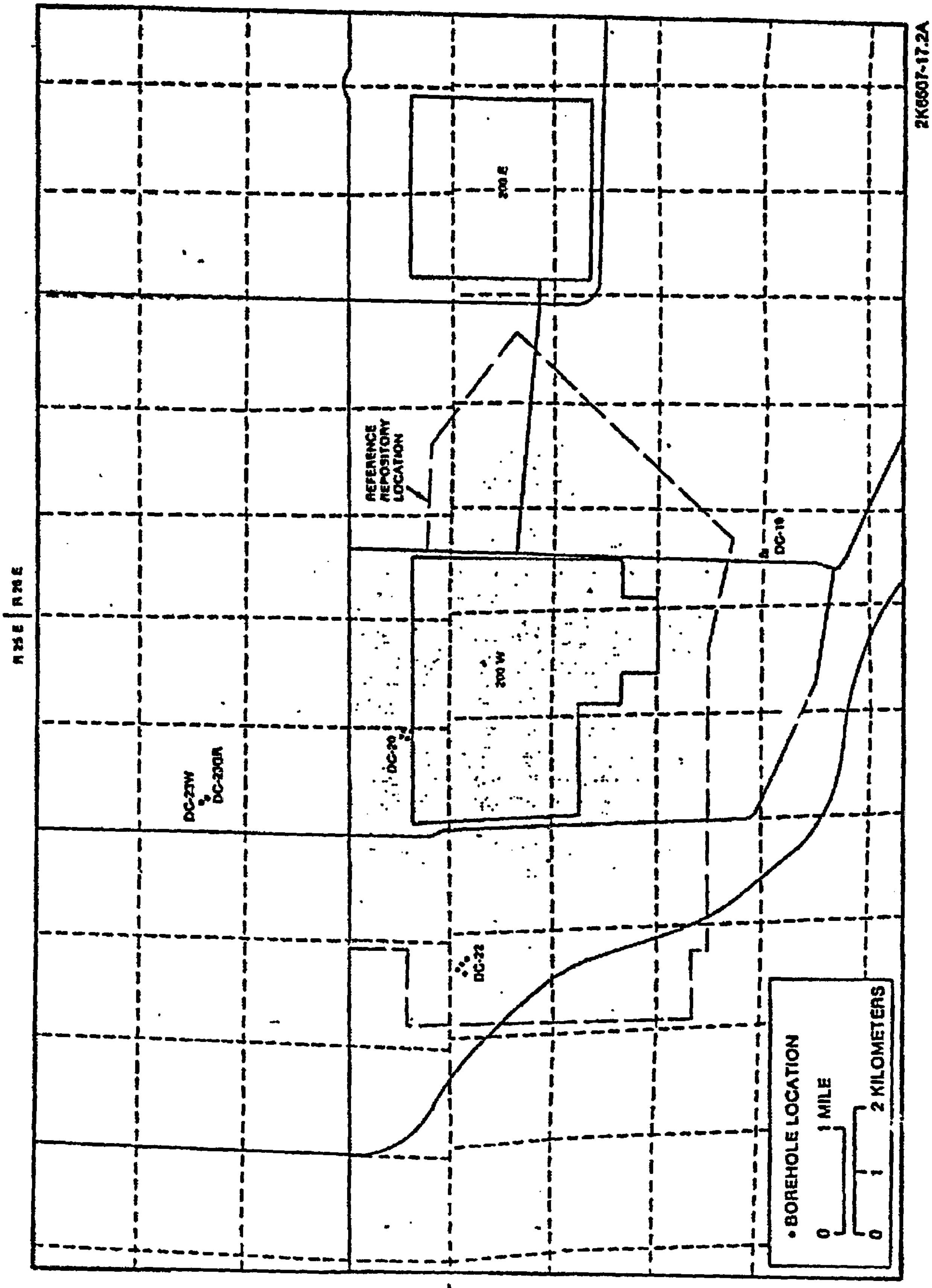


Figure 1. Location of DC-23W, -23GR, and Nested Piezometer Facilities DC-19, DC-20, and DC-22.

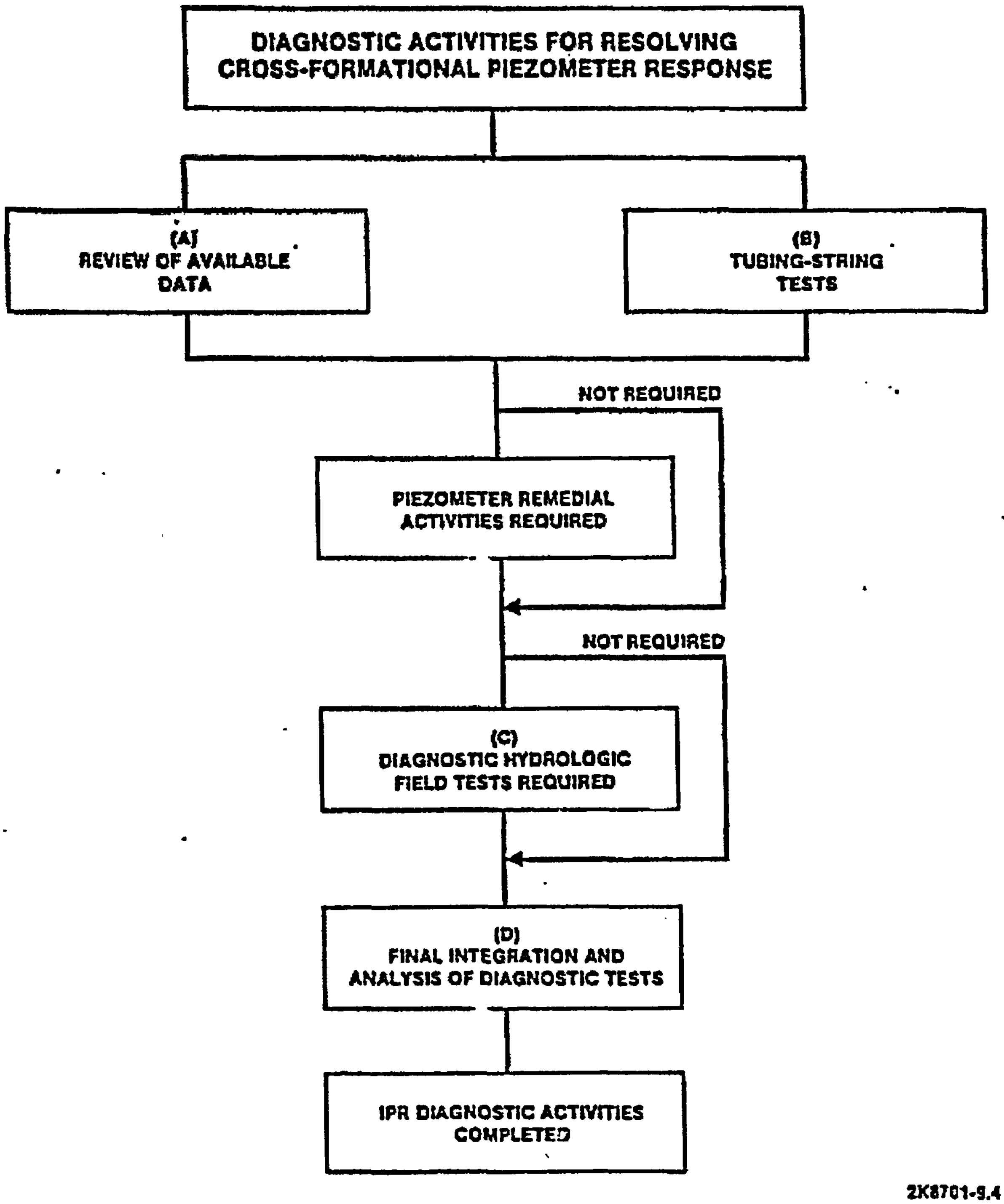


Figure 2. General Logic Diagram For Evaluating Cross-Formational Piezometer Response At DC-19C, DC-20C, and DC-22C.

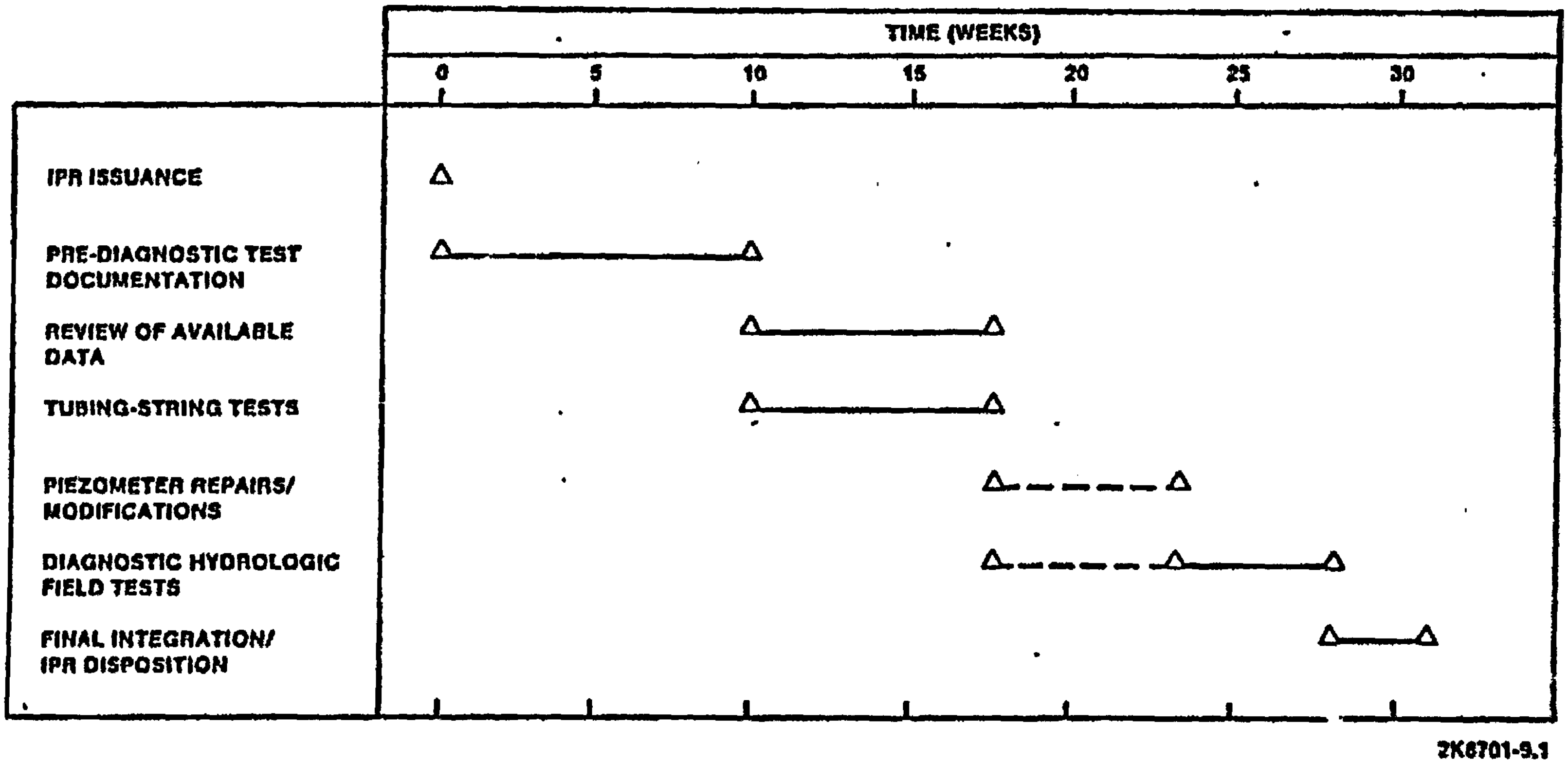


Figure 3. Estimated Schedule For Completing Diagnostic Activities For Evaluating Cross-Formational Piezometer Response At DC-19C, DC-20C, and DC-22C.

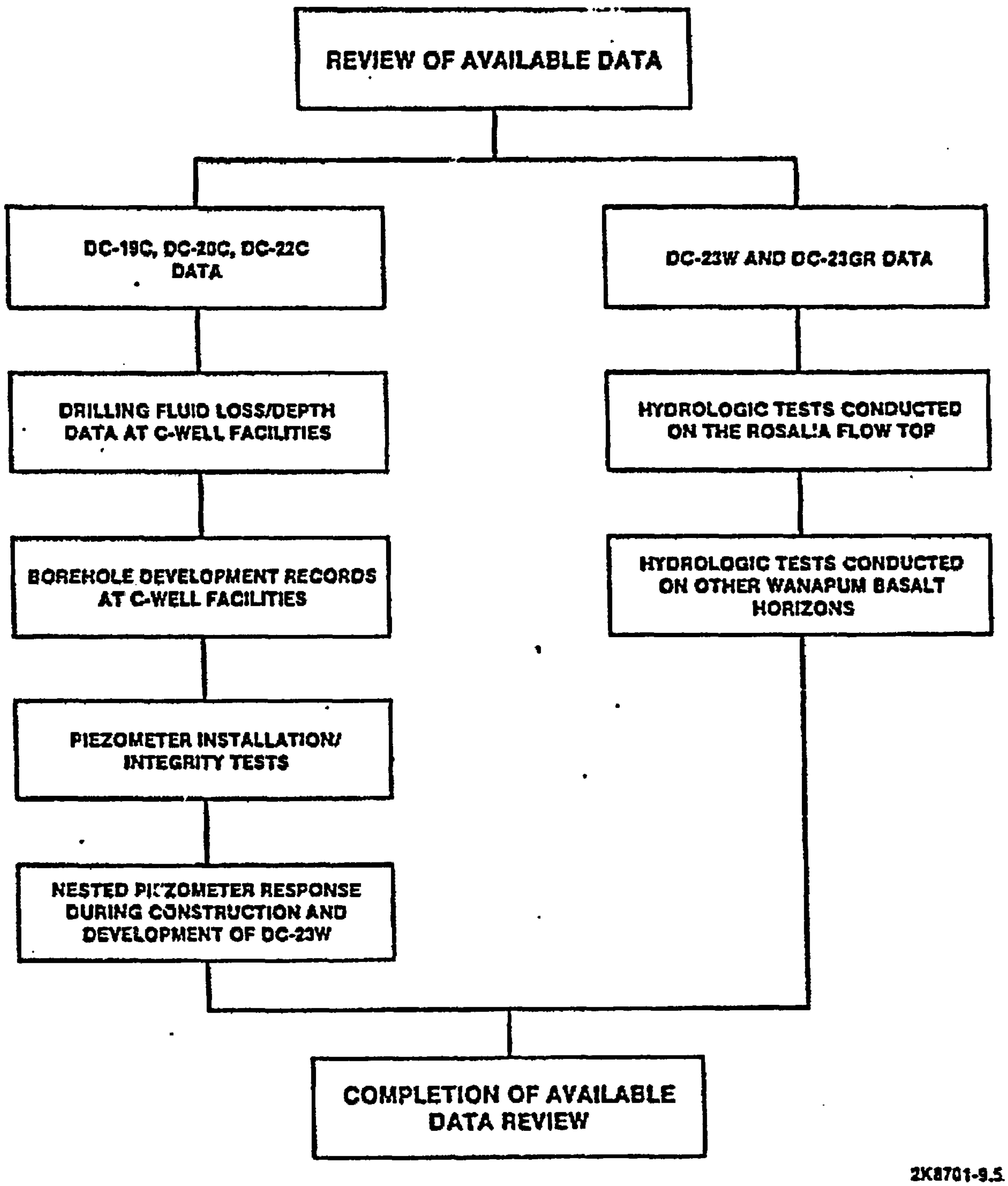


Figure 4. Review of Available Data For Evaluating Cross-Formational Piezometer Response At DC-19C, DC-20C, and DC-22C.

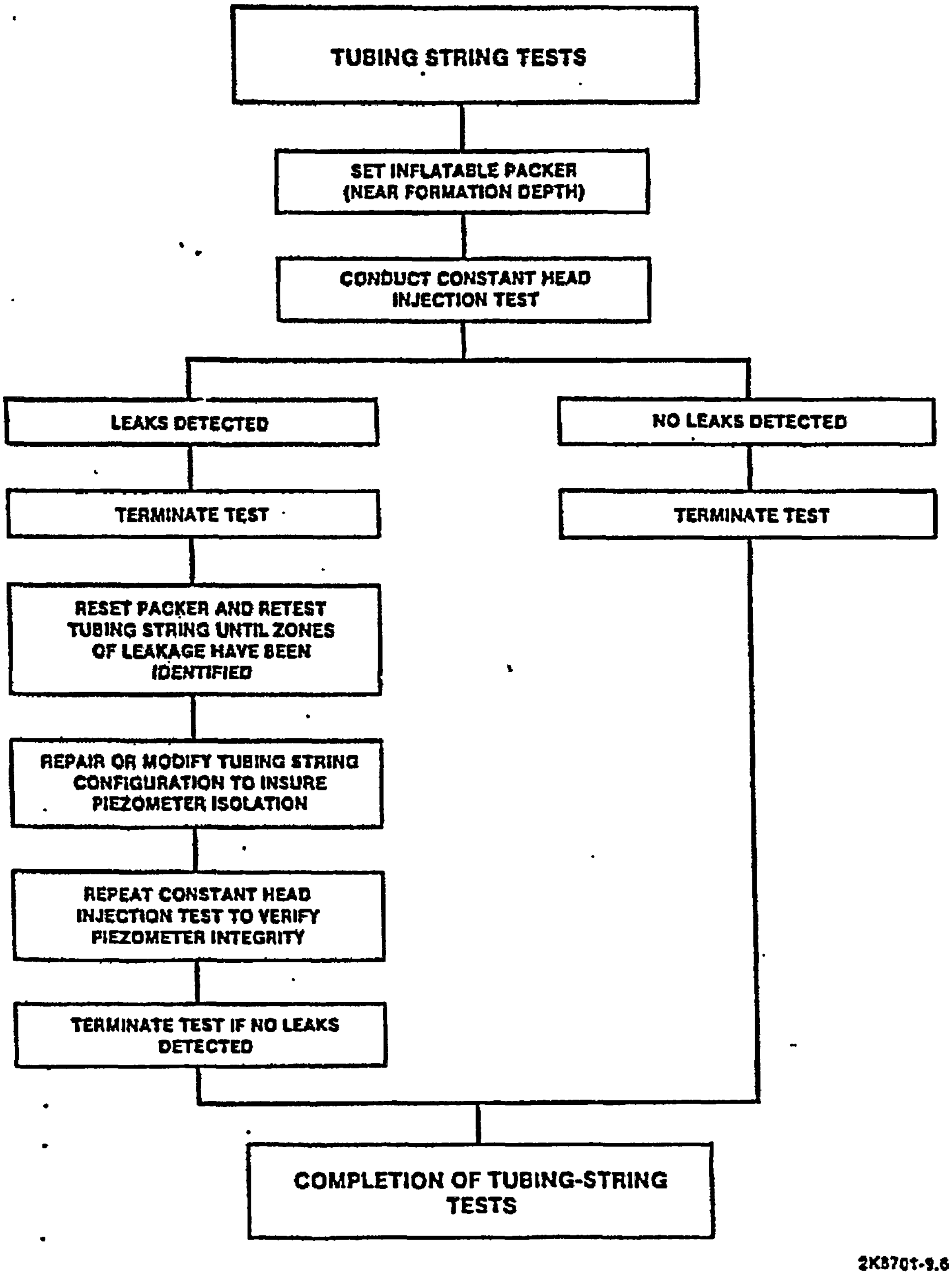


Figure 5. General Work Elements For Conducting Tubing-String Tests On Piezometers Within DC-19C, DC-20C, and DC-22C.

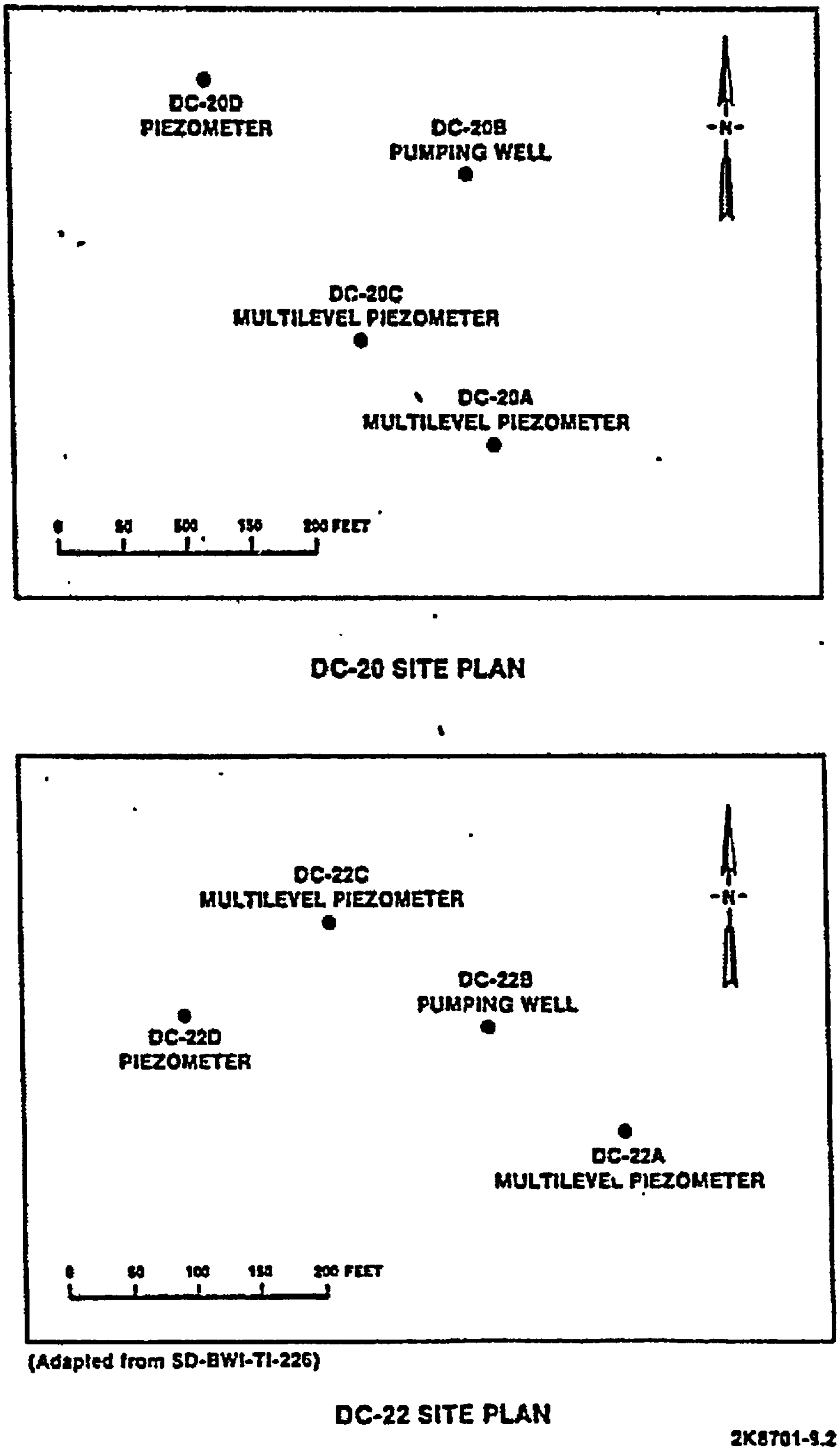


Figure 6. B-Well Distance Relationships to Monitoring Facilities at DC-20 and DC-22.

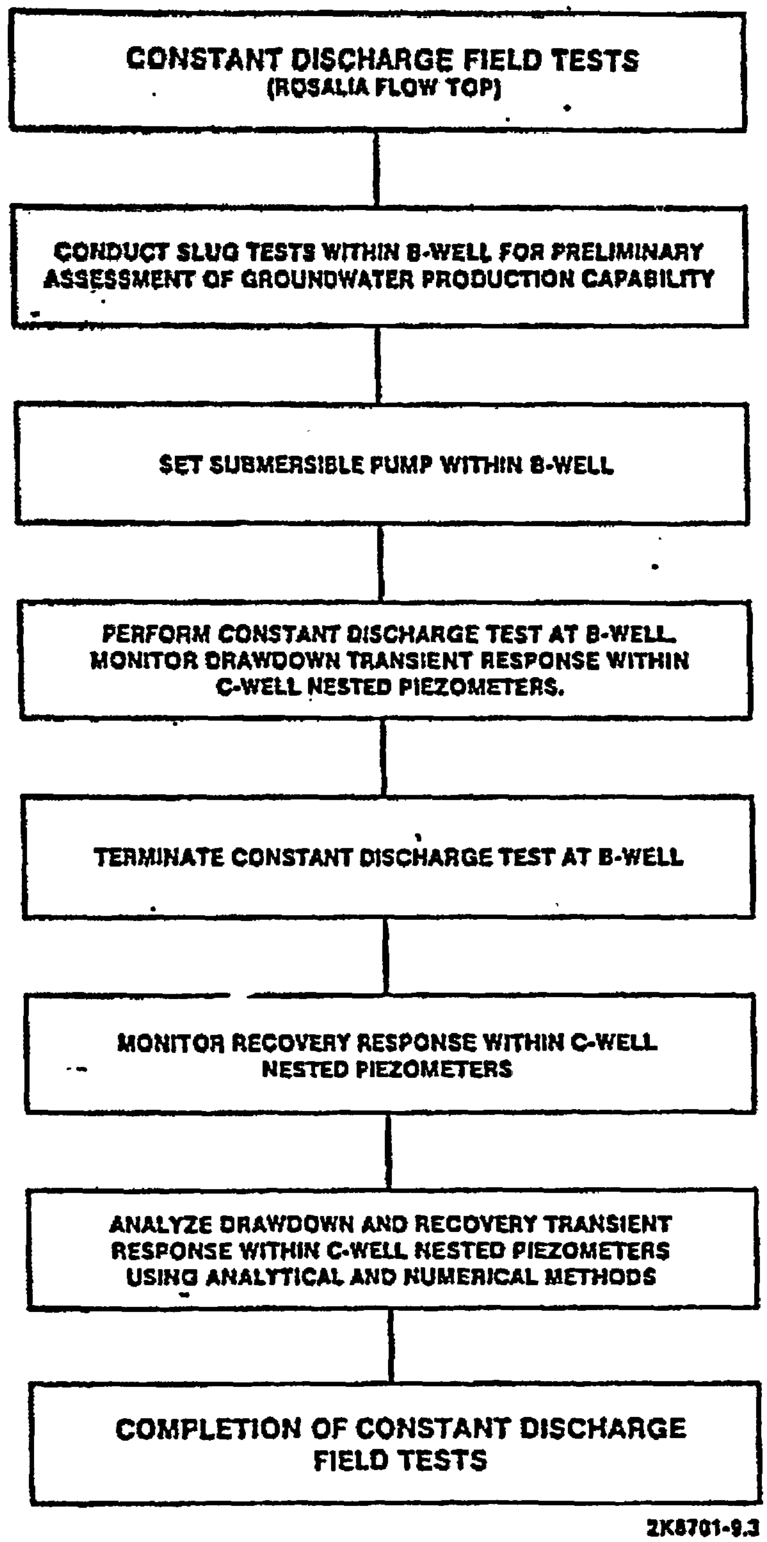


Figure 7. General Work Elements For Conduct of Constant Discharge Tests For the Rosalia Flow Top At DC-20B and DC-22B.

ATTACHMENT A

An extension of 60 days is requested for the Interirm Problem Report on integrity testing of the piezometers at DC-19, -20, and -22 (IPR-SD-BWI-TC-016-001). The extension is required tecause of the nature of the problem is such that it will require extensive analysis of existing data and potentially additional field work that will extend beyond the current five day limit as mentioned in PMPM 7-119.

INTERIM PROBLEM REPORT

1. REPORT NUMBER IPR-SD-BWI-TC-023-001

PAGE ____ **OF** ____

2. TEST PROCEDURE NUMBER AND SEQUENCE AND SUBTIER TEST PROCEDURE NUMBER, IF APPLICABLE N/A

3. WORK AREA RRL-2C/600 Area

4. EQUIPMENT
RRL-2C Piezometer Nest

5. REPORTED BY (NAME/ORG.)
L. C. Swanson, Hydrologic Testing Group
SCFI Department

6. PHONE NO. 3-5200

7. DATE AND TIME 8/85

8. COGNIZANT ENGINEER/SCIENTIST RESPONSIBLE FOR TEST ACTIVITY (NAME/ORG.)
L. C. Swanson, Hydrologic Testing Group/SCFI Dept.

11. VALIDATION (INITIAL REVIEW) 2/3/87 S.R. Strait

9. ITEM	10. PROBLEM DESCRIPTION
1	During piezometer development activities from June to August 1985 at
	borehole RRL-2C, pressure responses were observed in some instances in
	monitored intervals located stratigraphically above and/or below the
	piezometer under development. These responses were not expected and may indicate a lack of integrity of the RRL-2C piezometer nest. The pressure
	responses are described in detail in document SD-BWI-TI-329, Jackson, et al, 1986.

12. EVALUATION TEAM REQ. YES [X] NO [ ]

13. RETEST REQUIRED YES [ ] NO [X] **ITEMS:**

14. CONSTRAINTS YES [X] NO [ ] **TO:**

15. CONSTRAINT SIGNATURE, DATE

16. ITEM	17. DISPOSITION/CAUSE/CORRECTIVE ACTION
	The following tests will be used to evaluate the cause of the pressure
	responses observed at RRL-2C.
1.1	Literature and data review
1.2	Tubing string integrity test for piezometers at RRL-2C. (continued on attachment)

19. ACCEPTANCE APPROVALS

Signature	Function/Phone	Date
S. R. Strait		
L. C. Swanson		
W. A. Herber		

18. OTHER REPORT REQ. YES [ ] NO [ ]
TYPE ____
NUMBER ____

20. EVALUATION TEAM SIGNATURES (IF APPLICABLE) S. R. Strait
R. L. Jackson, F. A. Spane, W. A. Herber

21. FINAL CLOSEOUT

GROUP MANAGER ____ DATE ____

INTERIM PROBLEM REPORT (continuation sheet)	1. REPORT NUMBER IPR-SD-BWI-TC-023-001	PAGE 2 OF 2

2. TEST PROCEDURE NUMBER AND SEQUENCE AND SUBTIER TEST PROCEDURE NUMBER, IF APPLICABLE	N/A	3. WORK AREA RRL-2C/600 Area

4. ITEM Item 17 continued

1.3 Constant discharge test at RRL-2B in the Rocky Coulee flow top while monitoring piezometers at RRL-2C and RRL-2A.

These trouble shooting tests will be used to categorize the responses as either pervasive formational or borehole/site specific factors. Specific causes of the observed pressure responses might be:

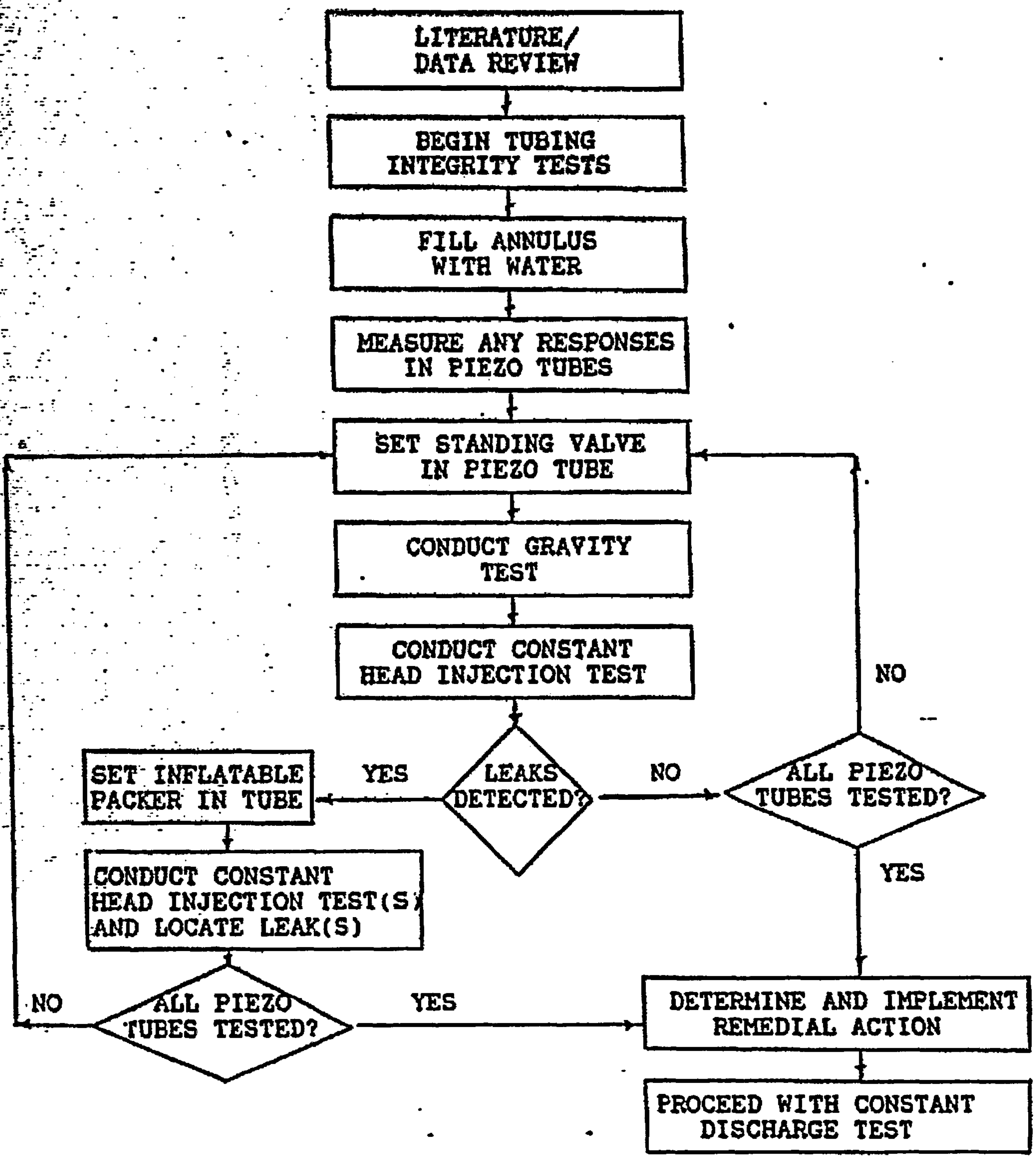
1. leaks in the piezometer tubing,
2. inadequate cement seals with channeling,
3. communication via a disturbed rock zone,
4. naturally occurring fractures or joints, and
5. structural or stratigraphic discontinuities.

An attached logic diagram (Figure 1) outlines the sequence for trouble-shooting the problem. Table 1 estimates the completion time for each of the trouble-shooting activities.

Corrective action will be determined when the cause(s) of the problem is identified.

5. FINAL CLOSURE SIGNATURE

LOGIC DIAGRAM FOR INTEGRITY TESTING AT BOREHOLE RRL-2C (6 Piezometer Tubes)



CONSTANT DISCHARGE
TEST

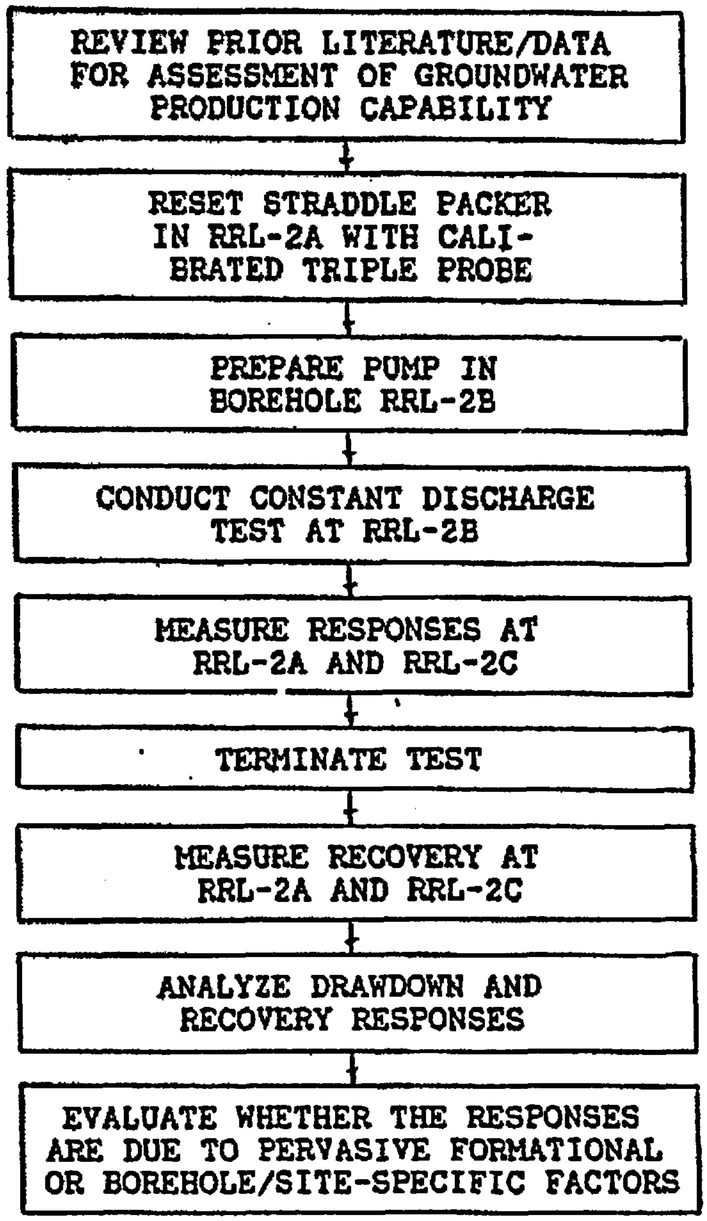


TABLE 1. Estimated Schedule for the Planned IPR Activities for Integrity Testing at Well RRL-2C.

WORK ITEM	ESTIMATED COMPLETION TIME
1. IPR Issuance	Start of Schedule
2. Documentation of Trouble-Shooting Plan	2 to 4 Weeks
3. Literature/Data Review	.5 Weeks
4. Annulus and Piezometer Tubing String Tests	1 to 2 Weeks
5. Remedial Work (if Essential)	0 to 6 Weeks
6. Pump and Pre-Test Preparation (e.g., Placement of Calibrated Probe in RRL-2A)	1 to 2 Weeks
7. Constant Discharge Test at Well RRL-2B	.5 to 1 Week
8. Test Analysis, Evaluation and IPR Disposition	2 to 3 Weeks

TOTAL ESTIMATED TIME = 7 to 19 Weeks

ATTACHMENT A

An extension of 60 days is requested for the Interirm Problem Report on integrity testing of the piezometers at RRL-2C (IPR-SD-BWI-TC-023-001). The extension is required because of the nature of the problem is such that it will require extensive analysis of existing data and potentially additional field work that will extend beyond the current five day limit as mentioned in PMPM 7-119.

INTERIM PROBLEM REPORT

1. REPORT NUMBER IPR-PO-K342029-001

PAGE 1 **OF** 2

2. TEST PROCEDURE NUMBER AND SEQUENCE AND SUBTIER TEST PROCEDURE NUMBER, IF APPLICABLE Not Applicable

3. WORK AREA Borehole RRL-14 600 Area

4. EQUIPMENT Polyurethane packer glands on prototype stainless steel multilevel packer (MP) system.

5. REPORTED BY (NAME/ORG.) R. L. Jackson Hydrologic Testing Group/SCFI Department

6. PHONE NO. 3-5300

7. DATE AND TIME 10/30/86

8. COGNIZANT ENGINEER/SCIENTIST RESPONSIBLE FOR TEST ACTIVITY (NAME/ORG.) R. L. Jackson Hydrologic Testing Group/SCFI Department

11. VALIDATION (INITIAL REVIEW) S. R. Strait 2/3/87 [signature]

9. ITEM	10. PROBLEM DESCRIPTION
1.0	To maximize the use of existing, small-diameter borehole facilities, a
	prototype modular multilevel packer (MP) system is being field tested at
	Borehole RRL-14. The MP system is designed to monitor downhole fluids
	pressure and sample groundwater from multiple hydrogeologic horizons within
	the Grande Ronde Basalt. Each horizon is isolated by a dual set of

12. EVALUATION TEAM REQ. YES ☒ NO ☐ R. L. Jones, S. R. Strait, R. L. Jackson

13. RETEST REQUIRED YES ☒ NO ☐ **ITEMS:** Verification Plan (Subcontractor)

14. CONSTRAINTS YES ☐ NO ☐ **TO:**

15. CONSTRAINT SIGNATURE, DATE

16. ITEM	17. DISPOSITION/CAUSE/CORRECTIVE ACTION
1.0	Subcontractor will provide an evaluation at their expense, summarizing the
	test results and evidence gathered in the probable cause of the degradation
1.1	Subcontract will provide recommended remedial measures including
	proposed packer design.

19. ACCEPTANCE APPROVALS

Signature	Function/Phone	Date
S. R. Strait		
R. L. Jones		
R. L. Jackson		

18. OTHER REPORT REQ. YES ☐ NO ☐

TYPE ______

NUMBER ______

20. EVALUATION TEAM SIGNATURES (IF APPLICABLE) R. L. Jones, S. R. Strait, R. L. Jackson

21. FINAL CLOSEOUT

GROUP MANAGER ______ DATE ______

INTERIM PROBLEM REPORT (continuation sheet)	1. REPORT NUMBER IPR-PO-K342029-001	PAGE 2 OF 2
TEST PROCEDURE NUMBER AND SEQUENCE AND SUBTIER TEST PROCEDURE NUMBER, IF APPLICABLE	Not Applicable	3. WORK AREA Borehole RRL-14 600 Area
ITEM	Not Applicable	

Item 10 (continued).

polyurethane packers as illustrated in Figure 1. The MP system was manufactured by Westbay Instruments Ltd. (Vancouver, B. C.) and installed in borehole RRL-14 in October 1985 under P.O. K342029. As part of the field testing of the MP system it was found that the polyurethane packer glands under went severe and almost complete degradation as verified after the MP system was removed from RRL-14 on October 30, 1986.

Items 16 and 17 (continued).

1.2 Re-install MP system with modified packer glands

1.3 Re-inflate packer glands.

1.4 Retest packer glands after four months to check whether packers remained inflated since their installation.

FINAL CLOSURE SIGNATURE

ATTACHMENT A

An extension of 60 days is requested for the Interim Problem Report on the degradation of the Westbay packers in RRL-14 (IPR-PO-K342029-001). The extension is required because additional time is needed to evaluate the cause behind the packer degradation. Westbay is performing the analysis and evaluation.

To. Ron Ballard / Neil Coleman

MS62355

Rockwell Hanford Operations
P.O. Box 800
Richland, WA 99352

Rockwell International

April 3, 1987

In reply, refer to letter R87-1484

Mr. J. H. Anttonen, Assistant Manager
Commercial Nuclear Waste
Department of Energy
Richland Operations Office
Richland, Washington 99352

Dear Mr. Anttonen:

REQUEST FOR APPROVAL TO RESTART COLLECTION REQUIREMENTS DEFINITION AND FACILITY DESIGN DEVELOPMENT AS AN EXPEDITED SPECIAL CASE FOR BOREHOLES DC-23, DC-24, DC-25, DC-32, AND DC-33 (Contract DE-AC06-77RL01030)

Rockwell Hanford Operations requests permission to restart Collection Requirements Definition and Facility Design Development as an Expedited Special Case for Boreholes DC-23, DC-24, DC-25, DC-32, and DC-33. This request is based upon our thorough evaluation of this project from standpoints of eligibility for restart status and thorough examination of restart qualifications.

The attachments to this letter summarize our two-fold review process and the findings.

Your approval is hereby requested.

Very truly yours,

D. C. Gibbs, Director
Basalt Waste Isolation Project

DCG/CCC/hls

Att.

cc: J. J. Keating - DOE-RL
A. W. Kellogg - DOE-RL
R. J. Light - DOE-RL

RECEIVED
APR 03 1987
DOE-RL/BWI DCC

DC-23--33,April 1, 1987

REQUEST FOR EXPEDITED SPECIAL CASE STATUS

BOREHOLES DC-23, 24, 25, 32 and 33 FACILITY DESIGN

BACKGROUND

Refs: (1) Letter, R. T. Johnson to R. A. Johnson, "Request for Expedited Special Case Status Restart of Borehole DC-24CX, and Start of Boreholes DC-25CX, DC-26CX and DC27CX", 78100-JM-86-013, dated September 8, 1986.

(2) Letter, D. C. Gibbs to O. L. Olson, "Request for Approval to Restart Drilling Boreholes DC-24 and DC-25", R86-4400, dated September 13, 1986

(3) Letter, J. J. Keating to General Manager Rockwell Hanford Operations, "Expedited Special Case Boreholes DC-24 and DC-25", 86-GTB-57, dated October 24, 1986

(4) "Quality Evaluation Board Level Assignments Expedited Special Case for Restart of Boreholes DC-24 and DC-25", T. D. Ault, F. V. Roeck, K. M. Singleton and A. P. Wicklund, December 1986, SD-BWI-AR-031, Rev. 0, Draft 3.

(5) Option Paper - The Option Paper for the "Geohydrologic Testing Program for the Hanford Site Before Construction of the Exploratory Shaft" describes the data needs for boreholes DC-23, 24, 25, 32 and 33. This paper was issued as a memorandum by the Geohydrology Working Group and approved by S. H. Kale, Associate Director, Office of Geologic Repositories, on March 16, 1987.

Reference (2) requested DOE-RL approval to drill and construct piezometer facilities DC-24 and DC-25 on an Expedited Special Case basis. This work was in preparation when the general Stop Work Order was issued. Reference (3) rejected that request, providing several comments for resolution. The Expedited Special Case package has undergone extensive evaluation and rework since that time to address those comments. During the course of that evaluation, it was recognized that design of the piezometer facilities must be accomplished within a formal design control process as required for Quality Assurance (QA) level 1 design. Further, the design requirements are derived from site characterization data collection needs, and this relationship must be documented and controlled.

Definition of site characterization data needs has begun with Issue Resolution Strategy, Study Plan development, the Option Paper (Reference 5) and activities that have been exempt from the Stop Work Order (Figure

1). Completing the formal definition of the Test Data Collection Specifications (TDCS), Design Requirements Document (DRD) and design for the piezometer facilities have been determined to be new work. This Expedited Special Case (ESC) request for status is being submitted for approval to conduct that new work.

As the controlled draft study plans progress towards approval the TDCS will be revised as necessary to agree with the study plans. Correspondingly the DRD will be revised to agree with the TDCS. The work concludes when the TDCS and the DRD are released. This work is necessary to provide the technical input for the design activity for boreholes DC-23, 24, 25, 32 and 33.

SCOPE OF WORK

Preparation of the draft Test Data Collection Specifications (TDCS), Design Requirements Document (DRD), and the Quality Assurance level 1 design for boreholes DC-23, 24, 25, 32 and 33 are activities requiring DOE-RL approval for restart by Expedited Special Case (Figure 1). This is new work that was not included in the previous Expedited Special Case Status for DC-24 and DC-25 that was recommended for approval on September 8, 1986. The TDCS uses draft Study Plans and the Option Paper as a basis for preparation. The DRD uses the draft TDCS and the Option Paper as a basis for preparation. The borehole and test facility design is based on the DRD and is performed by the A/E (Westinghouse Hanford Company).

The specific scope of work for consideration as an Expedited Special Case is as follows:

o Prepare, review and release the Test Data Collection Specifications for the study needs at boreholes DC-23, 24, 25, 32 and 33 based on the general study needs identified in the following draft Study Plans:

Stratigraphy Study Plan (SD-BWI-SP-035)
Intraflow Structures Study Plan (SD-BWI-SP-036)
Site Groundwater Study Plan (SD-BWI-SP-057)

The Option Paper for the "Geohydrologic Testing Program for the Hanford Site Before Construction of the Explatory Shaft" will also be used for identifying general study needs.

o Prepare, review and release the Design Requirements Document for boreholes DC-23, 24, 25, 32 and 33 based on the draft Test Data Collection Specifications described above and the Option Paper for the "Geohydrologic Testing Program for the Hanford Site Before Construction of the Explatory Shaft".

o Prepare and release borehole design specifications, drawings and supporting documentation by Westinghouse Hanford Company.

Quality level assignments have been made for boreholes and test facilities in DC-24 and DC-25 in the draft publication titled "Quality Evaluation Board Level Assignments Expedited Special Case for Restart of Boreholes DC-24 and DC-25" (Reference 4). The supporting documents that are included in the scope of work of this request for ESC status are not assigned a QA level, but because they support the design of facilities that are assigned QA level 1 items, they will be prepared to QA level 1 standards. Criteria 4, 5, 6, and 7 in the BWIP Quality Assurance Program Requirements Manual (RHO-QA-MA-3) require that project documentation be conducted to the QA level 1 standard which is compatible with the QA level assignments for DC-24 and DC-25. The quality requirements for data collection, borehole design and test facility design will be stipulated in the Test Data Collection Specifications, Design Requirements Document and Test Plans.

Preparation and release of the Test Data Collection Specification for DC-24 and DC-25 is part of the work breakdown structure (WBS) activity 1L3D1A0R03 for installing piezometers in DC-24 and DC-25 (L3465). Preparation and release of the Design Requirements Document for DC-24 is WBS No. 1L3D2A0D02 which includes DC-24CX piezometer installation (1053). Preparation and release of the Design Requirements Document for DC-25 is WBS No. 1L3D2A0D03 which includes DC-25CX piezometer installation (L1054).

Boreholes DC-23, 32 and 33 will be added to the accounts for DC-24 and DC-25.

DISCUSSION OF RISK/BENEFIT

A review of the proposed ESC activities against the restart justification criteria of Project Directive PD86-005 is summarized in the criteria matrix (Table-1). These risks and benefits associated with early restart of the data collection requirements definition for boreholes DC-23, 24, 25, 32 and 33 are discussed below.

<u>SCHEDULE:</u> The date of Study Plan approval by DOE-RL is estimated to be August 10, 1987. Starting preparation of the Test Data Collection Specification (TDCS) and the Design Requirements Document (DRD) using draft Study Plans and the Option Paper allows the DRD preparation to begin on March 30, 1987 which is a 19 week advance in the schedule for this activity. This also allows the other activities, which are dependent on preparation of the DRD, to proceed.

The BWIP Master Project Schedule (Revision 0, 2/12/87) shows the Restart milestone for start of drilling DC-24/25 on July 1,1987. This date was chosen without considering the new requirement for a QA level 1 design of the borehole and test facilities. The schedule assumed that the

DC-23--33,April 1, 1987

EXPEDITED SPECIAL CASE RESTART CRITERIA MATRIX

RESTART CRITERIA	STOPPED BENEFIT/ ADVANTAGE	STOPPED RISK DISADVANTAGE	RESTART BENEFIT/ ADVANTAGE	RESTART RISK DISADVANTAGE
SCHEDULE	NONE	19 WEEKS	19 WEEKS	NONE
COST	NONE	$40,000	$40,000	NONE
ENVIRONMENT	N/A	N/A	N/A	N/A
NATURAL SYSTEMS	N/A	N/A	N/A	N/A
SAFETY	N/A	N/A	N/A	N/A
PUBLIC/POLITICAL PERCEPTION	LOW	NONE	MEDIUM	LOW
TECHNICAL CREDIBILITY	LOW	MEDIUM	MEDIUM	LOW
QUALITY CONTROL/ ASSURANCE	LOW	NONE	MEDIUM	LOW
LEGAL/LICENSE IMPLICATIONS	LOW	HIGH	HIGH	LOW
TRACEABILITY OF REQUIREMENTS	MEDIUM	NONE	NONE	MEDIUM

Table 1. Summary of risks and benefits for restarting the preparation of the Test Data Collection Specification, Design Requirements Document and design for boreholes DC-23, 24, 25, 32 and 33.

existing designs would be acceptable and that completion of the study plans was not required. If the QA level 1 design were started after the previous ESC (Reference 2) scope of work is completed, the Master Project Schedule would be extended some time beyond the approval of the Study Plans. Approval of the Study Plans is not identified on the Master Project schedule; so an estimate of the schedule delay can not be made. The 19 week schedule reduction estimate is probably less than the true time savings.

COST: Remaining "stopped" is costing the Project a nonrecoverable $8,000 per month for the stand-by status of the rig now at DC-24. The Exploratory Shaft start of construction cost delays are approximately $2.5 million per week. The $2.5 million per week is based on the cost of one day's slip to the license application design.

Completing the work scope of this Request for ESC Status will reduce part of these stand-by and delay costs by shortening the schedule. The 19 week (approximately 5 months) schedule reduction could result in a $40,000 savings in DC-24 stand-by rig costs. Assuming that the 19 week schedule reduction applies directly to Exploratory Shaft schedule reduction the additional projected cost savings could be $50 million. However, the Exploratory Shaft has other prerequisites that may be more controlling than boreholes DC-23, 24, 25, 32 and 33 restart.

ENVIRONMENT: This ESC is for requirements definition and design only, hence there is no impact related to the Project's ability to obtain an acceptable environmental baseline.

REPOSITORY NATURAL SYSTEMS: This ESC is for Test Data Collection Specification, Design Requirements Document and borehole facility design preparation only, hence there is no impact related to impacts on the repository natural systems.

SAFETY: This ESC is for Test Data Collection Specification, Design Requirements Document and borehole facility design preparation only. Appropriate personnel safety requirements and design features will be included in the requirements documents and design documents as appropriate.

PUBLIC/POLITICAL PERCEPTION: The public and political perception cannot be quantified. The early restart of boreholes DC-23, 24, 25, 32 and 33 activities are expected to have strong favorable support from the technical community. It is also anticipated that strong negative opinions will arise from the early restart of this activity from those who have established a negative opinion regarding locating a repository at Hanford.

o The restart risk associated with the public and political perception of early restart of preparation of this effort is considered low because they contribute to the objective of carefully planning the evaluation of the characteristics of the site under consideration.

o The restart benefit is considered medium because those people with preconceived negative opinions may question the need for restart even though better quality data is being obtained at an earlier date which will allow an earlier and more accurate decision regarding the suitability of the site.

o The stopped benefit is considered low because obtaining better design sooner will allow more time to integrate the documents while meeting the long term schedule and objective for evaluating the site.

TECHNICAL CREDIBILITY: Boreholes DC-23, 24, 25, 32 and 33 and their test facilities will provide hydrogeologic information required to respond to the Site Ground Water Study Plan, Stratigraphy Study Plan and Intraflow Structures Study Plan. Therefore, program technical credibility resulting from preparing documents that will obtain a QA level 1 design of the boreholes and test facilities is increased.

o The restart benefit of this effort is medium because higher quality hydrogeologic data will be obtained, but accelerating the schedule does not materially increase credibility.

o The restart risk is low because all the prerequisite documents will be completed and reviewed before drilling begins. The only procedural departure would be that the completed and reviewed study plans and TDCS documents would probably not be approved.

o The stopped risk is medium because obtaining a QA level 1 design of the boreholes and test facilities will be delayed such that the opportunity to integrate the design with the TDCS and the Study Plans while they are being developed will be lost.

o The stopped benefit is low because the necessary procedures are released and all the other pertinent documents will be approved before drilling begins.

QUALITY CONTROL/ASSURANCE: The adverse impact relative to data collection associated with ESC start of this new work is the potential that the quality of the data collected would be unsuitable for licensing. This risk is mitigated by the use of approved procedures and the Rockwell Evaluation of readiness that will be conducted after all draft documents have been completed and before drilling commences. The completion of a QA level 1 design will further reduce the risk that the data may be determined to be unsuitable for licensing.

o The stopped benefit is low because all the controlling procedures will be in place and therefore control of the work is assured.

o The restart benefit is medium rather than high because the TDCS and DRD will be based on draft Study Plans and therefore it is possible that the design may have to change in response to revisions of the plans.

o The restart risk is low because all the necessary documents will be reviewed before drilling begins.

LEGAL/LICENSEABILITY IMPLICATIONS: The stopped risk is high because continued schedule delays will result in the inability to provide adequate data to support the license application.

o The restart benefit is high because the geohydrologic data will be available sooner and the early availability of the data will permit earlier determination of site suitability.

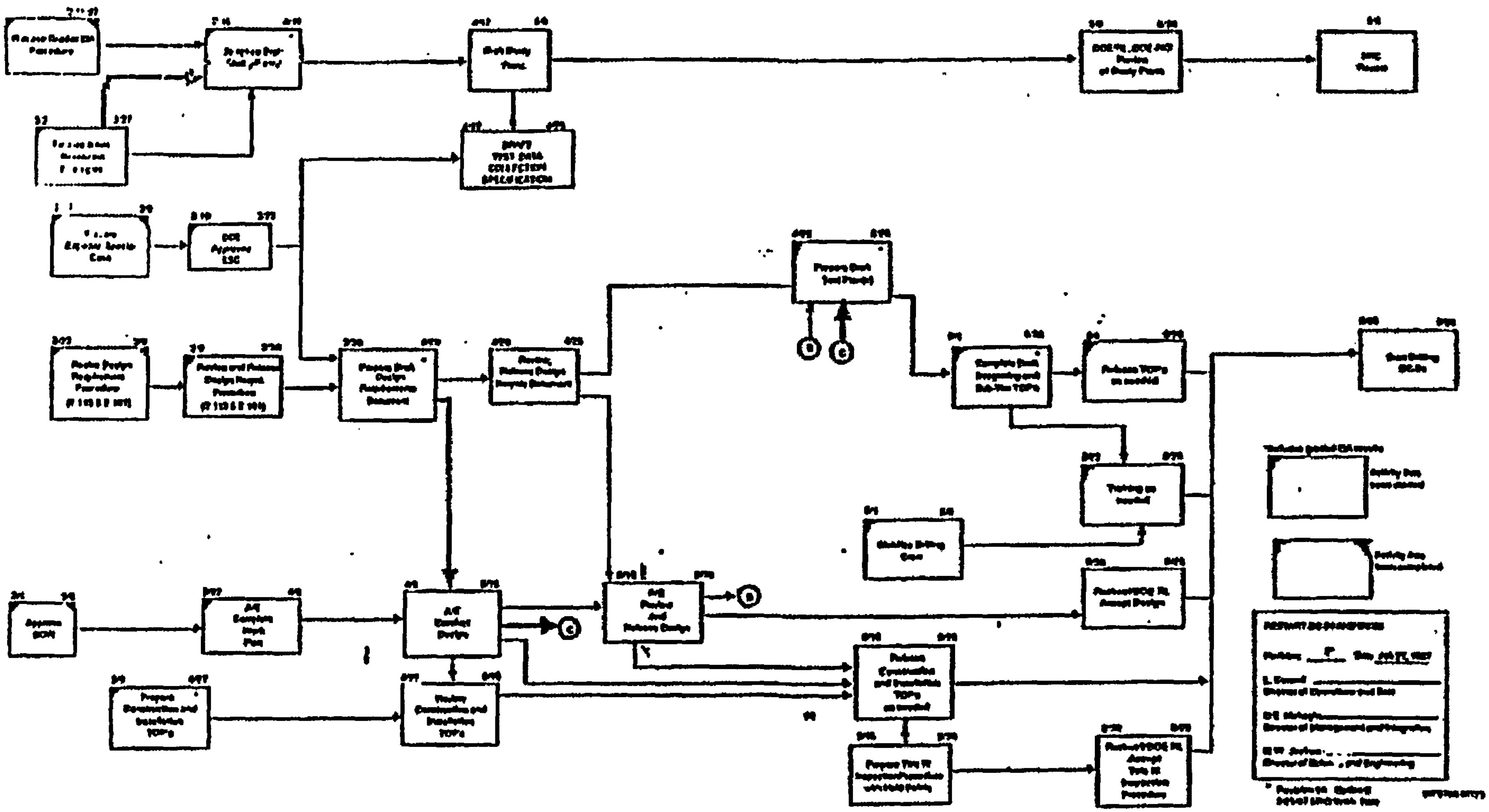
o The restart risk is low because all the necessary documents will be reviewed before drilling begins.

o The stopped benefit is low because all the quality controlling procedures will be in place before the design begins and all programmatic documents will be approved before drilling begins.

TRACEABILITY OF REQUIREMENTS: There is low risk that the facility will not fulfill its intended purpose because the licensing strategies will be completed prior to the review of the Study Plans and the Test Data Collection Specifications (Figure 1). The Design Requirements Document will be reviewed and approved by DOE-RL prior to the release of the borehole and test facility design. The Test Plans will be based on a QA level 1 design. All the effective documents will have been completed and reviewed prior to start of drilling.

o The restart risk is medium because the Study Plans and TDCS will not be released prior to release of the DRD. All the required documents will be completed and approved prior to start of drilling.

o The stopped benefit is medium because the licensing strategies will be completed prior to the review of the Study Plans and the Test Data Collection Specifications (Figure 1), and therefore there is low risk that the facility will not fulfill its intended purpose.



DEFINITIONS

DRAFT: Means the author is finished except for review comments

REVIEW: An independent examination by controlled process (such as PMPM 2 102, "Technical Document Review."

RELEASE: The act of custody transfer of a document to a company files (herein means complete Rockwell management sign-off of document)

APPROVAL: The documented act of endorsing or adding positive authorization (herein limited to Department of Energy Management).

ACCEPT: Means REVIEW and RELEASE of documents that were produced by organizations other than BWIP

Figure 1. Activities and hold points included in Expedited Special Case for DC-23, 24, 25, 32, and 33.

REQUEST FOR EXPEDITED SPECIAL CASE RESTART

BOREHOLES DC-23, 24, 25, 32 and 33 FACILITY DESIGN

ROCKWELL HANFORD OPERATIONS APPROVALS FOR
BOREHOLES DC-23, DC-24, DC-25, DC-32, AND DC-33
EXPEDITED SPECIAL CASE FOR DESIGN DOCUMENT PREREQUISITE PACKAGE

J. G. Patricio for 4-2-87

G. S. Hunt, Manager for
Site Characterization Program
Date

N/A 4/3/87

T. A. Curran, Manager
Site Department
Date

4/3/87

Restart Review Board
M. F. Nicol, J. F. Marron, D. J. Brown
Date

D E Mahagin 4-2-87

D. E. Mahagin, Director
Management and Integration
Date

R J Johnson 4-3-87

R. T. Johnson, Manager
BWIP Quality Assurance
Date

4/3/87

D. C. Gibbs, Director
Basalt Waste Isolation Project
Date

Table of Contents

REQUEST FOR EXPEDITED SPECIAL CASE RESTART

BOREHOLES DC-23, 24, 25, 32 and 33 FACILITY DESIGN

1.0 SCOPE OF WORK

1.1 PROPOSED WORK ACTIVITIES

The specific scope of work for consideration as an Expedited Special Case is as follows:

o Prepare, review and release the Test Data Collection Specifications for the study needs at boreholes DC-23, 24, 25, 32 and 33 based on the general study needs identified in the following draft Study Plans:

Stratigraphy Study Plan (SD-BWI-SP-035)
Intraflow Structures Study Plan (SD-BWI-SP-036)
Site Groundwater Study Plan (SD-BWI-SP-057).

The Option Paper for the "Geohydrologic Testing Program for the Hanford Site Before Construction of the Exploratory Shaft" will also be used for identifying general study needs.

o Prepare, review and release the Design Requirements Document for boreholes DC-23, 24, 25, 32 and 33 based on the draft Test Data Collection Specifications described above and the Option Paper for the "Geohydrologic Testing Program for the Hanford Site Before Construction of the Exploratory Shaft".

o Prepare and release borehole design specifications, drawings and supporting documentation by Westinghouse Hanford Company.

Preparation of a Test Data Collection Specification (TDCS) and preparation of a Design Requirements Document (DRD), and the ability to use these documents for the design of boreholes DC-23, 24, 25, 32 and 33, are the activities requiring Department of Energy - Richland (DOE-RL) approval for restart by Expedited Special Case (ESC) as shown in the logic chart for procedures and activities (Attachment 1). The TDCS uses study plans, currently in preparation, for an input source; likewise, the DRD uses the TDCS as a source of input.

As the controlled draft study plans progress towards approval the TDCS will be revised as necessary to agree with the study plans. Correspondingly the DRD will be revised to agree with the TDCS. The work concludes when the TDCS and the DRD are released. This work is necessary to provide the technical input for the design activity for boreholes DC-23, 24, 25, 32 and 33.

1.2 CONTRACTORS

Rockwell Hanford Operations (Rockwell) is responsible for preparation of the TDCS and the DRD under DOE-RL Contract Number DE-AC06-77RL01030.

Westinghouse Hanford Company is responsible to prepare the borehole facility design per direction in the statement of work for Facility Design of DC-23, 24CX, 25CX, 32CX and 33CX (Attachment 6) and in accordance with their approved Quality Assurance (QA) program and procedures.

1.3 DESIGN CONTROL SYSTEM REAPPRAISAL

Based on review of corrective actions taken and proposed to correct the discrepancies identified in the initial design control system appraisal, and preliminary indications from the design control system reappraisal currently in process, no substantive changes to the procedural controls for performing the borehole design are identified.

2.0 REFERENCES/DEFINITIONS

Several documents are required as direct references for the activities constituting the scope of work in Section 1.0. These references are the Site Groundwater Study Plan SD-BWI-SP-057, the Stratigraphy Study Plan SD-BWI-SP-035, and the Intraflow Structures Study Plan SD-BWI-SP-036. Other applicable references are identified below and in the list of prerequisite documents provided in Section 4.

REFERENCES

(1) Letter, R. T. Johnson to R. A. Johnson, "Request for Expedited Special Case Status Restart of Borehole DC-24CX, and Start of Boreholes DC-25CX, DC-26CX and DC27CX", 78100-JM-86-013, dated September 8, 1986.

(2) Letter, D. C. Gibbs to O. L. Olson, "Request for Approval to Restart Drilling Boreholes DC-24 and DC-25", R86-4400, dated September 13, 1986

(3) Letter, J. J. Keating to General Manager Rockwell Hanford Operations, "Expedited Special Case Boreholes DC-24 and DC-25", 86-GTB-57, dated October 24, 1986

(4) "Quality Evaluation Board Level Assignments Expedited Special Case for Restart of Boreholes DC-24 and DC-25", T. D. Ault, F. V. Roeck, K. M. Singleton and A. P. Wicklund, December 1986, SD-BWI-AR-031, Rev. 0, Draft 3.

(5) Option Paper - The Option Paper for the "Geohydrologic Testing Program for the Hanford Site Before Construction of the Exploratory Shaft" describes the data needs for boreholes DC-23, 24, 25, 32 and 33. This paper was issued as a memorandum by the Geohydrology Working Group and approved by S. H. Kale, Associate Director, Office of Geologic Repositories, on March 16, 1987.

(6) Project Directive: Expedited Special Case Restart, PD86-004, Rev. 2.

The following definitions are included to provide a singular meaning for the terms used in the context of this document.

DRAFT: Means the author is finished except for review comments.

REVIEW: An independent examination by a controlled process (such as PMPM 2-102, "Technical Document Review."

RELEASE: The act of custody transfer of a document to company files (herein means complete Rockwell management sign-off of document).

APPROVAL: The documented act of endorsing or adding positive authorization (herein limited to Department of Energy Management).

ACCEPT: Means REVIEW and RELEASE of documents that were produced by organizations other than Basalt Waste Isolation Project (BWIP).

3.0 BASIS FOR RESTART RECOMMENDATION

3.1 TECHNICAL SCOPE

The purpose and objectives of the pre-Exploratory Shaft hydrology program including the justification and need for the data from boreholes DC-23, 24, 25, 32 and 33 is described in the attached Option Paper.

3.2 INTEGRATION

The integration of the activities proposed for restart in this Expedited Special Case are shown in Attachment 1.

3.3 BASIS FOR EXPEDITING

Early restart of boreholes DC-23, 24, 25, 32 and 33 piezometer facilities is required to obtain the potentiometric baseline before drilling commences on the exploratory shaft due to perishability of the hydrologic baseline. Drilling and large-scale hydrologic testing and groundwater sampling will create disturbances that would preclude obtaining the undisturbed baseline required for site characterization.

The risks and benefits associated with early restart of the TDCS, DRD and design for this effort are discussed below.

SCHEDULE: The date of study plan approval by the DOE-RL is estimated to be August 10, 1987. Starting preparation of the TDCS using draft study plans allows the TDCS preparation to begin on March 30, 1987, a 19 week advantage in the schedule for this activity. This also allows the other activities dependent on preparation of the TDCS to proceed.

The BWIP Master Project Schedule (Revision 0, 2/12/87) shows the Restart milestone for start of drilling DC-24/25 on July 1,1987. This date was chosen without considering the new requirement for a QA level 1 design of the borehole and test facilities. The schedule assumed that the existing designs would be acceptable and that completion of the study plans was not required. Approval of the Study Plans is required in accordance with Quality level 1 requirements. An estimate of the schedule delay would probably be in excess of nine months.

COST: Remaining "stopped" is costing the Project a nonrecoverable $8,000 per month for the stand-by status of the rig now at DC-24. The Exploratory Shaft start of construction cost delays are approximately $2.5 million per week. The $2.5 million per week is based on the cost of one day's slip to the license application design.

Completing the work scope of this Request for ESC Status will reduce part of these stand-by and delay costs by shortening the schedule. The 19 week (approximately 5 months) schedule reduction could result in a $40,000 savings in DC-24 stand-by rig costs. Assuming that the 19 week schedule reduction applies directly to Exploratory Shaft schedule reduction the additional projected cost savings could be $50 million. However, the Exploratory Shaft has other prerequisites that may be more controlling than boreholes DC-23, 24, 25, 32 and 33 restart.

ENVIRONMENT: This ESC is for requirements definition and design only, hence, there is no impact related to the Project's ability to obtain an acceptable environmental baseline.

REPOSITORY NATURAL SYSTEMS: This ESC is for Test Data Collection Specification, Design Requirements Document and borehole facility design preparation only, hence, there is no impact related to impacts on the repository natural systems.

SAFETY: This ESC is for Test Data Collection Specification, Design Requirements Document and borehole facility design preparation only. Appropriate personnel safety requirements and design features will be included in the requirements documents and design documents as appropriate.

PUBLIC/POLITICAL PERCEPTION: The public and political perception cannot be quantified. The early restart of boreholes DC-23, 24, 25, 32 and 33 activities are expected to have strong favorable support from the technical community. It is also anticipated that strong negative opinions will arise from the early restart of this activity from those who have established a negative opinion regarding locating a repository at Hanford.

o The restart risk associated with the public and political perception of early restart of preparation of this effort is considered low because they contribute to the objective of carefully planning the evaluation of the characteristics of the site under consideration.

o The restart benefit is considered medium because those people with preconceived negative opinions may question the need for restart even though better quality data is being obtained at an earlier date which will allow an earlier and more accurate decision regarding the suitability of the site.

o The stopped benefit is considered low because obtaining better design sooner will allow more time to integrate the documents while meeting the long term schedule and objective for evaluating the site.

TECHNICAL CREDIBILITY: Boreholes DC-23, 24, 25, 32 and 33 and their test facilities will provide hydrogeologic information required to respond to the Site Ground Water Study Plan, Stratigraphy Study Plan and Intraflow Structures Study Plan. Therefore, program technical credibility resulting from preparing documents that will obtain a QA level 1 design of the boreholes and test facilities is increased.

o The restart benefit of this effort is medium because higher quality hydrogeologic data will be obtained, but accelerating the schedule does not materially increase credibility.

o The restart risk is low because all the prerequisite documents will be completed and reviewed before drilling begins. The only procedural departure would be that the completed and reviewed study plans and TDCS documents would probably not be approved.

o The stopped risk is medium because obtaining a QA level 1 design of the boreholes and test facilities will be delayed such that the opportunity to integrate the design with the TDCS and the Study Plans while they are being developed will be lost.

o The stopped benefit is low because the necessary procedures are released and all the other pertinent documents will be approved before drilling begins.

<u>QUALITY CONTROL/ASSURANCE:</u> The adverse impact relative to data collection associated with ESC start of this new work is the potential that the quality of the data collected would be unsuitable for licensing. This risk is mitigated by the use of approved procedures, and the Rockwell evaluation of readiness that will be conducted after all draft documents have been completed and before drilling commences. The completion of a QA level 1 design will further reduce the risk that the data may be determined to be unsuitable for licensing.

o The stopped benefit is low because all the controlling procedures will be in place and therefore control of the work is assured.

o The restart benefit is medium rather than high because the TDCS and DRD will be based on draft Study Plans and therefore it is possible that the design may have to change in response to revisions of the plans.

o The restart risk is low because all the necessary documents will be reviewed before drilling begins.

<u>LEGAL/LICENSEABILITY IMPLICATIONS:</u> The stopped risk is high because continued schedule delays will result in the inability to provide adequate data to support the license application.

o The restart benefit is high because the geohydrologic data will be available sooner and the early availability of the data will permit earlier determination of site suitability.

o The restart risk is low because all the necessary documents will be reviewed before drilling begins.

o The stopped benefit is low because all the quality controlling procedures will be in place before the design begins and all programmatic documents will be approved before drilling begins.

<u>TRACEABILITY OF REQUIREMENTS:</u> There is low risk that the facility will not fulfill its intended purpose because the licensing strategies will be completed prior to the review of the Study Plans and the Test Data Collection Specifications (Figure 1). The Design Requirements Document will be reviewed and approved by DOE-RL prior to the release of the borehole and test facility design. The Test Plans will be based on a QA level 1 design. All the effective documents will have been completed and

reviewed prior to start of drilling.

o The restart risk is medium because the Study Plans and TDCS will not be released prior to release of the DRD. All the required documents will be completed and approved prior to start of drilling.

o The stopped benefit is medium because the licensing strategies will be completed prior to the review of the Study Plans and the Test Data Collection Specifications (Figure 1), and therefore there is low risk that the facility will not fulfill its intended purpose.

3.4 RESTART REVIEW BOARD RECOMMENDATION

The Restart Review Board recommendation is contained in Attachment 9.

3.5 SUMMARY OF ISSUES

1. Rockwell can produce the test data collection specification for DC-23, 24, 25, 32 and 33.

2. Rockwell can produce documented design requirements that enable conduct of design by an Archetect Engineer (A/E) for the subject facilities.

3. Westinghouse Hanford Company can produce a Quality level 1 borehole facility design documentation package.

4. Preparation of the documents of issues 1, 2 and 3 from draft status precedent documents will not cause unacceptable quality or licensing risks from data.

5. This defined scope of activity will ultimately satisfy all Basalt Waste Isolation Project (BWIP) Quality Assurance program requirements.

3.6 RESOLUTION OF ISSUES

The activity logic contained herein (see Attachment 1) depicts the flow of tasks leading to the start of drilling. Certain tasks are in progress as permitted work required for general lift of the Stop Work (e.g., preparation of Study Plans and Procedures).

Trained Rockwell employees will be available and will be assigned to prepare the TDCS and DRD. Quality Assurance personnel will conduct a surveillance before the work is performed to verify that their qualifications to prepare the documents are properly documented.

Issue number 1 concerns the completion, review and release of the test data collection specification. Completion of the draft will be controlled by PMPM 3-106; review will be conducted per PMPM 2-102; and release will be controlled by PMPM 8-106.

Issue number 2, preparation, review and release of the design requirements document will be performed using PMPM's 2-113, 2-102, and 8-106. It is noted that PMPM 2-113 is presently not approved pending review and as such is a hold point. It is further noted that the Department of Energy-Richland Operations Office (DOE-RL) approval of the design requirements document is contingent on a Rockwell Director's request for that action and until the request is made, a hold point is imposed.

Issue number 3 is raised to obtain DOE-RL concurrence to release detailed design work to the A/E while under a stop work order.

Issue number 4 is raised in the interest of undertaking activities that adversely impact the project schedule. The risk attendant to producing subordinate documents from draft status precedent documents lies in the possibility of changing the precedent draft and thus losing the technical continuity of the document family. An ancillary risk is the potential for performance of unnecessary work in the preparation of the subordinate document.

The logic illustrated shows that while preparation is based on drafts, release of the documents is dependent on a hierarchial sequence where the precedent document release is done prior to a subordinate document. This illustration is supported by the procedural dictate in PMPM 2-102, "that the review process shall include specific validation of technical references." A series of hold points will be utilized to further ensure that this logic mechanism is instituted for this special case.

Under these premises, the risk is reduced to the potential for unnecessary document preparation work and the licensing and quality risk potential is logically eliminated.

The resolution of issue number 5 regarding Quality Assurance program requirements is partially assured by the recommendation of the Restart Review Board provided in Section 3.4. The Restart Review Board examines the restart package and recommends restart only if the Board determines that the QA requirements will be satisfied. The Board's recommendation is based upon the Prerequisites Documents listed in Section 4.0. This list presents the status of program control for the special case.

During review of the TDCS and DRD these documents will be examined to assure that they comply with the needs of the controlled draft Study Plans which are in review. Quality Assurance surveillances will be conducted prior to the beginning of the work and during the work to assure that procedures are followed.

Further resolution of issue number 5 is accomplished by the sequence of activities and the hold points identified in Section 3.7 and Attachment 1. The entire package of plans, designs, and procedures will undergo a Rockwell and DOE-RL evaluation of readiness prior to the start of drilling and testing. At this time, the integration of the documents will examined prior to their release by Rockwell and by DOE prior start of drilling.

3.7 IDENTIFICATION OF HOLD POINTS

The following hold points have been identified for these restart activities.

Hold #1 - Start TDCS Preparation

- o DOE-RL Approval of ESC
- o Author Training: PMPM 3-106

ROCKWELL AND DOE APPROVAL REQUIRED BEFORE PREPARING TDCS

BWIP DIRECTOR

DOE-RL

Hold #2 - Start Design Requirements Document Preparation

- o Approval of PMPM 2-113, Revision 2 by the Procedure Review Committee
- o Author Training: PMPM 2-113 with pre-approved Revision 2

ROCKWELL AND DOE APPROVAL REQUIRED BEFORE PREPARING DRD

BWIP DIRECTOR

DOE-RL

Hold #3 - Start Design Documents Preparation

- o Approved statement of work

- o Draft Completion of DRD
- o Draft Completion of Quality Evaluation Board report(s)

ROCKWELL AND DOE APPROVAL REQUIRED BEFORE TRANSMITTING DRD

BWIP DIRECTOR

DOE-RL

Hold #4 - Release of Design Documents

- o Approved DRD
- o Draft Completion of TDCS
- o Technical review and acceptance by Rockwell

ROCKWELL AND DOE APPROVAL REQUIRED BEFORE TRANSMITTING DRD

BWIP DIRECTOR

DOE-RL

3.8 APPLICATION OF QUALITY ASSURANCE GRADING

3.8.1 Quality Level of ESC Tasks

Quality level assignments have been made for boreholes and test facilities in DC-24 and DC-25 in the draft document titled "Quality Evaluation Board Level Assignments Expedited Special Case for Restart of Boreholes DC-24 and DC-25" (Reference 4). The supporting documents that are included in the scope of work of this request for ESC status are not assigned a QA level, but because they support the design of facilities that are assigned QA level 1 items, they will be prepared to QA level 1 standards. Criteria 5, 6, and 7 in the BWIP Quality Assurance Program Requirements Manual (RHO-QA-MA-3) require that project documentation be conducted to the QA level 1 standard which is compatible with the QA level assignments for DC-24 and DC-25. Boreholes DC-23, 32 and 33 are very similar in construction and purpose to DC-24 and 25; therefore, the QA level determinations are expected to be the same as in Reference 4. Reference 4 will be revised to include DC-23, 32 and 33 prior to the completion of the design and compliance with the correct QA levels will be assured during technical review of the TDCS, DRD and design documents.

The quality requirements for data collection, borehole design, and test facility design will be stipulated in the Test Data Collection Specifications, Design Requirements Document, and Test Plans.

3.8.2 Quality Level Assignment Method

The assignment of quality levels to items is conducted in accordance with PMPM 4-121, Revision 0. Performance of quality level assignment occurs as initiated by procedural dictates during certain document preparation tasks.

PMPM 4-121, Revision 0; Page 1; Section 2.0:
"This procedure is applied . . . and . . . the results are incorporated in the appropriate interface documents . . ."

PMPM 3-106, Revision 0; Page 3; Section 6.1.2.1:
When preparing a Test Data Collection Specification "the determination of quality level for component activities, shall be made per PMPM 4-121."

PMPM 2-113, Revision 0; Page 6; Section 6.3.8:
Requirements for preparation of design requirements documents state, "This section shall define the quality requirements for the . . . design. Sections on Quality Assurance classification of . . . elements . . . shall be included."

It is understood that quality grading is an activity implicit to document preparation where appropriate. For the purpose of this ESC, Quality Assurance grading is enabled by current release of the implementing procedures.

4.0 PREREQUISITE DOCUMENTS

The following tabulations summarize the governing documents and the procedures which control the scope of work defined for this Expedited Special Case Request. The BWIP Project Management Procedures Manual (PMPM) contains two classifications of procedures. Those designated PMPM are released by Rockwell and are subordinate to the Quality Assurance Administrative Procedures (QAAP). The QAAP's are released by Rockwell and approved by DOE-RL.

The prerequisite documents that are not in place at the time the work begins will be integrated with the completed work when the prerequisite documents are released.

Part I identifies the prerequisite PMPM's, QAAP's, plans and documents that implement the RHO-QA-MA-3 Criteria that apply to this case. Each of these documents is named in Part II or III.

Part II lists the PMPM's and QAAP's with their revision/release status. A description is provided of why and to what degree each procedure applies.

Part III lists the Project Documents that directly guide the work of this ESC request and shows their status.

Part I: Prerequisite List

RHO-QA-MA-3 Criterion	Prerequisites
1.0 Organization	Org. 1.1, QAAP 4-104, QAAP 4-115, QAAP 4-116, QAAP 4-120, QAAP 4-121, QAAP 6-101, 1-107, DOE-RL-87-01 (SEMP), DOE-RL-87-02 (PP), DOE-RL-87-03 (PMP), SD-BWI-PMP-006 (M&IP), SD-BWI-SP-035, SD-BWI-SP-036, SD-BWI-SP-057.
2.0 Quality Assurance Program	QAAP 1-114, QAAP 4-121, QAAP 7-119, QAAP 8-133, QAAP 13-106, QAAP 14-102, 13-107, 13-108, 13-109, 13-110, 13-111, 13-112, 13-113, 13-114, 13-116, 13-118, 13-119, 13-120, DOE-RL-86-01 (BOARD), Westinghouse QA Program, SD-BWI-AR-031
3.0 Design Control	QAAP 2-126, QAAP 3-102, QAAP 14-102, 2-102, 2-113, 3-106, 5-101, 11-106, SD-BWI-CM-001 (CMP), SD-BWI-AR-031
4.0 Procurement Document Control	- Does Not Apply -
5.0 Instructions, Procedures & Drawings	QAAP 1-114, 1-110, 1-101, 8-118, 8-127
6.0 Document Control	QAAP 7-119, QAAP 8-133, 5-101, 8-106, 8-121, 8-125, 8-127, 12-101, 2-102, 3-106, SD-BWI-AP-001 (RMP). SD-BWI-AP-009 (DCP)
7.0 Control of Purchased Items & Services	QAAP 4-103, QAAP 4-104, QAAP 6-101, 6-105

8.0 Identification & Control of Items	- Does Not Apply -
9.0 Control of Processes	- Does Not Apply -
10.1 Inspection	- Does Not Apply -
10.2 Surveillance	QAAP 4-103, QAAP 4-105, QAAP 4-122, QAAP 8-103, QAAP 4-111
10.3 Training . . . et al . . .	- Does Nc' Apply -
10.4 Training . . . et al . . .	- Does Not Apply -
11.1 Construction Test Control	- Does Not Apply -
11.2 Data Collection Test Control	QAAP 4-103, QAAP 4-104, QAAP 4-105, QAAP 4-122, QAAP 8-103, QAAP 7-119, QAAP 14-102, SD-BWI-AP-011 (TCP)
12.0 Control of Measuring & Test Eq.	- Does Not Apply -
13.0 Handling . . . and Shipping	- Does Not Apply -
14.0 Inspection, Test & Operating Status	- Does Not Apply -
15.0 Control of Nonconforming Items	QAAP 4-105, QAAP 14-102
16.0 Corrective Action	QAAP 1-111, QAAP 4-115, QAAP 4-122, QAAP 11-103
17.0 Quality Assurance Records	QAAP 8-103, 8-105
18.1 Audi.:	QAAP 4-104, QAAP 4-111, QAAP 4-122, QAAP 8-103
18.2 Training . . . Auditors	QAAP 4-104, QAAP 13-106

Part II

Procedures Prerequisites

QAAP (Quality Assurance Administrative Procedures)
TDCS (Test Data Collection Specification)
DRD (Design Requirement Document)
PMPM (Project Management Procedures Manual)
ESCR (Expedited Special Case Restart)
BWIP (Basalt Waste Isolation Project)
* Status Date 3/18/87

PMPM Revision* Release Date	QAAP (Q) or PMPM (P) Number	Title	Justification
0 : 3/4/87	Q Org 1.1	Rockwell Organization and Responsibilities	This procedure defines Rockwell BWIP's organization, authority, and responsibilities, and provides essential background for all other PMPMs. This procedure is released as Project Directive PD87-003 therefore low risk is incurred by its implementation. Directly Applicable
4 : 3/5/87	P 1-101	Preparation and Control of PMPs	This procedure enables the preparation, control and revision of Project Management Procedures. (i.e., 2-113 which is being revised for use with th ESC). This procedure is released therefore no risk is incurred by its implementation. Directly Applicable
1 : 2/11/87	P 1-107	Resource Management System	This procedure establishes the requirements for developing guidelines for resource management in BWIP activities. Resource management includes allocation of human resources to accomplish a given task. This procedure is released therefore no risk is incurred by its implementation. Directly Applicable
3 : 3/2/87	P 1-110	Project Directives	This procedure is required to control the release of Project Directives. Project Directives number 86-004 and 86-005 control the two step restart process of obtaining ESC status and preparing and ESCR package. Directly Applicable

1 : 3/5/87	Q 1-111	BWIP Action Tracking System	ESCR activities will be subject to surveillance and audit (PMPM 4-103; 4-104); therefore there must be a method of tracking corrective action (PMPM 4-122) to any deficiencies that are found. This procedure is released therefore no risk is incurred by its implementation. <u>Possibly Applicable</u>
1 : 2/12/87	Q 1-114	Project Management and Work Process Control	This procedure identifies the requirements and responsibilities for establishing the BWIP management and work process controls through the use of written approved plans, instructions, procedures, and drawings/specifications. The TDCS and DRD fall into the category of drawings/ specifications, and therefore they are subject to the requirements of this procedure. This procedure is released therefore no risk is incurred by its implementation. <u>Directly Applicable</u>
1 : 2/25/87	P 2-102	Technical Document Review	The preparation and release of a test data collection specification and a design requirements document (the scope of work of this ESC) includes a review and approval cycle thereby requiring the implementation of this procedure. The procedure is released therefore no risk is incurred by its implementation. <u>Directly Applicable</u>
1 : 2/13/87 Being Revised	P 2-113	Preparation and Control of Design Requirements Documents	A part of the scope of work of this ESC is preparation and release of a design requirements document (DRD). The DRD is required to provide input for the design of the borehole facility for DC-24 and DC-25, thereby requiring the implementation of this procedure. This procedure is being revised to apply to the resulting design effort and the revision will be approved by the PRC before the design requirements document is begun, therefore no risk is incurred by its implementation. This is hold point 2. <u>Directly Applicable</u>

) : 2/26/87	Q 2-126	Design Control	This QA Administrative Procedure specifies the Site Function (Section 6.1.1) which "identifies design requirements for boreholes . . . to support data collection." The procedure identifies organization functions and interfaces for design control. This procedure is released therefore no risk is incurred by its implementation. Directly Applicable
0 : 11/25/86	P 3-106	Test Data Collection Specifications	A part of the scope of work of the ESC is preparation and release of a test data collection specification (TDCS). The TDCS is required as an input to the DRD, thereby requiring implementation of this procedure. The procedure is released therefore no risk is incurred by its implementation. Directly Applicable
0 : 7/28/86	Q 4-103	Surveillance Activities	Preparation of Test Data Collection Specifications (TDCS) and Design Requirements Document (DRD) affect quality and therefore are subject to surveillance. PMPM 4-103 controls and implements a comprehensive system of internal and external surveillances of restart activities. This procedure is released therefore no risk is incurred by its implementation. Directly Applicable
1 : 1/28/87	Q 4-104	Quality Assurance Audits	Preparation of TDCS and DRD affect quality and therefore are subject to periodic audits to assure compliance with established requirements. This procedure is released therefore no risk is incurred by its implementation. Directly Applicable
1 : 3/5/87	Q 4-111	Trend Analysis	This procedure describes a method of analyzing trends adverse to quality. It will be applied to results of Quality Assurance surveillances and audits to determine the root causes to quality problems. This procedure is released therefore no risk is incurred by its implementation. Possibly Applicable

: 1/28/87	O 4-115	Stop Work Order	This procedure provides the mechanism to process Stop Work Orders. Stop work orders may be applied to restart activities if this work is found to be in direct violation of Rockwell policies or BWIP procedures. This procedure is released therefore no risk is incurred by its implementation. <u>Possibly Applicable</u>
) : 3/18/87	Q 4-116	Resolution of Disputes with Quality Assurance	This procedure provides a mechanism to resolve disputes over the interpretation or implementation of quality requirements as a result of audits, surveillances, or document reviews. This procedure is released therefore no risk is incurred by its implementation. <u>Possibly Applicable</u>
) : 10/24/86	P ‘-120	Quality Concerns Program	This procedure provides a means for individuals to report concerns that they, for personal reasons, do not wish to report through established procedural channels such as Corrective Action Reports or Unusual Occurrence Reports. This procedure is released therefore no risk is incurred by its implementation. <u>Possibly Applicable</u>
0 : 2/25/87	Q 4-121	Graded Quality Assurance	The "Project Directive for Expedited Special Cases Restart," PD86-004, Revision 2, requires in Section 5.3 "Quality Level Determination" that "a determination of the quality level and possible Q-List inclusion of the ESC shall be made in accordance with procedure 04-121 <u>Graded Quality Assurance</u>." This procedure is released therefore no risk is incurred by its implementation. <u>Directly Applicable</u>
0 : 3/9/87	Q 4-122	Corrective Action Report	This procedure provides a means to correct conditions adverse to quality, should any be identified during ESCR activities. This procedure is released therefore no risk is incurred by its implementation. <u>Possibly Applicable</u>

: 3/13/87	P 5-101	Change Proposal Processing	The results and the resulting effects of the work of this ESC could dictate the need for a change to the Project Description Base. This procedure is released therefore no risk is incurred by its implementation. Possibly Applicable
: 1/5/87	Q 6-101	Major Participant Interface Control	This QA Administrative Procedure defines "technical information" and its transfer between Major Participants. The use of the documents of this ESC, if by Major Participants, would be controlled by this QAAP. This procedure is released therefore no risk is incurred by its implementation. Possibly Applicable
: 2/05/87	P 6-105	Direction of Technical Work	This procedure gives implementing means for use of the ESC documents. This function may be superseded by the administrative alternative provided in PMPM 6-101. This procedure is released therefore no risk is incurred by its implementation. Possibly Applicable
) : 1/05/87	Q 7-119	Data Collection Test Control	This QA Administrative Procedure guides test control document preparations and refers extensively to precedent documents of the type provided by this ESC. This "point-of-use" for the ESC products requires related document correspondence and requires formal control of deficiencies (such as Document Change Request or Interim Problem Reports) which could impact on the completion of the ESC products. This procedure is released therefore no risk is incurred by its implementation. Indirectly Applicable

leased as Project rective PD87-003, :v. 0 '23/87	Q 8-103	BWIP Records Management System	The TDCS and DRD, as BWIP documents, will be handled and controlled through the BWIP Record Management System. PMPM 8-103 establishes responsibilities and requirements for operation of the Record Management System. The risk of not having this prerequisite as a procedure is low because the procedure has been issued as a Project Directive, and therefore will be implemented. <u>Directly Applicable</u>
: 3/9/87	P 8-105	Recording Data for Quality Assurance Records and Recording Corrections	This procedure defines requirements and responsibilities for recording information to provide objective evidence that an activity was performed in accordance with approved procedures. For ESCR activities such information includes surveillance reports, audits, review comment records, and the TDCS and DRD themselves. This procedure is released therefore no risk is incurred by its implementation. <u>Directly Applicable</u>
: 1/02/87	P 8-106	Control of Supporting Documents	The test data collection specification and the design requirements document preparation procedures require implementation of this procedure. This procedure is released therefore no risk is incurred by its implementation. <u>Directly Applicable</u>
: 8/11/86	P 8-118	Use of the Metric System	This procedure provides specific instruction for the numeric content of the ESC products. This procedure is released therefore no risk is incurred by its implementation. <u>Directly Applicable</u>

2 : 3/2/87	P 8-121	Document Receipt Control	This procedure controls the receipt of documents by BWIP Document Control from internal or external sources. Receipt control verifies completeness of documents and assigns document numbering, if applicable. The TDCS and DRD will be transmitted to BWIP Document Control. This procedure is released therefore no risk is incurred by its implementation. Directly Applicable
0 : 9/18/86	P 8-125	Document Distribution and Update Control	This procedure governs distribution and revision of controlled documents pertaining to ESCR activities (e.g., Project Management Procedures Manual, Project Directives). This procedure is released therefore no risk is incurred by its implementation. Indirectly Applicable
0 : 12/19/86	P 8-127	BWIP Document Control Transmittal Numbering System	This procedure provides instruction for transmittal numbering of ESC products. This edure is released therefore no risk is rred by its implementation. tly Applicable
0 : 1/9/87	Q 8-133	Document Control	oducts (documents) of this ESC are subject ocedural control. This procedure is released efore no risk is incurred by its ementation. rectly Applicable
1 : 3/5/87	Q 11-103	Unusual Occurrence Reporting System	During ESCR activities, events that could have a significant detrimental programmatic, safety, health, or environmental impact will be reported per PMPM 11-103. This procedure is released therefore no risk is incurred by its implementation. Possibly Applicable

0 : 3/5/[illegible]	P 11-106	Review of Documents for Safety Concerns	Procedure provides means to assess safety requirements for ESC products. This procedure is released therefore no risk is incurred by its implementation. Directly Applicable
0 : 7/18/86	P 12-101	Clearance of BWIP Documentation for External Distribution to Program Participants	ESC generated documents are subject to the requirements of this procedure prior to program distribution. This procedure is released; therefore, no risk is incurred by its implementation. Indirectly Applicable
0 : 9/16/86	P 13-106	Administration of Qualification and Training	This QA Administrative Procedure provides a means for establishing training requirements and will be used when training needs for the ESC are considered. This procedure is released therefore no risk is incurred by its implementation. Directly Applicable
0 : 9/13/86	P 13-107	Request for Training	This procedure enables initiation of the training needed for conduct of ESC activities. This procedure is released therefore no risk is incurred by its implementation. Directly Applicable
0 : 9/23/86	P 13-108	Qualification of Instructional Staff	This procedure implements the general training program for the ESC work. This procedure is released therefore no risk is incurred by its implementation. Indirectly Applicable
Released as Project Directive PD87-005, Rev. 0 3/11/87	P 13-109	Job/Task Analysis	This procedure implements the general training program for the ESC work. This procedure is released therefore no risk is incurred by its implementation. Indirectly Applicable

0 : 9/16/86	P 13-110	Training Materials Development	This procedure implements the general training program for the ESC work. This procedure is released therefore no risk is incurred by its implementation. <u>Indirectly Applicable</u>
0 : 9/13/86	P 13-111	Instructional Assessment Program	This procedure implements the general training program for the ESC work. This procedure is released therefore no risk is incurred by its implementation. <u>Indirectly Applicable</u>
1 : 1/27/87	P 13-112	Conduct of Training	This procedure directs training conduct. This procedure is released therefore no risk is incurred by its implementation. <u>Directly Applicable</u>
0 : 9/10/86	P 13-113	On-the-job Training	This procedure directs training conduct. This procedure is released therefore no risk is incurred by its implementation. <u>Directly Applicable</u>
0 : 9/18/86	P 13-114	Writing Learning Objectives	This procedure implements the general training program for the ESC work. This procedure is released therefore no risk is incurred by its implementation <u>Indirectly Applicable</u>
1 : 2/10/87	P 13-116	Qualification of Training Documentation and Records	This procedure controls the record keeping for the training done for ESC tasks. This procedure is released therefore no risk is incurred by its implementation. <u>Directly Applicable</u>
0 : 9/10/86	P 13-118	Academic and Administrative Review Boards	This procedure implements the general training program for the ESC work. This procedure is released therefore no risk is incurred by its implementation. <u>Indirectly Applicable</u>

: 1/28/87	P 13-119	Trainee Performance Evaluation	This procedure implements the general training program for the ESC work. This procedure is released therefore no risk is incurred by its implementation. <u>Indirectly Applicable</u>
: 9/16/86	P 13-120	Training Program Evaluation	This procedure implements the general training program for the ESC work. This procedure is released therefore no risk is incurred by its implementation. <u>Indirectly Applicable</u>
nreleased	Q 14-102	Software Change Control	The results of this ESC may possibly dictate the need for software changes. This procedure was submitted to DOE-RL for approval on April 3, 1987. The risk of not having this prerequisite is low because the approval copy will be used while waiting DOE-RL approval. <u>Possibly Applicable</u>

Part III: Project Document Prerequisites

SD-BWI-SP-035 - INCOMPLETE - The Stratigraphy Study Plan establishes the need for stratigraphic data to be obtained from the boreholes and is the basis for preparing the TDCS. This plan is now in preparation. This in process draft and the Option Paper will be used to prepare the TDCS. The risk of using the draft plan is low because the TDCS will have technical review, at which time it will be made compatible with the approved study plan.

SD-BWI-SP-036 - INCOMPLETE - The Intraflow Structures Study Plan establishes the need for intraflow structural data to be obtained from the boreholes and is the basis for preparing the TDCS.This plan is now in preparation. This plan is now in preparation. This in process draft and the Option Paper will be used to prepare the TDCS. The risk of using the draft plan is low because the TDCS will have technical review, at which time it will be made compatible with the approved study plan.

SD-BWI-SP-057 - INCOMPLETE - The Site Groundwater Study Plan establishes the need for groundwater data to be obtained from the boreholes and is the basis for preparing the TDCS. This plan is now in preparation. This plan is now in preparation. This in process draft and the Option Paper will be used to prepare the TDCS. The risk of using the draft plan is low because the TDCS will have technical review, at which time it will be made compatible with the approved study plan.

OPTION PAPER - COMPLETE - The Option Paper for the "Geohydrologic Testing Program for the Hanford Site Before Construction of the Exploratory Shaft" describes the data needs for boreholes DC-23, 24, 25, 32 and 33. This paper was issued as a memorandum by the Geohydrology Working Group and approved by S. H. Kale, Associate Director, Office of Geologic Repositories, on March 16, 1987. The risk of using this paper is low because this paper has been approved and will be reviewed by the Nuclear Regulatory Commission before the design is completed.

SD-BWI-AR-031 - INCOMPLETE - The "Quality Evaluation Board Level Assignments Expedited Special Case for Restart of Boreholes DC-24 and DC-25" set the QA levels for the items and activities for the boreholes and test facilities. This document is under going technical review and does not include boreholes DC-23, 32 and 33. The purpose and construction boreholes DC-23, 32 and 33 are very similar to those of DC-24 and 25; therefore, the QA levels are expected to be the same. The existing draft document will be used to start preparation of the DRD at Hold Point 3. This document will be revised to include the additional boreholes before the design is released (See Hold Point 4). The risk of not having this prerequisite is medium because it directly affects ESC scope of work.

DOE-RL-87-01 - COMPLETE - The Systems Engineering Management Plan (SEMP) establishes the BWIP technical program engineering approaches and methods, and the integration thereof. The SEMP was approved by DOE and was released on March 18, 1987. There is no risk because the SEMP has DOE approval.

DOE-RL-87-02 - INCOMPLETE - The Project Plan and Charter (PP) describes the key elements of the project and establishes the project baseline against which overall progress and management effectiveness are measured. The PP was submitted to DOE for review on August 28, 1986. The risk of not having this prerequisite is low because it does not directly affect ESC scope of work. The review copy of the prerequisite will be used while waiting DOE approval.

DOE-RL-87-03 - INCOMPLETE - The Project Management Plan (PMP) provides the guidance and direction for management of all programmatic work performed in the project. The PMP was resubmitted to DOE for review on November 24, 1986.
The risk of not having this prerequisite is low because it does not directly affect ESC scope of work. The review copy of the prerequisite will be used while waiting DOE approval.

SD-BWI-AP-001 - INCOMPLETE - The Records Management Plan (RMP) describes the processing of all documents for retention into the projects formal record via the Basalt Records Management Center (BRMC). The RMP is subordinate to the Documentation Management Plan (DOE-RL-86-09-02). The RMP was resubmitted for approval to DOE on December 23, 1986. The risk of not having this prerequisite is medium because it directly affects ESC scope of work. The review copy of the prerequisite will be used while waiting DOE approval.

SD-BWI-AP-009 - INCOMPLETE - The Document Control Plan (DCP) describes the series of administrative activities necessary to process and control a document during its active life. The DCP is a subordinate document to the Documentation Management Plan. Revision 1 of the DCP was resubmitted to DOE on December 23, 1986. The risk of not having this prerequisite is medium because it directly affects ESC scope of work. The review copy of the prerequisite will be used while waiting DOE approval.

SD-BWI-AP-011 - COMPLETE - The Test Control Plan (TCP) is an annex to the Management and Integration Plan (M&IP). The TCP provides for a controlled system for development of test plans. Test Plans use output from the TDCS for DC-24 and DC-25. The TCP was released on March 6, 1987. There is no risk associated with this prerequisite because it is released.

SD-BWI-CM-001 - INCOMPLETE - The BWIP Configuration Management Plan (CMP) is an annex to the M&IP and in this capacity provides a system for identification, definition, control, and change control of technical requirements such as the Design Requirements Document, and the Test Data Collection Specification. The CMP was submitted to DOE for approval on December 8, 1986. The risk of not having this prerequisite medium because it directly affects ESC scope of work. The review copy of the prerequisite will be used while waiting DOE approval.

SD-BWI-PMP-006 - INCOMPLETE - The Management and Integration Plan (M&IP) is a project-level document that, with its annexes, expands on guidance provided in the BWIP-PMP and SEMP. The M&IP assists in determining which annex or other plans to consult for specific management details. The M&IP was submitted to DOE for approval on December 10, 1986. The risk of not having this prerequisite medium because it directly affects ESC scope of work. The review copy of the prerequisite will be used while waiting DOE approval.

DOE-RL-86-01 - COMPLETE - The Basalt Quality Assurance Requirements Document (BQARD) applies QA requirements to items on the Q-List and Level 1 items, some items of DC-23, 24, 25, 32 and 33 may be assigned a Level 1 classification. Also, all documents are processed according to QA Level 1 requirements. Revision 2 of the BQARD was released on February 19, 1987. There is no risk associated with this prerequisite because it has been released.

Westinghouse Quality Assurance Program - COMPLETE - This program will control the design of the boreholes and the facilities. Westinghouse Hanford Company is not under a stop work order and this program is approved; therefore, there is no risk associated with using it for this design.

5.0 SCHEDULE AND COST IMPACTS

Preparation and release of the Test Data Collection Specification for DC-24 and DC-25 is part of the work breakdown structure (WBS) activity 1L3D1A0Q03 for TDCS for LHS Test Plans, L3424 (Attachment 3). Preparation and release of the Design Requirements Document for DC-24 is WBS No. 1L3D2A0D02 which is included in DC-24CX piezometer installation, L1053 (Attachment 4). Preparation and release of the Design Requirements Document for DC-25 is WBS No. 1L3D2A0D03 which is included in DC-25CX piezometer installation, L1054 (Attachment 5). The Cost Account Plans (CAP) for the above activities define the following items:

- o Scope of work,
- o Allocation of funds,
- o Spending schedule and
- o Milestones.

Boreholes DC-23, 32 and 33 will be added to the accounts for DC-24 and DC-25.

Attachment 1 shows the overall task logic network for the efforts required prior to the start of drilling for DC-24. Within the overall network, the darkly shaded area identifies the scope of this package (preparation of documents for design support).

Attachment 2 reflects the identical logic network but the purpose of the figure is to establish activity durations and target dates.

The hold points identified within this package are reflected on Attachment 1, and their descriptions and closure statements are found in Sectio: 3.7.

The cost of conducti ig the proposed work is estimated as follows:

I. Employee hourly basis: $25 + 33% + 19.4% = $41/hour
= $1640/employee per week

II. Time Basis

TDCS Draft:	6 weeks x 3 employees	= 18
Review:		= 12
Release:		= 2
	(employee weeks)	32
Design Requirements Draft:	7 weeks x 2 employees	= 14
Review:		= 10
Release:		= 2
	(employee weeks)	26

III. Cost Estimate

TDCS	= (1640) (32)	= $ 52,480
Design Requirements	= (1640) (26)	= $ 42,640
Estimated Total Cost:		$ 95,120

IV. A/E Design = $ 481,000

6.0 RECORDS AND CONFIGURATION MANAGEMENT

The following attachments are included in this ESC request for restart.

1. Activities and hold points included in Expedited special Case for DC-23, 24, 25, 32 and 33.

2. Logic and schedule for obtaining DA level 1 design for boreholes and test facilities.

3. Cost account plan for TDCS for Large Hydrau..ıc Stress (LHS) test plan.

4. Cost account plan for DC-24CX piezometer installation.

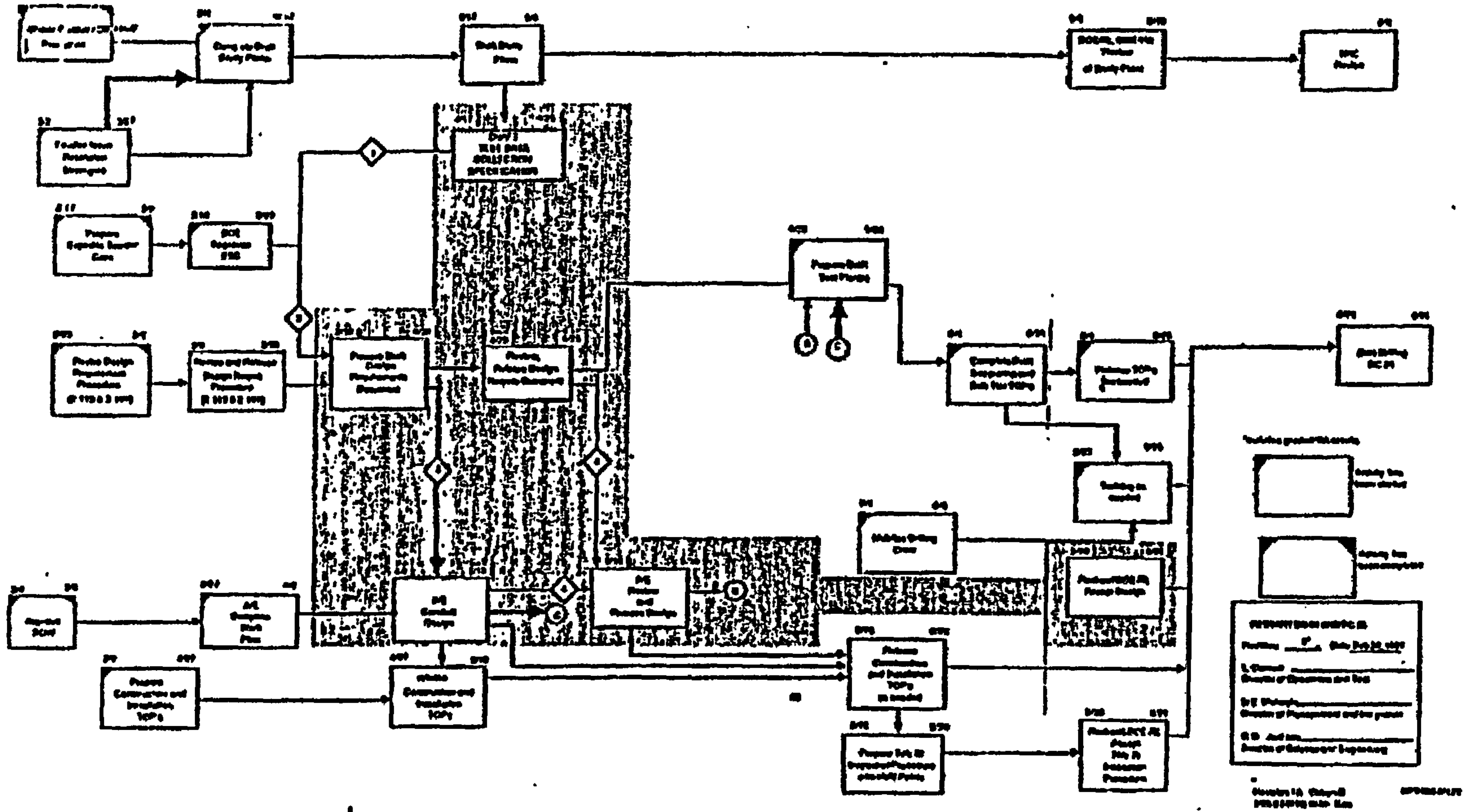
5. Cost account plan for DC-25CX piezometer installation.

6. Statement of work for facility design of boreholes DC-23, 24, 25, 32 and 33.

7. Option Paper for the "Geohydrologic Testing Program for the Hanford Site Before Construction of the Exploratory Shaft".

8. Request for ESC status for boreholes DC-23, 24, 25, 32 and 33.

9. Recommendation foe ESC restart for boreholes DC-23, 24, 25, 32 and 33.



Attachment 1. Activities and hold points included in Expedited Special Case for DC 23, 24, 25, 32 and 33

DEFINITIONS

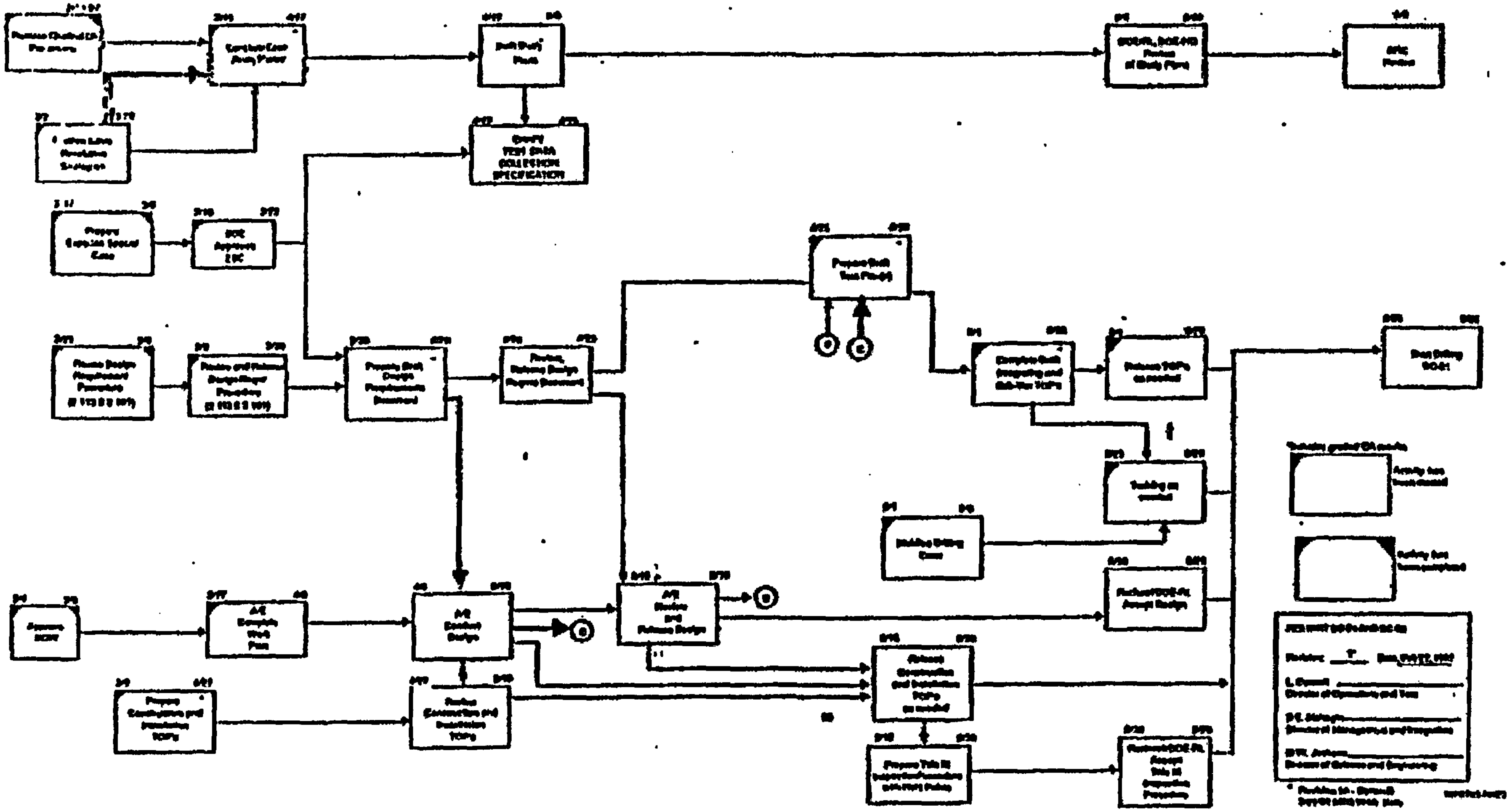
DRAFT Means the [illegible] is [illegible] except for [illegible] comments

REVIEW A [illegible] examination by controlled process (such as [illegible] 2 102 "Technical Document Review")

RELEASE The act of custody transfer of a document to a company files (herein [illegible] complete Rockwell management sign off documents)

APPROVAL The documented act of endorsing or adding positive authorization (herein limited to Department of Energy Management)

ACCEPT Means REVIEW and RELEASE of documents that were produced by organizations other than BWIP



DEFINITIONS

DRAFT. Means the outline is finished except for review comments.

REVIEW: An independent examination by controlled process (such as PMPM 2-102, "Technical Document Review."

RELEASE: The act of custody transfer of a document to a company files (herein means complete Rockwell management sign off of document)

APPROVAL: The documented act of endorsing or adding positive authorization (herein limited to Department of Energy Management).

ACCEPT: Means REVIEW and RELEASE of documents that were produced by organizations other than BWIP

Attachment 2. Activities and hold points included in Expedited Special Case for DC-23, 24, 25, 32, and 33.

SK Overhead		0.0	0.0	0.0	0.0	0.3	0.4	0.3	0.4	0.1	0.1	0.2	0.0	1.7
tal BCWS	Hrs	0	0	0	0	29	37	29	36	15	13	18	0	177
	$	0.0	0.0	0.0	0.0	1.1	1.4	1.1	1.4	0.6	0.5	0.7	0.0	6.8

****

ing P1L3D1A0Q03 L3424 TCDS FOR LHS TEST PLAN
rming Org: 77421 PHYSICAL HYDROLOGY
thod:
ved By: Date: / /

Scope Of Work:
DETERMINE AND WRITE TCDS FOR LHS TEST PLAN
NOT FULLY FUNDED DUE TO BUDGET REDUCTION
(NEW * EXEMPT)

Revision No:
Date: 12/15/86
Cin Num:

lones: Narrative BCWS

0 04/30/87 PERFORM LHS PRE TEST ANALYSIS TO ESTABLISH TEST DESIGN REQUIREMENTS
MILESTONE #1 ON CAA

0 05/30/87 PREPARE TEST DATA COLLECTION SPECIFICATION DOCUMENT FOR RRL-2 LHS TEST MILESTONE #2 ON CAA

Elements:

al Year: 1987		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
EMPT	Hrs	0	0	0	0	143	186	146	178	145	127	0	0	925
	$	0.0	0.0	0.0	0.0	3.9	5.1	4.0	5.0	4.0	3.5	0.0	0.0	25.7
O OVERHEAD		0.0	0.0	0.0	0.0	1.4	1.8	1.4	1.7	1.4	1.2	0.0	0.0	9.0
tal BCWS	Hrs	0	0	0	0	143	186	146	178	145	127	0	0	925
	$	0.0	0.0	0.0	0.0	5.3	6.9	5.5	6.7	5.5	4.8	0.0	0.0	34.7

TASK		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
EMPT	Hrs	0	0	0	0	143	186	146	178	145	127	0	0	925
	$	0.0	0.0	0.0	0.0	3.9	5.1	4.0	5.0	4.0	3.5	0.0	0.0	25.7
SK Overhead		0.0	0.0	0.0	0.0	1.4	1.8	1.4	1.7	1.4	1.2	0.0	0.0	9.0
tal BCWS	Hrs	0	0	0	0	143	186	146	178	145	127	0	0	925
	$	0.0	0.0	0.0	0.0	5.3	6.9	5.5	6.7	5.5	4.8	0.0	0.0	34.7

****

1L3D1A0Q04 L3288 ADMINISTER CONTRACTS
rming Org: 77421 PHYSICAL HYDROLOGY
ethod: 4 LEVEL OF EFFORT METHOD
ved By: Date: / /

Scope Of Work:
ADMINISTER SUBCONTRACTS FOR HYDRAULIC PROPERTIES
SW#386185-386188,386192 1L3D010K02-06 E4

Revision No:
Date: 12/05/86
Cin Num:

Elements:

al Year: 1987		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
EMPT	Hrs	26	34	24	28	29	37	29	36	29	25	35	0	332
	$	0.7	0.8	0.7	0.8	0.8	1.0	0.8	1.0	0.8	0.7	1.0	0.0	9.2

Attachment 3

Cost Account Plan for TDCS for LHS Test Plan

ng P1L3D2A0D02 L1053 DC-24CX PIEZOMETER INSTALL
ming Org: 71320 HYDROLOGIC TESTING
:thod: 5 MODIFIED MILESTONE METHOD
ed By: Date: / /

Scope Of Work:
INSTALL AND DEVELOP PIEZOMETERS IN BOREHOLE DC-24CX IN PREPARATION FOR HYDRAULIC HEAD MONITORING - 1L3D020W02 - STOPPED

Revision No:
Date: 11/25/88
Cia Num:

ones:	Narrative	BCWS
	0 08/30/87 COMPLETE PIEZOMETER INSTALLATION AT DC-24CX	
	0 09/30/87 ISSUE REPORT ON DC-24 PIEZOMETERS	

:lements: il Year: 1987		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
(-EXEMPT	Hrs	0	0	0	0	82	106	84	102	83	72	101	92	722
	$	0.0	0.0	0.0	0.0	1.4	1.8	1.4	1.8	1.4	1.2	1.7	1.8	12.4
:MPT	Hrs	0	0	0	0	69	89	68	85	70	61	84	77	603
	$	0.0	0.0	0.0	0.0	1.7	2.2	1.7	2.1	1.8	1.5	2.1	2.0	15.2
) OVERHEAD		0.0	0.0	0.0	0.0	1.1	1.4	1.1	1.4	1.1	1.0	1.4	1.2	9.7
tal BCWS	Hrs	0	0	0	0	151	195	152	187	153	133	185	169	1325
	$	0.0	0.0	0.0	0.0	4.2	5.5	4.3	5.3	4.3	3.8	5.2	4.8	37.3

TASK		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
N-EXEMPT	Hrs	0	0	0	0	82	106	84	102	83	72	101	92	722
	$	0.0	0.0	0.0	0.0	1.4	1.8	1.4	1.8	1.4	1.2	1.7	1.8	12.4
.EMPT	Hrs	0	0	0	0	69	89	68	85	70	61	84	77	603
	$	0.0	0.0	0.0	0.0	1.7	2.2	1.7	2.1	1.8	1.5	2.1	2.0	15.2
.SK Overhead		0.0	0.0	0.0	0.0	1.1	1.4	1.1	1.4	1.1	1.0	1.4	1.2	9.7
tal BCWS	Hrs	0	0	0	0	151	195	152	187	153	133	185	169	1325
	$	0.0	0.0	0.0	0.0	4.2	5.5	4.3	5.3	4.3	3.8	5.2	4.8	37.3

Attachment 4
Cost Account Plan for DC-24CX Piezometer Installation

ng P1L3D2A0D03 L1054 DC-25CX PIEZOMETER INSTALL ning Org: 71320 HYDROLOGIC TESTING thod: 5 MODIFIED MILESTONE METHOD ed By: Date: / /	Scope Of Work: INSTALL AND DEVELOP PIEZOMETERS IN BOREHOLE DC-25CX IN PREPARATION FOR HYDRAULIC HEAD MONITORING - 1L3D020W02 - STOPPED	Revision No: Date: 11/25/88 Cim Num:

ones:	Narrative	BCWS
O 07/31/87	COMPLETE PIEZOMETER INSTALLATION AT DC-25CX	
O 09/30/87	ISSUE REPORT ON DC-25 PIEZOMETERS	

lements:

l Year: 1987		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
l-EXEMPT	Hrs	0	0	0	0	82	106	84	102	83	72	101	92	722
	$	0.0	0.0	0.0	0.0	1.4	1.8	1.4	1.8	1.4	1.2	1.7	1.6	12.4
MPT	Hrs	0	0	0	0	41	53	42	50	42	36	50	46	360
	$	0.0	0.0	0.0	0.0	1.0	1.3	1.1	1.3	1.1	0.9	1.3	1.2	9.1
OVERHEAD		0.0	0.0	0.0	0.0	0.9	1.1	0.9	1.1	0.9	0.8	1.1	1.0	7.5
al BCWS	Hrs	0	0	0	0	123	159	126	152	125	108	151	138	1082
	$	0.0	0.0	0.0	0.0	3.3	4.3	3.4	4.1	3.4	2.9	4.1	3.7	29.0

l TASK		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
ON-EXEMPT	Hrs	0	0	0	0	82	106	84	102	83	72	101	92	722
	$	0.0	0.0	0.0	0.0	1.4	1.8	1.4	1.8	1.4	1.2	1.7	1.6	12.4
XEMPT	Hrs	0	0	0	0	41	53	42	50	42	36	50	46	360
	$	0.0	0.0	0.0	0.0	1.0	1.3	1.1	1.3	1.1	0.9	1.3	1.2	9.1
ASK Overhead		0.0	0.0	0.0	0.0	0.9	1.1	0.9	1.1	0.9	0.8	1.1	1.0	7.5
otal BCWS	Hrs	0	0	0	0	123	159	126	152	125	108	151	138	1082
	$	0.0	0.0	0.0	0.0	3.3	4.3	3.4	4.1	3.4	2.9	4.1	3.7	29.0

Attachment 5

Cost Account Plan for DC-25CX Piezometer Installation

STATEMENT OF WORK FOR THE BASALT WASTE ISOLATION PROJECT

PREPARED BY

ROCKWELL HANFORD OPERATIONS

FOR THE

DEPARTMENT OF ENERGY
RICHLAND OPERATIONS OFFICE
RICHLAND, WASHINGTON

FACILITY DESIGN
DC-23GR, DC-24CX AND DC-25CX
DC-32CX AND DC-33CX

COST ACCOUNT L:

FY 1987 Expense
FY 1987 Capital
TOTAL

PREPARED BY: S. R.
Shafik H. Rifaey

ROCKWELL APPROVAL

T. A. Curran, Site Department — Date 3/13/87

G. T. Harper, Engineering and Design Department — Date 3/12/87

R. T. Johnson, Quality Assurance — Date 3/17/87

L.C. HUBBARD ~~J. R. Kirkendall~~, Program Business Management — Date 3/17/87

L. Connell, Operations and Test — Date 3/13/87

G. S. Hunt, Site Program — Date 3-12-87

N/A
Department of Energy-Richland Operations Office — Date

STATEMENT OF WORK

FACILITY DESIGN
DC-23GR, DC-24CX, DC-25CX, DC-32CX, AND DC-33CX

TABLE OF CONTENTS

STATEMENT OF WORK

FACILITY DESIGN
DC-23GR, DC-24CX, DC-25CX, DC-32CX, AND DC-33CX

1.0 INTRODUCTION

1.1 OBJECTIVE

The objective of this Statement of Work for Westinghouse Hanford Company (WHC) is to conduct, verify, and issue a design for piezometer facilities DC-23GR, DC-24CX, DC-25CX, DC-32CX, and DC-33CX to prepare inspection procedures, and to review and approve construction and installation test procedures.

1.2 BACKGROUND

Rockwell Hanford Operations (Rockwell) is investigating the feasibility of using a thick, layered sequence of the Columbia River Basalts underlying the Hanford Site in south-central Washington as a host medium for high-level radioactive waste disposal. The project is being sponsored by the Department of Energy (DOE) in conjunction with the Office of Civilian Radioactive Waste Management as mandated by the Nuclear Waste Policy Act of 1982. Rockwell serves as the prime contractor to the DOE in operating the Basalt Waste Isolation Project (BWIP).

As part of the site characterization effort, BWIP is planning on drilling and completing CX-Series boreholes with multi-level piezometers. CX-Series piezometers are permanent stand pipe installations in the flow tops of the Rosalia, Sentinel Gap, Ginkgo, Rockee Coulee, Cohassett, Birkett, and Umtanum flows. The plan includes piezometer design and field work associated with drilling, borehole geophysical logging, borehole preparation, piezometer installation, and piezometer development for DC-23GR, DC-24CX, DC-25CX, DC-32CX and DC-33CX piezometer nests.

The CX-Series multi-level piezometer nests are intended to (a) provide a pre-exploratory shaft baseline for hydraulic head in the Controlled Area Study Zone for initial boundary conditions, (b) provide several multi-level piezometer sites required to establish the hydraulic head baseline monitoring network in the Cold Creek syncline, (c) determine horizontal hydraulic gradients across the Controlled Area Study Zone, and (d) determine vertical head gradients across the Controlled Area Study Zone.

Installation of multi-level piezometers at locations DC-23GR, DC-24CX, DC-25CX, DC-32CX, and DC-33 CX are needed for pre-exploratory shaft groundwater level baseline data and to establish observation points for large-scale hydrologic stress tests. These data will be used for preparation of conceptual and numerical models of the Controlled Area Study Zone.

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2.0 WORK SCOPE

Four distinct work packages are grouped within the engineering and design services needed for the piezometer facilities:

1. Conduct of design and verification of design constitute the basic design effort. The design scope includes (a) the borehole with casing and cementing items, and (b) the piezometer components, configurations, and grout mix specifications.

2. Determining the installation inspection needs (Title III) and preparing inspection procedures is required. Coordination with inspections planned for test basis purposes is necessary. As-built drawings shall be provided.

3. Reviewing and accepting the construction and installation procedures prepared by the Rockwell Operations and Test organization. This activity ensures operations conformance with design intentions and assumptions. A technical work plan will be submitted to Rockwell for review and approval before starting work.

4. Engineering support during construction.

Begin work using the information sources specified in Section 4.0 of this Statement of Work. However, design deliverables shall not be finalized until review for compliance with the Design Requirements Document for Facilities DC-23GR, DC-24CX, DC-25CX, DC-32CX, and DC-33CX.

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3.0 SCHEDULE

The following milestones are identified within the general program schedule for installation activity preparations:

o Delivery of Design Requirements Document from Rockwell	April 25, 1987
o Design Completion	May 17, 1987
o Design Verification and Release	May 30, 1987
o Title III Procedures Complete	May 30, 1987
o Construction and Installation Procedures Submitted	June 8, 1987
o Construction Procedures Accepted	June 26, 1987

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4.0 INFORMATION SOURCES

The fundamental design input source will be the formal design requirements document. This document contains a comprehensive listing of functional requirements, performance criteria and constraints, codes and standards as well as quality and general site requirements and is to be prepared by Rockwell.

Sources of design information and background are the specification and the completion documents for existing similar installations:

- o Drilling and Completion Specifications for Boreholes RRL-2B (Test Weld), and RRL-2C (Multi-Level Piezometer Nest); SD-BWI-TC-023, Revision 0
- o Design, Drilling, and Construction of Well RRL-2B and Piezometer Nest RRL-2C; SD-BWI-TI-329, Revision 0
- o Piezometer Completion Report for Borehole Cluster Sites DC-19, DC-20, and DC-22; SD-BWI-TI-226, Revision 1

The source for quality level assignments that pertain to the work scope is:

- o Quality Evaluation Board Level Assignments, Expedited Special Case for Restart of Boreholes DC-23GR (only for the portion of the facility that remains to be completed), DC-24CX, DC-25CX, DC-32CX, and DC-33CX; SD-BWI-AR-031, (Draft)

Copies of each above information source are appended to this Statement of Work. These source listings may not be complete and additional source information may be included. Additional information sources include:

- o Accident Prevention Standards, Volumes 1 and 2; RHO-MA-221
- o Basalt Quality Assurance Requirements Document; DOE/RL-1, Rev. 2

The listed sources and any additions when combined with this Statement of Work form the complete work direction package. Additional source information will be provided by revision to this Statement of Work.

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5.0 SERVICES REQUIRED

The required engineering disciplines shall perform calculations, evaluations, and other activities to support the design. Design and drafting shall produce the necessary drawings. Technical staff shall prepare the procedures, reviews, specifications, and reports needed for final expression of the design and records.

Standard design of a sub-assembly or component shall be produced for use with the facility-specific designs named in this Statement of Work. Standard designs shall be prepared for but not limited to:

- Piezometer Standard Design
- Riser String Standard Design
- Piezometer Centralizer Standard Design
- Piezometer Isolation Seals

The design services outlined are for the installation of a facility that will be used for conduct of characterization testing. The scope of these services is limited to facility design and does not include activity that could be construed as test design. Acceptance testing of the facility will be conducted to determine the suitability of the facility for the testing to be undertaken. Since the acceptance testing data becomes a part of the test package database, acceptance testing will be a part of the test design effort done by Rockwell.

Construction and installation procedures are prepared by Rockwell Operations and Test in parallel to the conduct of the design. Since these procedures must complement the design, an interface between the design organization and the operations organization must function for exchange of information.

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6.0 PROJECT CONTROL REQUIREMENTS

6.1 PROJECT MANAGEMENT REPORTING

6.1.1 Cost Account Plan

The Cost Account Plan form or the equivalent will be used for cost account detailed planning. The plan delineates cost account work packages, milestones, schedules, and budgets. It is then used as a statusing document throughout the fiscal year. Cost Account Plans shall be generated and submitted to Rockwell for review.

6.1.2 Monthly Reports

Westinghouse Hanford Company shall furnish to the Basalt Business Management Office, the Rockwell technical contact, and the end function manager a monthly report for the work described in this Statement of Work. Rockwell will be responsible for the distribution of the official record copy to the Basalt Records Management Center.

The report shall contain a narrative description of work progress during the reporting period and how the progress relates to the end objective and a Quality Assurance (QA) section describing WHC QA Program audit/surveillance and all programmatic actions. Major problems encountered and action taken shall be discussed. The milestones included in the Statement of Work shall be listed in the monthly report and a status provided for each milestone. Planned work for the next two reporting periods shall be discussed including QA program. If capital equipment is to be utilized, the progress, problems, and action planned or taken, milestone status, and planned work shall be discussed.

The monthly report shall include a cost performance report at the cost account level based on the Cost Account Plan which will identify current period and fiscal year-to-date budget (budgeted cost of work scheduled), actual costs (actual cost of work performed), and earned value (budgeted cost of work performed) for the work contained in this Statement of Work. Cost and schedule variances shall be calculated. Variances (favorable or unfavorable) exceeding plus or minue 100% or $50,000 for the current period and 30% or $200,000 fiscal year-to-date shall have a variance analysis explanation. The analysis shall identify causes, work around plans/corrective action, and impacts to the scope, schedule, and cost objectives of the Statement of Work. Each month an estimate

STATEMENT OF WORK

FACILITY DESIGN
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at completion shall be provided. The estimate at completion is to be based on actual costs to date plus the estimate to complete the work scope. An analysis of the estimate at completion shall be prepared as it relates to the budget at completion and shall discuss any changes in the estimate at completion since the last report.

Formal transmittal of the monthly report to Rockwell shall be on or before the 10th work day after the close of the DOE-RL accounting month.

6.1.3 Cost Estimates

Cost estimates and allocation for the completion of the tasks in this Statement of Work are to be defined by WHC in the Cost Account Plan.

6.2 BASELINE/CHANGE CONTROL

The Design Requirements Document for Facilities DC-23GR, DC-24CX, DC-25CX. DC-32CX, and DC-33CX (supporting document number to be determined) is the technical baseline for the related design activities. The cost and schedule baseline is the Cost Account Plan.

If a deficiency or discrepancy is found in the Design Requirements Document Rockwell shall be notified immediately. This notification may be by documented telephone conversation which must be followed up by written notification to BWIP Director of Science and Engineering. Rockwell will evaluate the project impacts based on the submitted information.

Should changes to the technical and cost baselines be required they shall be process through the WHC change control system prior to submittal to Rockwell.

6.3 MEETINGS

Meetings shall be held in areas requiring only "WA" badges for access. Minutes of meetings shall be kept by WHC and distributed within three work days after the meeting date.

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6.3.1 Kickoff Meeting

A kickoff meeting shall be held prior to start of design to review the scope of work, clarify any questions on the technical and project control requirements, and establish interfaces for information exchange.

6.3.2 Design Progress Meetings

Design progress meetings will be held on a monthly basis after the kickoff meeting, during which the monthly narrative report will be discussed.

6.4 CONTROLS

Design activities which address items shall be controlled, as a minimum, in a manner commensurate with the assigned QA level of the item (Table 1).

Westinghouse Hanford Company shall satisfy the following requirements from the Basalt Quality Assurance Requirements Document (BQARD).

6.4.1 Organization

Westinghouse Hanford Company shall document the organizational structure, functional responsibilities, and lines of communication for the performance of this instruction.

6.4.2 Quality Assurance Program

The QA plan and the implementing procedures shall be in compliance with BQARD. Westinghouse Hanford Company shall use the Rockwell approved WHC QA Program (HEDL-MG-197) for implementing the work performed under this Statement of Work. Westinghouse Hanford Company QA planned actions audit/surveillances shall be submitted for approval monthly.

6.4.3 Design Control

- Appropriate quality standards shall be specified and shown on design documents
- Materials and equipment shall be suitable for their function

STATEMENT OF WORK

FACILITY DESIGN
DC-23GR, DC-24CX, DC-25CX, DC-32CX, AND DC-33CX

TABLE 1

ITEMS IDENTIFIED AND
QUALITY ASSURANCE LEVEL ASSIGNMENT

ITEM	QA LEVEL
Site Evaluation and Preparation (BHL-001)	
Site Excavation	3
Survey Borehole Coordinates	1
Drilling (BHL-002)	
Mobilization/Demobilization	2
Cable Tool Drilling	2
Set Conductor Pipe	2
Rotary Drilling	1
Spot Cementation	2
Set Casing/Cement	2
Fluid Circulation Monitoring	3
Drill Cuttings	1
Workover Rig	2
Set Pump - Clean Hole	3
Piezometer (BHL-003)	
Set Cement Plug (Top and Bottom)	1
Assemble, Measure, and Place Piezometer (Includes Welding Centralizers)	1
Tubing Test (Joint and Composite Test)	1
Filter Pack Placement	1
Develop Piezometer	1
Install and Monitor Transducer	1
Materials	3
Geologic/Geophysical Logging (BHL-004)	
Open and Cased Hole Logs	1
Developmental Logs	3
Borehole Geologic Logs	3

STATEMENT OF WORK

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- o Design interfaces (e.g., between disciplines) shall be identified and controlled
- o All drawings and specifications shall be reviewed and approved by WHC prior to release to Rockwell
- o Verification of design adequacy as compared with (1) design criteria and database, (2) "as fabricated" conditions, and (3) final "as-built" conditions by qualified personnel is required
- o Examination for material compatibility shall be performed
- o Documentation of reviews, verification, and examination shall be established, maintained, and transmitted to Rockwell upon completion of work.

6.4.4 Instructions, Procedures, and Drawings

Special requirements involving fabrication, procurement, inspection, installation, and testing shall appear in drawings and specifications.

6.4.5 Document Control

Drawings and specifications shall be controlled, i.e., preparation, review, approval, and issuance of documents must be done in a prescribed manner. Design inputs shall be documented, controlled, and retrievable.

Design products (e.g., drawings, specifications, procedures) transmitted for Rockwell acceptance shall be "Revision 0". Number revisions shall be used in response to change orders. Design product numbers shall be coordinated with BWIP no later than four weeks after contract award.

All deliverables shall be submitted to Basalt Document Control using a properly completed "Participating Contractor Document Transmittal" form (Figure 1). Information copies of Cost Account Plans, monthly reports, and cost performance reports shall also be submitted to Basalt Business Management. The following transmittal numbering system specific to this Statement of Work shall be used:

- o The prefix "WHCBWIP" followed by "-A-" and sequential numbers beginning with "00001" provides the unique transmittal number for each document. For example, the first transmittal will be: WHCBWIP-

A-00001. In the event a document that has been submitted required resubmittal (e.g., comments resulting from Integrating Contractor review) the same transmittal number that was originally used shall again be used but with the addition of letters beginning with the letter "A." For example, the first resubmittal of WHCBWIP-A-00001 would be transmitted using the number WHCBWIP-A-00001A, the number for the second resubmittal would be WHCBWIP-A-00001B, etc.

When received, a copy of the document transmittal form shall be returned to the Participating Contractor as a receipt acknowledgement. If the transmittal package is rejected by Basalt Document Control, the package will either be returned with instructions for correction or retained and a request for a resubmittal submitted to the Participating Contractor.

The Participating Contractor shall submit only one document type per transmittal (e.g., raw data shall not be transmitted with monthly reports). Documents shall be transmitted at a frequency consistent with the established milestones and reporting deliverables. All official written correspondence from the Participating Contractor shall be submitted to Basalt Document Control.

6.4.6 Quality Assurance Records

Records supporting the design process shall be maintained and transmitted to Rockwell for retention upon completion of work. Original records of the following are required for work done under this instruction:

- o Drawings
- o Specifications
- o Design Verification
- o Personnel Qualifications
- o Calculations
- o Technical correspondence used for design
- o Meeting Minutes as required by this instruction.
- o Surveillances

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- o Audits
- o Quality Assurance Program Plans
- o Monthly Reports
- o Corrective Actions
- o Nonconformance Reports
- o Software Verification

Records shall have identification uniquely traceable to this instruction. All records shall be acceptable for incorporation in the Basalt Records Management Center and shall meet project microfilming requirements.

6.4.7 Inspections and Audits

Basalt Waste Isolation Project QA, technical, and management representatives shall have right of access to conduct evaluations and perform audits and surveillance of activities required by this Statement of Work agreement.

Rockwell BWIP shall notify WHC in advance of the need to perform audits or surveillance. In order to assure the availability of key personnel without distrupting ongoing work, this notification will be at least one week for audits and 48 hours for surveillance. To the extent possible, Rockwell BWIP's audit or surveillance of WHC work shall be coordinated and scheduled to coincide with WHC QA's audit or surveillance activities.

6.4.8 Nonconformances

Nonconformances affecting activities dispositioned "repair" or "rework" shall be submitted to Rockwell prior to implementation of the disposition for review and approval.

6.4.9 Corrective Actions

Westinghouse Hanford Company shall be responsive to deficiencies identified by Rockwell during surveillance, audit, inspection, or evaluation of WHC's quality program. Rockwell reserves the right to exercise controls over

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FACILITY DESIGN
DC-23GR, DC-24CX, DC-25CX, DC-32CX, AND DC-33CX

further design activities conducted in the performance of this instruction. This control may be effected by a stop work order to WHC.

6.4.10 Design Review

A review shall be conducted at the 30% complete stage, i.e., when a final design approach has been developed, drafted in a preliminary form, and specifications have been completed in draft form. The review shall include the Rockwell cognizant engineer, Rockwell QA, and WHC personnel.

Another review, prior to release of drawings and specifications, shall be conducted at the 90% complete stage, i.e., when the design documents are complete although verification may not be complete. This review shall also include the Rockwell cognizant engineer, Rockwell QA, and WHC personnel.

Copies of the documents to be reviewed shall be transmitted by WHC to Rockwell one week prior to the design reviews. Westinghouse Hanford Company shall provide meeting agendas, and keep and distribute meeting minutes incorporating all comments and action items.

6.4.11 Safety Review

Westinghouse Hanford Company shall review the design to verify conformance with Hanford Accident Prevention Standards. Special instructions/requirements shall be included on the construction drawings and specifications.

STATEMENT OF WORK

FACILITY DESIGN
DC-23GR, DC-24CX, DC-25CX, DC-32CX, AND DC-33CX

7.0 DELIVERABLES

The following lists constitute the package expected from this work.

- o Drawings
  - General arrangement(s) for each facility (includes arrangement of borehole and of completed piezometer facility)
  - Piezometer standard design
  - Riser string standard design
  - Piezometer centralizer design
  - Typical isolation seal
- o Specifications
  - Borehole drilling/construction specification
  - Piezometer installation specification
  - Welding specification (centralizers)
  - Materials specifications
- o Procedures
  - Title III inspection requirements as needed to support design and construction
  - Construction and installation procedure approval and acceptance.
- o Technical Work Plan
  - Including, but not limited to: schedule, qualification of personnel, organization, interfaces with Rockwell
- o Quality Assurance Records
  - Audits
  - Surveillances
  - Quality Assurance Program Plans
  - Design Verification
  - Quality Assurance Personnel Qualifications
  - Monthly Reports
  - Corrective Actions
  - Nonconformance Reports
  - Software Verification

BASALT WASTE ISOLATION PROJECT
PARTICIPATING CONTRACTOR DOCUMENT TRANSMITTAL

TRANSMITTAL NUMBER ______

SHEET ___ OF ___

TO: ROCKWELL BWIP DOCUMENT CONTROL
ADDRESS: P.O. BOX 800, RICHLAND, WA. 99352
SUBJECT: ______
FROM: ______
ADDRESS: ______

THE FOLLOWING DOCUMENTS ARE SUBMITTED FOR:

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DOCUMENT NUMBER	REV	TITLE	ROCKWELL BWIP DOCUMENT NUMBER	REV	R-BWIP ACTION

ROCKWELL - BASALT WASTE ISOLATION PROJECT

R-BWIP ACTION LEGEND: A AN I NA R P

TO BE REVIEWED: ___ YES ___ NO
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BDC DATA ENTRY COMPLETE. DATE: ______
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COGNIZANT ENGINEER: ______
SIGNATURE: ______
DATE: ______
COMMENTS: ______

COMMENTS: ______

BDC RECEIPT ACKNOWLEDGEMENT: ______ DATE: ______

Figure 1

OPTION PAPER

GEOHYDROLOGIC TESTING PROGRAM FOR THE HANFORD SITE BEFORE CONSTRUCTION OF THE FIRST EXPLORATORY SHAFT

EXECUTIVE SUMMARY

<u>Purpose</u>: To define the geohydrologic testing program to be conducted at the Hanford site before construction of the first exploratory shaft (ES).

<u>Objectives of testing program</u>: The principal objectives of the pre-ES geohydrologic testing program are as follows:

- To collect data on geohydrologic conditions that will be changed by site characterization activities.
- To collect data having the potential for providing an early indication of the presence of disqualifying conditions.
- To collect data on geohydrologic conditions in order to identify the effects of the ESF on the geohydrologic system and on subsequent geohydrologic tests.
- To collect data on geohydrologic conditions that may affect the design of the ESF or the repository.

<u>Types of tests that are needed</u>: Four types of tests are needed before shaft construction:

- Baseline hydraulic-head monitoring.
- Large-scale hydraulic stress (LHS) tests.
- Hydrochemical sampling in conjunction with LHS tests.
- Tracer tests in conjunction with LHS tests.

<u>Options evaluated</u>: Five options for the pre-ES geohydrology testing program were evaluated. As shown below, each has a different degree of risk of not attaining the objectives of the pre-ES testing program:

	Option	Risk
a.	Baseline hydraulic-head only	Very high
b.	Baseline hydraulic-head and LHS testing of one flow top (Rocky Coulee) with hydrochemical sampling and tracer tests	High
c.	Baseline hydraulic-head and LHS testing of one flow top (Birkett) with hydrochemical sampling and tracer tests	High
d.	Baseline hydraulic-head and LHS testing in multiple horizons at the RRL-2 location with hydrochemical sampling and tracer tests	Low

e. Baseline hydraulic-head and LHS testing in multiple horizons at multiple locations with hydrochemical sampling and tracer tests — Very low

Recommendation: Option d, consisting of baseline hydraulic-head monitoring, LHS tests, hydrochemical sampling and tracer tests at the RRL-2 location in multiple horizons (Rocky Coulee, Cohassett, and Birkett flow tops and the Cohassett vesicular zone).

Principal strengths of recommended option: The principle strengths of the recommended option can be summarized as follows:

- Provides predisturbance hydraulic-head baseline;
- Documents geohydrologic conditions at the RRL-2 site before changes by ES construction;
- Has potential to indicate the presence of disqualifying conditions;
- Provides engineering design data for ESF before the start of construction;
- Provides hydraulic-stress data base to identify the effects of the ESF on the geohydrologic system and later geohydrologic tests.

Proposed pre-ES testing program: The principal activities of the pre-ES testing program include:

- Drill and install multilevel piezometers in DC-24 and DC-25 and allow system equilibration;
- Drill and install multilevel piezometers in DC-32 and DC-33 and allow system equilibration;
- Modify existing monitoring wells DC 4/5, RRL-2A, RRL-6, RRL-14, RRL-17, DC-16, and McGee;
- Use well RRL-2B to perform LHS tests, hydrochemical sampling, and tracer tests in the Rocky Coulee, Cohassett, and Birkett flows.

Expected schedule impact: The proposed pre-ES geohydrologic testing program will require approximately 22 months from the start of drilling.

DOE F 1325.8
(12-84)

United States Government | Department of

memorandum

DATE: 3/11/87

REPLY TO ATTN OF: RW-23.3

SUBJECT: *Geohydrologic Testing Program for the Hanford Site Before* Construction of the First Exploratory Shaft

TO: Stephen Kale, Associate Director
Office of Geologic Repositories

FROM: Geohydrology Working Group
Allan Jelacic (Chairman), DOE/HQ
Glen Faulkner, DOE/USGS
David Dahlem, DOE/RL
Michael Thompson, DOE/RL
David Siefken, Weston
John Robertson, Weston
Sam Panno, Weston
Phil Rogers, RHO
Peter Clifton, RHO

A. ISSUE

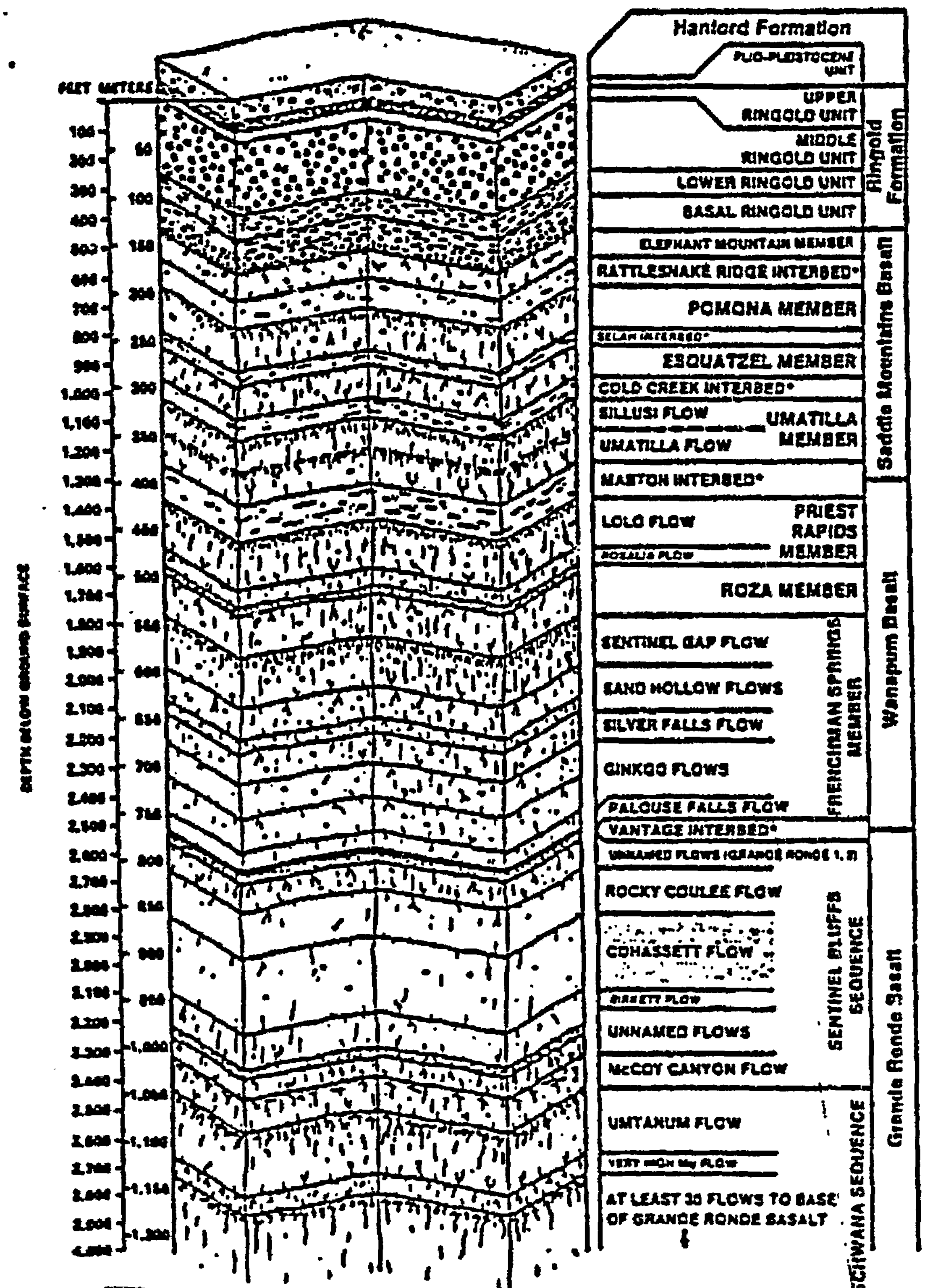
The construction and operation of an exploratory shaft facility (ESF) at the Hanford site will significantly alter the existing geohydrologic system. These changes could compromise the results of some key geohydrologic tests if performed after ESF construction starts. Given this circumstance, a problem exists to define a pre-ES geohydrologic testing program which provides necessary data before the disruptive events caused by the ESF and provides reliable information for resolving licensing issues.

B. BACKGROUND

1. Current Understanding of the Geohydrology at Hanford Site

The candidate site for a geologic repository at Hanford is in the Cold Creek valley, a topographic and structural basin that slopes southeastward and opens toward the Columbia River. The Hanford site is underlain by at least 50 basalt flows with a cumulative thickness greater than 3,000 m (Exhibit I). The candidate repository horizon (dense interior of the Cohassett flow) lies between 807 and 1,100 m below ground surface in the Grande Ronde Basalt. Basalt flows generally consist of an upper vesicular and/or brecciated flow top overlying a dense, jointed interior. Flow tops typically account for about 15-percent of the total flow thickness.

The main ground-water occurrence and horizontal movement in the basalt formations is within the flow tops and the sedimentary interbeds that separate some flows. Vertical ground-water movement between flow tops is constrained by the basalt flow interiors, which appear to act as aquitards. Current geohydrologic understanding allows more than one conceptual flow model. One model being considered has hydraulic boundaries coincident with the anticlines



CANDIDATE REPOSITORY HORIZON

*INTERBEDS ARE STRATIGRAPHICALLY CONTAINED IN THE ELLENSBURG FORMATION

Stratigraphy of the Columbia River Basalt Group from within the Grande Ronde to the surface, and sediments within the RRL.

that bound the Cold Creek syncline. The model has both horizontal and vertical components of flow, with a horizontal pattern of flow that tends to reflect the shape of the Cold Creek syncline. Although not controlled by the structural dip, the direction of horizontal flow tends to be similar to the direction of dip of the basalt, with flow paths that trend southwest beneath the candidate repository and may turn southeastward in the vicinity of the synclinal axis (see the conceptualized potentiometric map in Exhibit III). Some upward movement of ground water through fractures in the Grande Ronde Basalt is thought to occur at least up through the lower part of the overlying Wanapum Basalt. Above the Wanapum, vertical flow is thought to be mostly downward through the Saddle Mountains Basalt into the upper part of the Wanapum. In addition to available hydraulic-head data, hydrochemical data support the concept of vertical ground-water movement.

Horizontal hydraulic conductivities in flow tops and interbeds have been estimated from more than 200 single-hole, small-scale hydraulic stress tests in some 35 boreholes across the Hanford site. About 40 of these tests are from flow tops in the Grande Ronde Basalt. The radius of influence of each of these tests is probably small and representative of very local conditions around the borehole.

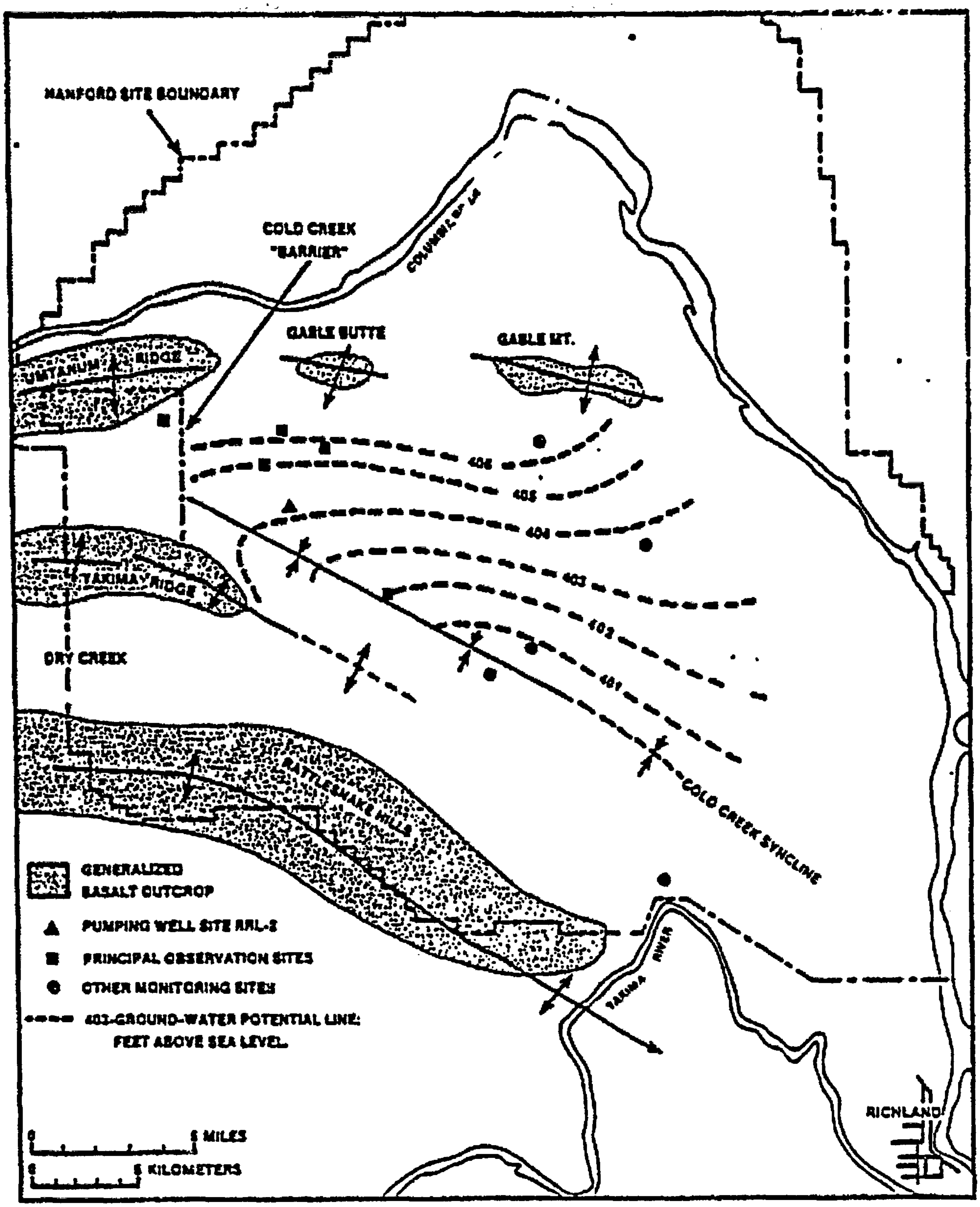
Measured flow top conductivities have ranged over 10 orders of magnitude. A more well-defined hydraulic conductivity field is necessary for improved confidence in calculations of radionuclide transport and ground-water travel time.

For the dense flow interiors, horizontal hydraulic conductivities estimated from field tests have a range of 6 orders of magnitude, the highest value being about 7 orders of magnitude lower than the highest value estimated for the flow tops. No measurements of vertical hydraulic conductivity in the dense interiors have been made, and thus a low level of confidence exists over what constitutes a representative range for purposes of calculating flux, travel time across flow interiors, and inflow to the ESF and repository. The ratio of vertical to horizontal hydraulic conductivity for flow interiors is unknown but is currently estimated to be approximately 3 to 1.

Two small-scale tracer tests have been conducted in the McCoy Canyon flow top of the Grande Ronde Basalt. From these tests, longitudinal dispersivity values have been calculated and effective-thickness estimates have been made. Dispersivity and effective thickness are important variables in calculating ground-water travel time and radionuclide transport. However, because of the limited data base, a large uncertainty is associated with what constitutes representative ranges of values for these variables.

A more detailed discussion of current knowledge about the geohydrology at Hanford, including numerical ranges of hydraulic parameters, is given in Appendix A.

EXHIBIT II



CONCEPTUALIZED POTENTIOMETRIC SURFACE NEAR TOP OF GRANDE RONDE BASALT, COLD CREEK SYNCLINE, FALL 1986 WATER LEVELS

2. Concerns Raised by the Nuclear Regulatory Commission

The geohydrologic testing program at Hanford has been the subject of criticism by various organizations outside the Department. The concerns expressed by the staff of the Nuclear Regulatory Commission (NRC) typify many of the criticisms. In December 1985, DOE/RL held a workshop to inform the NRC staff about plans for the first large-scale hydraulic stress (LHS) tests; summary meeting minutes and a subsequent letter (Appendix B) document the staff's concerns. Some of the concerns that have affected the pre-ES testing program are briefly summarized below.

Limitations of current monitoring facilities need to be assessed; if necessary, facilities should be upgraded. Numerical modeling of the monitoring network's adequacy would be desirable before testing.

Monitoring facilities were considered inadequate for the LHS tests due to the lack of wells at intermediate distances (150 to 2250 m) from the pumping well and the small number of observation wells in the Birkett flow.

The NRC staff agreed that the DOE had demonstrated the ability to predict water-level trends well enough to support LHS testing. However, those trends would have to be reestablished after drilling new monitoring wells. They recommended sequential activities in order to minimize mutual interference (e.g., establish hydraulic-head baseline before LHS testing). The NRC staff called on DOE to establish conservative baseline acceptance criteria.

As for LHS testing, the NRC staff favored tests of the Cohassett flow top and vesicular zone. They also recommended a very large pump test of a highly transmissive unit in order to investigate the boundaries of the geohydrologic system. Further details about NRC's concerns may be found in Appendix B. Those concerns were considered in defining the recommended pre-ES geohydrologic testing program in this option paper.

C. DISCUSSION

1. Objectives of the Pre-ES Testing Program

The overall objective of the geohydrologic testing program is to provide sufficient data to determine whether the site is qualified for licensing in terms of the governing regulations (10 CFR 60, 10 CFR 960, and 40 CFR 191). The pre-ES testing program will satisfy some of the information needs derived from the above regulations. Initially the program focuses on collecting information about conditions that may be significantly changed or rendered unobtainable (i.e., conditions that are "perishable") after shaft construction. In addition, the pre-ES testing program is structured to provide an early indication of whether disqualifying conditions (as defined in 10 CFR 960) are present before proceeding with construction of the ES, to provide data on geohydrologic conditions that may affect the design of the ESF or the repository, and to collect data on geohydrologic conditions in order to identify the effects of the ESF on the geohydrologic system and on subsequent geohydrologic tests.

2. Identification of Pre-ES Tests

The geohydrologic testing needs for the Hanford site were determined by examining the Department's Issues Hierarchy for a Mined Geologic Disposal System (DOE/RW-0101, September 1986) for issues whose resolution require geohydrologic tests. Those issues having geohydrologic test requirements are listed in [redacted] For each issue, the geohydrologic information needs that comprise the issue, the types of geohydrologic parameters that comprise the information need, the kind(s) of test(s) needed to obtain the parameter values, and the timing or sequencing of each test are identified. The timing of each test—that is, before or after ES construction—was determined by consideration of the following factors: a) potential for monitoring "perishable" conditions, b) potential for obtaining an early estimate of important design parameters, c) potential for early recognition of disqualifying conditions, and d) potential for unacceptable interference from the ESF.

Only two issues contain disqualifying conditions which can be evaluated solely with geohydrologic information. These are postclosure geohydrology (Issue 1.9.1 with respect pre-waste emplacement ground-water travel time) and preclosure hydrology (Issue 4.1.4 with respect to engineering measures beyond reasonably available technology). Criteria for evaluating the presence of disqualifying conditions are given in [redacted] tests needed to provide data to evaluate the site against these criteria are also identified. Should the testing program provide data that exceed the evaluation criteria and thereby indicate the potential presence of a disqualifying condition, all available data related to that criterion will be evaluated and/or additional testing will be performed to confirm whether the data are representative of the site and the condition is pervasive across the site.

The approach described herein led to the identification of four types of tests that will be conducted before ES construction: (1) baseline hydraulic-head monitoring, (2) large-scale hydraulic stress (LHS) tests, (3) hydrochemical sampling in conjunction with the LHS tests, and 4) tracer tests in conjunction with the LHS tests.

Baseline hydraulic-head monitoring establishes the horizontal and vertical hydraulic-head distribution in and near the site. This test will provide the potentiometric surfaces of key hydrostratigraphic horizons before disturbances of the ground-water flow system by other site-characterization activities. Such activities include LHS testing, shaft sinking, construction of the ESF, and subsequent dewatering for underground testing in the ESF. Establishment of the hydraulic-head baseline for undisturbed conditions is necessary to evaluate the postclosure performance of the repository. Baseline monitoring should also enable test-induced perturbations to the geohydrologic system to be distinguished from background changes from other causes (e.g., seasonal fluctuations).

Large-scale hydraulic stress (LHS) tests will yield hydraulic parameter values that contribute to the evaluation of ground-water flux, ground-water travel time, and solute transport characteristics of hydrostratigraphic units at, above, and below the

SUMMARY OF HYDROLOGIC TESTS TO RESOLVE ISSUES HAVING GROUND WATER INFORMATION NEEDS

Issue	Information Needs	Parameters	Tests	Timing Need	Comments
1.1 Release to accessible environment	Diffusion in dead-end pore (matrix diffusion)	Diffusion coefficients	Multiple well tracer tests; Lab tests on rock samples	Post ES, should be incidental with other tracer tests	
	Flow & mass transport through fractures versus continuum	Kh (horizontal hydraulic conductivity) of flow tops or T(transmissivities); Kv (vertical hydraulic conductivities) and Kh of flow interiors; response shapes of hydrographs	LHS tests; borehole cluster tests in ESF	Pre ES at RRL2 Post ES for others	Pre ES for: perishable conditions; identify disqualifying conditions
		Effective thickness of flow tops; Dispersivities; Storativity of flow tops and specific storage of flow interiors	Multiple well tracer tests; borehole cluster tracer tests in ESF; core analyses	Pre ES at RRL-2; Post ES, coordinate with other tracer tests	Pre ES for: same as above for 1.1
	Hydraulic properties and thickness of damaged rock	K(hydraulic conductivity) effective porosity	Borehole tests in ESF	Post ES	
	Spatial distribution of hydraulic properties including directionality of hydraulic conductivity or T of flow tops and interiors, Umtanum to Ringold	3-D head distribution; K_v flow interiors; T and Kh of flow tops; effective thickness; dispersivity effective pososity	Baseline monitoring; LHS tests and tracer test (for T, Kv effective thickness, effective porosity, Kh, dispersivities); single-well tests for T Dual well test (T, effective thickness, dispersivity) Drill & test piezometers, T	Pre ES; At least RRL2 Pre ES Post ES Post ES Concurrent with ES	Results of RRL-2 tests would determine need to do others pre ES Pre ES for: same as above for 1.1
	Hydraulic boundary conditions	3-D distribution of hydraulic head	Baseline head monitoring	Pre ES	Pre ES for: Same as 1.1
		Spatial distribution of Kh or T of flow tops and K_v of flow interior	LHS tests at RRL2 Other LHS tests	Pre ES Some may be Pre ES, Others Post ES	Depends on results of RRL-2 Pre ES for: same as above for 1.1.

Symbols:
- CASZ - Controlled Area Study Zone
- ES - Exploratory Shaft
- ESF - Exploratory Shaft Facility
- Kh - Horizontal Hydraulic Conductivity
- Kv - Vertical Hydraulic Conductivity
- LHS - Large-Scale Hydraulic Stress
- T - Transmissivity

EXHIBIT III

Issue	Information Needs	Parameters	Tests	Timing Need	Comments
1.2 Individual Protection	Ground-water travel time	Same as 1.6	Same as 1.6	Same as 1.6	Pre ES for: same as above for 1.1
	Ground-water flux rates past waste package and at accessible environment	Same as 1.1, 1.4, 1.6	Same as 1.1, 1.4, 1.6	Same as 1.1, 1.4, 1.6	
1.4 Waste Package Life	Ground-water flux past waste package	Hydraulic head in Cohassett and Birkett flow tops	Baseline monitoring	Pre ES	Pre ES for: perishable condition
		Kv Cohassett flow interior Kh Cohassett flow interior	LHS tests, borehole cluster tests in ES, ESF tests (borehole and/or chamber)	Pre ES RRL-2 Post ES for others Post ES	Decision to run other LHS tests pre- or post-ES will be made after evaluating results of RRL-2 tests
1.5 Release Rates	Ground-water flux	Same as 1.4	Same as 1.4	Same as 1.4	Pre ES for: same as 1.4
1.6 Groundwater Travel Time	Disturbed zone outer boundary	Kv, Kh Cohassett interior	LHS tests Borehole tests in ESF	RRL-2 Pre ES Others Post ES Post ES test results	Need for other LHS tests pre ES would be decided after RRL-2 Pre ES for: same as 1.1
		Effective porosity and Kh, Birkett, Rocky Coulee, Cohassett flow tops	Porthole tests in ES LHS tests Tracer tests	Post ES RRL-2 Pre ES, others Post ES	
		Kv Birkett, Rocky Coulee flow interiors	Porthole tests in ES LHS tests	Post ES RRL-2, Pre ES	
	Accessible environment boundary	3-D distribution of hydraulic properties over CASZ and surrounding area			
		• Hydraulic head in flow tops	Baseline head monitoring		
		• T of flow tops • Effective thickness, porosity of flow tops • Kv flow interiors of Birkett, Cohassett, Rocky Coulee	LHS tests Tracer tests	RRL-2 Pre ES, others after ES	Pre ES for: same as 1.1
			Kv Cohassett flow interior will also be measured in ESF tests	Post ES	

Issue	Information Needs	Parameters	Tests	Timing Need	Comments
	Hydraulic parameters and boundary conditions within and surrounding CASZ	Same as previous information need plus hydraulic properties or other evidence of hydraulic boundaries and leakance in hydrographs of LHS tests and as indicated by regional flow system modeling	Same as previous	Same as previous	
	Hydrochemistry of upper Grande Ronde water in vicinity of CASZ	Concentration of carbon isotopes (C-12, C-13, C-14), Cl-36, H-3, I-129, deuterium, O-18, major dissolved and suspended solids and gases, pH, temp., in flow tops of Birkett, Cohassett, Rocky Coulee, Umtanum, and perhaps others	Samples from drill and test wells	Pre ES for some Post ES for others	Pre ES for: identifying disqualifying condition
			LHS tests: RRL-2 Others	Pre ES Post ES	Depends on results of RRL-2 tests
			Samples from other available wells	As many pre ES as possible from available wells	Pre ES for: identifying disqualifying condition
1.7 Performance Confirmation	Hydraulic properties of Cohassett interior and flow top and Birkett flow top immediately adjacent to repository excavation	Same as 1.6	Various in situ tests in repository excavation during and after construction (to be designed later)	Post ES (during and after repository construction)	
1.8 Favorable and Adverse Conditions	Ground-water flow rates to ESF and repository during construction and operation	Specific storage and K_V of Cohassett flow interior and K_H and storativity of Birkett and Cohassett flow tops	Same as 1.4	Same as 1.4	Pre ES for: identifying disqualifying condition; engineering design data
	Combustible gas inflow to ESF and repository during construction and operation	Concentration of major dissolved gases in Birkett, Cohassett and Rocky Coulee flow tops	Same as 1.6 plus hydrochemistry tests	Same as 1.6 plus hydrochemistry tests	

Issue	Information Needs	Parameters	Tests	Timing Need	Comments
1.9 Postclosure Guidelines	Boundary Conditions and distribution of hydraulic properties of flow tops Umtanum, McCoy Canyon, Birkett, Cohassett to Ginko	Same as 1.6	Same as 1.6 and 1.4	Same as 1.6 and 1.4	Pre ES for: Perishable condition, identify disqualifying condition
	Hydraulic properties of flow interiors-Birkett, Cohassett, Rocky Coulee	Same as 1.6	Same as 1.6 and 1.4	Same as 1.6 and 1.4	
	Hydrochemistry of groundwater in flow tops	Same as 1.6	Same as 1.6 and 1.4	Same as 1.6 and 1.4	
1.11 Repository Design	Inflow rates of water and combustible or toxic gases to repository	Same as related information need in 1.8 and 4.1.4	Same as 1.8 and 4.1.4	Same as 1.8 and 4.1.4	Pre ES for: same as 1.8
	Hydraulic properties of Cohassett flow interior and adjacent flow tops surrounding the repository	Same as 1.6, 1.7, and 1.8	Same as 1.6 and 1.7	Same as 1.6 and 1.7	
1.12 Seals Postclosure	Hydraulic conductivities of seals and zone between seals and rock or casing	Same as information need	Hydraulic and tracer tests in borehole and shafts plus lab tests	Post ES	
2.6 Waste Package Design Preclosure	Ground-water flux past package	Same as 1.4	Same as 1.4	Same as 1.4	
2.7 Repository Design Preclosure	Same as 1.1, 1.2, 1.6, 1.8, 1.9	Same as 1.1, 1.2, 1.4, 1.6	Same as 1.1, 1.2, 1.4, 1.6	Same as 1.1, 1.2, 1.4 1.6	Pre ES for: same as 1.8
4.1.1 Ease and Cost of Construction	Water and gas inflow to repository	Same as 1.8	Same as 1.8	Same as 1.8	
4.1.3 Rock Characteristics	Distribution of hydraulic properties of Cohassett flow interior and adjacent flow tops	Same as 1.1, 1.2, 1.6	Same as 1.1, 1.2, 1.6	Same as 1.1, 1.2, 1.6	
4.1.4 Preclosure Hydrology	Ground water and gas inflow to ESF and repository	Same as 1.8	Same as 1.8	Same as 1.8	Pre ES for: same as 1.8

Issue	Information Needs	Parameters	Tests	Timing Need	Comments
4.2 Repository design: nonradiological worker safety	Same as 1.8 and 1.11	Same as 1.8	Same as 1.8	Same as 1.8	Pre ES for: same as 1.8
4.4 Repository design; adequate technology for repository construction, operation, closure, decommissioning	Same as 1.8 and 1.11	Same as 1.8	Same as 1.8	Same as 1.8	Pre ES for: same as 1.8
4.5 Repository design: cost of waste packages and repository	Same as 1.11	Same as 1.8	Same as 1.8	Same as 1.8	Pre ES for: engineering design data

STRATEGIES TO INVESTIGATE DISQUALIFYING CONDITIONS

	ISSUE	DISQUALIFYING CONDITION	PARAMETERS	EVALUATION CRITERIA*	TESTS
1.9.1	Post-Closure Geohydrology	Groundwater travel time less than 1000 years	a. Hydraulic properties of flow tops	$\frac{Ti}{nb} > 5$m/yr	
			• Hydraulic gradient (i)		Spatial and temporal distribution of hydraulic head
			• Transmissivity (T)		LHS tests in flow tops
			• Effective thickness (nb)		Multiwell tracer tests
			• Storativity		LHS tests in flow tops
			b. Hydraulic properties of flow interior	K'v 10^{-9} m/s	
			• Vertical hydraulic conductivity (K'v) of dense interior		LHS tests in flow tops
			• horizontal hydraulic conductivity (Kh) of flow		LHS Tests in flow tops
			• Specific storage		Estimated from tests of core samples
			• Effective porosity		Estimated from tests of core samples
			c. Presence or absence of discrete, highly transmissive features which cross-cut flows	Unexpected vertical response to LHS, such as responses across several intervening flow interiors	
			• Leakance	Recharge boundary within 5km	LHS tests in flow tops
			• Hydraulic boundaries		LHS tests in flow tops
			d. Radioisotope content of ground water	Presence of recent meteoric water:	Sampling and analysis
			• Radioisotope concentrations	H-3 0.2TU C-14 80% modern I-129 10^{-8} pCi/L	

STRATEGIES TO INVESTIGATE DISQUALIFYING CONDITIONS (Cont'd)

ISSUE	DISQUALIFYING CONDITION	PARAMETERS	EVALUATION CRITERIA*	TESTS
4.1.4 Pre-closure Hydrology	Engineering conditions beyond reasonably available technology	a. Hydraulic properties of Cohassett dense interior	$K'v \geq 10^{-8}$ m/s	
		• Vertical hydraulic conductivity		LHS test in Birkett flow top
		• Specific storage		Estimated from tests core samples
		b. Hydraulic properties of adjacent flow tops	N.A.	
		• Transmissivity		LHS test in flow tops
		• Storativity		LHS test in flow tops
		• Head distribution		Spatial and temporal distribution of hydraulic head
		c. Gas content of groundwater	$CH_4 \geq 1200$ mg/L	
		• Gas concentration		Sampling and analysis

*Conditions that are so severe as to be indicative of potential disqualification. Futher evaluations and/or investigations to resolve the conditions will be necessary.

proposed repository horizon. Such tests must be performed at the repository location prior to ESF construction because these construction activities will disrupt the site geohydrologic system. The disruption could be such that subsequent LHS tests in the area of the ESF cannot be analyzed to an acceptable level of confidence.

Hydrochemical sampling would be conducted in conjunction with ground-water withdrawal during LHS tests. Such sampling and analysis will aid in defining the hydrochemical baseline for interpreting ground-water flow conditions. In addition, radioisotope analyses of samples taken for age-dating purposes will be used along with existing data to evaluate the presence of a disqualifying condition.

Tracer tests in conjunction with LHS tests would yield values for the effective porosity of selected flow tops. Effective porosity is necessary in order to calculate travel times along ground-water flow paths. Effective porosity in the vicinity of ESF construction may be considered a perishable condition due to the potential effects of dewatering and grouting. The tracer tests would also provide dispersivity values needed for solute-transport modeling.

3. *Impacts of the ESF on the Local Ground-Water System*

As already mentioned, the pre-ES geohydrology testing program should be designed, in part, to collect data on geohydrologic conditions needed to predict and interpret the effects of the ESF on the geohydrologic system and on subsequent geohydrologic tests.

Possibly the most significant change in the local ground-water flow system that could result from drilling the exploratory shafts is an increase of several orders of magnitude in the vertical hydraulic conductivity within the zone of damaged rock adjacent to the shafts. If the pressure grouting of the shaft liner does not effectively seal the annular space or penetrate the damaged-rock zone, the increased vertical hydraulic conductivity could cause individual heads in successive flow tops to reach a common hydraulic head or could lead to an overestimation of the natural system's vertical leakage across the intervening dense flow interior during subsequent LHS tests. The most effective solution is to avoid any problem resulting from drilling the ES by completing the necessary geohydrologic testing before shaft construction. Post-ES geohydrologic tests, especially in regard to the ability to demonstrate effective sealing of shafts, are planned in order to quantify these potential effects.

Construction, operation, and testing of the underground testing facility could also have significant effects on geohydrologic conditions (e.g., hydraulic head) and hydraulic properties (e.g., vertical hydraulic conductivity of the Cohassett flow interior). These effects may include:

- Creation of a damaged rock zone around the drifts induced by drilling and blasting. The vertical hydraulic conductivity in the damaged-rock zone may be significantly increased as the proposed repository horizon. Such tests must be performed at the repository location prior to ESF construction because these construction activities will disrupt the site geohydrologic system. The disruption could be such that subsequent LHS tests in the area of the ESF cannot be analyzed to an acceptable level of confidence.

Hydrochemical sampling would be conducted in conjunction with ground-water withdrawal during LHS tests. Such sampling and analysis will aid in defining the hydrochemical baseline for interpreting ground-water flow conditions. In addition, radioisotope analyses of samples taken for age-dating purposes will be used along with existing data to evaluate the presence of a disqualifying condition.

Tracer tests in conjunction with LHS tests would yield values for the effective porosity of selected flow tops. Effective porosity is necessary in order to calculate travel times along ground-water flow paths. Effective porosity in the vicinity of ESF construction may be considered a perishable condition due to the potential effects of dewatering and grouting. The tracer tests would also provide dispersivity values needed for solute-transport modeling.

3. Impacts of the ESF on the Local Ground-Water System

As already mentioned, the pre-ES geohydrology testing program should be designed, in part, to collect data on geohydrologic conditions needed to predict and interpret the effects of the ESF on the geohydrologic system and on subsequent geohydrologic tests.

Possibly the most significant change in the local ground-water flow system that could result from drilling the exploratory shafts is an increase of several orders of magnitude in the vertical hydraulic conductivity within the zone of damaged rock adjacent to the shafts. If the pressure grouting of the shaft liner does not effectively seal the annular space or penetrate the damaged-rock zone, the increased vertical hydraulic conductivity could cause individual heads in successive flow tops to reach a common hydraulic head or could lead to an overestimation of the natural system's vertical leakage across the intervening dense flow interior during subsequent LHS tests. The most effective solution is to avoid any problem resulting from drilling the ES by completing the necessary geohydrologic testing before shaft construction. Post-ES geohydrologic tests, especially in regard to the ability to demonstrate effective sealing of shafts, are planned in order to quantify these potential effects.

Construction, operation, and testing of the underground testing facility could also have significant effects on geohydrologic conditions (e.g., hydraulic head) and hydraulic properties (e.g., vertical hydraulic conductivity of the Cohassett flow interior). These effects may include:

- Creation of a damaged rock zone around the drifts induced by drilling and blasting. The vertical hydraulic conductivity in the damaged-rock zone may be significantly increased as the apertures of existing fractures are increased or as new fractures are opened. This damaged rock zone may extend several drift diameters in any direction, potentially intersecting both the Cohassett vesicular zone and the Birkett flow top.

- Fracturing around the underground workings induced by stress redistribution over a period of several months. Such fracturing may also significantly increase the vertical hydraulic conductivity in the Cohassett dense interior, potentially intersecting both the Cohassett vesicular zone and the Birkett flow top.

- Hydraulic-head changes. The ESF workings will be at atmospheric pressure, whereas the ground water within fractures in the Cohassett dense interior and in adjacent flow tops is confined at 1300 to 1500 psi. A very large head differential towards the underground workings will result in inflow to the underground workings and an attendant reduction in hydraulic head in the Cohassett and other flows to distances as great as several kilometers ([redacted] In essence, the dewatering of the underground testing facility will have the effect of a long, horizontal well, with the volume of water withdraw (estimated to range from less than 1 gpm to more than 1000 gpm) potentially much greater than the pumping rates of the small-diameter wells used for post-ES LHS testing. This is especially true if any discrete, through-going, highly transmissive, vertical features are encountered in the excavation for the underground testing facility.

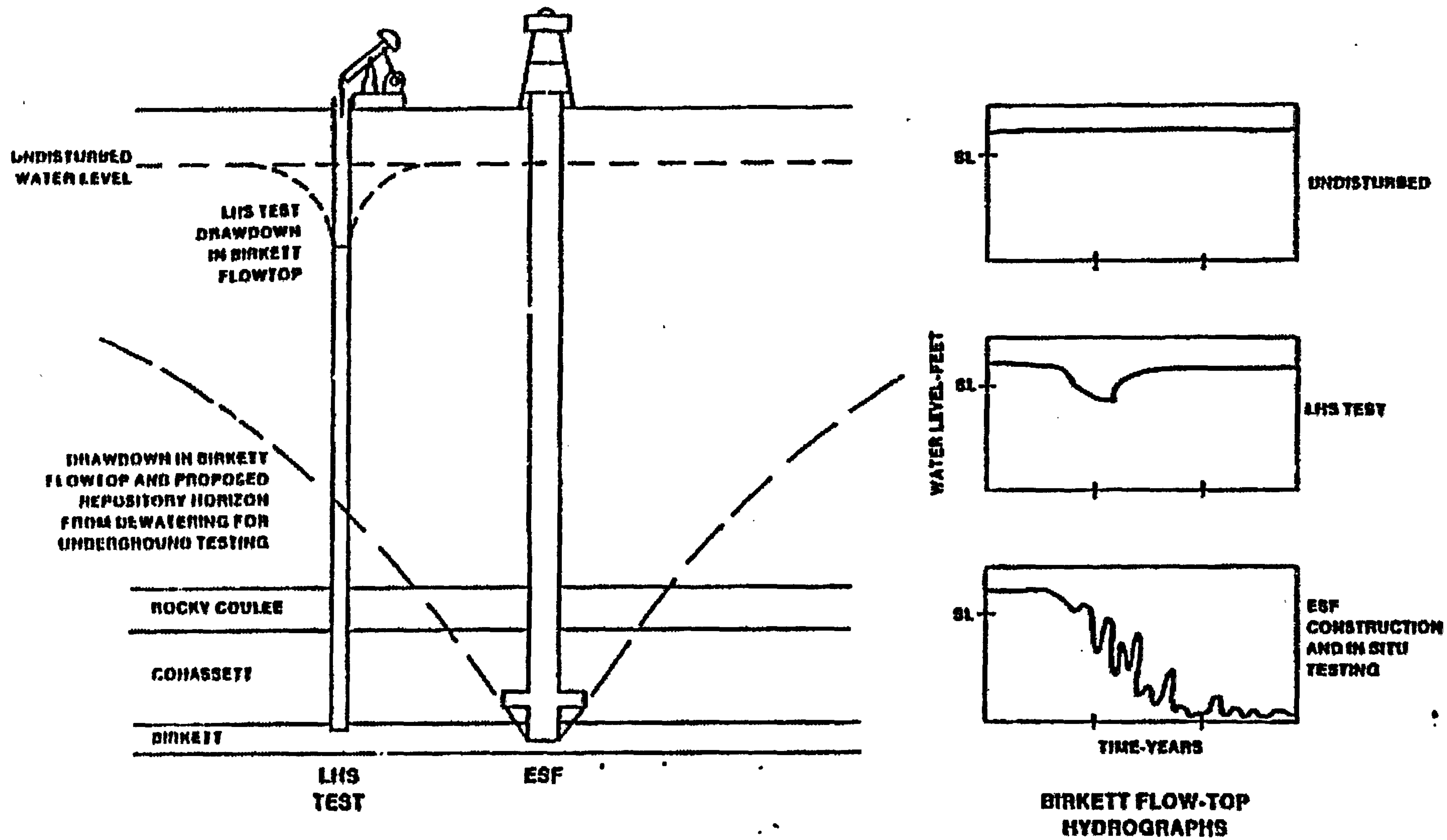
D. OPTIONS

Several options have been considered for the pre-ES geohydrologic testing program, ranging from establishing only the site hydraulic-head baseline to performing virtually the entire surface-based geohydrology testing program for the Hanford site. For purposes of this analysis, five options are considered:

Option (a) Establish the site hydraulic-head baseline only. This option would provide information on hydraulic-head conditions that may be significantly changed by subsequent site-characterization activities.

Option (b) Establish the baseline, conduct one LHS test in the Rocky Coulee flow top (the basalt flow immediately above the proposed repository flow), collect hydrochemical data and perform tracer tests in the Rocky Coulee flow top at the RRL-2 location. This option would test what is presently considered the first transmissive flow top above the repository horizon.

Option (c) Establish the baseline, conduct one LHS test in the Birkett flow top (the basalt flow immediately below the repository horizon), collect hydrochemical data and perform tracer tests in the Birkett flow top at the RRL-2 location. This option would provide for the investigation of the most transmissive unit in proximity to the repository horizon.



SCHEMATIC OF RELATIVE EFFECTS OF SITE CHARACTERIZATION ACTIVITIES ON GROUND-WATER LEVELS IN PUMPED INTERVALS

EXHIBIT V

Option (d) Establish the baseline, conduct LHS tests, collect hydrochemical data and perform tracer tests in multiple horizons at the RRL-2 location. This option would allow direct testing of transmissive intervals in the Grande Ronde Basalts above, below, and including the repository horizon at the ESF site.

Option (e) Establish the baseline, conduct LHS tests, collect hydrochemical data and perform tracer tests in multiple horizons at several different locations around the candidate site. This option would provide areally-distributed information on the geohydrologic properties of basalt flows around and including the repository horizon.

These options and their apparent advantages and disadvantages are compared below and summarized in Exhibit VI.

1. Option (a)

<u>Description</u>. This option assumes that all hydraulic testing can be performed and adequately interpreted after the exploratory shafts and the underground testing facility are completed. Measurements of water levels would be taken in about 35 existing facilities. Two new nested piezometers, DC-24 and DC-25, would be added to this network in order to meet minimal needs for the hydraulic-head baseline. The establishment of a baseline would provide information on three-dimensional flow direction, which is important in calculating the pre-waste emplacement ground-water travel time and, hence, in performance assessment.

<u>Advantages</u>. This option would have the least effect on the ESF schedule and would yield data on conditions that may be changed by shaft construction.

<u>Disadvantages</u>. Option (a) would provide insufficient information for identifying disqualifying conditions and no information for the design of the exploratory shaft facility or the repository. Furthermore, this option would provide no geohydrologic testing data on which to base interpretations of post-ES geohydrologic test results or to predict the effects of ESF construction. Such a limited program would draw little support from the technical community.

2. Option (b)

<u>Description</u>. This option would consist of option (a) plus one LHS test, collection of hydrochemical data and tracer tests in the Rocky Coulee flow top. The Rocky Coulee flow top (Exhibit I) is currently considered the first unit above the Cohassett flow having sufficiently high hydraulic conductivity to provide an important lateral flow path to the accessible environment.

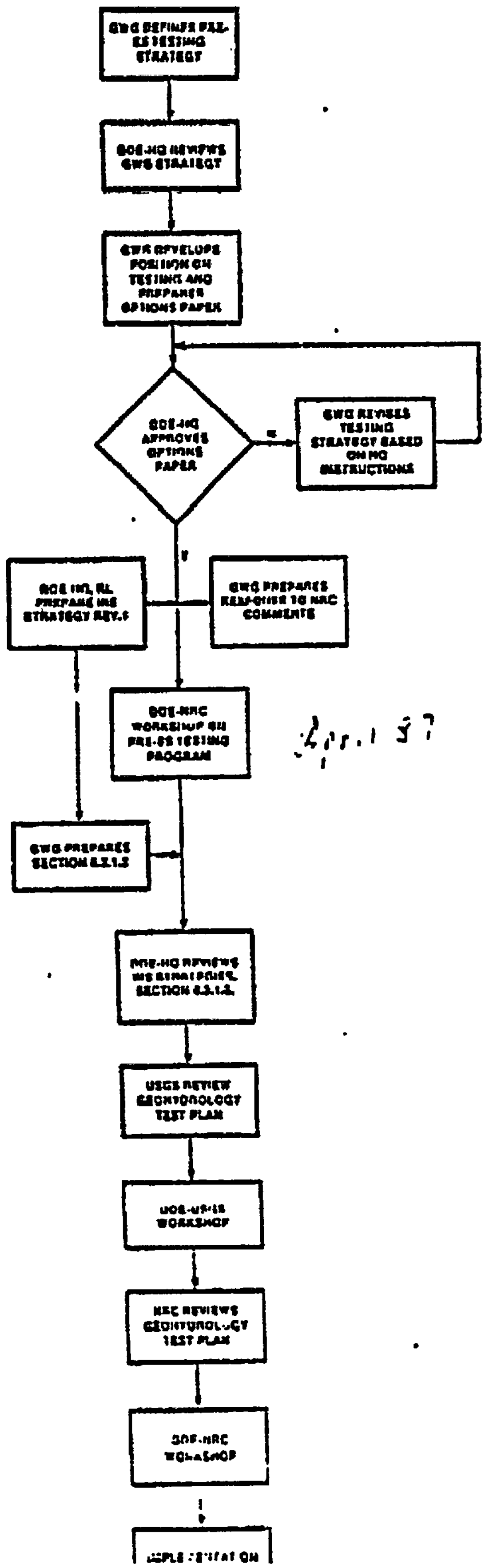
Site facilities are presently configured for the LHS test in the Rocky Coulee flow top and include RRL-2 (A, B, C), DC-19, DC-20, DC-22, DC-23, RRL-14, and RRL-17. However, two new nested piezometers, DC-32 and DC-33, would be installed about [illegible] meters

OPTIONS FOR PRE-ES HYDROLOGY TESTING PROGRAM

	OPTION	PRO	CON
A.	Establish baseline only - drill and equilibrate DC-24, 25	• Minimal schedule disruption on start of ES • Least cost impact • Yields data on perishable head conditions	• Provides insufficient information about disqualifying conditions Provides no information to support engineering design • Potential compromise of interpreting future test results • Probably not credible with technical community • Subject to severe programmatic criticism • Gains no experience with testing procedures and equipment • Potential change of hydraulic parameters in vicinity of ES not detectable
B.	Establish baseline; Test Rocky Coulee only - drill and equilibrate DC-24,25,32,&33 - pump RRL-2B - take samples from Rocky Coulee - run tracer test	• No reprogramming necessary; conform to current test plan and facilities • Yields data on perishable conditions and hydraulic parameters of Rocky Coulee • Provides some information on disqualifying conditions • Expedites start of ES construction	• Provides little information to support engineering design • Provides little information on impact of ESF on future tests • May not be credible with technical community • Limited experience with testing procedures and equipment
C.	Establish baseline; Test Birkett only - drill and equilibrate DC-24,25,32,&33 - deepen and pump well RRL-2B - take samples from Birkett - run tracer test	• Provides some information for engineering design • Yields data on perishable hydraulic properties and conditions of Birkett flow top and Cohassett interior • Provides some information on disqualifying conditions • Provides some information on impacts of ESF on future tests	• Limited credibility with technical community • Limited experience with testing procedures and equipment • May delay ES construction schedule • Requires modification to pumping well and additional monitoring facilities • Some reprogramming required
D.	Establish baseline; test multiple flow tops (Rucky Coulee, Cohassett, and Birkett) and Cohassett vesicular zone - drill and equilibrate DC-24,25,32,&33 - deepen and pump well RRL-2B - take smaples from flow tops run tracer tests	• Yields data on perishable conditions in Grande Ronde • Provides substantial information for engineering design at RRL-2 site • Provides information on disqualifying conditions at RRL-2 site • Enhances credibility with technical community • Provides information to predict impacts of ES on future geohydrologic tests	• Delays ES construction schedule • Near-term site costs increase • Requires additional monitoring facilities • Reprogramming required
E.	Establish baseline; test multiple flow tops (Rocky Coulee, Cohassett, and Birkett) and Cohassett vesicular zone at several (3-4) additional pumping centers - drill and equilibrate DC-24,25,32&33 - deepen and pump well RRL-2B drill and pump other centers - take smaples from flow tops	• Yields definitive data on perishable conditions in Grande Ronde • Provides definitive design information over wide area of Cohassett flow • Provides definitive information on disqualifying conditions over much of CASZ • Provides some information on flow system boundaries	• Major delays in ES construction schedule • Near-term site costs increase substantially • Major reprogramming required • Requires considerable monitoring and pumping facilities

EXHIBIT VI

ACTIVITIES FOR THE IMPLEMENTATION OF OPTION D



southwest and southeast of the RRL-2B location, respectively, before the Rocky Coulee LHS test. In addition, several monitoring points will be established in the Birkett flow top. The test would be conducted by pumping from the Rocky Coulee flow top (at RRL-2B) and measuring drawdowns and pressures in the monitoring facilities listed above. Responses to pumping would be monitored in the Ginkgo flow top, the Rocky Coulee flow top, flow tops above and below the pumped zone, and in the Cohassett dense interior.

Advantages. Option (b) requires no major reprogramming of site activities, because the Rocky Coulee test conforms to the current test plan and existing or planned facilities, except for wells DC-32 and-33; thus, disruption of the ES schedule would be minimal. Tests conducted under this option would yield data on geohydrologic conditions in the Rocky Coulee flow top that may changed by shaft construction and would produce some of the information needed to identify the presence of disqualifying conditions.

Disadvantages. The tests would provide little information for engineering design, little information on the repository horizon and adjacent horizons, and limited information on the effects of the shafts and the underground testing facility on future geohydrologic tests. In addition, there are reasons to believe that a pre-ES test program of such limited scope would not be acceptable to much of the technical community.

3. Option (c)

Description. Option (c) consists of option (a) plus a single LHS test, the collection of hydrochemical data, and tracer tests in the Birkett flow top. There are indications that the Birkett flow top (Exhibit I) (immediately below the Cohassett dense interior) is more transmissive than the Cohassett and Rocky Coulee flow tops and could yield a more a really-extensive LHS test. Limited data indicate that the Birkett flow top could be the major contributor to water inflow to the underground testing facility. Because of the proximity of the flow top to the repository horizon, it is important to characterize the Birkett in order to assess site performance and to obtain data for ESF and repository design.

Site facilities are presently not set up for an LHS test in the Birkett flow top; a pumping well would have to be provided by deepening RRL-2B. In addition, several monitoring boreholes (i.e., RRL-2A, RRL-6, RRL-17, RRL-14, DC 4/5, and DC-16) would need to be reconfigured and two new nested piezometers, DC-32 and DC-33, would be installed about 1000 meters southwest and southeast of RRL-2B, respectively. The Birkett could probably be pumped at a greater rate than that expected for the Rocky Coulee test of option (b). The effects of the test on hydraulic heads would be monitored in the Birkett flow top, the Cohassett dense interior and flow top, the Rocky Coulee flow top, and the Umtanum flow top.

Advantages. Because the Birkett flow top may be the most transmissive of the flow tops in the upper part of the Grande Ronde Basalt at the candidate site, and because it is immediately adjacent to the base of the Cohassett flow, an LHS test in the Birkett flow top has the best potential for assessing the hydraulic characteristics of the Cohassett dense interior, particularly the vertical hydraulic conductivity. This test has some potential for indicating the presence of disqualifying conditions and would provide engineering information.

Disadvantages. Option (c) would require a significant effort to drill and reconfigure boreholes for pumping or monitoring. Some delay in the ES schedule may occur. Because of the limited scope of LHS testing in the vicinity of the exploratory shafts before the start of shaft construction, option (c) would not be acceptable to some of the technical community.

4. Option (d)

Description. This option consists of option (a) plus LHS tests, the collection of hydrochemical data, and tracer tests in the Rocky Coulee, Cohassett and Birkett flow tops and the Cohassett vesicular zone. It is based on the assumption that the drilling and construction of the exploratory shafts and the underground testing facilities will result in a significant disruption of the geohydrologic system.

Existing boreholes and planned piezometer nest[redacted]uld provide the necessary hydraulic-head baseline data. As in option (c), several existing boreholes would need to be reconfigured to optimize monitoring locations in the horizon being tested. Furthermore, it will be necessary to install new nested piezometers DC-32 and DC-33 about 1000 meters southwest and southeast of RRL-2, respectively. The sequence of testing would be the Rocky Coulee flow top, the Cohassett flow top, the Cohassett dense interior (vesicular zone), and the Birkett flow top, unless further and more detailed planning identifies a technically more advantageous approach. LHS tests would be performed in each unit capable of adequate sustained yield for an appropriate duration. Small-scale injection tests would be performed in those units not sufficiently transmissive for an LHS test.

Advantages. Option (d) would establish the necessary hydrologic baseline and provide for "perishable" geohydrologic conditions in key basalt flow tops and dense interiors (especially the proposed repository horizon, the Cohassett dense interior) prior to sinking the exploratory shafts. The tests would provide information on whether disqualifying conditions are present near the ESF and would yield a substantial amount of information important to ESF and repository design. In addition, the tests would provide information useful in evaluating the effects of ESF construction on the hydraulic characteristics of the geohydrologic system. The tests would establish a data base that could be essential for interpreting subsequent LHS tests conducted during underground testing activities. This option is considered more technically defensible and one that would receive appreciable acceptance from the technical community.

Disadvantages. Option (d) would result in delays in the ES schedule, largely because of the time needed to prepare for and carry out the full series of LHS tests at the RRL-2 location.

5. Option (e)

Description. This option differs from option (d) only in that it incorporates LHS tests at other pumping centers in addition to RRL-2. These other pumping centers would serve to better define potential heterogeneities in the basalt flows tested at RRL-2. Whereas all of the facilities outlined in option (d) would be needed, the number of additional pumping and monitoring wells necessary for option (e) has not been determined.

Advantages. Option (e) would yield definitive data on perishable geohydrologic conditions, information needed for ESF and repository design, and information on whether disqualifying conditions are present at the site. In addition, the tests would cover much of the candidate-area study zone and help define geohydrologic boundaries. Option (e) would have the greatest support of the technical community.

Disadvantages. Option (e) would cause major delays in the ES schedule and expenditure of substantial funds before the start of ES construction.

E. RECOMMENDATION

The five options described in the preceeding section are associated with various degrees of risk of not attaining the objectives of the pre-ES geohydrology testing program.

Option (a) has very high risk because it satisfies only one of the several objectives of the pre-ES geohydrology testing program — establishing the hydraulic-head baseline. Under this option, definitive testing results necessary to resolve some licensing issues would be subject to the uncertainty caused by interference from the ESF. This uncertainty may be sufficiently large to cast doubt on all subsequent test results and prevent issue resolution. Such an outcome may compromise the site's licensability.

Option (b) is deemed to have a high risk. Whereas the results of a single test of the Rocky Coulee flow top could provide some data indicative of the presence of disqualifying conditions, the test would have limited value in meeting other objectives. The single test will not define the hydraulic properties sufficiently to discriminate subsequent test results from the disruptive effects of the ESF. At best, the hydraulic characteristics of the Rocky Coulee flow top will be well defined while the potential for a good estimate of the hydraulic characteristics of adjacent flows may be very limited.

Option (c) is also considered to have a high risk for much the same reasons as option (b). However, this option does have the potential for yielding more useful information over a broader areal extent if the Birkett flow top proves to be as transmissive as expected. The Birkett test should also allow better inferences as to the properties of the Cohassett interior than option (b).

Option (d) is a low risk option because values of many of the hydraulic properties of the Grande Ronde Basalt in the vicinity of the ESF would be obtained before shaft construction. It would provide information about disqualifying conditions near the RRL-2 location and useful design information on the expected behavior of the Cohassett dense interior. This option would yield a data base from which to evaluate the results of post-ES tests.

Option (e) has a very low risk because it would give a three-dimensional perspective on a substantial portion of the site before the start of other site characterization activities. Testing from several pumping centers should establish, with a high degree of confidence, the ability of the Cohassett dense interior to host a repository. Any subsequent geohydrologic testing would be largely confirmatory.

Given these considerations, including the many past criticisms leveled by NRC and others, it is recommended that the prudent, low-risk approach represented by option (d) be adopted. This option would give the best opportunity for satisfying pre-ES geohydrologic testing program objectives without major delays in other components of site characterization.

The basis for the logic of the program and activities required to implement the program, including construction of new facilities, are explained in Appendix C.

F. APPROVALS

The recommended option is approved and the activities required to implement the option may proceed as proposed.

Approve: ____________________ Ralph Stein
Director
Engineering and
Geotechnology Division

Disapprove: ____________________

Comments: ____________________

Date: ____________________

Approve: ____________________ John Anttonnen
Assistant Manager for Commercial
Nuclear Waste
Richland Operations Office

Disapprove: ____________________

Comments: ____________________

Date: 2/16/87

Approve: *S. H. Kale*   Stephen Kale
Associate Director
Office of Geologic Repositories

Disapprove: ______________

Comments: ______________

Date: *3/16/87*

G. NEXT STEPS

Subsequent activities related to the implementation of the recommended approach are presented in a diagram ~~(Exhibit VII)~~ and include the development of: (a) a strategy for the total geohydrology program; (b) a revised issue resolution strategy; (c) Section 8.3.1.3 of the Site Characterization Plan (SCP); (d) geohydrology-related study plans; (e) approved drilling plans for wells DC-24, -25, -32, and -33; (f) numerical analyses required to support planning decisions; and (g) responses to NRC concerns. The goal is to conduct an NRC workshop on the pre-ES geohydrology program in April, 1987 and to start drilling of ~~DC-24 and DC-25 by September, 1987~~.

At least two workshops with the NRC staff, States and affected Indian Tribes will be necessary before the start of testing. The objective of the first workshop will be to obtain closure on the pre-ES geohydrologic testing program and the resolution of earlier NRC comments. Preparation for this workshop will require the completion of the pre-ES geohydrology testing strategy and a comment-response document. Materials needed for a second workshop include the issue resolution strategy, Section 8.3.1.3 of the SCP, the hydrology-related study plans and documentation supporting the first test, such as test plans with specifications, QA plans and procedures, baseline acceptance and test-decision criteria, and numerical analyses suppo[illegible]ng planning decisions. The second workshop would occur soon after issu[illegible]s of the SCP.

APPENDIX A

Geohydrology of the Hanford Site

Within the northern half of the Columbia Plateau, composite potentiometric surfaces have been mapped and data limitations described. One surface is drawn for each hydrostratigraphic unit: Saddle Mountains, Wanapum, and Grande Ronde Basalts. These data suggest that the Pasco Basin is an area of regional ground-water flow convergence. This is expected since the basin occupies the lowest topographic point in the plateau. Knowledge of vertical hydraulic head distributions across the plateau (outside of the Hanford site) is limited to about 12 piezometers established by the Washington Department of Ecology and numerous composite wells (within a single formation) developed for agricultural use. Generally, these data show a trend of decreasing head with increasing depth. This means ground-water recharge is taking place at the monitored locations. Comparison of the above-mentioned potentiometric surfaces also suggests recharge is taking place across large portions of the plateau.

Hydraulic heads are monitored in 35 wells on the Hanford site in support of the basalt studies. Most head measurements are within single basalt flow tops or interbeds rather than composite measurements of several hydrostratigraphic units. Within the central part of the controlled area study zone, the observed horizontal head gradients in the basalts appear to range between 10^{-5} and 10^{-4}. Vertically, head gradients are directed downward across the Saddle Mountains Basalt and upward across the lower Wanapum and Grande Ronde Basalts, convergency in the upper Wanapum.

Within the area bounded by multilevel piezometer wells DC-19, 20, and 22, ground-water movement in the Wanapum and Grande Ronde Basalts appears to be south to southwest. The local hydraulic influence of geologic structures (Umtanum Ridge-Gable Mountain anticline, Yakima Ridge anticline, and the Cold Creek flow impediment) bordering the proposed repository site requires further investigation.

Horizontal hydraulic conductivities estimated from field tests within flow interiors range between 10^{-15} and 10^{-9} m/s. No definitive estimates of vertical hydraulic conductivity within flow interiors presently exist. The ratio of vertical to horizontal hydraulic conductivity for flow interiors is estimated to be approximately three to one.

More than 200 single-hole, small-scale hydraulic tests have been completed in flow tops and interbeds in some 35 boreholes across the Hanford site. These data have identified the stratigraphic locations of several significant sources of ground water and have provided information about the spatial variability of conductivities within individual flow tops and interbeds. Values as large as 10^{-2} m/s or as small as 10^{-12} m/s are reported. The geometric mean for the flow tops and interbeds of the Saddle Mountains and Wanapum Basalts is 10^{-5} to 10^{-4} m/s. The geometric mean for Grande Ronde Basalt flow tops is between 10^{-3} and 10^{-7} m/s.

Some hydraulic testing of tectonic features has occurred. This includes the few faults or shear zones penetrated in boreholes or the large-scale testing of major geologic structures. The tectonic features tested have equivalent hydraulic conductivities that are either high (10^{-3} to 10^{-4} m/s) or low (less than 10^{-11} m/s).

Two small-scale tracer tests have been conducted in the flow tops of the McCoy Canyon flow of the Grande Ronde Basalt. Longitudinal dispersivity values reported were 0.46 and 0.84 m and effective thickness estimates were 2×10^{-3} and 3×10^{-3} m. Estimates of large-scale transverse dispersivities for Wanapum and Grande Ronde Basalts were also calculated by modeling changes in chloride concentrations. Transverse dispersivities ranging from 20 to 370 m were reported. Values of about 45 m are interpreted as most reliable.

Specific storage values reported from field tests of basalt flow tops range between 10^{-4} and 10^{-5} 1/m. By assuming reasonable ranges for compressibility of fractured and solid rocks, specific storage values for basalt flow interiors are estimated to be about 10^{-6} to 10^{-7} 1/m.

Ground waters in basalt aquifers across the Columbia Plateau are relatively dilute, bicarbonate waters with cation ratios (Na+K)/(Na+K+Ca+Mg) varying between 12 and 99 percent. Low values correspond to recently recharged waters and high values exist in older, more evolved waters. Ground-water ages vary from approximately 5,000 to over 30,000 years, as estimated from the percentage of modern carbon-14 present in water samples. Chlorine-36 analyses indicate that ground-water ages in the Grande Ronde Basalts at the controlled area study zone are greater than 100,000 years. Data on ground-water ages are sparsely distributed in the Columbia Plateau; therefore, it is not possible to rigorously evaluate ground-water travel times from expected recharge to discharge areas using age-dating techniques.

Beneath the Hanford site, shallow basalt water is of a sodium-bicarbonate chemical type; deep basalt water is of a sodium-chloride chemical type. On a location-by-location basis, chemical and isotopic shifts can be pronounced and are believed to delineate flow system boundaries, chemical evolution taking place along flow paths, and ground-water mixing. Most ground waters sampled from across the Columbia Plateau appear to be compositionally similar to shallow ground water from the Hanford site as represented by water samples from springs, the unconfined aquifer, and the Saddle Mountains Basalt. These similarities exist for major cations, anions, pH, and the stable isotopes of hydrogen, carbon, and oxygen. There are no reported ground-water analyses from the regional data base that manifest the same degree of enrichment in sodium, chloride, and fluoride as do most Wanapum and Grande Ronde ground waters underlying the Hanford site.

An analysis of hydrochemical data suggests that a geochemical evolutionary trend exists that developed as a result of rock and water interaction. It appears that dissolution-precipitation reactions involving volcanic glass, plagioclase feldspar, calcite, clays, and zeolites are important components in this process. Evidence also suggests that the deep Grande Ronde Basalt waters form an evolutionary trend distinct from shallower waters. This deep ground water is thought to move upward in the stratigraphic section and mix with shallower ground water. The best evidence for such mixing exists in the Wanapum Basalt beneath the central portion of the controlled area study zone. Several preliminary conceptual flow models have been developed and data needs have been identified. On a regional basis, the Pasco Basin appears to be an area of regional ground-water flow convergence. Although specifics are sometimes unavailable, it is proposed that the shallow basalts are locally recharged and discharged within sub-basins of the Columbia Plateau, while deeper basalts are part of a larger, regional flow system. The topographic and hydraulic effects of major anticlines trending generally east-west across the plateau likely contribute to the development of local flow systems and complicate (i.e., impede, redirect, or vertically mix) interbasin ground-water movement.

The layered geology at the controlled area study zone consists of alternating basalt flows containing high to low-conductivity intraflow units. Such heterogeneity causes rectilinear, three-dimensional ground-water movement to occur with lateral movement in flow tops and interbeds and vertical movement across flow interiors. Hydrochemical data suggest two possible conceptual models for ground-water movement within the controlled area study zone. One model proposes that upward ground-water movement is largely restricted in the central portion of the controlled area study zone. Subsequent lateral flow to the east within the Wanapum Basalt creates a plume of mineralized waters that traces the direction of ground-water movement. In the second model, a stagnant or near-stagnant flow system is proposed in the upper Cold Creek syncline. This condition is created by the presence of the Cold Creek flow impediment, Umtanum Ridge-Gable Mountain anticline, and the Yakima Ridge anticline. In this model, the degree of lateral flushing increases to the east and southeast where the syncline opens and the anticlines die out.

APPENDIX B

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

APR 10 1986

Mr. O. L. Olson
Director
Basalt Waste Isolation Division
U. S. Department of Energy
Richland Operations Office
P. O. Box 550
Richland, WA 99352

Dear Mr. Olson:

By this letter, the U. S. Nuclear Regulatory Commission (NRC) is transmitting the staff's review of the document entitled "Test Plan for Multiple-Well Hydraulic Testing of Selected Hydrogeologic Units at the RRL-2 Site, Basalt Waste Isolation Project (BWIP), Reference Repository Location" (SD-BWI-TP-040). The staff's observations resulting from the December 9-10, 1985 meeting have been integrated into these comments.

Based on the staff's review of the document prior to the December 1985 meeting, it was initially determined that the proposed testing strategy was consistent with that presented in the NRC's BWIP Site Technical Position (STP) 1.1. The test plan indicated that testing would begin with a repository scale, multiple-well pump test of the Rocky Coulee flow top. Additionally, testing would occur only after baseline hydraulic heads had been established and would continue until sufficient data were collected to allow identification and evaluation of hydrologic boundaries and hydraulic continuity of the hydrogeologic units surrounding the RRL.

Discussions during the meeting, however, indicated that the BWIP's present strategy deviates significantly from the strategy presented in STP 1.1 in two key areas. First, initial testing will not be on a repository scale, and thus, will not adequately evaluate the hydrologic and hydraulic properties of the Columbia River Basalts within the Cold Creek Syncline. This reduced scale of testing will not support development and calibration of repository performance models. Although the test plan indicated that repository scale testing would be performed, the BWIP refused, during the December meeting, to commit to performing such a test. Second, BWIP indicated during the meeting that baseline hydraulic heads, with respect to characterization of the pre-emplacement ground water flow system, will not be established prior to initiating the testing. Stage I of the strategy presented in STP 1.1 calls for a technical consensus that piezometric baseline, which is adequate for use in developing defensible assessments with respect to 10 CFR 60, has been established prior to initiating testing. The primary NRC concern is that perturbations on the system may be of such a magnitude that baseline determination may be delayed for a long period of time or be impossible to obtain within DOE's schedule for repository development. As the BWIP has stated in the past, other site activities, such as exploratory shaft construction and testing, may also significantly perturb hydraulic heads around the RRL further delaying establishment of baseline. This premise is substantiated by the hydraulic head perturbations evidenced in wells DC-19, 20, and 22 caused by removal of bridge plugs from RRL-14 and the drilling of DC-23, thus delaying the establishment of an LHS test baseline by several months. If such small-scale activities can create significant perturbations, it is conceivable that perturbations caused by exploratory shaft construction could delay the establishment of hydrologic baseline, with respect to characterization of the pre-emplacement groundwater flow system, for a period of several years. Such perturbations, should they occur while LHS testing is being performed, could also limit the DOE's ability to interpret LHS test data. The DOE's hydrologic testing strategy should allow for sequencing of site activities so that effects of one activity will not compromise the ability to perform others. Hydrologic baseline should be established to the extent possible with existing wells prior to performing any hydrologic testing. The DOE should be conservative with respect to baseline establishment, as this may be the only opportunity to collect necessary information in this area. Should the DOE determine that a testing program that significantly deviates from the agreed to strategy in STP 1.1 is more appropriate for characterizing the hydrologic regime at the BWIP, the DOE should provide to the NRC their rationale for deviating from STP 1.1 and explain how the proposed plan will provide a better hydrologic characterization of the site.

It became apparent during the December 1985 meeting that the BWIP's proposed plans for hydrologic site characterization were not sufficiently developed to allow commencement of testing in February 1986, as proposed. A sound technical rationale for the purpose and timing of the proposed testing was not presented nor was documentation provided to the NRC at the meeting. In addition, testing procedures and quality assurance plans had not yet been finalized, and the BWIP could not satisfactorily demonstrate how the testing strategy was being integrated with other site characterization activities.

It is our understanding, based on several telephone conversations between our staffs, that the BWIP is currently reevaluating their strategy and plan for hydrologic testing. In accordance with NRC/DOE agreements on pre-licensing consultations, it is requested that NRC/DOE consultations take place during the development of any new testing strategy so that the NRC can provide timely guidance that can be considered during your planning stages and thereby avoid unnecessary schedule delays. Additionally, the staff also requests early involvement in the readiness review process to provide the DOE guidance in this area prior to issuance of the Draft Readiness Review Plan.

Prior to initiating any hydrologic test work, the DOE should also develop a comprehensive quality assurance plan that is consistent with the criteria of Appendix B of 10 CFR 50. Backfitting of QA procedures after the fact is not acceptable.

Although most of the attached comments were discussed during the December 1985 meeting, few were resolved to the satisfaction of the NRC staff. Many of our comments required analyses that the BWIP had either not performed or was not prepared to present at the meeting. When revising the test plan document, the DOE should reincorporate the consultation review steps as agreed at the May 1985 Hydrology meeting. Additionally, the attached detailed comments together with the observations and agreements in the signed meeting minutes resulting from the December 1985 meeting should be addressed. The NRC considers resolution of these comments necessary prior to initiating hydrologic testing or exploratory shaft construction. The next appropriate forum for resolving these comments is the NRC/DOE workshop tentatively planned for July or August of this year.

Should you have any questions, please contact Paul Hildenbrand of my staff at FTS 427-4672 or Michael Weber at FTS 427-4746.

Sincerely,

John J. Linehan, Section Leader
Repository Projects Branch
Division of Waste Management
Office of Nuclear Material Safety
and Safeguards

Enclosure:
NRC Review Comments

cc: R. Stein, DOE-HQ

NRC'S DETAILED COMMENTS ON
"TEST PLAN FOR MULTIPLE-WELL HYDRAULIC TESTING OF
SELECTED HYDROGEOLOGIC UNITS AT THE RRL-2 SITE,
BWIP, RRL" SD-BWI-TP-040

The following comments have been classified into several categories as they pertain to BWIP's proposed large-scale hydraulic stress (LHS) testing at RRL-2.

Monitoring Facilities

1. Monitoring Locations and Frequencies

Because of the uneven distribution of monitoring facilities around the pumping well (RRL-2B), BWIP's ability to characterize and interpret hydraulic responses to pumping stress in three dimensions is limited. As planned, water levels will not be monitored between radial distances of 152 m (RRL-2A) and 2250 m (RRL-14). Without water level information at intermediate scales between RRL-2A and RRL-14, results from LHS testing of the Grande Ronde Basalts at RRL-2 may yield considerable uncertainty in interpretations drawn from the test results. For example, deviations from expected drawdown responses may be caused by distributed leakage through flow interiors or discrete features, or by interference by hydrogeologic boundaries. It appears that current monitoring facilities at the Hanford Site are inadequate to achieve the objectives of LHS testing because of their locations and limited number.

The inadequacy of present monitoring facilities is especially acute for the third planned LHS test, which will stress the Grande Ronde 5 flow top. Of the three proposed tests, the LHS test of the Grande Ronde 5 flow top has the greatest potential to be a repository-scale test because of the unit's apparent high transmissivity in the vicinity of the RRL-2 cluster. However, only two facilities presently monitor the Grande Ronde 5 flow top: RRL-2C at 75 m from RRL-2B and RRL-14 at 2250 m. The limited number and locations of these facilities appear to be inadequate to characterize hydrologic boundaries and hydraulic continuity, and the spatial distribution of hydraulic properties. BWIP should install additional monitoring facilities or substantially modify existing facilties prior to conducting the proposed LHS test in the Grande Ronde Number 5 flow top.

Prior to conducting LHS testing, BWIP needs to demonstrate how proposed monitoring facilities will provide necessary hydraulic head and response data for site characterization. BWIP should assess the limitations of the present monitoring network at the Hanford Site and improve the network to accomplish the objectives of LHS testing and site characterization. Potential improvements to the network range from increasing the frequency and location of head measurements at existing facilities to installing new monitoring facilities. A more comprehensive piezometer network (both in frequency of measurement and location) would support characterization of the groundwater flow system in the Pasco Basin and provide a potentiometric baseline against which BWIP could compare effects of drilling, well development, testing, and other activities (e.g., exploratory shaft construction, off-site perturbations, wastewater disposal activities).

2. Cement Effects

During the drilling of RRL-2A and -6, the Rocky Coulee flow top was cemented to reduce mud loss. This cementing may adversely complicate the interpretation of water level responses and tracer breakthrough during the first LHS test. Such complications in RRL-2A could be especially important because of the sensitivity of test interpretations to water level responses at this location and because cement may inhibit tracer injection into the Rocky Coulee flow top.

During the meeting, BWIP asserted that cement does not significantly interfere with hydraulic communication between RRL-2A and the Rocky Coulee flow top. This position was based on evaluation of dynamic temperature logs and comparisons of hydraulic test data. Dynamic temperature logging indicated that the Rocky Coulee flow top still contributes flow to the well. BWIP also compared the transmissivity value determined from a hydraulic test of the combined Grande Ronde 2 flow and the Rocky Coulee flow top in RRL-2A with the transmissivity value determined from a pulse test in RRL-2B. BWIP concluded that the two transmissivity values compared favorably, thus indicating that cement does not inhibit hydraulic communication between the borehole and the Rocky Coulee flow top.

Although BWIP provided a verbal basis for its assertion that cement in RRL-2A and -6 does not signficantly inhibit hydraulic communication with the Rocky Coulee flow top, BWIP did not provide any documentation of the conclusions nor supporting assessments. BWIP should document the basis for its assertion and then provide it to NRC for review and comment.

3. Borehole Interflow

Subsequent to the first LHS test in the Rocky Coulee flow top and removal of bridgeplugs, interformational flow via open boreholes between flow tops and other producing zones may occur within observation wells RRL-2A, DC-4, RRL-6, and the McGee Well. The bridgeplugs were originally installed to minimize borehole interflow, which could interfere with interpretations of LHS test results by perturbing water levels. BWIP indicated during the meeting that borehole interflow would not significantly perturb water levels, yet did not provide any rationale for this conclusion. BWIP should carefully analyze whether borehole interflow subsequent to bridgeplug removal will significantly affect interpretations of LHS test results. This analysis should then be presented to NRC for review.

4. Monitoring Facilities for the Ratio Test

BWIP proposes to analyze LHS test results using the Neuman-Witherspoon ratio method to derive estimates of vertical hydraulic conductivity of the flow interiors near RRL-2B. The utility of the first ratio test in the Rocky Coulee flow top is limited, however, because limitations of present monitoring facilities preclude determination of diffusivity for the flow interior above the Rocky Coulee flow. In addition, ratio testing could result in low, non-conservative estimates of hydraulic diffusivity for the Rocky Coulee flow interior because of piezometer compliance, which is the non-ideal response of piezometers caused by small-scale deformation of piezometer components.

The Neuman-Witherspoon (1972) ratio method requires head response data from within confining beds adjacent to the pumped aquifer (e.g., Rocky Coulee flow top in the first planned LHS test). These data are interpreted along with response data from within the pumped aquifer to estimate the hydraulic diffusivity of the confining units, where diffusivity equals the ratio of the confining unit's vertical hydraulic conductivity and its specific storage. Although response data can be collected from the piezometer completed within the Rocky Coulee flow interior at RRL-2C, response data cannot be collected within the flow interior above the Rocky Coulee flow top because BWIP has not completed a piezometer within the interior of Grande Ronde flow number 2. Thus, the first LHS test will not estimate the diffusivity of the flow interior above the Rocky Coulee flow top. Because of this limitation, the first LHS test will not serve as a good example of applying the ratio test to characterize vertical hydraulic conductivities of the Columbia River Basalts. In comparison, testing the Cohassett flow top may provide a better demonstration of ratio testing since flow interiors above and below the flow top will be monitored.

In addition, the utility of the first ratio test may also be limited because piezometer compliance could delay head responses in piezometers completed in the flow interiors. This delay could bias analyses of test results by underestimating the hydraulic diffusivity of the interiors, thus underestimating values of vertical hydraulic conductivity which would be nonconservative with respect to repository performance. BWIP should assess the significance of time-lag due to compliance of piezometers in the RRL-2C cluster that will be used for the ratio test. For example, BWIP could measure piezometer compliance prior to LHS testing by conducting pulse tests in appropriate piezometers. After the LHS test is completed and the results needed for the ratio test have been collected, BWIP could then compare the lag time determined in pulse tests with the time difference between the start of the test and initial response detected in the piezometers completed in the flow interiors. If the piezometer lag time is comparable with the initial response time, then BWIP may need to correct the response data to characterize hydraulic diffusivities.

5. Grout Permeabilities

During the meeting, BWIP indicated that the permeabilities of grouts used in the clustered piezometer installations (i.e. DC-19/20/22) had recently been estimated using permeameter testing. The contrast between the grout permeability in the cluster installations and that of the basalts is important to reliable performance of the piezometers. In addition, the effectiveness of the bond between the grout and basalt also affects the reliability of piezometer responses. Isolation of monitoring intervals using grout is especially important to reliable performance of piezometers completed within flow interiors because of the similarity of hydraulic conductivities between the grout and basalt. BWIP should present its analyses of grout permeability and integrity to NRC to demonstrate reliable performance of the piezometers.

6. Westbay Installation

Based on discussions during the meeting and the subsequent site visit by NRC consultants (12/11/85), the trial installation of a Westbay device in RRL-14 appears to be providing useful information about the device's utility within the Hanford site monitoring network. BWIP indicated during the meeting that the travelling pressure probe in the Westbay device will be used to monitor several horizons at RRL-14 during the LHS test. This does not appear feasible, however, because approximately 8 hours are required to complete a profile of all ports. The probe cannot be moved back and forth from one portal to another, thus it may not be useful to monitor several horizons during the LHS test because of the time consumed in moving the probe. BWIP should evaluate whether the configuration of the Westbay device can be effectively modified to monitor several flow horizons during LHS testing.

Despite their apparent limitations for near-field multi-level monitoring of LHS tests, Westbay devices may satisfy the need for additional far-field monitoring facilities at the Hanford Site (cf. USGS letter from Rollo to Olson, October 21, 1985). Additional facilities are needed to characterize the regional groundwater flow system in terms of both horizontal and vertical hydraulic gradients. For example, monitoring of such facilities outside of the Cold Creek Syncline may provide DOE with the ability to characterize vertical pressure profiles in areas where site activities are not expected to cause significant transient hydrologic responses. This type of additional information could significantly contribute to BWIP's understanding of the groundwater flow system at the Hanford Site. Based on experience gained with the Westbay device at RRL-14, BWIP should consider installing similar types of devices in boreholes distant from the RRL to characterize the regional groundwater flow system.

Testing Procedures

7. LHS Testing Focus

The test plan states on page 41 that the "real focus of large-scale hydraulic testing in the Grande Ronde Basalt at the RRL-2 site is the Cohassett flow interior." This statement appears to be inconsistent with both the objectives of LHS testing stated earlier in the plan and BWIP's approach to repository performance assessment. As described in other sections of the test plan and NRC's BWIP Site Technical Position 1.1, the primary objective of LHS testing at BWIP is to provide repository-scale hydraulic data to support licensing assessments of repository performance. This includes characterization of hydraulic parameters, identification of hydrologic boundaries, evaluation of far-field hydraulic continuity, and formulation of defensible conceptual models of the groundwater flow system. To accomplish these objectives, LHS testing should develop a far-field perturbation in response to controlled stress, which can best be done in the units with the highest transmissivities. Of the three units identified in the test plan for LHS testing, the Cohassett flow appears to have the lowest transmissivities. Therefore, BWIP's focus on the Cohassett flow may decrease t... potential for fulfilling the primary objective of LHS testing.

The focus on the Cohassett flow interior also appears inconsistent with BWIP's current approach to repository performance assessment. As stated on page 2-9 of the Exploratory Shaft Test Plan [SD-BWI-TP-007], "BWIP is following a logic which does not take credit for [groundwater] travel time [in] the preferred horizon dense interior." Since the goal of LHS testing is to develop information necessary for demonstrating compliance with licensing requirements, it would appear that BWIP should focus testing on hydrogeologic units that it plans to take credit for in the compliance demonstration.

In addition, if BWIP's proposed testing plan focuses on the Cohassett flow interior, the plan should be modified to include a long-term pumping test of the Cohassett flow top. The test plan implies that LHS testing will not be considered in the Cohassett flow top because of its assumed low transmissivity relative to other flow tops. However, long-term testing of the flow top may yield valuable information about the vertical hydraulic conductivity of the Cohassett and Rocky Coulee flow interiors. Uncertainty in estimates of vertical leakage can be reduced by pumping a lower transmissivity unit such as the Cohassett flow top because uncertainty in leaky aquifer analyses is reduced in LHS tests where aquifer response deviates substantially from the theoretical Theis response, and this deviation increases as the ratio in conductivities between the aquifer and confining units decreases. Thus, LHS testing of low transmissivity flow tops may provide more information about vertical hydraulic conductivity than tests in higher transmissivity units.

BWIP should determine the appropriate focus of LHS testing at RRL-2 with respect to its approach for performance assessment and the objectives for LHS testing. As discussed during the meeting, BWIP should also evaluate LHS testing of the Cohassett flow top based on preliminary estimates of the unit's transmissivity at RRL-2B that will be determined through pulse tests and well development.

8. Pump Selection

The test plan states that the first LHS test in the Rocky Coulee flow top will use a positive displacement (sucker rod) pump. Positive displacement pumps, however, do not produce a continuous and constant rate of discharge. Fluctuations in pressure at the pumping well caused by pump cycling may complicate interpretation of early-time drawdown data if the fluctuations cause oscillations in water levels at observation wells RRL-2C and -2A. In addition, changes in pumping rate may be difficult to accomplish during the early part of the test because of the operation of the pump. It appears BWIP would have to turn the pump off to alter the pump discharge rate, which may unnecessarily complicate interpretation of the LHS test results. If the production capability of RRL-2B in the Rocky Coulee flow top is greater than anticipated, the sucker rod pump may not be able to pump at sufficiently high rates to optimize the performance of the LHS test.

When the selection of the sucker rod pump was discussed during the meeting, BWIP indicated the selection was based on the need to minimize the effects of wellbore storage. Although this is an advantage of using the sucker rod pump, other pumping schemes such as submersible pumping may also acheive this advantage while providing relatively constant discharge rates.

BWIP should attempt to keep the discharge rate relatively constant, as appropriate, during the pumping test to minimize complications in interpreting the test results. In addition, BWIP should document its rationale for selecting the sucker rod pump and evaluate potential adverse effects of sucker rod pumping on interpretation of water level data from the pumping well and RRL-2C and -2A.

9. Criteria for LHS Testing

The LHS test plan describes a nominal 30-day period of pumping during the first test from the Rocky Coulee flow top. The plan recognizes satisfactory tracer recovery and indications of hydraulic boundary conditions as criteria to determine when pumping should be terminated. Premature termination of the pumping, however, may limit the ability of the test to fulfill its objectives.

During the meeting, BWIP elaborated on the termination criteria which included accomplishment of test objectives and jeopardization of synchronous head measurements. In their present form, however, both of these criteria are subjective and need to be defined in greater detail to develop objective criteria for determining when pumping should be terminated. BWIP should also develop criteria for determining when transient responses caused by LHS testing have sufficiently subsided to allow subsequent LHS tests to begin.

Similar criteria should be developed to determine when pressure trends have been reestablished after the first tracer has been injected during the first LHS test, but before the transducer is pulled out of the second piezometer prior to tracer injection. During the meeting, BWIP indicated that both transducers in RRL-2A and -2C in the Rocky Coulee flow top could be out of the piezometers at the same time, which would eliminate BWIP's capability of monitoring drawdown if measurable perturbations from the first test do not reach more distant monitoring facilities beyond 2250 m. Thus, BWIP would not be able to detect hydrogeologic boundaries. Further, the removal of the tracer injection apparatus may also perturb pressures in the flow top, which could not be characterized unless at least one transducer remained in a piezometer in the flow top. Once developed, these criteria should be incorporated into LHS and tracer testing procedures.

10. Development of RRL-2B

The LHS test plan does not discuss how the the pumping well, RRL-2B, has been or will be developed prior to the first LHS test in the Rocky Coulee flow top, or how the well will be developed prior to subsequent tests. Drill cuttings and drilling fluids remaining in the Rocky Coulee flow top may inhibit flow to the well, thus decreasing well efficiency and potential pumping rates. The purpose of well development is to remove cuttings and drilling fluids from the formation. The drilling and completion specifications document for RRL-2B and -2C [SD-BWI-TC-023] mentions that RRL-2C will be developed prior to installation of the piezometers, but does not discuss well development activities for RRL-2B. In addition to improving well efficiency, controlled development of RRL-2B using air-lift pumping or other suitable techniques may provide valuable pre-LHS testing transmissivity estimates allowing selection of optimal pumping rates from the Rocky Coulee flow top. Use of well development as a pre-test would require that BWIP monitor water levels and/or pressures, discharge rates, and hydraulic responses to the development stress. Controlled well development of RRL-2B may provide more accurate estimates of aquifer transmissivity and a more defensible basis for selection of optimal pumping rates than the proposed pulse testing, particularly in higher transmissivity units. Hydrochemical sampling during well development could also be used to evaluate whether the bulk of drilling fluids injected during drilling have been removed. BWIP should carefully document the development procedures used in RRL-2B. If the well has not been developed, BWIP should evaluate alternative development techniques and develop RRL-2B, as appropriate, prior to initiation of LHS testing.

11. Mechanical Effects

Based on pre-test analyses described in the test plan, BWIP expects that pumping from RRL-2B will develop significant drawdowns (e.g., 263 meters) in the vicinity of the pumping well during the first LHS test. Such large drawdowns may stimulate discontinuous deformation of the basalt flows by decreasing pore pressures and changing fracture apertures. Although stresses caused by changes in pore pressure may be insignificant compared with in-situ stresses, BWIP should recognize that changes in fracture apertures in close proximity to the pumping well may cause anomalous head responses during LHS testing.

12. Vesicular Zone Testing

As agreed in the meeting, BWIP needs to consider performing LHS tests of the vesicular zone in the Cohasset flow interior. BWIP's decision to conduct testing of the vesicular zone should be consistent with the test plan and be based on preliminary testing of the vesicular zone after the pumping well has been drilled through the zone.

13. Convergent Tracer Test

The test plan proposes integration of convergent well tracer testing with LHS testing of the Rocky Coulee flow top. The NRC is concerned that the tracer test may complicate the interpretation of LHS testing results. Injection of tracer solution and chase water under 250 m of head into RRL-2A and -2C, may result in pressure perturbations that could interfere with aquifer responses to pumping stress, especially within the flow interiors. Although such perturbations may not last long within flow tops (e.g., several hours to days), the pressure pulses in flow interiors may be on the order of meters and persist for periods up to tens of days. As discussed in comment number 9, conduct of the tracer test may also prevent continuous collection of pressure data at RRL-2A and -2C because the pressure transducers will be removed to inject the tracers.

In addition, the test plan does not provide a detailed rationale for how information derived from the convergent well tracer test will be utilized in evaluations of site performance. For example, the two-well recirculating tracer test conducted previously at the BWIP was not designed to provide repository-scale estimates of dispersivity (Leonhart et al., 1984). This same limitation also applies to the dispersivity values determined in the convergent well tests at RRL-2. The test plan's description of proposed tests does not evaluate whether lateral dispersion will be significant with respect to longitudinal dispersion, or whether the hydraulic gradients imposed during the test will result in tracer behavior that is fundamentally different from tracer behavior under ambient conditions. This difference may be especially significant if flow through fractured basalt is assumed to represent an equivalent porous medium. Further, the plan does not discuss uncertainties about the representativeness of effective porosity and dispersivity values for portions of the Rocky Coulee flow top distant from RRL-2 and other basalt flow tops.

The NRC agrees that the DOE needs to characterize effective porosity and dispersivity at the BWIP site, but this information should be collected in a manner that does not compromise the primary objective of the LHS testing, i.e. to characterize the groundwater flow system including hydrologic boundaries, hydraulic continuity, and hydraulic parameters. BWIP should assess potential complications of conducting the convergent tracer tests in conjunction with the LHS test and concurrent ratio test, particularly with respect to monitoring water level responses within the flow interiors. This assessment should also document the rationale for the tracer tests including a discussion of the limitations and uncertainties that will be associated with the tracer test results.

REFERENCE: Leonhart, L. R., R. Jackson, D. Graham, L. Gelhar, G. Thompson, B. Kauchoro, and C. Wilson, 1984, "Analysis and Interpretation of a Recirculating Tracer Experiment Performed in a Deep Basalt Flow Top," RHO-BW-SA-300 P, Rockwell Hanford Operations.

Hydrologic Baseline

14. Perturbations to Hydrologic Baseline

Based on reviews of recent water level data submitted by BWIP, NRC observes that trends in hydraulic heads appeared to have been sufficiently established for LHS testing in the Rocky Coulee flow top in May and June of 1985. Since that time, concurrent site preparation activities (e.g., drilling bridgeplugs at RRL-14 and drilling DC-23) have perturbed the groundwater system causing significant deviations to pre-test trends. During the meeting, BWIP acknowledged that more time is now required to reestablish pre-test trends before LHS testing can begin. These recent perturbations demonstrated that hydraulic stresses can be propagated across the Reference Repository Location, thus adding credence to the feasibility of conducting repository-scale LHS testing. The perturbations also indicate that future combinations of drilling, construction, and testing may perturb hydraulic heads to the extent that characterization of the pre-emplacement groundwater flow system and LHS testing would be delayed for a significant amount of time.

In developing strategies and schedules for site activities, BWIP should consider potential complications and delays of site activities caused by perturbations to the hydrologic system. For example, BWIP indicated that a multi-year period of reduced site activity might be required to establish hydrologic baseline if it cannot be established prior to LHS testing and Exploratory Shaft construction. BWIP's strategy for site characterization should consider the practicality of these contingencies in light of the ambitious project schedules.

15. Hydrochemical Sampling

The test plan lists constituents that will be analyzed in groundwater samples collected during pumping (cf. Table 13). Although the list appears comprehensive, the test plan does not discuss the objectives for collecting the hydrochemical data or provide a rationale supporting the list. Based on NRC's understanding of BWIP's current strategy for site characterization, these data will be used to characterize baseline hydrochemistry of the Hanford Site to confirm conceptual groundwater flow models and to support predictions of post-emplacement hydrochemical environments along potential radionuclide pathways. BWIP should amend the test plan to discuss the objectives and rationale for the hydrochemical sampling.

In addition, BWIP has omitted carbonate and bicarbonate species from the list of constituents that will be analyzed. Bicarbonate and carbonate species may significantly affect radionuclide transport by a variety of processes, such as complexing, pH buffering, and precipitation. In addition, concentrations of these two species are essential for calculating ion balances. The NRC recognizes that the concentrations of these two species may be calculated based on pH, alkalinity, and concentrations of other constituents (Stumm and Morgan, 1970). However, it would be prudent for BWIP to analyze for carbonate and bicarbonate as a more direct and precise method of determining their concentrations than through calculations. BWIP should include carbonate and bicarbonate in the list of constituents to be analyzed or amend the test plan to describe how their concentrations will be determined in lieu of analysis.

REFERENCE: Stumm, W. and J. J. Morgan, 1970, "Aquatic Chemistry: An Introduction Emphasizing Chemical Equalibria in Natural Waters," (New York, New York: Wiley-Interscience).

16. Data Release

Until several days before the meeting, the most recent water level information available to the NRC staff and contractors had been collected six months earlier (May/June 1985). NRC has not received pressure data from the BWIP site for the last 10 months. If NRC is to provide constructive comments to DOE on the adequacy of hydrologic data and interpretations, BWIP needs to release essential information such as the water level data on a more-timely basis. The meeting may have been postponed if the NRC had been informed about the perturbations caused by drilling activities prior to the meeting. BWIP should release tabulated and time profile data including down-hole pressures, water levels, and environmental heads in accordance with the Site Specific Agreement, which specifies a 45-day release time frame from the time of data acquisition to the time the data are provided to the NRC.

APPENDIX C

PROPOSED PRE-ES GEOHYDROLOGIC TESTING PROGRAM

After the establishment of a hydraulic-head baseline and before the start of construction of the exploratory shafts (ES), DOE will conduct hydraulic tests in the Rocky Coulee flow top, Cohassett flow top and vesicular zone, and Birkett flow top within the upper Grande Ronde Basalt sequence. The logical basis for the proposed testing program is presented in Figure 1.

The hydraulic-head baseline will be established, for the most part, from a network of about 36 monitoring sites within the Hanford site (Figure 2). These monitoring sites consist of single boreholes that monitor single basalt horizons and several nested piezometer wells that monitor multiple horizons (i.e., RRL-2C, DC-19, DC-20, and DC-22). Two additional nested piezometer wells (DC-24 and DC-25) will be completed and equilibrated as part of the hydraulic-head baseline network before the first LHS test takes place. These new facilities will be used for water-level monitoring of multiple hydrostratigraphic units; they will neither be hydraulically tested nor hydrochemically sampled while under construction.

The chemistry of the ground waters is not perceived to be a "perishable" condition in the pre-ES timeframe. However, if ground-water sampling is not on the critical path, provisions will be made to collect hydrochemical samples at DC-24 and DC-25 as drilling progresses.

For the LHS tests, several existing boreholes will be modified (fitted with piezometers) in order to add monitoring points in the Birkett flow top. Those boreholes requiring modification include the McGee well, RRL-2A, RRL-6, RRL-14, RRL-17, DC 4/5, and DC-16. In addition, new nested piezometers, DC-32 and DC-33, will be placed at locations about 1000 meters southwest and southeast of RRL-2, respectively, in order to provide additional monitoring locations in appropriate proximity to the RRL-2B pumping center. The distribution of primary monitoring facilities during LHS tests of key horizons of the Grande Ronde Basalt is presented in Figure 3. The total time required for drilling and modifying all boreholes and reestablishing a hydrologic baseline is estimated at approximately 10 months.

After the reestablishment of the hydraulic-head baseline in the controlled-area study zone (CASZ), a series of LHS tests will be initiated. The tests would be conducted in the following order: the Rocky Coulee flow top, the Cohassett flow top, the Cohassett vesicular zone, and the Birkett flow top. Testing the Rocky Coulee flow top offers the opportunity for exerting appreciable stress on the system by pumping RRL-2B. This borehole will be successively deepened after each test. The Cohassett flow top and vesicular zone are assumed to be not transmissive enough for an LHS test; therefore, small-scale injection tests in RRL-2B are planned for these units. In the event either of these zones proves sufficiently transmissive, then a full LHS test will be performed. The Birkett flow top is expected to yield sufficient water to perform an LHS test.

Convergent tracer tests will be conducted in conjunction with LHS tests either by injecting tracers prior to the start of pumping or late in the pumping portion of the tests. Different, nonradioactive tracers will be injected into two nearby observation wells (RRL-2A and RRL-2C); tracer arrival will be observed at the pumping well (RRL-2B). The time required to complete the four tests is estimated to be approximately 12 months.

The Birkett and the Rocky Coulee LHS tests will allow the testing of a large volume of rock, probably to repository scale (i.e., a volume comparable to that of the proposed repository). Since it is expected that the Birkett flow top can be pumped at a greater rate than the Rocky Coulee flow top, the Birkett test could yield more data about the geohydrologic system in the vicinity of the ESF. The tests in the Cohassett flow top and vesicular zone will probably be of shorter duration and would interrogate a lesser volume of rock because of the lower hydraulic conductivities of these units relative to other units to be tested.

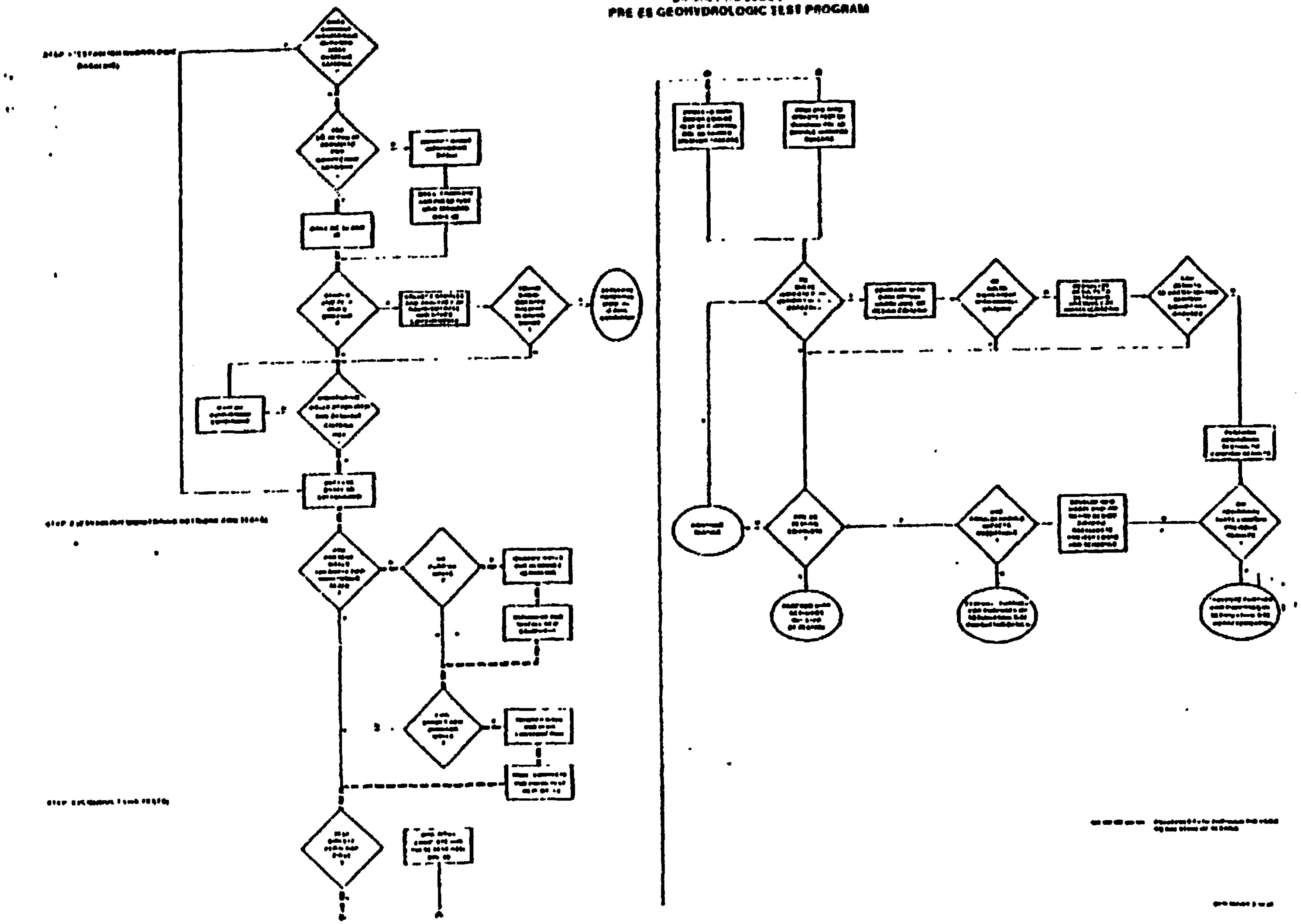
Results from these four tests will be evaluated for, among other things, hydraulic parameters that would be used to determine the presence of disqualifying conditions and any changes necessary to current ESF and repository designs (see Figure 1). The results of these evaluations will be used to determine whether and where further tests should be run before ES construction.

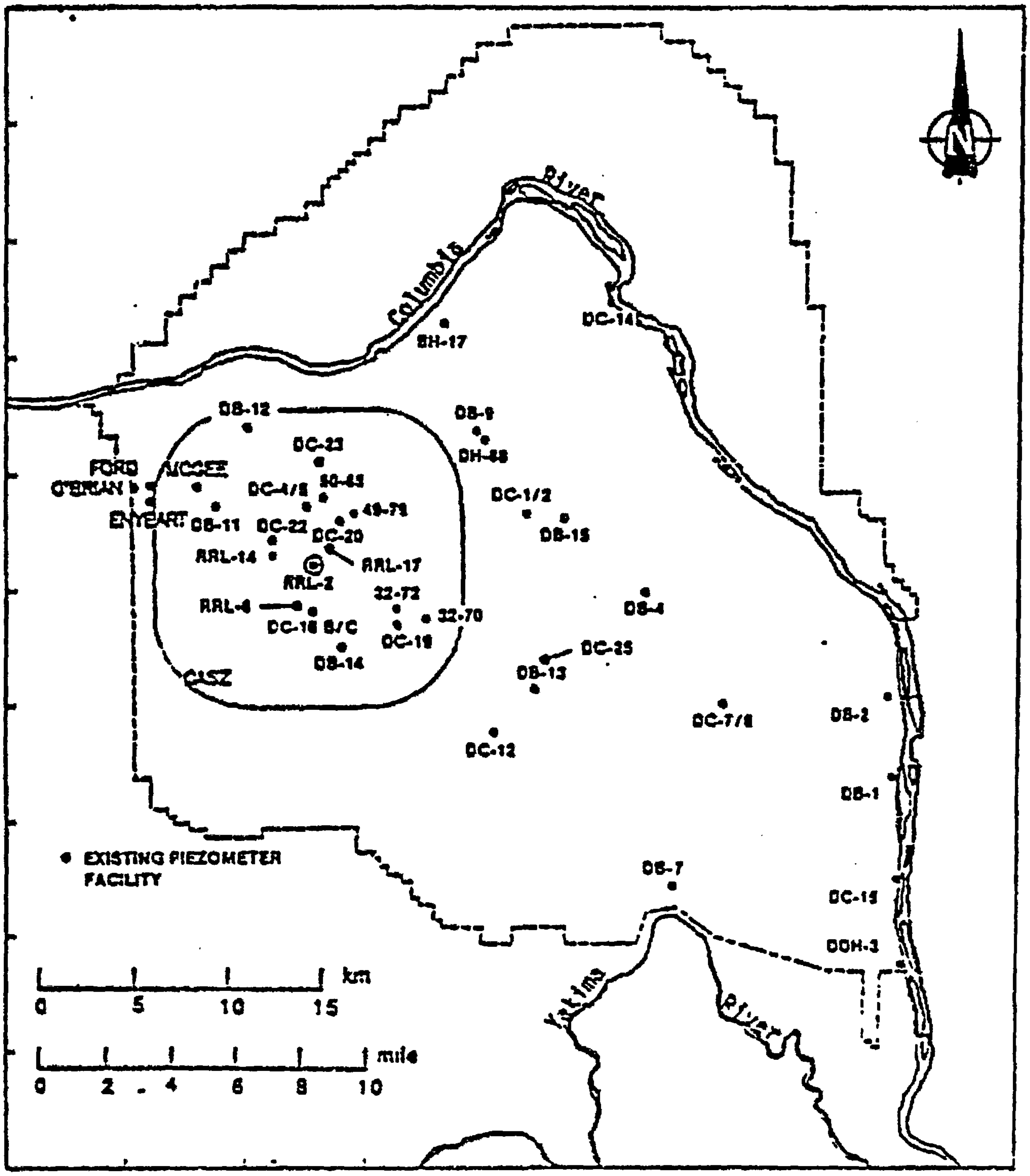
Pumping during the tests will provide an opportunity to collect representative ground-water samples from the Rocky Coulee and Birkett flow tops for chemical analysis. Water samples will be analyzed, at a minimum, for ^{14}C, ^{36}Cl, ^{129}I, tritium, major dissolved and suspended solids and gases, temperature, and pH. The results of these analyses, particularly for the short-lived radioactive isotopes, could yield an indication of the presence of a disqualifying condition. The collection and analysis of ground-water samples during LHS testing should not affect the ES schedule.

The combined schedule to carry out the recommended pre-ES geohydrologic testing program is presented in Figure 4. The total duration of the program is estimated at 22 months after the start of drilling.

FIGURE 1

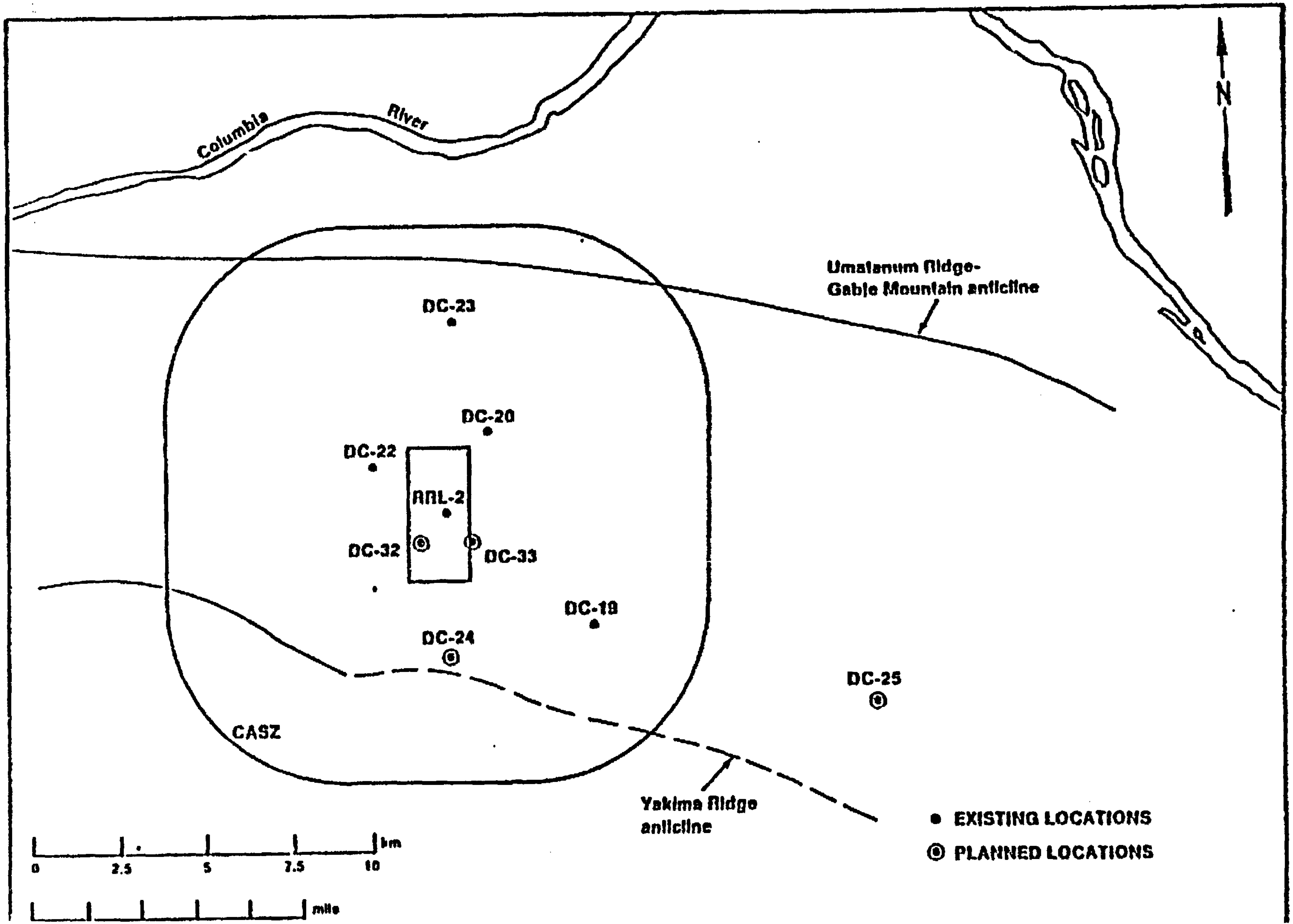
LOGIC PROCESS FOR PRE ES GEOHYDROLOGIC TEST PROGRAM



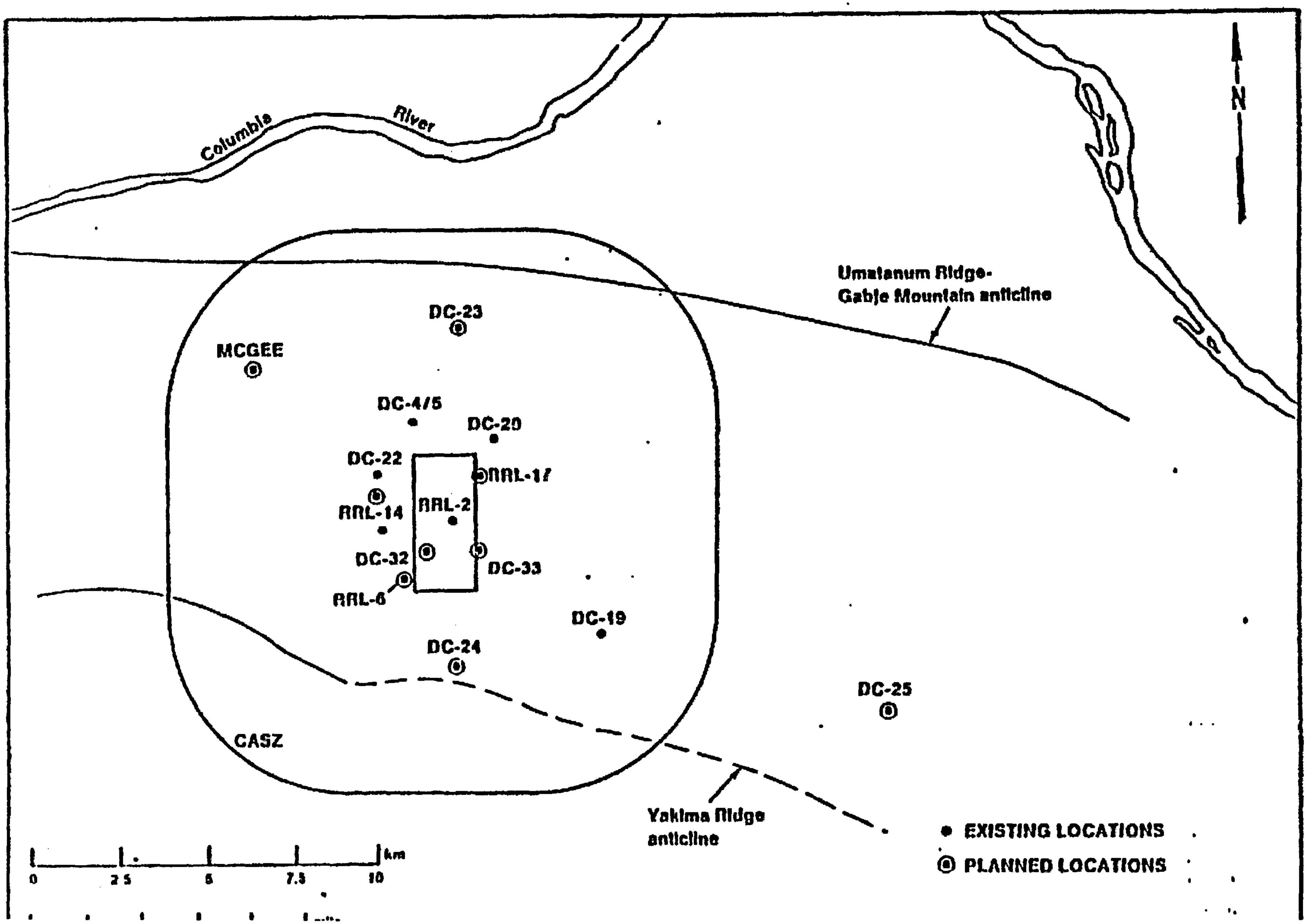


HYDRAULIC-HEAD BASELINE
MONITORING LOCATIONS AT THE HANFORD SITE

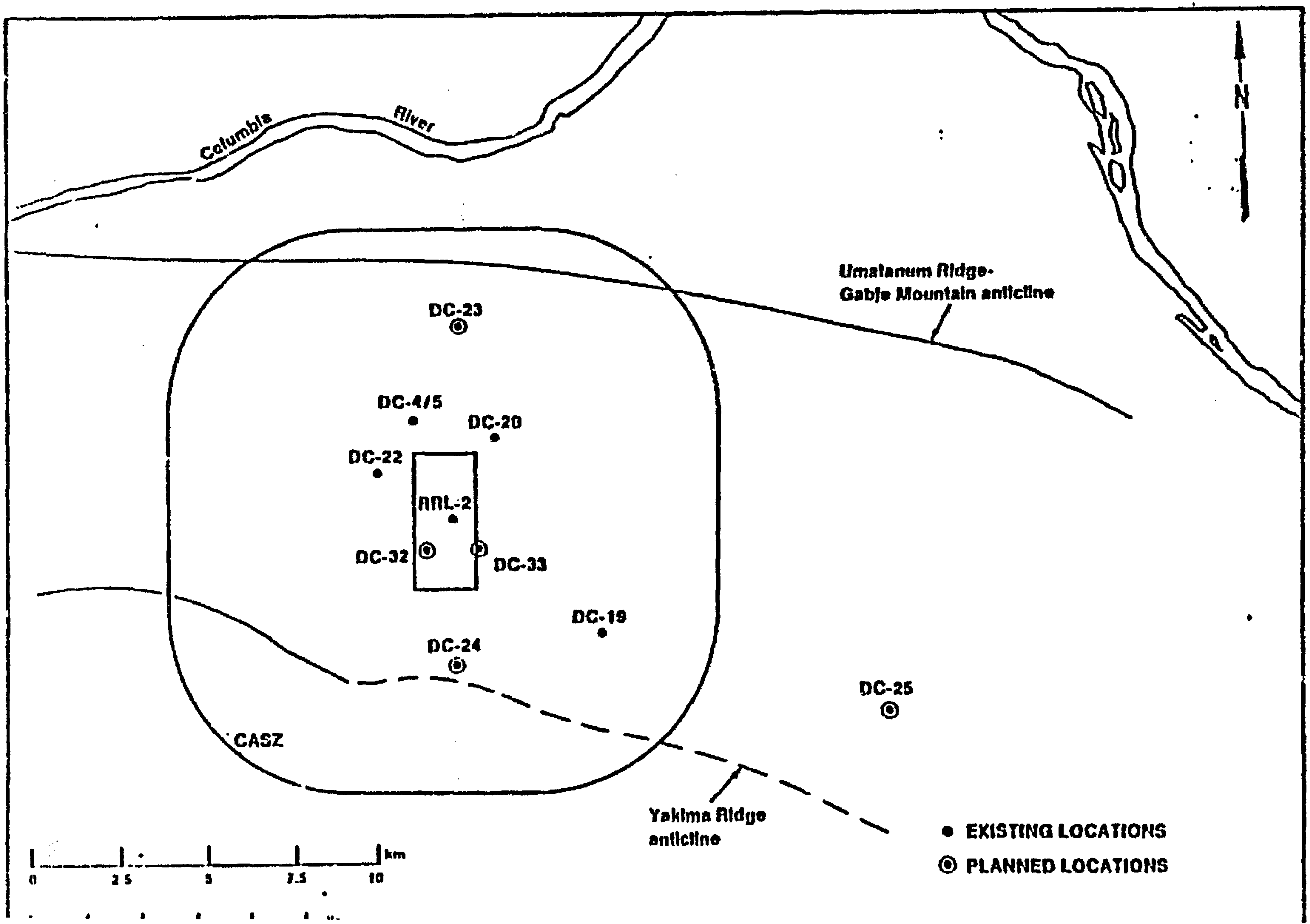
PRIMARY LHS TEST MONITORING FACILITIES IN THE GINKGO FLOW TOP



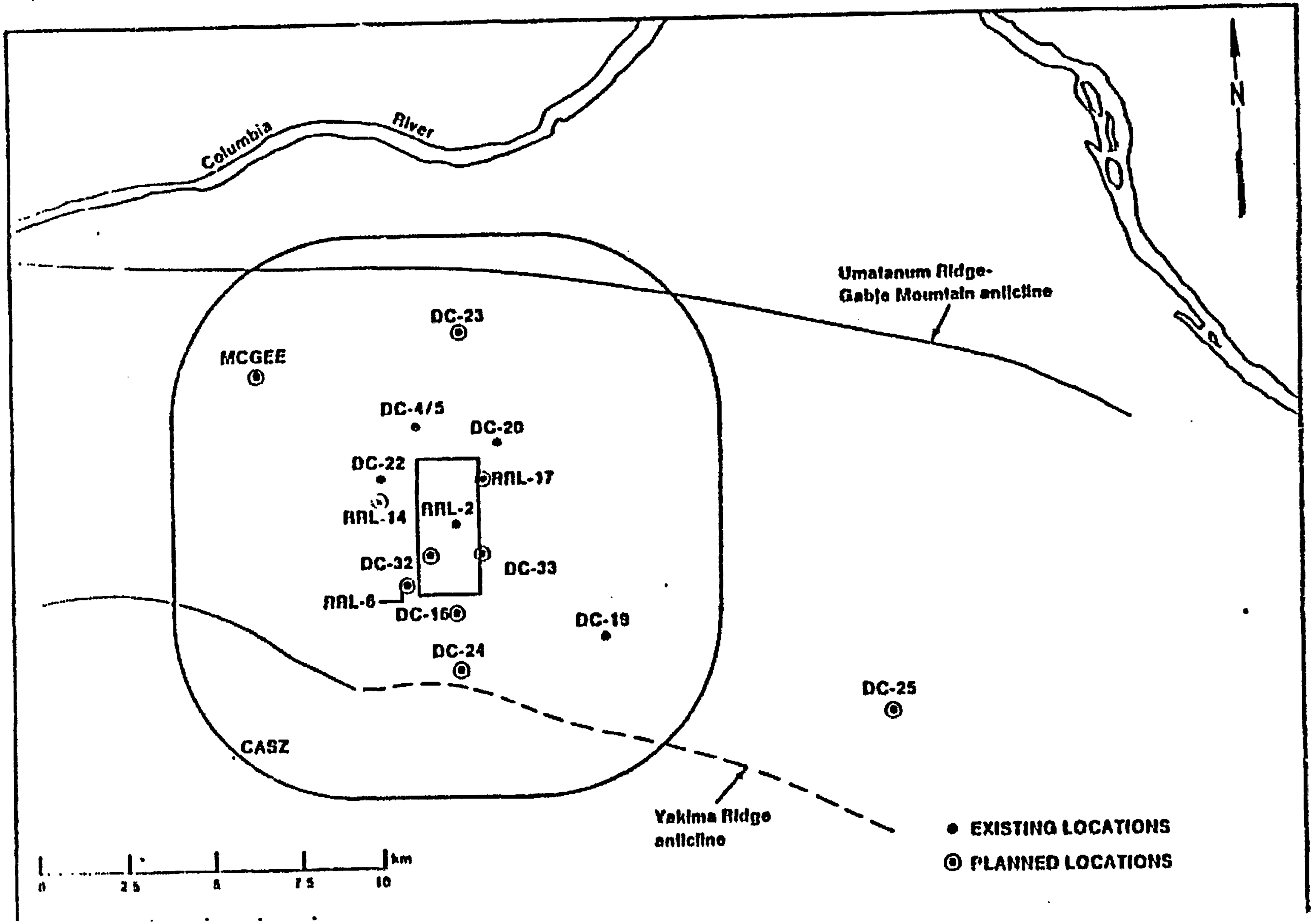
PRIMARY LHS TEST MONITORING FACILITIES IN THE ROCKY COULEE FLOW TOP



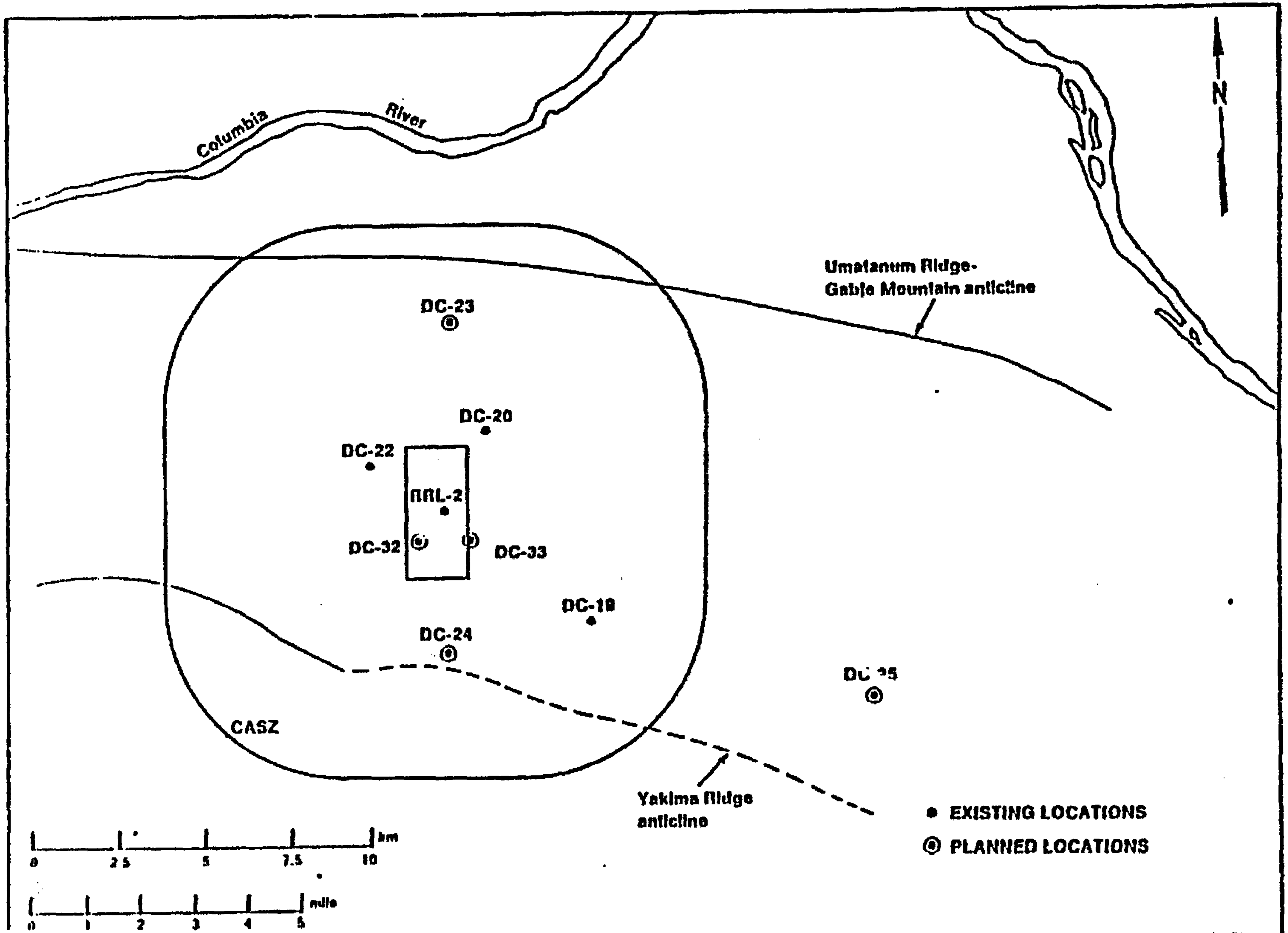
PRIMARY LHS TEST MONITORING FACILITIES IN THE COHASSETT FLOW TOP

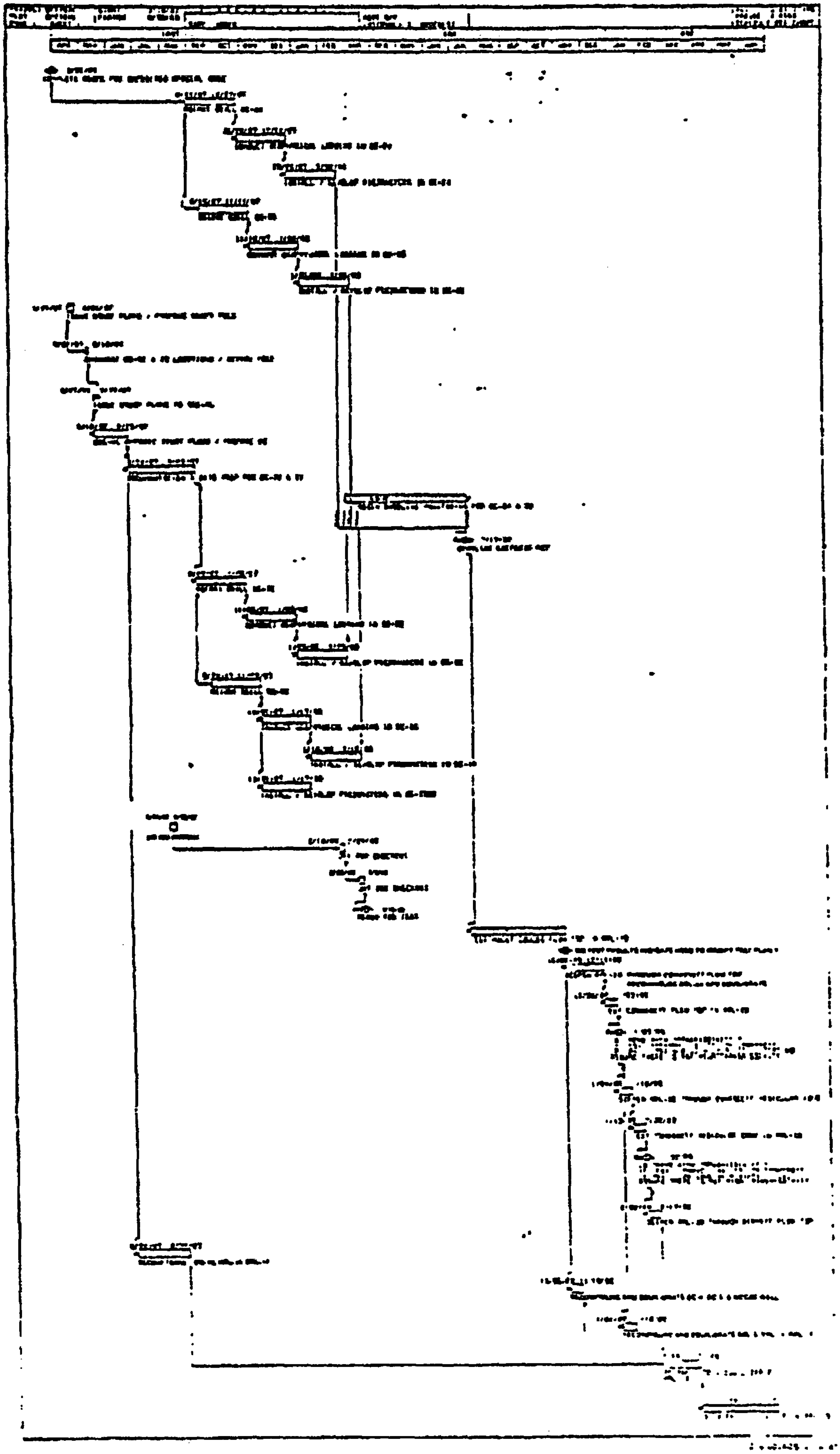


P'IIMARY LHS TEST MO:.:ITORING FACILITIES IN THE BIRKETT FLOW TOP



PRIMARY LHS TEST MONITORING FACILITIES IN THE UMTANUM FLOW TOP





ENCLOSURE C

RESPONSE TO LETTER FROM NRC STAFF

ABOUT THE GEOHYDROLOGY TESTING PROGRAM

AT HANFORD

The letter, dated April 10, 1986, from J. Linehan to O. Olson, made two major observations with regard to the geohydrology program presented at the December 1985 hydrology workshop. First, there was concern that the initial testing will not be on a repository scale. The NRC staff considered this to differ from the strategy defined by the NRC's Site Technical Position (STP) 1.1. Second, the staff felt that the ability to establish the hydraulic-head baseline may be in jeopardy from perturbations such as those caused by the Exploratory Shaft Facility (ESF). In the absence of a baseline, the evaluations of the pre-waste emplacement ground-water system and the results of future Large-scale Hydraulic Stress (LHS) tests could be compromised.

On the basis of an analysis of information needs to resolve licensing issues for the Hanford site, we have revised the geohydrologic program for the pre-ES time period. That program is structured around four objectives:

- To collect data on geohydrologic conditions that will be changed by site characterization activities.
- To collect data having the potential for providing an early indication of the presence of disqualifying conditions.
- To collect data on geohydrologic conditions in order to identify the effects of the ESF on the flow system and subsequent geohydrologic tests.
- To collect data on geohydrologic conditions that may affect the design of the ESF and/or the repository.

In order to meet the aforementioned objectives, the initial testing is planned to be of repository scale in areal extent. Therefore, we intend to stress four separate horizons: Rocky Coulee flow top, Cohassett flow top, Cohassett vesicular zone, and Birkett flow top. As a minimum, the tests of the Rocky Coulee flow top and Birkett flow top at the RRL-2B pumping well will be LHS tests and should reach to the boundaries of the proposed repository and beyond. In addition, we anticipate small-scale injection tests of the Cohassett flow top and vesicular zone. LHS tests of these units will be performed in the event they prove sufficiently transmissive. The tests identified above will be done in the absence of any external disturbances from other site characterization activities, especially ES construction. Further, descriptive information about the pre-ES testing program may be found in Section 8.3.1.3. of the Site Characterization Plan (in preparation), and the Department's option paper on pre-ES geohydrologic testing which gives a general overview of the program.

As for the hydraulic-head baseline, the program contains ongoing hydraulic-head monitoring which we believe provides the baseline needed to understand the ground-water flow regime and to evaluate subsequent hydraulic tests. As part of its pre-ES geohyrologic testing program, the Department of will supplement the monitoring network for hydraulic head. In particular, two multi-piezometer wells, DC-24 and DC-25, will be constructed. These facilities will be located to augment our understanding of the ground-water flow system and refine the preferred conceptual model. During the post-ES time period, additional monitoring wells will be installed and LHS tests will be performed to investigate the boundaries of the system.

Hydraulic head is monitored at 36 sites scattered over the Hanford site. Data from these sites, plus new multi-piezometer wells will, in our view, constitute a suitable baseline to characterize the pre-waste emplacement ground-water system at the site. We expect that the hydraulic-head data will be sufficient to meet our criteria for establishing the hydraulic-head baseline before the start of LHS testing. We expect these steps will adequately serve our testing objectives.

The NRC staff noted that the Department had not performed the analyses required to address their concerns. The results of the analyses will be available before start of the LHS test series at RRL-2B.

The NRC staff also requested early involvement in the readiness review process for the testing program. The Department agrees to keep the staff informed of progress with the readiness review. NRC's Onsite Representative and other interested staff will be invited to attend formal review meetings. Documentation related to the readiness review, including QA plans and procedures, will be provided as soon as internal management checks are completed. Whenever individual tests are performed, the NRC staff will be invited to attend as observers.

2. Responses to Detailed Comments

<u>Monitoring Facilities</u>

1. Monitoring Locations and Frequencies

NRC Comment -

Because of the uneven distribution of monitoring facilities around the pumping well (RRL-2B), BWIP's ability to characterize and interpret hydraulic responses to pumping stress in three dimensions is limited. As planned, water levels will not be monitored between radial distances of 152 m (RRL-2A) and 2250 m (RRL-14). Without water level information at intermediate scales between RRL-2A and RRL-14, results from LHS testing of the Grande Rhonde Basalts at RRL-2 may yield considerable uncertainty in interpretations drawn from the test results. For example, deviations from expected drawdown responses may be caused by distributed leakage through flow interiors or discrete features, or by interference by hydrogeologic boundaries. It appears that current monitoring facilities at the Hanford Site are inadequate to achieve the objectives of LHS testing because of their locations and limited number.

The inadequacy of present monitoring facilities is especially acute for the third planned LHS test, which will stress the Grande Ronde 5 flow top. Of the three proposed tests, the LHS test of the Grande Ronde 5 flow top has the greatest potential to be a repository-scale test because of the unit's apparent high transmissivity in the vicinity of the RRL-2 cluster. However, only two facilities presently monitor the Grande Ronde 5 flow top: RRL-2C at 76 m from RRL-2B and RRL-14 at 2250 m. The limited number and locations of these facilities appear to be inadequate to characterize hydrologic boundaries and hydraulic continuity, and the spatial distribution of hydraulic properties. BWIP should install additional monitoring facilities or substantially modify existing facilities prior to conducting the proposed LHS test in the Grande Ronde Number 5 flow top.

Prior to conducting LHS testing, BWIP needs to demonstrate how proposed monitoring facilities will provide necessary hydraulic head and response data for site characterization. BWIP should assess the limitations of the present monitoring network at the Hanford Site and improve the network to accomplish the objectives of LHS testing and site characterization. Potential improvements to the network range from increasing the frequency and location of head measurements at existing facilities to installing new monitoring facilities. A more comprehensive piezometer network (both in frequency of measurement and location) would support characterization of the groundwater flow system in the Pasco Basin and provide a potentiometric baseline against which BWIP could compare effects of drilling, well development, testing, and other activities (e.g., exploratory shaft construction, off-site perturbations, wastewater disposal activities).

DOE RESPONSE -

Current plans include the construction of additional multiple-level piezometer facilities at five sites; DC-23, DC-24, DC-25, DC-32, and DC-33 (figure 1) prior to initiating pre-ES LHS tests. At each site monitoring points will be provided in the Priest Rapids interflow, the Sentinel Gap flow top, the Ginkgo flow top, the Rocky Coulee flow top, the Cohassett flow top, the Birkett flow top, and the Umtanum flow top.

Eight existing boreholes will be modified for use as test observation points (figure 2). A permanent piezometer will be installed in DC-16 to monitor the Birkett flow top. The Birkett flow top was selected to be monitored in DC-16 based on comparison of the distribution of monitoring points available for each of the four pre-ES tests. Straddle packers and bridge plugs will be used to isolate test horizons in boreholes RRL-2A, RRL-6, RRL-14, RRL-17, DC-4, DC-5, and McGee well.

Borehole RRL-2A is currently configured to monitor the Rocky Coulee flow top and the Grande Ronde No. 2 flow above the Rocky Coulee flow. RRL-2A will be reconfigured for each of the three tests that follow the Rocky Coulee test such that the stressed (e.g., pumped or pulsed) horizon will be monitored. Monitoring of the stressed horizons at RRL-2A is important because of the near proximity of RRL-2A to the test well, RRL-2B. The remaining six boreholes, RRL-6, RRL-14, RRL-17, DC-4, DC-5, and McGee well will be configured to monitor the Rocky Coulee flow top during the Rocky Coulee flow top LHS test and then reconfigured to monitor the Birkett flow top during the Birkett flow top LHS test. Hydraulic response is not expected at RRL-6, RRL-14, RRL-17, DC-4, DC-5, and McGee well for the stress tests of the Cohassett flow top and Cohassett vesicular zone because of the distance the boreholes are from the test well and the expected low transmissivity of these horizons. However, if after deepening the test well, RRL-2B, it is found the Cohassett flow top and/or the Cohassett vesicular zone have sufficient transmissivity to support LHS tests, then the six facilities would be reconfigured to monitor the pumped horizon(s).

As reflected in the test plan for hydraulic testing at RRL-2B (Stone, et al., 1985), the frequency of measurement of hydraulic head or pressure at facilities in the Hanford Site Monitoring Network (figure 2) will be increased during hydraulic testing. Current monitoring frequencies are adequate for determining the hydraulic head baseline in the absence of any large perturbations.

2. Cement Effects

NRC COMMENT -

During the drilling of RRL-2A and -6, the Rocky Coulee flow top was cemented to reduce mud loss. This cementing may adversely complicate the interpretation of water level responses and tracer breakthrough during the first LHS test. Such complications in RRL-2A could be especially important because of the sensitivity of test interpretations to water level responses at this location and because cement may inhibit tracer injection into the Rocky Coulee flow top.

During the meeting, BWIP asserted that cement does not significantly interfere with hydraulic communication between RRL-2A and the Rocky Coulee flow top. This position was based on evaluation of dynamic temperature logs and comparisons of hydraulic test data. Dynamic temperature logging indicated that the Rocky Coulee flow top still contributes flow to the well. BWIP also compared the transmissivity value determined from a hydraulic test of the combined Grande Ronde 2 flow and the Rocky Coulee flow top in RRL-2A with the transmissivity value determined from a pulse test in RRL-2B. BWIP concluded that the two transmissivity values compared favorably, thus indicating that cement does not inhibit hydraulic communication between the borehole and the Rocky Coulee flow top.

Although BWIP provided a verbal basis for its assertion that cement in RRL-2A and -6 does not significantly inhibit hydraulic communication with the Rocky Coulee flow top, BWIP did not provide any documentation of the conclusions nor supporting assessments. BWIP should document the basis for its assertion and then provide it to NRC for review and comment.

DOE RESPONSE -

Available information indicates that spot cementing of the Rocky Coulee flow top during drilling of borehole RRL-2A had minimal effect on the hydraulic properties of this flow. Evidence suggesting that the cement did not significantly inhibit hydraulic communication between the borehole and the flow top includes:

- Single borehole tests performed on the composite Rocky Coulee and Grande Ronde No.2 flow tops at RRL-2A prior to cementing resulted in an estimated transmissivity ranging between 1 and 10 ft^2/d (Strait and Mercer, 1986). Pulse testing of the Rocky Coulee flow top was conducted at RRL-2B while monitoring hydraulic responses in the same horizon at RRL-2A and RRL-2C. Estimated transmissivity of the Rocky Coulee flow top at RRL-2A, following cementing of the Rocky Coulee flow top, was 6.5ft2/d (Jackson et al., 1986). The post-cementing test results are consistent with estimates of transmissivity obtained from the pre-cement test.

- Dynamic fluid-temperature logs (copies on file with Basalt Records Management System) run subsequent to cementing indicate water production (about two gallons per minute) from the Rocky

Coulee flow top at RRL-2A. This suggests a significant hydraulic connection between the Rocky Coulee flow top and the open interval in RRL-2A.

- Hydraulic responses were observed in the Rocky Coulee flow top at RRL-2A and RRL-2C while drilling RRL-2B in June, 1985 (Jackson et al. 1986, p. 23-24), indicating hydraulic connection.

The effects of cementing of the Rocky Coulee flow top at RRL-6 are not as well understood. Dynamic temperature logs of RRL-6 did not indicate a hydraulic connection between the Rocky Coulee flow top and the borehole. However, water-level data from subsequent monitoring of the Rocky Coulee flow top at RRL-6 are consistent with data from other Rocky Coulee flow top piezometers on the site.

3. Borehole Interflow

NRC COMMENT -

Subsequent to the first LHS test in the Rocky Coulee flow top and removal of bridgeplugs, interformational flow via open boreholes between flow tops and other producing zones may occur within observation wells RRL-2A, DC-4, RRL-6, and the McGee Well. The bridgeplugs were originally installed to minimize borehole interflow, which could interfere with interpretations of LHS test results by perturbing water levels. BWIP indicated during the meeting that borehole interflow, would not significantly perturb water levels, yet did not provide any rationale for this conclusion. BWIP should carefully analyze whether borehole interflow subsequent to bridgeplug removal will significantly affect interpretations of LHS test results. This analysis should then be presented to NRC for review.

DOE RESPONSE -

Preliminary, unpublished analyses (Internal letter 10130-85-034, S. M. Baker to W. H. Price) have been performed to determine the approximate effect of borehole interflow at DC-16. It was concluded from these analyses that borehole interflow at DC-16 would not affect water-level measurements at other observation points (e.g., DC-19, DC-20, DC-22, and RRL-2) for the Rocky Coulee flow top test.

We believe the results of the above described modelling can be used to qualitatively estimate the effect of borehole interflow at observation wells RRL-2A, DC-4, RRL-6, and McGee well. That is, effect on observed water levels at other observation points (e.g., DC-19, DC-20, and RRL-2C) is expected to be negligible due to borehole interflow at RRL-2A, DC-4, RRL-6, and McGee well. However, the water levels observed in the interval in which interflow occurs will not be accurate at the borehole (i.e., RRL-2A, DC-4, RRL-6, and McGee well). As recommended in internal letter 10130-85-034, additional modelling will be performed to estimate the effects of borehole interflow, subsequent to bridge plug removal to reposition the straddle packer in RRL-2A, DC-4, RRL-6, and the McGee Well. The approach taken to estimate the effects of borehole interflow will be described in the Site Groundwater Study Plan (SD-BWI-SP-047) which is expected to be released by July 1987. The results of the modelling will be used to chose the appropriate monitoring option.

4. Monitoring Facilities for the Ratio Test

NRC COMMENT -

BWIP proposes to analyze LHS test results using the Neuman-Witherspoon ratio method to derive estimates of vertical hydraulic conductivity of the flow interiors near RRL-2B. The utility of the first ratio test in the Rocky Coulee flow top is limited, however, because limitations of present monitoring facilities preclude determination of diffusivity for the flow interior above the Rocky Coulee flow. In addition, ratio testing could result in low, nonconservative estimates of hydraulic diffusivity for the Rocky Coulee flow interior because of piezometer compliance, which is the non-ideal response of piezometers caused by small-scale deformation of piezometer components. The Neuman-Witherspoon (1972) ratio method requires head response data from within confining beds adjacent to the pumped aquifer (e.g., Rocky Coulee flow top in the first planned LHS test). These data are interpreted along with response data from within the pumped aquifer to estimate the hydraulic diffusivity of the confining units, where diffusivity equals the ratio of the confining unit's vertical hydraulic conductivity and its specific storage. Although response data can be collected from the piezometer completed within the Rocky Coulee flow interior at RRL-2C, response data cannot be collected within the flow interior above the Rocky Coulee flow top because BWIP has not completed a piezometer within the interior of Grande Ronde flow number 2. Thus, the first LHS test will not estimate the diffusivity of the flow interior above the Rocky Coulee flow top. Because of this limitation, the first LHS test will not serve as a good example of applying the ratio test to characterize vertical hydraulic conductivities of the Columbia River Basalts. In comparison, testing the Cohassett flow top may provide a better demonstration of ratio testing since flow interiors above and below the flow top will be monitored.

In addition, the utility of the first ratio test may also be limited because piezometer compliance could delay head responses in piezometers completed in the flow interiors. This delay could bias analyses of test results by underestimating the hydraulic diffusivity of the interiors, thus underestimating values of vertical hydraulic conductivity which would be nonconservative with respect to repository performance. BWIP should assess the significance of time-lag due to compliance of piezometers in the RRL-2C cluster that will be used for the ratio test. For example, BWIP could measure piezometer compliance prior to LHS testing by conducting pulse tests in appropriate piezometers. After the LHS test is completed and the results needed for the ratio test have been collected, BWIP could then compare the lag time determined in pulse tests with the time *difference between the start of the test and initial response detected in the piezometers completed in the flow interiors. If the piezometer lag time is comparable with the initial response time, then BWIP may need to correct the response data to characterize hydraulic diffusivities.*

DOE RESPONSE -

A single multiple-piezometer nest, RRL-2C, was designed and constructed to serve as a nearby monitoring facility for the test at RRL-2B. One of the purposes RRL-2C is to serve is that of a facility for ratio tests to calculate vertical hydraulic diffusivity of several flow interiors. Piezometers are completed in flow tops (interflow zones) and flow interiors of the Rocky Coulee, Cohassett, and Birkett (Grande Ronde No. 5) flows. These piezometers will provide for ratio tests of the Rocky Coulee flow interior when the Rocky Coulee flow top is pumped, and of the Cohassett and Birkett flow interiors when the Birkett flow top is pumped. The practical limit to the number of piezometer tubes in a multiple-level installation was six at the time of construction of RRL-2C. Therefore, the interior of the Grande Ronde No. 2 was not fitted with a piezometer.

The ratio method is yet to be successfully applied in testing deep basalt flows. Therefore, the use of the ratio method to calculate vertical hydraulic diffusivity from the results of the first LHS test should be viewed as an evaluation of the methodology as well as an

attempt to estimate this parameter. Even if successful, the ratio test at RRL-2 may yield results of limited applicability because the vertical hydraulic diffusivity estimates derived from the test will apply to only a small region within the flow interior. Using the ratio method to evaluate results of the first LHS test will be valuable in developing plans for subsequent tests designed to determine vertical hydraulic properties.

Other approaches will be used to estimate flow interior vertical diffusivity. These approaches include analysis of the drawdown data in the pumped flow top with the Hantush-Jacob method (Hantush and Jacob, 1955) and Hantush Modified method (Hantush, 1960) and numerical analysis using the observed responses in the pumped flow top and adjacent flow tops. Estimating vertical diffusivity of confining units based solely on response of the pumped aquifer does have a disadvantage that should be noted here. That is, in a layered system it is generally not possible to discriminate the source of leakage into an aquifer if it is confined above and below such as the basalt flow tops are confined above and below by flow dense interiors.

The numerical analysis approach would use a quasi-three dimensional or fully three-dimensional numerical groundwater flow model of the site which would be "calibrated" to the observed water-level responses. The major disadvantage of the numerical approach is that solutions are not unique. However, with ever increasing data base, the number of solutions possible should be reduced.

Both the analytical and numerical approaches have the advantage of providing estimates of flow dense interior vertical diffusivity integrated over a large area. The application and limitations of all anticipated techniques will be discussed in the Site Groundwater Study Plan (SD-BWI-TP-047) which is expected to be released by July 1987.

The significance of time lag resulting from piezometer compliance in the RRL-2C piezometer cluster is an important consideration and will be assessed. Piezometer compliance due to compressibility of the fluid within the piezometer tube will be minimized by using a packer set at depth in the piezometer tube to isolate the lower part of the piezometer. Lag time due to compressibility of the remaining fluid in the piezometer tube and sand pack can be calculated. A detailed discussion of the plans for performing sensitivity studies and field tests of piezometer compliance and lag time are to be discussed in the Site Groundwater Study Plan (SD-BWI-SP-047).

As noted in response to comment 7, the Birkett flow top will be pumped prior to ES construction. When the Birkett flow top is pumped data from piezometers completed in the overlying Cohassett interior and the underlying Birkett interior and in the Birkett flow top will provide for ratio tests of both the Cohassett and the Birkett flow interiors.

5. Grout Permeability

NRC COMMENT -

During the meeting, BWIP indicated that the permeabilities of grouts used in the clustered piezometer installations (i.e. DC-19/20/22) had recently been estimated using permeameter testing. The contrast between the grout permeability in the cluster installations and that of the basalts is important to reliable performance of the piezometers. In addition, the effectiveness of the bond between the grout and basalt also affects the reliability of piezometer responses. Isolation of monitoring intervals using grout is especially important to reliable performance of piezometers completed within flow interiors because of the similarity of hydraulic conductivities between the grout and basalt. BWIP should present its analyses of grout permeability and integrity to NRC to demonstrate reliable performance of the piezometers.

DOE RESPONSE -

Formal documentation of the cement permeability is provided by Jackson et al. 1986, pp. 44-45. This document contains test results obtained by Rockwell and their cementing subcontractor. Details on the laboratory tests are found in the subcontractor's laboratory reports or in controlled notebooks, both of which are on file with the Site Characterization Field Investigation Department. The same document (pp. 49-65) shows the observed responses in RRL-2C piezometers during development pumping of each of the piezometer tubes. This information was provided to the NRC in December, 1986 at Richland, Washington.

In an effort to determine the sufficiency of piezometer seals a preliminary evaluation of historic hydraulic perturbations and monitored responses to drilling activities has been performed (Wilson, 1987, 29p.) The conclusion from the preliminary evaluation is that the piezometer seals are probably good and the observed vertical response to drilling activities is probably due to naturally occurring connections.

Additional activities to assess the integrity of piezometer seals and estimate the effect of a finite seal leakage on characterization activities will include numerical modelling of observed responses and sensitivity studies to estimate the effect of piezometer seal leakage on large-scale hydraulic test interpretation. Integrity tests similar to those done at DC-19, DC-20, and DC-22 will be performed at all new piezometer installations (e.g., DC-24, DC-25, DC-32, and DC-33) and evaluation of data from both new and existing piezometers will be ongoing for evidence of seal degradation or inadequacy.

6. Westbay Installation

NRC COMMENT -

Based on discussions during the meeting and the subsequent site visit by NRC consultants (12/11/85), the trial installation of a Westbay device in RRL-14 appears to be providing useful information about the device's utility within the Hanford Site monitoring network. BWIP indicated during the meeting that the travelling pressure probe in the Westbay device will be used to mintor several horizons at RRL-14 during the LHS test. This does not appear feasible, however, because approximately 8 hours are required to complete a profile of all ports. The probe cannot be moved back and forth from one portal to another, thus it may not be useful to monitor several horizons during the LHS test because of the time consumed in moving the probe. BWIP should evaluate whether the configuration of the Westbay device can be effectively modified to monitor several flow horizons during LHS testing.

Despite their apparent limitations for near-field multi-level monitoring of LHS tests, Westbay devices may satisfy the need for additional far-field monitoring facilities at the Hanford Site (cf. USGS letter from Rollo to Olson, October 21, 1985). Additional facilities are needed to characterize the regional groundwater flow system in terms of both horizontal and vertical hydraulic gradients. For example, monitoring of such facilities outside of the Cold Creek Syncline may provide DOE with the ability to characterize vertical pressure profiles in areas where site activities are not expected to cause significant transient hydrologic responses. This type of additional information could significantly contribute to BWIP's understanding of the groundwater flow system at the Hanford Site. Based on experience gained with the Westbay device at RRL-14, BWIP should consider installing similar types of devices in boreholes distant from the RRL to characterize the regional groundwater flow system.

DOE RESPONSE -

The BWIP agrees that the usefulness of the Westbay system at RRL-14 for near-field monitoring of several horizons during an LHS test is limited by the time required to complete a profile of all ports. However, this limitation is not so important at a large distance from the pumping well during a long-term test. The proximity of the DC-22 piezometer site to RRL-14 will also provide a backup monitoring point and a comparison for evaluating the usefulness of the Westbay system.

The Westbay system has been removed from RRL-14 because of an unanticipated problem with the packer material. The system will be reinstalled with new packers prior to LHS testing. Following evaluation of the renovated Westbay system, BWIP will develop a plan for its appropriate employment.

Testing Procedures

7. LHS Testing Focus

NRC COMMENT -

The test plan states on page 41 that the "real focus of large-scale hydraulic testing in the Grande Ronde Basalt at the RRL-2 site is the Cohassett flow interior". This statement appears to be inconsistent with both the objectives of LHS testing stated earlier in the plan and BWIP's approach to repository performance assessment. As described in other sections of the test plan and NRC's BWIP Site Technical Position 1.1, the primary objective of LHS testing at BWIP is to provide repository-scale hydraulic data to support licensing assessments of repository performance. This includes characterization of hydraulic parameters, identification of hydrologic boundaries, evaluation of far-field hydraulic continuity, and formulation of defensible conceptual models of the groundwater flow system. To accomplish these objectives, LHS testing should develop a far-field perturbation in response to controlled stress, which can best be done in the units with the highest transmissivities. Of the three units identified in the test plan for LHS testing, the Cohassett flow appears to have the lowest transmissivities. Therefore, BWIP's focus on the Cohassett flow may decrease the potential for fulfilling the primary objective of LHS testing.

The focus on the Cohassett flow also appears inconsistent with BWIP's current approach to repository performance assessment. As stated on page 2-9 of the Exploratory Shaft Test Plan [SD-BWI-TP-007], "BWIP is following a logic which does not take credit for [groundwater] travel time [in] the perferred horizon dense interior". Since the goal of LHS testing is to develop information necessary for demonstrating compliance with licensing requirements, it would appear that BWIP should focus testing on hydrogeologic units that it plans to take credit for in the compliance demonstration.

In addition, if BWIP's proposed testing plan focuses on the Cohassett flow interior, the plan should be modified to include a long-term pumping test of the Cohassett flow top. The test plan implies that LHS testing will not be considered in the Cohassett flow top because of its assumed low transmissivity relative to other flow tops. However, long-term testing of the flow top may yield valuable information about the vertical hydraulic conductivity of the Cohassett and Rocky Coulee flow interiors. Uncertainty in estimates of vertical leakage can be reduced by pumping a lower transmissivity unit such as the Cohassett flow top because uncertainty in leaky aquifer analyses is reduced in LHS tests where aquifer response deviates substantially from the theoretical Theis response, and this deviation increases as the ratio in conductivities between the aquifer and confining units decreases. Thus, LHS testing of low transmissivity flow tops may provide more information about vertical hydraulic conductivity than tests in higher transmissivity units.

BWIP should determine the appropriate focus of LHS testing at RRL-2 with respect to its approach for performance assessment and the objectives for LHS testing. As discussed during the meeting, BWIP should also evaluate LHS testing of the Cohassett flow top based on preliminary estimates of the unit's transmissivity at RRL-2B that will be determined through pulse tests and well development.

DOE RESPONSE -

The BWIP hydrology testing strategy has evolved significantly since the DOE/NRC workshop of December 1985. BWIP will establish a groundwater level baseline before the potential disturbance of LHS testing and ES construction occur. Hydraulic tests on four hydrostratigraphic units (Three flow tops and the Cohassett vesicular zone) will be performed at the RRL-2 site prior to ES construction. Two of the flow tops, the Rocky Coulee and Birkett flow top, are expected to have transmissivity sufficient to support LHS tests based on estimates of flow top hydraulic conductivity from the nearby corehole RRL-2A. The Cohassett flow top and vesicular zone are expected to not have sufficient transmissivity to support LHS tests thus, local-scale tests of the Cohassett flow top and Cohassett vesicular zone are expected.

8. Pump Selection

NRC COMMENT -

The test plan states that the first LHS test in the Rocky Coulee flow will use a positive displacement (sucker rod) pump. Positive displacement pumps, however, do not produce a continuous and constant rate of discharge. Fluctuations in pressure at the pumping well caused by pump cycling may complicate interpretation of early-time drawdown data if the fluctuations cause oscillations in water levels at observation wells RRL-2C and -2A. In addition, changes in pumping rate may be difficult to accomplish during the early part of the test because of the operation of the pump. It appears BWIP would have to *turn the pump off to alter the pump discharge rate, which may unnecessarily complicate interpretation of the LHS test results. If the production capability of RRL-2B in the Rocky Coulee flow top is greater than anticipated, the sucker rod pump may not be able to pump at sufficiently high rates to optimize the performance of the LHS test.*

When the selection of the sucker rod pump was discussed during the meeting, BWIP indicated the selection was based on the need to minimize the effects of wellbore storage. Although this is an advantage of using the sucker rod pump, other pumping schemes such as submersible pumping may also acheive this advantage while providing relatively constant discharge rates.

BWIP should attempt to keep the discharge rate relatively constant, as appropriate, during the pumping test to minimize complications in interpreting the test results. In addition, BWIP should document its rationale for selecting the sucker rod pump and evaluate potential adverse effects of sucker rod pumping on interpretation of water level data from the pumping well and RRL-2C and -2A.

DOE RESPONSE -

The pumping system selected to remove water from the Rocky Coulee flow top in RRL-2B is powered by an electric motor, operated by 60 cycle alternating current. The system embodies a reciprocal positive displacement pump and a geared reduction system for translating the rotary motion of the motor to the linear, reciprocal motion of the pump plunger. A multiple belt drive is used to transmit power from the motor to the geared reduction system. Short of belt slippage, which can be prevented by proper adjustment, the system must produce a constant rate of discharge from minute to minute, provided the current frequency does not vary substantially.

The pump will lift about 8 gpm at about 10 strokes per minute. The estimated hydraulic head fluctuation 250 ft from the pumping well caused by removal of 0.8 gallon (i. e., one stroke of the pump) is so small its estimation with the Theis equation is out of range of the W(u) tables. This fluctuation is not expected to have an adverse effect on the interpretation of data from the observation wells and is expected to be attenuated in travel to the nearest observation well, 250 feet away.

Changes in pumping rate are not difficult to accomplish with the sucker rod pump system, but they do require stopping the pump. If changes in discharge rate are needed in the early part of the test, it would be advisable to stop, equilibrate, and start the test over. The lack of ability to adjust pumping rate continuously is not viewed as a disadvantage.

If the Rocky Coulee flow top yields more than about 15 gpm, a different pumping system may be needed. Yield of more than 15 gpm is viewed as unlikely, but if it is the case, the test design will be reevaluated in light of the apparent differing hydraulic conditions. If all test objectives would not likely be accomplished using the above pump operating at the maximum discharge rate (i.e., 15 gpm) then, a different pumping system would be required. The pump that is presently installed at RRL-2B is adequate to produce the greatest flow that can be reasonably expected from the Rocky Coulee flow top with approximately 800 feet of drawdown.

A submersible pump has the advantage of producing a continuous flow. However, the groundwater must be degassed before it enters the pump to avoid gas lock and wellbore storage must be minimized. Minimizing wellbore storage in combination with the degasser is difficult. A packer has to be set above the pump to reduce borehole storage which requires an elaborate system for venting gas to the surface plus providing electric power to the submersible motor and monitoring groundwater pressure change below the packer. Without the gas separation and venting capability, the submersible pump would be likely to fail due to gas lock.

Pressure measurements only will be made in RRL-2B, the pumping well. The measurements during pumping are not regarded as particularly useful in estimating hydraulic parameter values because of the frictional losses in flow near the well bore and on entry into the well bore. This commonly recognized fact negates the supposed adverse effect of "sucker rod pumping on interpretation of water level data from the pumping well." Pressure measured after pumping ceases in RRL-2B will be useful information for recovery analysis to estimate hydraulic property values, etc.

9. Criteria for LHS Testing

NRC COMMENT -

The LHS test plan describes a nominal 30-day period of pumping during the first test from the Rocky Coulee flow top. The plan recognizes satisfactory tracer recovery and indications of hydraulic boundary conditions as criteria to determine when pumping should be terminated. Premature termination of the pumping, however, may limit the ability of the test to fulfill its objectives. During the meeting, BWIP elaborated on the termination criteria which included accomplishment of test objectives and jeopardization of synchronous head measurements. In their present form, however, both of these criteria are subjective and need to be defined in greater detail to develop objective criteria for determining when pumping should be terminated. BWIP should also develop criteria for determining when transient responses caused by LHS testing have sufficiently subsided to allow subsequent LHS tests to begin.

Similar criteria should be developed to determine when pressure trends have been reestablished after the first tracer has been injected during the first LHS test, but before the transducer is pulled out of the second piezometer prior to tracer injection. During the meeting, BWIP indicated that both transducers in RRL-2A and -2C in the Rocky Coulee flow top could be out of the piezometers at the same time, which would eliminate BWIP's capability of monitoring drawdown if measurable perturbations from the first test do not reach more distant monitoring facilities beyond 2250 m. Thus, *BWIP would not be able to detect hydrogeologic boundaries. Further, the removal of the tracer injection apparatus may also perturb pressures in the flow top, which could not be characterized unless at least one transducer remained in a piezometer in the flow top. Once developed, these criteria should be incorporated into LHS and tracer testing procedures.*

DOE RESPONSE-

Hydraulic testing will not begin until synchronous hydraulic head baseline criteria have been reached. Criteria will be developed to determine when pumping should be terminated and when transient responses caused by earlier testing have subsided sufficiently to allow subsequent tests to begin. The criteria will be included in the Site Groundwater Study Plan (SD-BWI-SP-047) and are expected to be released by July 1987.

Tracer injection can precede pumping and/or be delayed until all other hydraulic test objectives have been met in order to minimize the effect on hydraulic testing (see response to comment 13). The installation of additional monitoring points (i.e., DC-32 and DC-33) at an intermediate distance will also help in determining when hydraulic testing objectives have been met. Criteria for starting and stopping the tracer test will be developed and will also be included in the Site Groundwater Study Plan (SD-BWI-SP-047).

10. Development of RRL-2B

NRC COMMENT -

The LHS test plan does not discuss how the pumping well, RRL-2B, has been or will be developed prior to the first LHS test in the Rocky Coulee flow top, or how the well will be developed prior to subsequent tests. Drill cuttings and drilling fluids remaining in the Rocky Coulee flow top may inhibit flow to the well, thus decreasing well efficiency and potential pumping rates. The purpose of well development is to remove cuttings and drilling fluids from the formation. The drilling and completion specifications document for RRL-2B and -2C [SD-BWI-TC-023] mentions that RRL-2C will be developed prior to installation of the piezometers, but does not discuss well development activities for RRL-2B. In addition to improving well efficiency, controlled development of RRL-2B using air-lift pumping or other suitable techniques may provide valuable pre-LHS testing transmissivity estimates allowing selection of optimal pumping rates from the Rocky Coulee flow top. Use of well development as a pre-test would require that BWIP monitor water levels and/or pressures, discharge rates, and hydraulic responses to the development stress. Controlled well development of RRL-2B may provide more accurate estimates of aquifer transmissivity and a more defensible basis for selection of optimal pumping rates than the proposed pulse testing, particularly in higher transmissivity units. Hydrochemical sampling during well development could also be used to evaluate whether the bulk of drilling fluids injected during drilling *have been removed. BWIP should carefully document the development procedures used in RRL-2B. If the well has not been developed, BWIP should evaluate alternative development techniques and develop RRL-2B, as appropriate prior to initiation of LHS testing.*

DOE RESPONSE -

The test plan will be revised to discuss well development which was conducted at RRL-2B prior to pump installation and any further development planned prior to subsequent tests. Hydrochemical sampling will be conducted during any future development pumping to determine the degree of drilling fluid removal. Well RRL-2B was developed, as described by Jackson et al., 1986 (p. 39), prior to installation of the sucker rod pumping system. The borehole clean-up involved circulating Hanford system water in the open-hole part of the borehole immediately after reaching the interim depth of 2,858 ft. This was done to remove drill cuttings that may have accumulated in the borehole during the drilling operation (note: the drilling fluid was water with no additives). In addition to this work, limited borehole development was performed by air-lift pumping in September, 1985. An estimated 1,000 gal of fluid was removed from the borehole. Further flushing of the borehole was accomplished in October, 1985. The total volume of Hanford system water used to flush the borehole was about 48,000 gal. A video survey indicated that only minor amounts of particulate matter remained suspended in the water after circulation.

Air-lift pumping was not used as the principal technique to develop the borehole because of the low transmissivity of the Rocky Coulee flow top. Preliminary estimates of transmissivity of the Rocky Coulee flow top range from about 2 to 6 ft_2/d in the vicinity of RRL-2B.

11. Mechanical Effects

NRC COMMENT -

Based on pre-test analyses described in the test plan, BWIP expects that pumping from RRL-2B will develop significant drawdowns (e.g., 263 meters) in the vicinity of the pumping well during the first LHS test. Such large drawdowns may stimulate discontinuous deformation of the basalt flows by decreasing pore pressures and changing fracture apertures. Although stresses caused by changes in pore pressure may be insignificant compared with in-situ stresses, BWIP should recognize that changes in fracture apertures in close proximity to the pumping well may cause anomalous head responses during LHS testing.

DOE RESPONSE -

The BWIP agrees with NRC that "changes in fracture apertures in close proximity to the pumping well may cause anomalous headresponses during...testing." BWIP also agrees with the NRC that changes in pore pressure should be insignificant and the changes in fracture aperture would occur only very near the pumping well where the maximum change in groundwater pressure will occur. The nearby piezometer, RRL-2C and RRL-2A, would not be affected by either mechanical effects or wellbore inefficiency. For these reasons, and for reasons stated in response to comment 8, the pumping well is not relied on for data during drawndown.

12. Vesicular Zone Testing

NRC COMMENT -

As agreed in the meeting, BWIP needs to consider performing LHS tests of the vesicular zone in the Cohasset flow interior. BWIP's decision to conduct testing of the vesicular zone should be consistent with the test plan and be based on preliminary testing of the vesicular zone after the pumping well has been drilled through the zone.

DOE RESPONSE -

Preliminary results from testing the Cohassett vesicular zone at RRL-2A during drilling indicates that the vesicular zone possesses a transmissivity of 10^{-4} ft^2/d (Strait and Mercer, 1986). Because the Cohassett vesicular zone is believed to be of such low transmissivity, BWIP is anticipating performing a pressurized pulse test or constant head injection test. If conditions are identified at RRL-2B that indicate sufficient water is available to pump, a constant discharge pumping test will be performed at that well site.

13. Convergent Tracer Test

NRC COMMENT -

The test plan proposes integration of convergent well tracer testing with LHS testing of the Rocky Coulee flow top. The NRC is concerned that the tracer test may complicate the interpretation of LHS testing results. Injection of tracer solution and chase water under 250 m of head into RRL-2A and -2C, may result in pressure perturbations that could interfere with aquifer responses to pumping stress, especially within the flow interiors. Although such perturbations may not last long within flow tops (e.g., several hours to days), the pressure pulses in flow interiors may be on the order of meters and persist for periods up to tens of days. As discussed in comment number 9, conduct of the tracer test may also prevent continuous collection of pressure data at RRL-2A and -2C because the pressure transducers will be removed to inject the tracers.

In addition, the test plan does not provide a detailed rationale for how information derived from the convergent well tracer test will be utilized in evaluations of site performance. For example, the two-well recirculating tracer test conducted previously at the BWIP was not designed to provide repository-scale estimates of dispersivity (Leonhart et al., 1984). This same limitation also applies to the dispersivity values determined in the covergent well tests at RRL-2. The test plan's description of proposed tests does not evaluate whether lateral dispersion will be significant with respect to longitudinal dispersion, or whether the hydraulic gradients imposed during the test will result in tracer behavior that *is fundamentally different from tracer behavior under ambient conditions. This difference may be especially significant if flow through fractured basalt is assumed to represent an equivalent porous medium. Further, the plan does not discuss uncertainties about the representativeness of effective porosity and dispersivity values for portions of the Rocky Coulee flow top distant from RRL-2 and other basalt flow tops.*

The NRC agrees that the DOE needs to characterize effective porosity and dispersivity at the BWIP site, but this information should be collected in a manner that does not compromise the primary objective of the LHS testing, i.e., to characterize the groundwater flow system including hydrologic boundaries, hydraulic continuity, and hydraulic parameters. BWIP should assess potential complications of conducting the covergent tracer tests in conjunction with the LHS test and concurrent ratio test, particularly with respect to monitoring water level responses within the flow interiors. This assessment should also document the rationale for the tracer tests including a discussion of the limitations and uncertainties that will be associated with the tracer test results.

REFERENCE: Leonhart, L. R., R. Jackson, D. Graham, L. Gelhar, G. Thompson, B. Kauchoro, and C. Wilson, 1984, "Analysis and Interpretation of a Recirculating Tracer Experiment Performed in a Deep Basalt Flow Top," RHO-BW-SA-300 P, Rockwell Hanford Operations.

DOE RESPONSE -

As discussed under comment 9, the tracer test should not be conducted until specific criteria have been met to insure that objectives of the hydraulic portion of the test have been met. These criteria will be developed prior to the LHS test.

The detailed rationale for how information derived from the convergent well tracer test will be utilized in evaluation of site performance will be contained in the site groundwater study plan and performance assessment plans, issue resolution strategies, and other higher-order documents. These documents drive the test plan.

The BWIP does recognize the need to understand the degree of scale-dependency of dispersivity parameters. The strategy being developed within the site groundwater study plan therefore proposes to conduct several tracer tests at different scales up to about 1 km. This will allow the BWIP to determine if functional relationships with distance can be defined. The tests at RRL-2 will provide input to this data base but are not intended to fulfill the entire data need.

The NRC is correct in noting that the proposed convergent tracer tests will not yield a direct estimate of lateral (transverse) dispersivity. The assumption of zero lateral dispersivity is conservative, and performance measures will be insensitive to the parameter, thereby precluding the need for actual field measurement.

The hydraulic gradients imposed during the test will obviously be much greater than under ambient conditions. The flow, however, is expected to be laminar under test conditions except very near to the pumping well. In order to investigate the effect of scale with respect to gradient, tracer tests will be carried out in other flow tops and locations in the CASZ at several selected gradients. Information on these tracer tests is provided in the Site Groundwater Study Plan (SD-BWI-SP-047) to be released by July 1987.

The NRC expressed other concerns implying that underlying assumptions traditionally made in the analysis of convergent tracer tests may not be maintained by the test conditions. The basis of these concerns focused on a consideration that the hydraulic gradient imposed by the pumping test may be so steep (as compared to ambient conditions) as to affect the dispersivity and effective porosity measurement. This effect will be examined theoretically and/or (if necessary) experimentally to demonstrate the sensitivity. Conceptually, this concern would arise if (1) groundwater flow conditions exceeded threshold values for Reynold's Number, thereby invalidating the assumption of Darcian flow conditions; (2) porous medium assumptions were invalid, or (3) there were a change in hydraulic properties resulting from changes in elastic or inelastic properties of the aquifer due to the high stress conditions. It is not clear that any of these conditions would exist in the case of the proposed testing of RRL-2.

Past discussions with the NRC have also revealed concerns over the role of diffusive versus dispersive properties of the porous medium. It is recognized that gradients of magnitudes imposed by the assumed pumping test conditions would not permit discrimination between the relative contributions of diffusion and dispersion in flow tops with regard to the transport of a conservative solute. Under planned test conditions the diffusive component is insignificant compared to the dispersive component.

The comment reads in paragraph 3: "NRC agrees that the DOE needs to characterize effective porosity and dispersivity at the BWIP site, but this information should be collected in a manner that does not compromise the primary objective..., i.e., to characterize the groundwater flow system..." Performing radial convergent tracer tests as adjunct to the LHS test is one means from which effective porosity and dispersivity data can be obtained without compromising the hydraulic objectives of the test. Modifications to the test plan that will assure both data from tracer tests and pumping tests are not compromised are being considered and developed.

For the purpose of developing a methodology that assures neither test is compromised the following is being considered. Two discrete suites of tracers are required. One suite of tracers is injected prior to pumping. Tracer arrival observations would then be analyzed on a real time basis to define the mass and dilution of the second suite of tracers. The second suite of tracers would be injected after all pumping test objectives are accomplished. The expectation is that nearly identical results can be demonstrated from analysis of the two tracer tests. If so, then future radial convergent tracer tests performed as adjunct to LHS test will use the "pre-pumping" injection methodology which would minimize test duration and interference between test objectives (i.e. perturbations associated with removal of transducers, injection of tracers, and reinstallation of transducers). Other concerns associated with tracer tests include the effects of scale of separation and scale of test gradient. Plans to address these concerns and other limitations and uncertainties are provided in the Site Groundwater Study Plan (SD-BWI-SP-047).

The need and rationale for tracer tests are discussed in detail in issue resolution strategies and study plans, respectively. The rationale underlying our initial proposal to conduct convergent tracer tests as adjunct to pumping tests at RRL-2 involved recognition of the need to build a representative data base on effective porosity of basalt flow tops. This need arises in support of groundwater travel time and radionuclide transport estimations. If it is possible to obtain effective porosity data in such a manner, the opportunity exists to obtain a more substantial assemblage of field-measured effective porosity at an earlier time in the site characterization schedule than would be possible through independent tests.

Hydrologic Baseline

14. Perturbations to Hydrologic Baseline

NRC COMMENT -

Based on reviews of recent water level data submitted by BWIP, NRC observes that trends in hydraulic heads appeared to have been sufficiently established for LHS testing in the Rocky Coulee flow top in May and June of 1985. Since that time, concurrent site preparation activities (e.g., drilling bridgeplugs at RRL-14 and drilling DC-23) have perturbed the groundwater system causing significant deviations to pre-test trends. During the meeting, BWIP acknowledged that more time is now required to reestablish pre-test trends before LHS testing can begin. These recent perturbations demonstrated that hydraulic stresses can be propagated across the Reference Repository Location, thus adding credence to the feasibility of conducting repository-scale LHS testing. The perturbations also indicate that future combinations of drilling, construction, and testing may perturb hydraulic heads to the extent that characterization of the pre-emplacement groundwater flow system and LHS testing would be delayed for a significant amount of time.

In developing strategies and schedules for site activities, BWIP should consider potential complications and delays of site activities caused by perturbations to the hydrologic system. For example, BWIP indicated that a mult-year period of reduced site activity might be required to establish hydrologic baseline if it cannot be established *prior to LHS testing and Exploratory Shaft construction. BWIP's strategy for site characterization should consider the practicality of these contingencies in light of the ambitious project schedules.*

DOE RESPONSE -

The BWIP agrees that the installation of monitoring facilities will perturb the baseline, however, we will reestablish the baseline prior to initiation of LHS testing.

15. Hydrochemical Sampling

NRC COMMENT -

The test plan lists constituents that will be analysed in groundwater samples collected during pumping (cf. Table 13). Although the list appears comprehensive, the test plan does not discuss the objectives for collecting the hydrochemical data or provide a rationale supporting the list. Based on NRC's understanding of BWIP's current strategy for site characterization, these data will be used to characterize baseline hydrochemistry of the Hanford Site to confirm conceptual groundwater flow models and to support predictions of post-emplacement hydrochemical environment along potential radionuclide pathways. BWIP should amend that test plan to discuss the objectives and rationale for the hydrochemical sampling.

In addition, BWIP has omitted carbonate and bicarbonate species from the list of constituents that will be analyzed. Bicarbonate and carbonate species may significantly affect radionuclide transport by a variety of processes, such as complexing, pH buffering, and precipitation. In addition, concentrations of these two species are essential for calculating ion balances. The NRC recognizes that the concentrations of these two species may be calculated based on pH, alkalinity, and concentrations of other constituents (Stumm and Morgan, 1970). However, it would be prudent for BWIP to analyze for carbonate and bicarbonate as a more direct and precise method of determining their concentrations than through calculations. BWIP should include carbonate and bicarbonate in the list of constituents to be analyzed or amend the test plan to describe how their concentrations will be determined in lieu of analysis.

REFERENCE: Stumm, W. and J. J. Morgan, 1970, "Aquatic Chemistry: An Introduction Emphasizing Chemical Equalibria in Natural Waters," (New York, New York: Wiley-Interscience).

DOE RESPONSE -

As the NRC staff notes, two objectives of the hydrochemistry program are to: test groundwater flow concepts, and identify the geochemical environment that radionuclides released from a repository would encounter. Other objectives are to: establish a baseline of radionuclide concentrations in groundwater, and contribute to quantification of groundwater flow rate using age dating techniques.

The SCP and appropriate study plans will reflect these objectives. BWIP agrees with the NRC staff that carbonate and bicarbonate concentrations can be calculated using pH and alkalinity (obtained by titration) (Greenburg et al, 1985). To our knowledge reliable techniques to directly measure the concentrations of carbonate and bicarbonate are not available.

16. Data Release

NRC COMMENT -

Until several days before the meeting, the most recent water level information available to the NRC staff and contractor had been collected six months earlier (May/June 1985). NRC has not received pressure data from the BWIP site for the last 10 months. If NRC is to provide constructive comments to DOE on the adequacy of hydrologic data and interpretations, BWIP needs to release essential information such as the water level data on a more-timely basis. The meeting may have been postponed if the NRC had been informed about the perturbations caused by drilling activities prior to the meeting. BWIP should release tabulated and time profile data including down-hole pressures, water levels, and enviromental heads in accordance with the Site Specific Agreement, which specifies a 45-day release time frame from the time of data acquisition to the time the data are provided to the NRC.

DOE RESPONSE -

DOE's policy on data release is to provide data in accordance with the Site Specific Agreement. DOE Will comply with this policy to the best of its ability.

REFERENCES

Basalt Records Management Center, Basalt Waste Isolation Project, Rockwell Hanford Operations, P.O. Box 800, Richland, Washington 99352, Telephone (509) 376-7114.

Early, Spice, and Mitchell (1986), "A Hydrochemical Data Base for the Hanford Site, Washington," Rockwell Hanford Operations, RIchland, Washington, SD-BWI-DP-061).

Greenburg, Trussell, and Clesceri, Eds., (1985). "Standard Methods for the Examination of Water and Wastewater," 16th edition, AWWA and WPCF.

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Jackson, R. L., L. C. Swanson, L. D. Diediker, R. L. Jones, and R. K. Ledgerwood, 1986, Design, Drilling, and Construction of Well RRL-2B, and iezometer Nest RRL-2C, SD-BWI-TI-329, Rev. 0, Rockwell Hanford Operations, Richland, Washington.

Marinelli, F., 1986, Time-Lag in Flow Interior Piezometers, Technical Memorandum to A. Brown and M. Galloway, Dated December 20, 1986.

Stone, R., A. H. Lu, P. M. Rogers, R. W. Bryce, 1985, Plans for Multiple-well Hydraulic Testing of Selected Hydrogeologic Units at the RRL-2 Site, Basalt Waste Isolation Projection, Reference Repository Location, SD-BWI-TP-040 (Draft 11/85), Rockwell Hanford Operations, Richland, Washington.

Strait, S. R. and R. B. Mercer, 1986, Hydraulic Property Data From Selected Test Zones on the Hanford Site, SD-BWI-DP-051, Rev. 2 (in preparation), Rockwell Hanford Operations, Richland, Washington.

LOCATION OF MULTIPLE-LEVEL PIEZOMETER FACILITIES

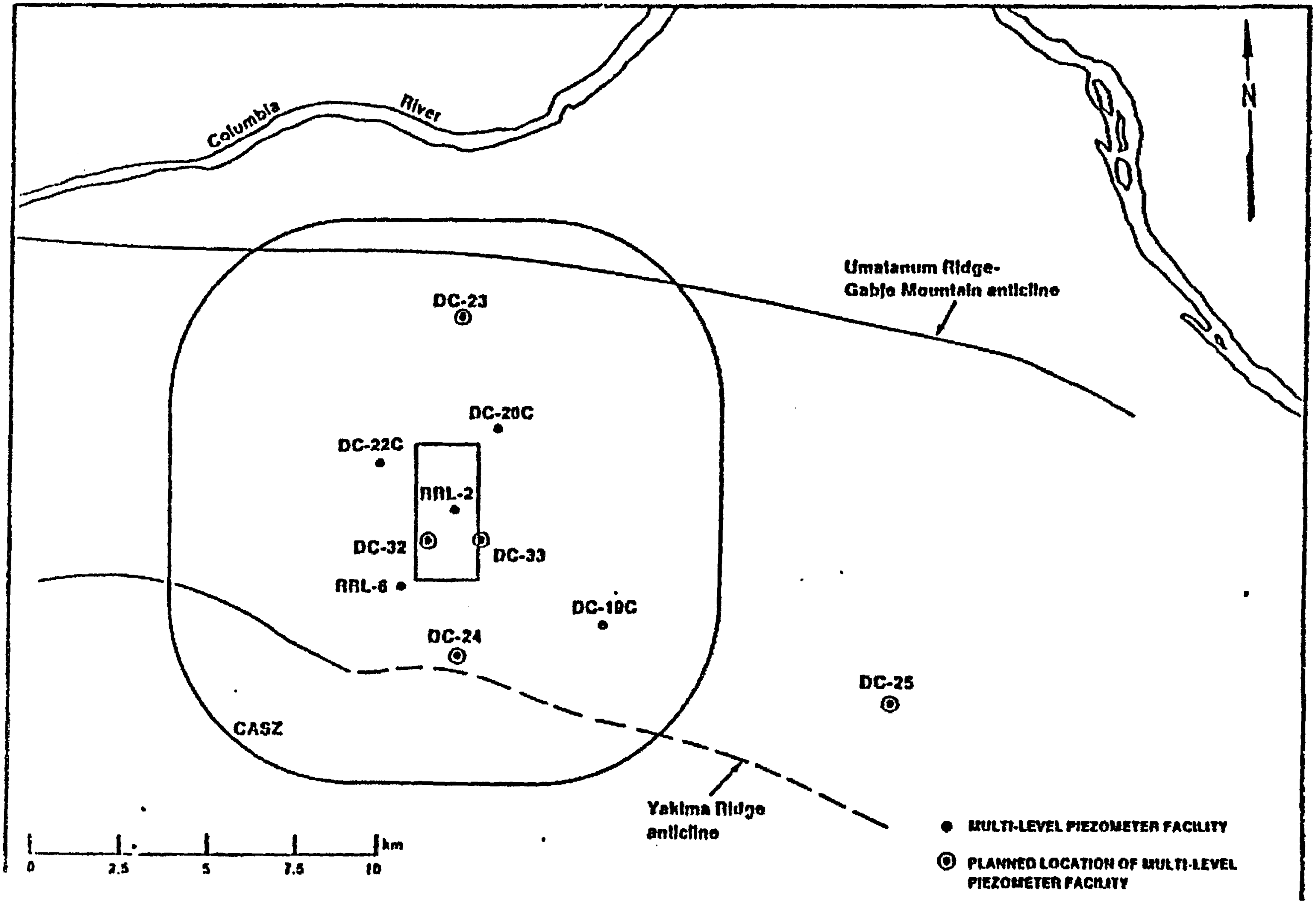
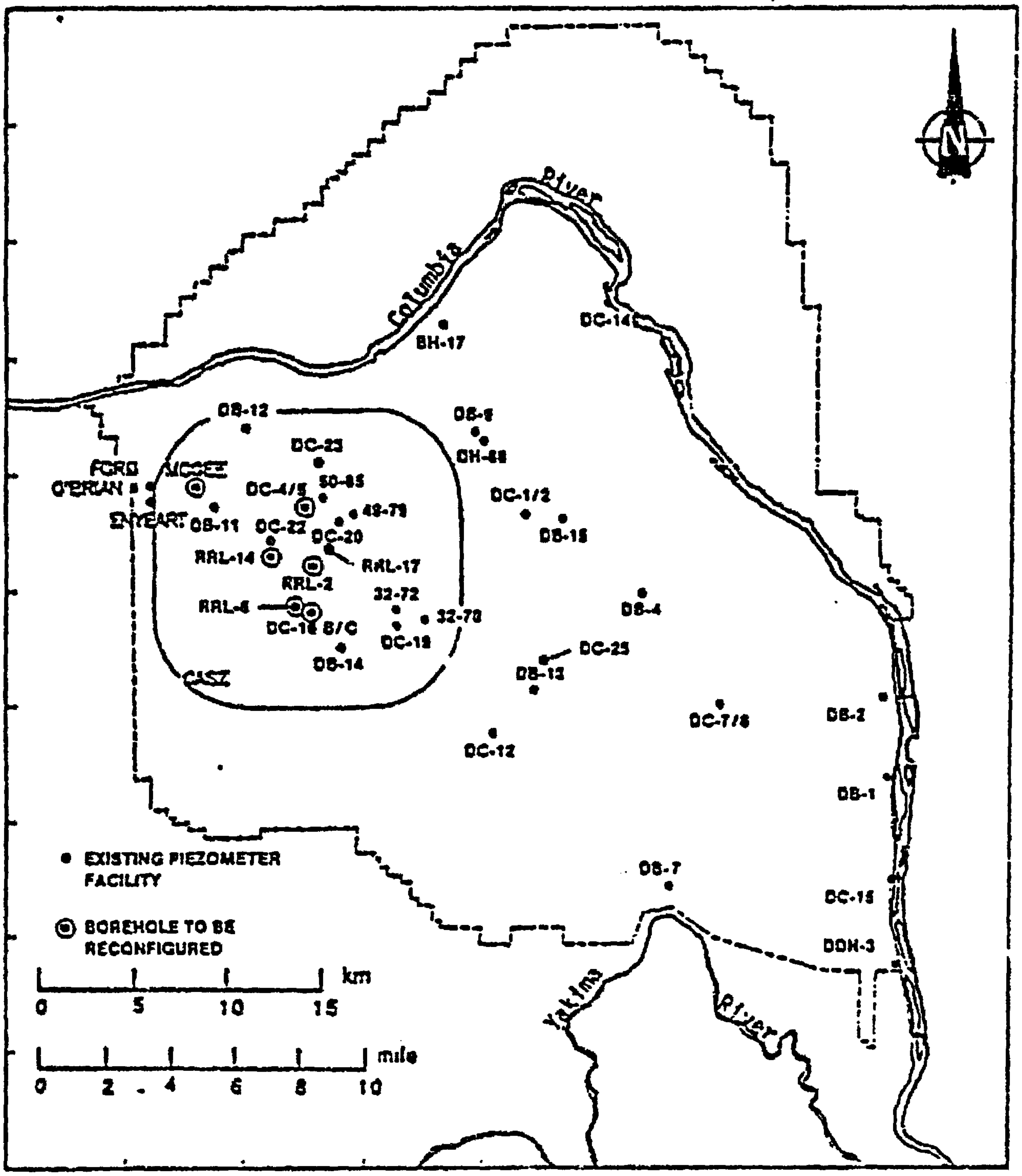


FIGURE 1



MONITORING LOCATIONS AT THE HANFORD SITE

Attachment 8

Internal Letter

Rockwell International

Date April 2, 1987

No 12100-87-MFN-087

TO Name Organization Internal Address

D. E. Mahagin
Management and Integration
CDC-2/3000 Area

FROM Name Organization Internal Address Phone

D. J. Brown, 6-6274
R. T. Johnson, 6-8358

Subject DC-23/24/25 and DC-32/33 Data Collection Requirements Definition and Facility Design Development - Request for Expedited Special Case Status

Attached is the signed approval sheet for the DC-23/24/25 and DC-32/33 Request for Expedited Special Case Status.

R. T. Johnson
Screening Board

D. J. Brown
Screening Board

RTJ/DJB/MFN/lgs

Attachments

cc: L. Cornell
D. C. Gibbs
T. A. Curran
G. C. Evans
G. T. Harper
G. W. Jackson
J. F. Marron
M. F. Nicol
R. L. Snow
ERMC (2) 003/3503/G950

REQUEST FOR EXPEDITED SPECIAL CASE STATUS
BOREHOLES DC-23, DC-24, DC-25, DC-32, AND DC-33

Rockwell Approvals:

G. S. Hunt, Manager
Site Characterization Program

Screening Board 4/2/87

D. E. Mahagin, Director
Management and Integration

Internal Letter

Rockwell International

Date April 2, 1987

No. 78300-87-023

TO (Name Organization Internal Address)
D. J. Brown
R. T. Johnson

FROM (Name Organization Internal Address Phone)
D. E. Mahagin
Management and Integration
CDC-2/33/3000
6-6091

Subject: DC-23, DC-24, DC-25, DC-32 and DC-33 Data Collection Requirements Definition and Facility Design Development - Request for Expedited Special Case Status

Reference: Letter, April 2, 1987, G. S. Hunt to D. E. Mahagin, same subject

Attached for your review is the request for Expedited Special Case status for DC-23, DC-24, DC-25, DC-32 and DC-33 Data Collection Requirements Definition and Facility Design Development Approval Sheet. If the attached document is complete, sign the approval sheet and return the package to me.

D. E. Mahagin, Director
Management and Integration

DEM/CCC/lgj

Att.

cc: C. C. Cejka
G. C. Evans
G. S. Hunt
File/LB/BRMC

Internal Letter

Rockwell International

Date April 2, 1987

No. 78300-87-022

TO (Name, Organization, Internal Address)
. D. E. Mahagin
. Management and Integration
. CDC-2/33/3000

FROM (Name, Organization, Internal Address, Phone)
. G. S. Hunt
. Site Characterization
. CDC-2/6/3000
. 6-5559

Subject . DC-23, DC-24, DC-25, DC-32 and DC-33 Data Collection Requirements Definition and Facility Design Development - Request for Expedited Special Case Status

References: (a) Letter, March 30, 1987, D. J. Brown, R. J. Johnson, to D. E. Mahagin, "DC-24/-25 Data Collection Requirements Definition and Facility Design Development - Request for Expedited Special Case Status"

(b) Letter, March 25, 1987, G. S. Hunt to D. E. Mahagin, "DC-24/-25 Data Collection Requirements Definition and Facility Design Development - Request for Expedited Special Case Status"

Reference (a) granted Expedited Special Case status for DC-24/-25 Data Collection Requirements Definition and Facility Design Development. Subsequently, as described in the attachment, it was recognized that the Test Data Collection Specification and the Design Requirements Document must be complete for DC-23, DC-32, DC-33 along with DC-24/-25. Therefore, the new request for status incorporates the additional boreholes in the Test Data Collection Specifications and Design Requirements Document formal control process and supersedes t'e referenced Expedited Special Case status.

(for)

G. S. Hunt, Manager
Site Characterization

GSH/lgj

Att.

cc: D. J. Brown
C. C. Cejka
G. C. Evans
R. T. Johnson
M. F. Nicol
File/LB/BRMC (2) 003/3503/G950

Attachment 9

Internal Letter

Rockwell International

Date April 3, 1987

No. 78000-87-7-1

TO (Name, Organization, Internal Address)

D. E. Mahagin
Management and Integration
CDC-2/33/3000

FROM (Name, Organization, Internal Address, Phone)

D. J. Brown, 6-6274
J. F. Marron
M. F. Nicol

Subject: Restart of Expedited Special Case

Ref: Letter, April 2, 1987, G. S. Hunt to D. J. Brown, "Request for Approval for DC-23, 24, 25, 32, 33, Expedited Special Case Request for Approval of Design Document Package"

The Restart Review Board has reviewed the prerequisite package contained in the reference and finds no substantive issues that would disqualify it.

The Board recommends that the subject Expedited Special Case be approved. The signed approval sheet is attached.

Signed:

D. J. Brown, Management and Integration

J. F. Marron, Systems Engineering

M. F. Nicol, Quality Assurance

Internal Letter

Rockwell International

Date April 3, 1987

No. 78000-87-DEM-030

To (Name, Organization, Internal Address)

D. C. Gibbs
Basalt Waste Isolation Project

From (Name, Organization, Internal Address, Phone)

D. E. Mahagin
Management and Integration
CDC-2/3000 Area
6-6091

Subject: Approval of Borehole DC-23, 24, 25, 32, and 33 Collection Requirements Definition and Facility Design Development as an Expedited Special Case

The Expedited Special Cases Restart Review Board has approved the subject boreholes as a result of the satisfaction of Directives 1 and 2, which respectively qualified the project as a restart candidate and qualified the project as having either (1) fulfilled all requirements for restart, or (2) provided acceptable explanation of the Management Risk associated with those prerequisites not yet completed. The entire review package is herewith transmitted for your approval.

D. E. Mahagin 4-3-87

D. E. Mahagin, Director
Management and Integration

DEM/cml

Enc. Directive 1 Packet
Directive 2 Packet

Internal Letter **Rockwell International**

Date April 2, 1987 No. 78300-87-024

TO (Name Organization Internal Address)
D. J. Brown

FROM (Name Organization Internal Address Phone)
G. S. Hunt
Site Characterization
CDC-2/3000 Area
6-5559

Subject Request for Approval of Boreholes DC-23, DC-24, DC-25, DC-32, and DC-33 Collection Requirements Definition and Facility Design Development as an Expedited Special Case

Reference: Letter, March 27, 1987, G. S. Hunt to D. E. Mahagin, Screening Board Signature Approvals

In response to your elevating Boreholes DC-23, DC-24, DC-25, DC-32, and DC-33 to Expedited Special Case Status, the Site Characterization Program has assembled the attached information to enable the Expedited Special Case Review Board to evaluate Boreholes DC-23, DC-24, DC-25, DC-32, and DC-33 Expedited Special Case for review of Design Document Prerequisite Package.

Chris Cejka 4-3-87
for
G. S. Hunt, Manager
Site Characterization

GSH/CCC/hls

Att.

cc: Restart Review Board (S)
L. Connell
T. A. Curran
D. C. Gibbs
G. W. Jackson
W. H. Price
File/LB
BRMC (2) 3503/003/G950

Internal Letter

Rockwell International

Date April 2, 1987

No. 77000/87/040

TO (Name Organization Internal Address)

G. S. Hunt
Site Characterization Program
Office

FROM (Name Organization Internal Address Phone)

G. W. Jackson
Science and Engineering
CDC-1/3000 Area
6-4572

Subject Request for Expedited Special Case Restart for Boreholes DC-23, 24, 25, 32 and 33

This request for Expedited Special Case restart package for Boreholes DC-23, 24, 25, 32 and 33 facility design has been reviewed, accepted and is ready to be submitted to the Restart Review Board.

GWJ

G. W. Jackson, Director
Science and Engineering
Basalt Waste Isolation Project

GWJ/GCE/lm

CONCURRENCE:

G. T. Harper 4/2/87
G. T. Harper Date

T. A. Curran 4/2/87
T. A. Curran Date

W. H. Price 4/3/87
W. H. Price Date

Department of Energy
Richland Operations Office
P O Box 550
Richland, Washington 99352

87-GTB-36

APR 15 1987

General Manager
Rockwell Hanford Operations
Richland, Washington

Dear Sir:

EXPEDITED SPECIAL CASE (ESC) FOR BOREHOLES DC-23, DC-24, DC-25, DC-32, and DC-33, TO RESTART COLLECTION REQUIREMENTS DEFINITION AND FACILITY DESIGN DEVELOPMENT

Reference is made to your letter R87-1484, subject as above, dated April 3, 1987. We have reviewed the subject package and you are authorized to proceed with design of the ESC facilities subject to the following conditions as discussed with your staff on April 14, 1987.

Two new Project Directives need to be written as follows:

1. A directive authorizing the deviations from procedures which are described in the ESC (e.g., utilizing draft documents).

2. A directive implementing a manual system to track in process (draft) documents used for design.

Hold point number three of the ESC needs to certify the placement of Westinghouse Hanford Company on a qualified suppliers list.

Hold point number four of the ESC needs to also assess and correct the deficiencies resulting from the Rockwell Design Control System reappraisal that affect work performed on the ESC.

The efforts of your staff in reaching this milestone are greatly appreciated. If you have any questions please contact Mr. A. G. Lassila (6-6158).

Sincerely,

Robert D. Larson

Robert D. Larson, Director
Procurement Division

BWI:AGL

cc: D. C. Gibbs, Rockwell