

Report of the Nuclear Regulatory Commission - Department of Energy
Meeting of the Geohydrology Testing Program before Construction of the
Exploratory Shaft

April 9, 1987

A meeting was held on April 7 - 9, 1987, at the Rivershore Motel, Richland, Washington. The purpose of the meeting was (1) for the Department of Energy (DOE) to present the planned program of geohydrologic testing at the Hanford site that would precede construction of the exploratory shaft; (2) for the DOE to respond to concerns raised by the Nuclear Regulatory Commission (NRC) staff, States and Tribes at the December, 1985, meeting on the Basalt Waste Isolation Project's (BWIP) geohydrology program and in the staff's letter dated April 10, 1986; and (3) for all interested parties to reach agreement on the planned testing program or to reach agreement on how to resolve any major concerns with the planned program.

The DOE opened the meeting at 8:30 a.m. with introductions of the key representatives (including contractors) from DOE, NRC, State of Washington, State of Oregon, Nez Perce Indian Tribe, Confederated Tribes of the Umatilla Indian Reservation (CTUIR), and Yakima Indian Nation. The listing of registered participants is provided in attachment 11. The DOE then introduced the members of the task force (attachment 12) which prepared the option paper (attachment 13).

As the first order of business, the DOE announced that the DOE presentations in the 9:00 a.m. - 12:15 p.m. time period on April 7, 1987, would be rearranged

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from the published agenda (attachment 14) and presented in the following order:

1. Options Paper for Pre-ES Testing, by A. Jelacic
2. Planned ES Testing Program, by M. Thompson
3. Overview of Geohydrology Program, by D. Dahlem
4. Geohydrologic Testing Program, by R. Stein

The DOE presentations were based on the pre-meeting material that was distributed to attendees.

Additionally, the Yakima Indian Nation representative requested time to make a presentation. His presentation, based on the material in attachment 16, was given after lunch on April 7, 1987. The agenda was rearranged accordingly.

On the morning of April 7, 1987, the DOE described the work that needs to be done to meet the four objectives of the pre-ES testing program.

The pre-Exploratory Shaft (ES) testing program was the primary focus of the meeting, but a general description of the overall geohydrology program was provided to show that the pre-ES work is only the first piece of a much larger program. The remainder of the first day provided time for each participating group to caucus and for group discussions. The representatives from all the participating groups were active in the discussions and provided valuable contributions.

On April 8, 1987, the DOE presented the status of concerns previously raised by NRC, based on attachment 1(b). The meeting participants contributed to the

discussion on the DOE presentation.

On the afternoon of April 8, 1987, the participants were asked to prepare comments on the pre-ES testing program and on the status of NRC concerns. Written comments were provided by the NRC, State of Washington, State of Oregon, Yakima Indian Nation, Nez Perce Indian Tribe and Confederated Tribes of the Umatilla Indian Reservation (CTUIR).

The DOE prepared responses to the written comments which were discussed on April 9, 1987. The comments and responses, as revised following the discussions, are presented in the following pages.

Written Comments by NRC

See Attachment 1.

DOE Response to NRC

See Attachment 2.

Written Comments by State of Washington

See Attachment 3.

DOE Response to State of Washington

See Attachment 4.

Written Comments by State of Oregon

See Attachment 5.

DOE Response to State of Oregon

See Attachment 6.

Written Comments by Yakima Indian Nation

See Attachment 7.

DOE Response to Yakima Indian Nation

See Attachment 8.

Written Comments by Nez Perce Indian Tribe and CTUIR

See Attachment 9.

DOE Response to Nez Perce Indian Tribe and CTUIR

See Attachment 10.

List of Additional Attachments

11. List of Attendees April 7 - 9, 1987.
12. Working Group Members for preparation of Option Paper.
13. Pre-meeting Materials: Letter, J. Knight (DOE) to R. Browning (NRC) March 26, 1987, and the Working Group's Option Paper.
14. Final Agenda (Letter, J. Knight (DOE) to R. Browning (NRC) March 26, 1987).
15. Viewgraphs presented by DOE.
16. Submittals by Yakima Indian Nation:
 - a. Role of the Yakima Indian Nation in the LHST Meeting, by Russell Jim
 - b. "Hanford Site Baselineing and LHST Scheduling: Review/Assessment/Independent Verification", by A. Djerrari, et al.
 - c. Critical Comments:


"Review of Groundwater Travel Time Analysis for the Reference Repository Location at the Hanford Site", Terra Therma/Nuclear Waste Consultants (June 13, 1986).


"Re-Review of Clifton's BWIP Groundwater Travel Time Analysis", Terra Therma/Nuclear Waste Consultants (January 13, 1987) by G. Dagan, et al., dated April 3, 1987.
 - d. YIN comments on GWTT Generic Technical Position (July 30, 1986).
 - e. "Evaluation of DOE Analysis of GWTT Hanford Site", by A. Djerrari, et al., July 1986.
 - f. "Evaluation of Hydraulic Head Data of Selected Hydrogeologic Units at the Hanford Site, Washington", by A. Djerrari, et al., dated February 6, 1987.


Acknowledgement

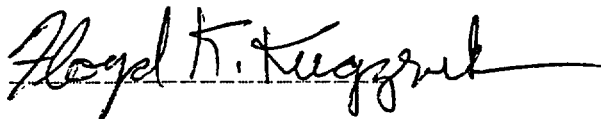
The undersigned representatives from the participating groups agree that the preceeding report represents an accurate summary of the presentations and written observations of the participants at the meeting. Although the representatives do not necessarily endorse the comments by other groups or the corresponding DOE responses, all groups were able to participate fully in the meeting and were provided adequate opportunity to present their views. The meeting provided a valuable technical interchange between DOE, NRC, and affected States and Indian Tribes.

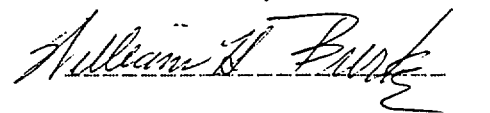

R. Stein,
DOE

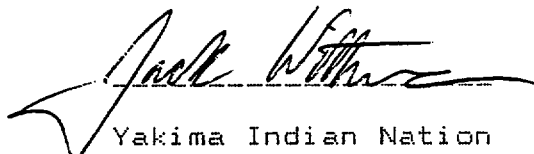

R. Browning,
NRC


State of Washington


State of Oregon


Nez Perce Indian Nation


Confederated Tribes of
the Umatilla Indian
Reservations


Yakima Indian Nation

Written Comments by NRC on DOE Pre-ES Hydrologic Testing Program

a. Pre-ES Hydrologic Testing Program

1. The NRC agrees that the proposed hydrologic testing program, as described in Option "D", is a reasonable approach for the next step in hydrologic characterization of the Hanford site, and provides a frame-work for hydrologic testing prior to sinking of the Exploratory Shaft (ES). Based on data obtained from the proposed test program, DOE should evaluate their hydrological conceptual model for the site and determine whether or not additional testing is warranted prior to sinking of the exploratory shaft. In performing this evaluation DOE will evaluate the data against the test objectives, including how the data affects their conceptual model of the site, and the criteria in Exhibit IV of the concept paper. Following this evaluation DOE will consult with NRC, the States, and Tribes prior to proceeding with sinking of the ES or additional testing.

The NRC staff feels that while the proposed hydrologic testing strategy is consistent with the general intent of STP 1.1, additional testing, such as Option "E", or other testing as appropriate will be required to satisfy the information needs of STP 1.1.

The DOE will develop detailed test plans, both quality assurance and technical, for implementing Option "D". These plans will include technical criteria for hydraulic-head baseline, pre-test conditions, and magnitude and duration of the LHS and tracer tests. Such plans will be provided to the NRC at least 6 months prior to the proposed start of testing.

The proposed testing under Option "D" will provide a better understanding of the hydrology of the site. It will also provide a better data base for

determining additional testing needs to resolve the GWTT and post-closure repository performance issues.

2. The DOE will provide the rationale for how the limited pre-ES hydrochemical testing fits in with the overall Site Characterization geochemistry program. Specifically, DOE will address the basis for the testing to be performed, the selection of parameters to be analyzed, and DOE's determination that data to be collected after the ES is not "perishable". The hydrochemical sampling objectives presented by DOE in the meeting (see Attachment 13) are reasonable.

3. Quality Assurance

- The DOE will provide the criteria used to classify the pre-ES hydrologic testing activities, equipment and instrumentation into different quality levels. The DOE will also address how the lessons learned from the DOE evaluation of equipment and instrumentation problems (such as piezometers, transducers, and Westbay system, etc.) have been factored into the development of these criteria.

4. Consistent with the NRC-DOE "Procedural Agreement", DOE will ensure that a current data catalogue will be available for all hydrologic data. This catalog will enable involved participants to select and request data for detailed review. Such data will be made available 45 days after a test has been completed.
5. The meeting agendas for future meetings will specifically reference relevant pre-meeting materials.

6. The DOE will develop decision criteria for all major decision points in the pre-ES hydrology testing program.
7. The DOE will provide for consultation and review of the progress of the pre-ES hydrologic testing program at the following decision points:
 1. At the issuance of the study plans and the draft TDCS.
 2. Before proceeding to drill the DC-24 and DC-25 observation wells.
 3. At the completion of the baseline monitoring program.
 4. Before and after each hydrologic zone is tested.
 5. At the planned termination of the pre-ES testing program.
 6. At anytime that a major change is contemplated to the pre-ES testing program.

The DOE Geohydrology Planning Schedule will be revised to incorporate these consultation points.

Written Comments by NRC*

b. Notes on Previous NRC Comments

During the meeting, and in materials provided prior to the meeting, the DOE responded to previous NRC comments about the geohydrology testing program at Hanford. The DOE commented on 16 items raised in NRC's letter from Linehan to Olson, dated April 10, 1986. The relative status (open/closed) of each item was reviewed during the meeting.

1. MONITORING LOCATIONS AND FREQUENCIES (Status: Open).

This item remains open. DOE will respond in their detailed hydrologic testing program plan and supporting documents. NRC agrees with the approach outline in Attachment 13.

2. CEMENT EFFECTS ON RRL-2A AND RRL-6 (Status: Open).

NRC has not yet reviewed DOE's recently received response.

3. BOREHOLE INTERFLOW (Status: Open)

It is noted that the DOE plans to describe the approach used to estimate the effects of borehole interflow in the Site Groundwater Study Plan (SGSP), expected to be released by July 1987.

Particular attention should be given to borehole DC-16A and 16C if they are to be used as monitoring wells as suggested by A. Lu (1985). Borehole RRL-14 also should be given particular attention because it has remained open since the Westbay packers failed. In addition, RRL-2A appears to be completed with bridge plugs which runs the risk of interconnection problems.

4. MONITORING FACILITIES FOR THE RATIO TEST (Status: Open)

This item remains open because questions about past piezometer compliance during tests remain unresolved. DOE will address in the test plan.

5. GROUT PERMEABILITY AND PIEZOMETER PERFORMANCE (Status: Open)

The status of this item remains open until the program of piezometer integrity testing is satisfactorily completed.

6. WESTBAY INSTALLATION (Status: Open)

The status of the Westbay device remains open until its use is demonstrated to be both feasible and satisfactory at RRL-14. The potential for borehole interflow effects during the intervening period should be assessed.

7. LHS TESTING FOCUS (Status: Open)

As discussed in the meeting NRC agrees with the approach for LHS in Option "D". DOE will address specific concerns in the detailed hydrologic testing program plan. These plans should incorporate contingency plans for possible scenarios that may arise in the course of testing.

8. PUMP SELECTION (Status: Open)

Selection of the pump is considered an open item pending dry run tests on pump operation by DOE.

9. CRITERIA FOR LHS TESTING (Status: Open)

This item remains open because criteria have not yet been developed for:

- o hydraulic head baseline acceptance;
- o initiating and terminating pumping and recovery portions of LHS tests;
- o initiating and terminating tracer test; and
- o locations of new observation wells (DC-24, -25, -32, and - 33).

10. DEVELOPMENT OF RRL-2B (Status: Open)

This item is considered open because details of developing RRL-2B in the Cohasset and Birkett flow tops have not been received by NRC.

11. MECHANICAL EFFECTS (Status: Closed)

The DOE's presentation provided adequate information to resolve NRC's concern about the possibility of anomalous head responses in close proximity to the pumping well during testing.

12. VESICULAR ZONE TESTING (Status: Closed)

The DOE's proposal to evaluate the potential for conducting a pumping test in this zone satisfies NRC's previous concerns about this issue.

13. CONVERGENT TRACER TEST (Status: Open)

This issue is open because of the complex nature of tracer tests and their interpretation, and because detailed test plans are not available.

14. PERTURBATIONS TO HYDROLOGIC BASELINE (Status: Open)

This issue is open because detailed criteria for baseline have not been provided by the DOE.

15. HYDROCHEMICAL SAMPLING (Status: Open)

This item is open pending the release of criteria for hydro-chemical sampling and subsequent interactions between DOE and NRC geochemistry staff. Refer to specific comment.

16. DATA RELEASE (Status: Open)

The DOE noted that it will comply with the Site Specific Agreement (re: release of data) to the best of its ability.

* Revised late in meeting; all participants did not receive copies of these final comments.

DOE Response to NRCA. Pre-ES Testing Program General Comments

1. The DOE agrees with the NRC comment subject to the following clarifications made verbally by NRC staff during discussions on April 8, 1987.
 - In the second paragraph, the additional testing required to satisfy the informational needs of STP 1.1 may be either pre-ES testing, such as identified in the logic process outlined in appendix C of the Option Paper on the pre-ES geohydrologic testing program, or post-ES testing as part of the total geohydrology testing program to be presented in the Site Ground-water Study Plan accompanying the SCP.
 - In the third paragraph, the types of plans mentioned by the NRC will be provided by DOE at least six months prior to the start of testing in the Rocky Coulee flow top.
2. The DOE agrees with the NRC comment and will provide the rationale for how the pre-ES hydrochemical testing fits into the overall site geochemistry program in Section 8.3.1.4 of the SCP and related study plans.
3. The DOE agrees with the NRC comment and will provide the basis for quality level assignments of the pre-ES hydrologic testing activities, equipment, and instrumentation. This material will be provided as part of the design package for review prior to the start of drilling of DC-24 and -25.

4. The DOE agrees with the NRC comment. A comprehensive data catalog is being developed and will be available upon issuance of the SCP. An Option "D" data catalog will be available prior to the start of testing in the Rocky Coulee flow top.
5. The DOE agrees with the NRC comment and will specifically reference directly relevant pre-meeting materials on future meeting agendas.
6. The DOE agrees with the NRC comment and will develop decision criteria for all major decision points shown in the schedule for the pre-ES geohydrology testing program. The decision criteria will be provided to all parties at least six months prior to the start of testing in the Rocky Coulee flow top.
7. The DOE agrees with the NRC comment subject to clarification that the type of interaction may differ for the six identified decision points, especially since DOE will make decision criteria available for review at least six months prior to testing the Rocky Coulee flow top and because DOE has invited the NRC, States, and Indian Tribes as observers to the testing. The observers will have real-time access to the data and will have ample opportunity for face-to-face staff-level discussion of the issues in advance of the decision points. The DOE anticipates a less formal interaction at the decision points for testing of the Cohasset flow top and the Cohasset vesicular zone than the interaction needed at the conclusion of the planned pre-ES geohydrologic testing program.

B. Previous NRC Comments

The comments NRC indicated as open will be addressed in appropriate planning documents which will be available to NRC, States, and Indian Nations prior to pre-test interactions. The comments will be tracked and the documents in which they are addressed identified. Clarification to NRC notes on DOE responses to previous NRC comments follow.

1c. Monitoring Location and Frequency

The DOE has performed integrity tests at existing multiple-level piezometers DC-19, -20, -22, and RRL-2C. The results of integrity tests that were performed will be provided to the NRC. Plans for future analyses and tests will be provided prior to pre-tests interactions.

2. Cement Effects on RRL-2A and RRL-6.

For clarification RRL-6 is not planned for use of trace injection.

4. Monitoring Facilities for the Ratio Test

See clarification to comment 1c.

5. Grout Permeability and Piezometer Performance

See clarification to comment 1c.

7. LHS Testing Focus

As part of the Options Paper, a logic chart was developed (figure 1, Appendix C) which provides a process for dealing with all unexpected hydrologic responses. In addition, evaluation criteria (Exhibit 4, Option Paper), which if exceeded, would result in reconsideration of the planned testing have been identified (Exhibit B). This approach is preferable to attempting to identify all possible testing scenarios in advance.

9. Criteria for LHS Testing - Fourth Bullet

The location of observation wells DC-24 and DC-25 have been established and site preparation has begun. The locations of DC-32 and DC-33 are tentative. The basis for locating these facilities (DC-32 and DC-33) will be provided prior to pre-test interaction. The DOE will provide the documentation for DC-24 and DC-25.

Washington State's Preliminary Comments
April 8, 1987

Preliminary to our comments on the hydrology program, since these will be considered our formal comments. I must repeat so that the record will reflect that we believe DOE should not have selected Hanford as one of the 3 final sites - least safe - most costly of those under consideration and we submit that Hanford should be eliminated before the program goes forward - we are and will continue to aggressively pursue this object in the congress and the courts.

However, until we are successful in those efforts, we will continue to participate fully in the site characterization process and carry out our role as called for in the NWPA.

1. Based on the objectives of the pre-ES Hydrology Testing program, we cannot accept the DOE recommended approach. In our opinion, a "yellow flag" is already flying (1000 yr GW TT issue) and the testing program must be designed accordingly. We understand that DOE does not agree that a yellow flag is flying, we believe the responsible approach requires that DOE immediately request the Hydrology Task Force to develop a testing program designed to resolve the 1000 GWTT issue prior to beginning to drill the exploratory shaft. (The Task Force work product should include a description of the testing required and a schedule which is integrated with the overall pre-ES hydrology program schedule).

2. The proposed strategies to investigate disqualifying conditions lists evaluation criteria which are defined as conditions that are so severe as to be indicated of potential disqualification. The criteria listed are severe conditions which if found should require disqualification. The final hydrology criteria should include the following:

Criteria 1: Severe conditions, which if found, should require disqualification (red card).

Criteria 2: A range of conditions, which if found, are indicative of serious problems requiring further evaluations and/or investigations prior to continuation of pre-ES hydrology studies (yellow card).

Criteria 3: The expected range of conditions.

The state of Washington's position is that, data from earlier BWIP studies have already identified a range of conditions indicative of serious problems.

3. The schedule must be redone to include adequate opportunity for meaningful consultation with states/tribes. Meaningful consultation includes:

- a. Materials provided in advance.
- b. Face to face discussion of issues (right people)
- c. Response to concerns.

Consultation points should be agreed upon based on the concepts laid out in STP 1.1. Scientific study must not be compromised by management driven schedules.

4. Premature drilling of ES

The hydrology program we have been discussing is called the pre-ES hydrology program. To us that meant that drilling of the ES will not commence until the test program is satisfactorily completed and the results are analyzed. If USDOE Headquarters decides to consider beginning to drill prior to completion of the pre-ES hydrology testing program, before they add such activity to the schedule DOE Headquarters will:

1. Immediately notify states/tribes that the idea is under consideration, and
2. Request the hydrology task force to assess the potential impacts of such actions on the pre-ES hydrology program, and
3. Distribute the task force study to the states and tribes, and
4. Consult with states and tribes after adequate opportunity to review the task force study.

5. Hydrologic studies are being conducted with insufficient attention to geologic structures which could provide pathways. Groundwater movement on faults and shears appears to be discounted. Drillers' logs of all holes in basalt should be reviewed for lost circulation and where it exists the cause(s) should be determined. Non-darcian flow and fracture porosity should be evaluated and, if possible, modeled to determine its effect on 1000 year and 10,000 year travel time standards. Existing and new geophysical information on the CASZ should be analyzed for discrete structures and these should be drilled.

6. USDOE must make a commitment to comply with all state permits and regulations related to the hydrology program.

DOE Response to State of Washington

1. The DOE current information on geohydrologic conditions suggests with high probability that GWTT will exceed 1000 years, and thus DOE did not orient the pre-ES testing program solely around this issue. The DOE has documented its position in detail in its final Environmental Assessment (EA) for the Hanford site. In making findings in the EA, DOE considered fully comments from all interested parties. Because of this, the task force has addressed the problem appropriately, and did not focus on resolving the issue of GWTT prior to ES construction.
2. The DOE cannot agree with the Washington State Comment. We believe that the evaluation criteria provided in the Options Paper are suitable to meet the objectives of providing an early indication of the presence of a disqualifying condition.

The geohydrologic data derived from the pre-ES testing program may be representative of only that part of the "Controlled Area Study Zone" (CASZ) in proximity to the RRL-2 pumping center. Therefore, if the data collected in the proposed pre-ES testing program (Option D) equal or exceed any of the evaluation criteria, the possible presence of a disqualifying condition may be indicated, but not necessarily throughout the CASZ.

Disqualification of the site on such information alone would not be appropriate. However, as illustrated in the logic diagram in Figure 1 of Appendix C of the Option Paper, reanalysis of available data may be deemed necessary. Reanalysis may result in additional tests not previously

included in the pre-ES test plan. The reanalysis and additional testing would be directed toward determining whether geohydrologic characteristics that combine to indicate a disqualifying condition are sufficiently pervasive in the CASZ to warrant terminating site characterization. The DOE considers that the evaluation criteria as presented in Exhibit IV of the Options Paper are appropriate for carrying out such an evaluation.

3. The DOE agrees with this comment and will revise the schedule to indicate adequate opportunities for meaningful interactions with the States and Indian Tribes. As indicated in the DOE response to the NRC on this subject, DOE will interact with the NRC, States, and Indian Tribes at the following decision points:

- issuance of study plans and draft TDCS;
- prior to proceeding to drill DC-24 and -25;
- at completion of the hydrologic baseline monitoring program;
- before and after each hydrologic zone is tested;
- at the planned termination of the pre-ES testing program; and
- at any time that a major change is contemplated to the pre-ES geohydrologic testing program.

These proposed interactions are consistent with the concepts laid out in STP 1.1.

4. Premature drilling of ES

The Department has not made a decision to drill the ES through the

sedimentary layers prior to completion of the pre-ES testing. The DOE will not initiate such drilling if it will compromise the integrity of pre-ES test program as described in the Options paper.

Further, the Department has not decided to evaluate the technical aspects of this drilling, in particular the effects on the pre-ES test program. If a decision to evaluate the technical aspects of this drilling is made, the Department will inform the States and other participants of the decision and its plans to implement the evaluation, keeping in mind the steps proposed by the State to implement the process.

5. Geologic structures potentially affecting groundwater flow will be characterized in the pre-ES and post-ES components of the characterization effort. At least two Large-Scale Hydraulic Stress (LHS) tests will be performed in the pre-ES period. It is expected that these tests will be able to indicate the presence of hydrologically significant geologic features in the near-repository area that may affect site performance. Post-ES LHS tests are specifically designed to assess the hydrologic behavior of structural features that are suspected boundaries of the site groundwater flow system. The LHS and small-scale tests are expected to provide sufficient data to formulate defensible conceptual and numerical models to assess site performance. Test data will be analyzed to evaluate the potential for non-Darcian flow. Evaluation of lost circulation and other drilling data for their geohydrologic significance is a normal field operation practice at BWIP.
6. The issue of state permits was not the subject of the workshop and was not

discussed. However, the Department of Energy plans to fully comply with all applicable Federal, State, and Local regulatory and permitting requirements during the conduct of the BWIP hydrology program. The BWIP environmental regulatory compliance plan will define the broad-base approach to assuring that all site characterization activities are conducted in a manner consistent with applicable regulations. A key element in the environmental compliance planning process is the BWIP environmental review procedure. This procedure, which is currently in place, requires a full regulatory compliance review prior to approving the conduct of any BWIP site characterization activity.

STATE OF OREGON COMMENTS
ON
GEOHYDROLOGY TESTING PROGRAM
FOR THE HANFORD SITE
BEFORE CONSTRUCTION OF THE EXPLORATORY SHAFT

1. The State of Oregon has a unique position of not being officially designated an affected state in the Hanford geologic repository program.

But, because of Oregon's close proximity to the Hanford location, the nearness of the possible repository location to the Columbia river and the fact that Oregon aquifers may be connected to the repository aquifers, Oregon feels a vital concern with all aspects of the repository siting.

We of the technical staff sincerely appreciate the courtesy and technical help given us by the NRC, the State of Washington, and the three Indian nations.

2. The State of Oregon's greatest concern is the groundwater travel time issue. We feel it has not been properly addressed to date. We are reserving further comment until we have reviewed the SCP.

STATE OF OREGON
COMMENTS ON
DOE RESPONSE TO NRC COMMENTS

DOE appears to have made a significant effort to address the NRC concerns based on the presentation this morning. Many of the 16 concerns on the list will more fully be addressed in the Site Characterization Plan Hydrology section. Since we have not seen the SCP yet, we are not going to make detailed comments on the DOE response to the NRC until after reviewing the SCP.

The State of Oregon representative is satisfied for the present that DOE has made a good faith effort to address the NRC comments, and will make his comments upon reviewing the SCP.

DOE Responses to State of Oregon

No comment.

YAKIMA NATION OBSERVATIONS
ON DOE RESPONSE TO NRC
COMMENTS FROM APRIL, 1986 LETTER

NRC
COMMENT#

1. Comment Re: Nature of NRC Concern

- Comprehensiveness Assessment of Monitoring Adequacy

The determination of monitoring adequacy should be made prior to and for each of the stress tests. This assessment must be made available in advance of the initiation of the tests.

The determination of sampling frequency should be made prior to each of the tests. This should also be made available to the affected parties prior to the initiation of sampling.

We agree that this is an open item.

2. Cement Effects

To our knowledge, the Yakima Indian Nation has not been provided the documentation referred to in the handout, and therefore, we cannot make any statements about the adequacy of DOE's response.

We feel that this item is open.

3. We agree that this is an open item.

4. We agree that this is an open item.

5. Agree

6. Agree

7. LHS Testing Focus

The YIN agrees that this is a closed item contingent upon the effective execution of the formal consultation points during the geohydrology planning schedule and the effective transfer of information during the testing program.

8. We agree that this is an open item

9. Criteria for LHS Testing

Numerical and analytical models used in the design of the tracer tests should be made available for verification by the YIN. Current DOE tracer tests do not appear to consider the concentration of mass for tracer concentration. Justification must be made to explain the utility of the break-through curve. Therefore, we agree that this item should remain open.

10. Development of Pumping Well RRL-2B

We consider this item open because we have not received the hydrochemical sampling plan.

11. We agree

12. We agree

13. Convergent Tracer Tests

Neglecting lateral dispersion may lead to a conservative estimate of transport parameter, but would create problems in using a model to interpret the break-through curves (see comment on #9).

The matching of the predicted vs. observed test values using EPM models is a necessary but not significant to validate the underlying porous medium assumption. In order to sufficiently demonstrate the validity of the EPM model, the statistical parameter used to define the goodness of fit should be set a priority.

We suggest that geostatistical analysis be used in conjunction with EPM models to address the problem of spatial variability. A scientific strategy for the use of different approaches should be made available for evaluation.

Perturbations of Baseline

14. We agree that this is a closed item dependent upon the effectiveness of the mechanism allowing YIN independent analysis and verification.

15. Agree

Data Release

16. We consider this item open pending DOE's response to YIN April 7, 1987 presentation comments.

OBSERVATIONS OF YAKIMA INDIAN NATION
AT
DOE-NRC MEETING ON
THE GEOHYDROLOGY TESTING PROGRAM
FOR THE HANFORD SITE
BEFORE CONSTRUCTION OF THE EXPLORATORY SHAFT
Richland, Washington
April 7-9, 1987

1. The Department of Energy (DOE) will formally respond to contractor comments submitted on August 4, 1987, entitled "Evaluation of DOE Analysis of Groundwater Travel Time, Hanford Site."
 - a. The Yakima Indian Nation (YIN) suggests that there be a reasonable time for such a response (30 days). Without such a formal response we will be unable to actively or substantively participate in the NWPA process.
 - b. If appropriate, either party should be in the position to suggest interfacing meeting dates to resolve outstanding issues.
2. The YIN understands that the DOE will provide a description of the rationale for locating hydrologic monitoring facilities 6 months prior to the start of testing. Accordingly, the DOE will send the document(s) describing the siting of DC-24 and 25 to the YIN in a timely manner.
3. The DOE will formally assure the availability of any computer codes to be used in interpreting the data collected in the regional and site geohydrologic studies, both pre and post ES, in a timely manner.
4. The DOE will make the data collected in the pre-ES geohydrologic tests available as soon as it is provided to the DOE-BWIP subcontractors. After independent analysis, resolution of issues raised (yellow flags) will be through interfacing meetings and/or formal written response.
5. The DOE agrees that affected parties should observe the LHST.
6. The DOE agrees that any change in the LHST schedule, as described in the hand-out material entitled "Geohydrology Planning Schedule" will be communicated to the affected parties. This communication will be timely, contain all technical rationale for such a change. The DOE agrees that No Changes will be contemplated without effective consultation with the affected parties.

7. DOE will identify a single contact for the pre-ES geohydrologic testing program.
8. The YIN agrees that the formal pre-ES geohydrologic consultation points suggested by the DOE are reasonable, provided that they are complemented by an ongoing review and analysis of the data as it becomes available.
9. The NRC will respond to the comments provided by the YIN on the groundwater travel time GTP as a part of the formal comment response documentation.

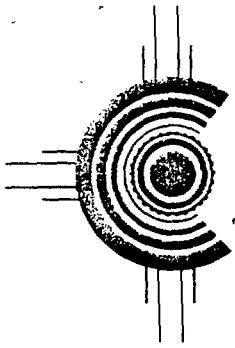
DOE Response to Yakima Indian Nation

A. General Comments

1. The DOE will respond within 30 days of receipt of specific comments provided by letter. The response will identify arrangements for any technical meetings needed to address unresolved issues.
2. Agreed.
3. Computer codes being used by the project will be provided upon request. Commercially available (proprietary) codes can be purchased with grant funds.
4. Agreed.
5. Agreed.
6. Agreed.
7. Agreed. The DOE designated contact point for hydrology is D. H. Dahlem. Participants are requested to provide a single technical contact point. The NRC has identified Tilak Verma as its technical contact point.
8. Agreed.
9. NRC agreed with this comment.

B. Observations on DOE Response to NRC Comments from April, 1986 letter

The comments of the Yakima Nation will be addressed in appropriate planning documents which will be available prior to pre-test interaction. The comments will be tracked and the documents in which they are addressed identified.



Council of Energy Resource Tribes

NUCLEAR WASTE POLICY ACT PROGRAM

1933 Jadwin — Suite 135
Richland, Washington 99352
(509) 943-5301

Executive Committee:

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Ute Mountain Ute
Edward T. Begay
Vice Chairman
Navajo
J. Herman Reuben
Secretary
Nez Perce
Melvin R. Sampson
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Cheyenne Arapaho
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Chippewa Cree
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Crow
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Hopi
Hualapai
Jemez Pueblo
Kalispel
Laguna Pueblo
Muckleshoot
Northern Cheyenne
Pawnee
Ponca
Rosebud Sioux
Santa Ana Pueblo
Saginaw Chippewa
Seminole of Florida
Shoshone - Bannock
Southern Ute
Spokane
Standing Rock Sioux
Tule River
Turtle Mountain Chippewa
Umatilla
Ute
Walker River
Zia Pueblo

Executive Director:

A. David Lester

COMMENTS FROM THE NEZ PERCE TRIBE AND CTUIR PERTAINING TO THE PRE-ES HYDROGEOLOGIC TESTING PROGRAM

April 8, 1987

1. We concur that Option D for the LHST is an appropriate first step toward the elimination of some of the uncertainties of the hydrogeologic nature of the CASZ. However, should any "yellow flags" arise using Option D, Option E should be required prior to the start of the ES.
2. We understand that scheduling is very important in terms of management of the program. Scheduling should, however, be done in such a way that:
 - o Sufficient time be allowed for evaluation of the hydrogeologic data prior to ES start to determine the adequacy of Option D and need for additional testing.
 - o It does not jeopardize the technical credibility of the overall program.
 - o Significant time is allowed for testing of the equipment (we feel that the one week periods as shown in the existing schedule are not long enough).
 - o Significant time is allowed for consultation with and comments from the affected parties at the appropriate decision points.
 - o The ES schedule not be driven by the pre-ES testing program.
3. Based on the data available, we feel that it is

**Serving the Nez Perce Indian Tribe and Confederated
Tribes of the Umatilla Indian Reservation**

too early to obtain a consensus on travel time and that data generated from the LHS test would be a more appropriate starting point.

4. There should be an appropriate decision point during or after the LHS test for deciding to proceed with the characterization program.
5. Plans should be made to assess the impact of the sinking of the ES on the groundwater regime at the site.
6. The hydrogeology program contains an insufficient number of wells west of the Yakima "flow impediment" to determine its impact on any hydrogeologic model or on the ES.
7. DOE analysis of the NRC, Yakima, or any other non-DOE reports pertaining to BWIP should be made available to all affected parties.
8. The Tribal On-Site Representative should be made aware of all upcoming technical "interactions" between any affected party and DOE.
9. The definition of "pre-ES" testing period needs to be agreed upon by NRC/DOE/affected parties.
10. Test plans for the hydrogeology program need to be made available to the affected parties as soon as possible, as well as part of the SCP.
11. A geostatistical approach may be inadequate due to the statistically small population represented by the wells in the DOE hydrogeologic testing program.

DOE Response to Nez Perce Indian Tribe and CTUIR

1. The Department agrees that Option D is an appropriate option. If a yellow flag arises, then additional testing may be appropriate as illustrated in Appendix C of the Option Paper.
2. We agree with the scheduling objectives. If the one week equipment testing periods are not sufficient, then longer tests will be conducted.
3. We agree with the comment.
4. The Department agrees that there should be a decision point after the Birkett test to determine if the objectives of the pre-ES testing program have been met and subsequent characterization can proceed as planned.
5. We agree with the comment which is consistent with the third objectives of the pre-ES test program.
6. The pre-ES testing program is not intended to evaluate the Yakima flow impediment. However, the characterization program calls for construction of additional borehole facilities to assess the hydraulic significance of primary geologic structures during and after construction of the ES.
7. We agree.
8. We agree and will meet with the on-site representatives to work out arrangements.

9. The definition of the pre-ES period is that period preceding the initiation of construction of the ES.
10. We agree.
11. We agree that the small data populations that will be available, limit the usefulness of geostatistical analyses. However, geostatistics used in conjunction with scientific data and professional judgement may be useful, and should not be rejected out-of-hand.

WORKING GROUP MEMBERS
FOR PRESENTATION OF
OPTION PAPER

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

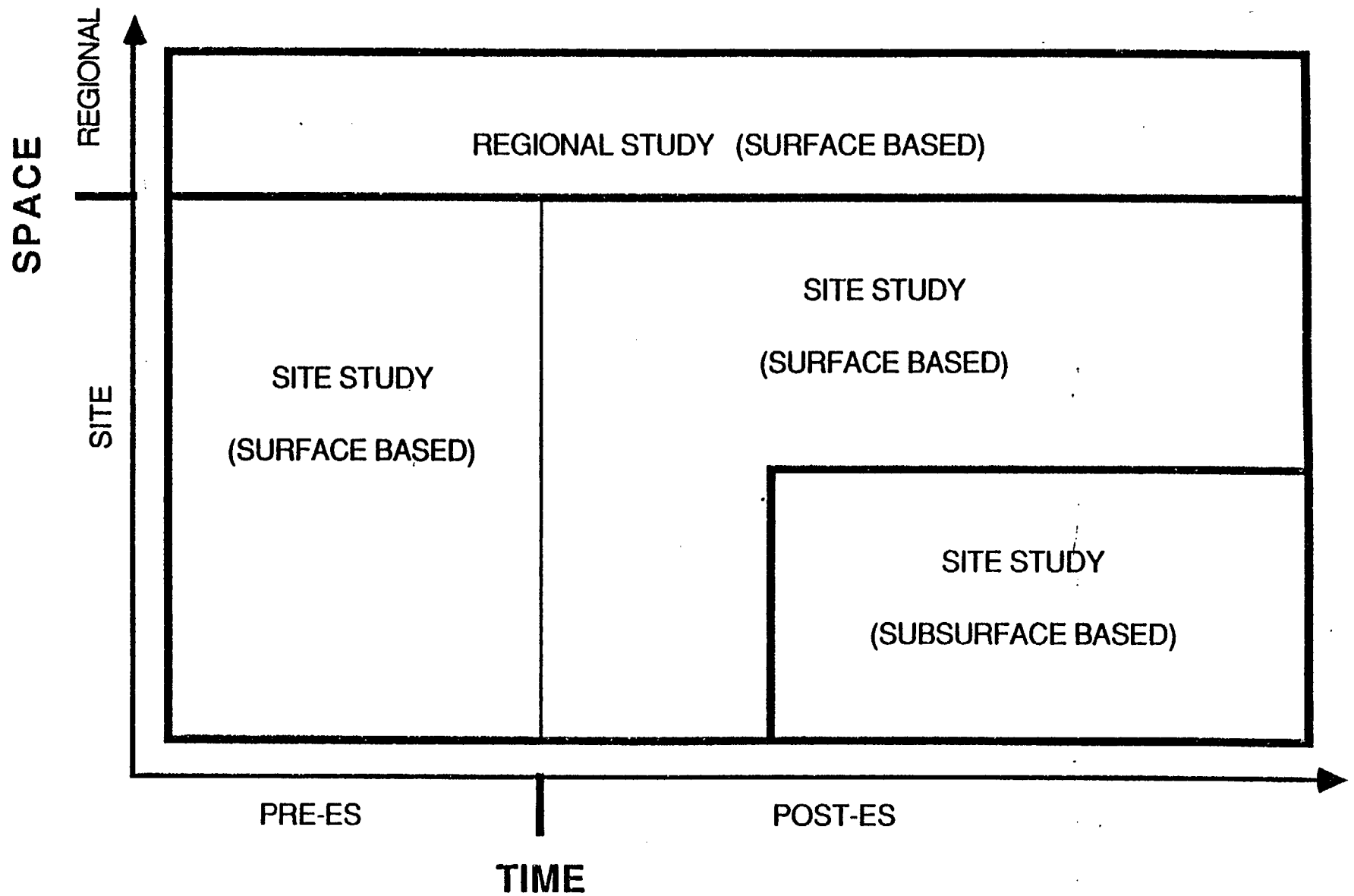
**DOE-NRC Meeting
on the
Geohydrology Testing Program
for the Hanford Site
Before Construction
of the
Exploratory Shaft**

Richland, Washington

April 7-9, 1987

WORKSHOP OBJECTIVES

- Present the option paper on the pre-exploratory shaft geohydrology program to the NRC, States, and Indian Tribes in order to receive comments from the participants, and to prepare for start of surface based testing.
- To discuss and come to closure on NRC comments of April 10, 1986 concerning the previous geohydrology testing program at Hanford.
- To lay the ground-work for a follow-up workshop with the NRC, States, and Indian Tribes that will focus on the full geohydrology testing program at Hanford.



**TIME-SPACE RELATIONSHIP BETWEEN THE SITE
AND REGIONAL GEOHYDROLOGIC STUDIES**

OPTION PAPER

GEOHYDROLOGIC TESTING

PROGRAM

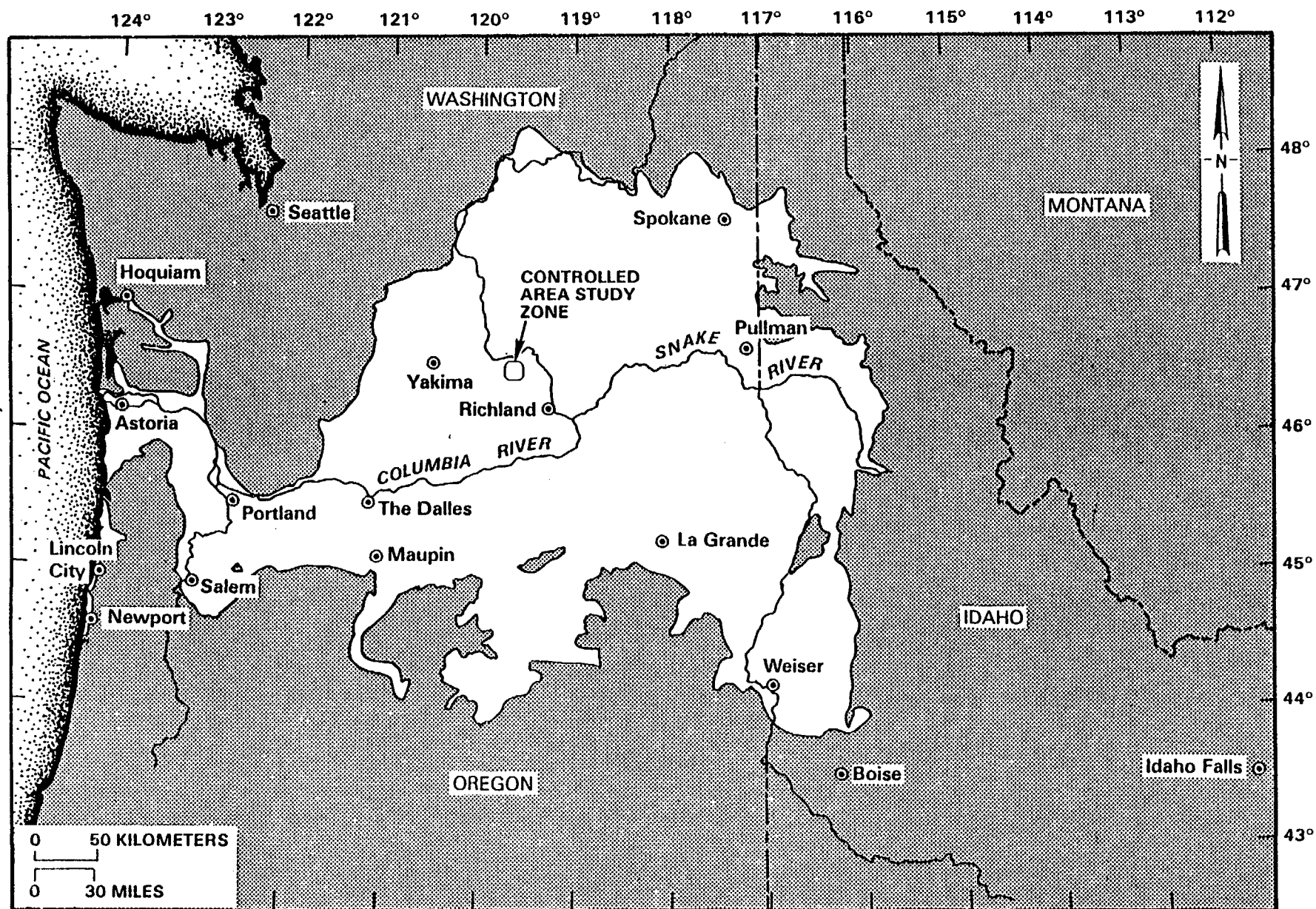
FOR THE

HANFORD SITE

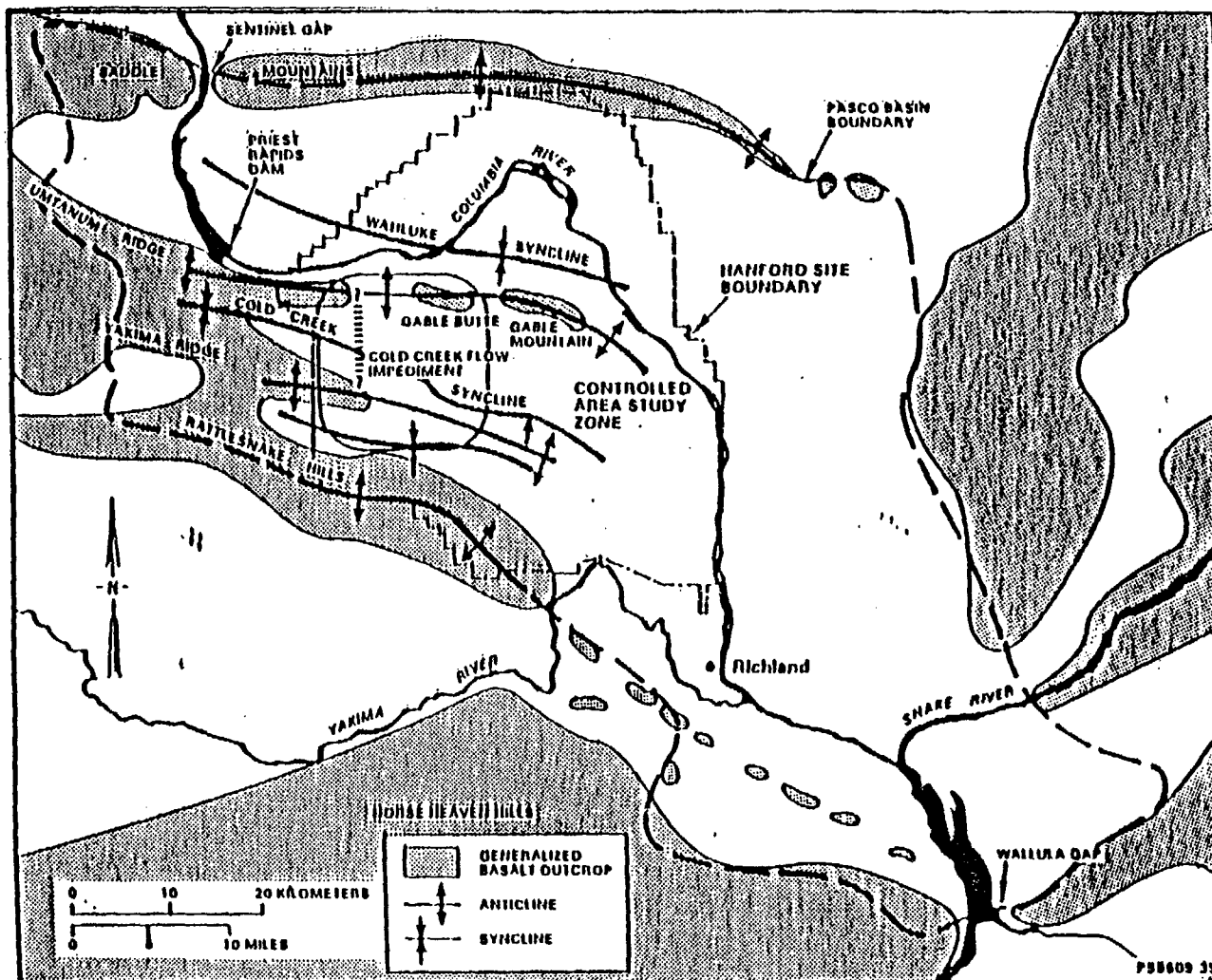
BEFORE CONSTRUCTION OF

THE

FIRST EXPLORATORY SHAFT

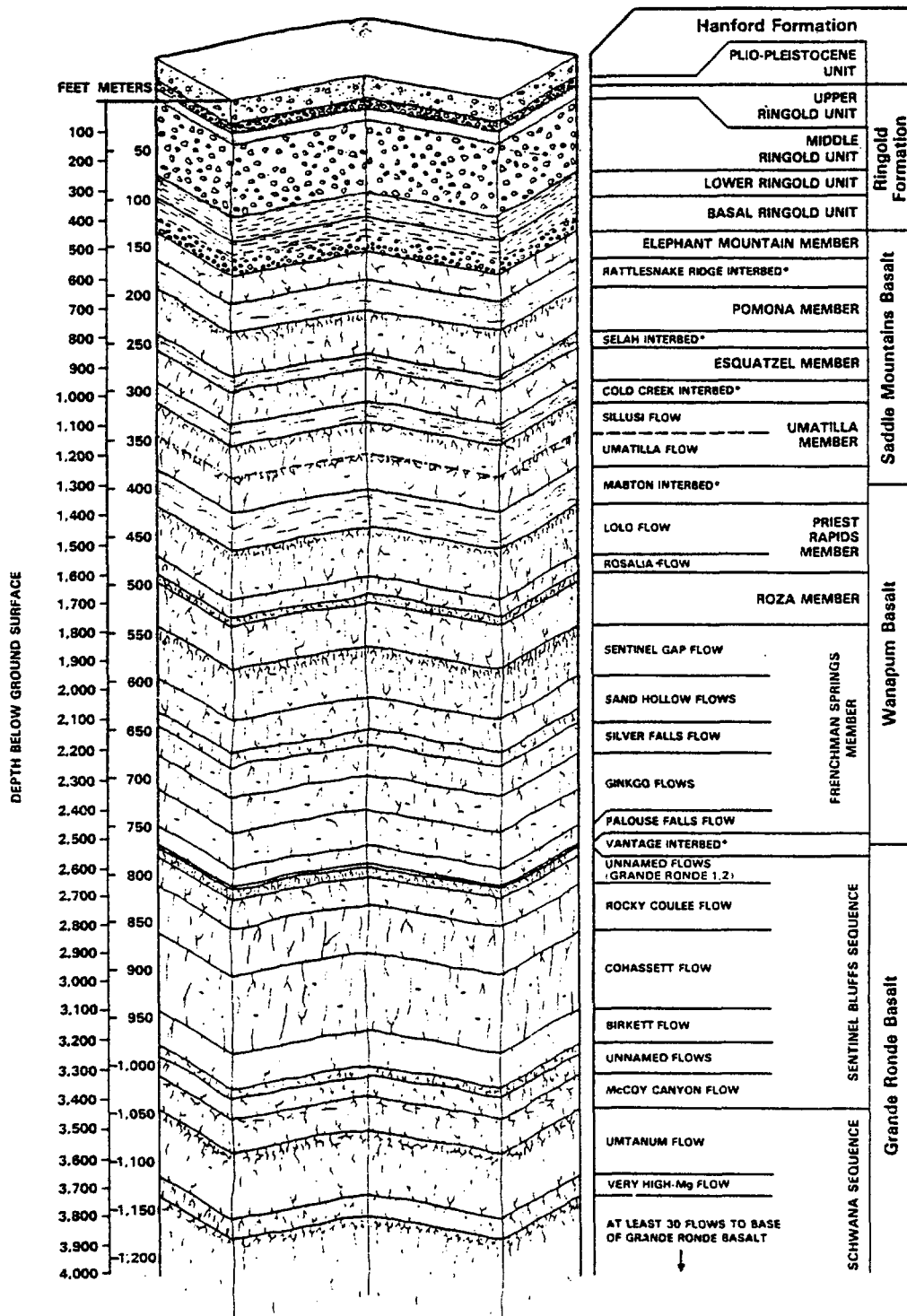


Background



LOCATION MAP OF HANFORD SITE SHOWING MAJOR
STRUCTURAL FEATURES

STRATIGRAPHIC UNITS FOUND WITHIN RRL-2



*INTERBEDS ARE STRATIGRAPHICALLY CONTAINED IN THE ELLENSBURG FORMATION

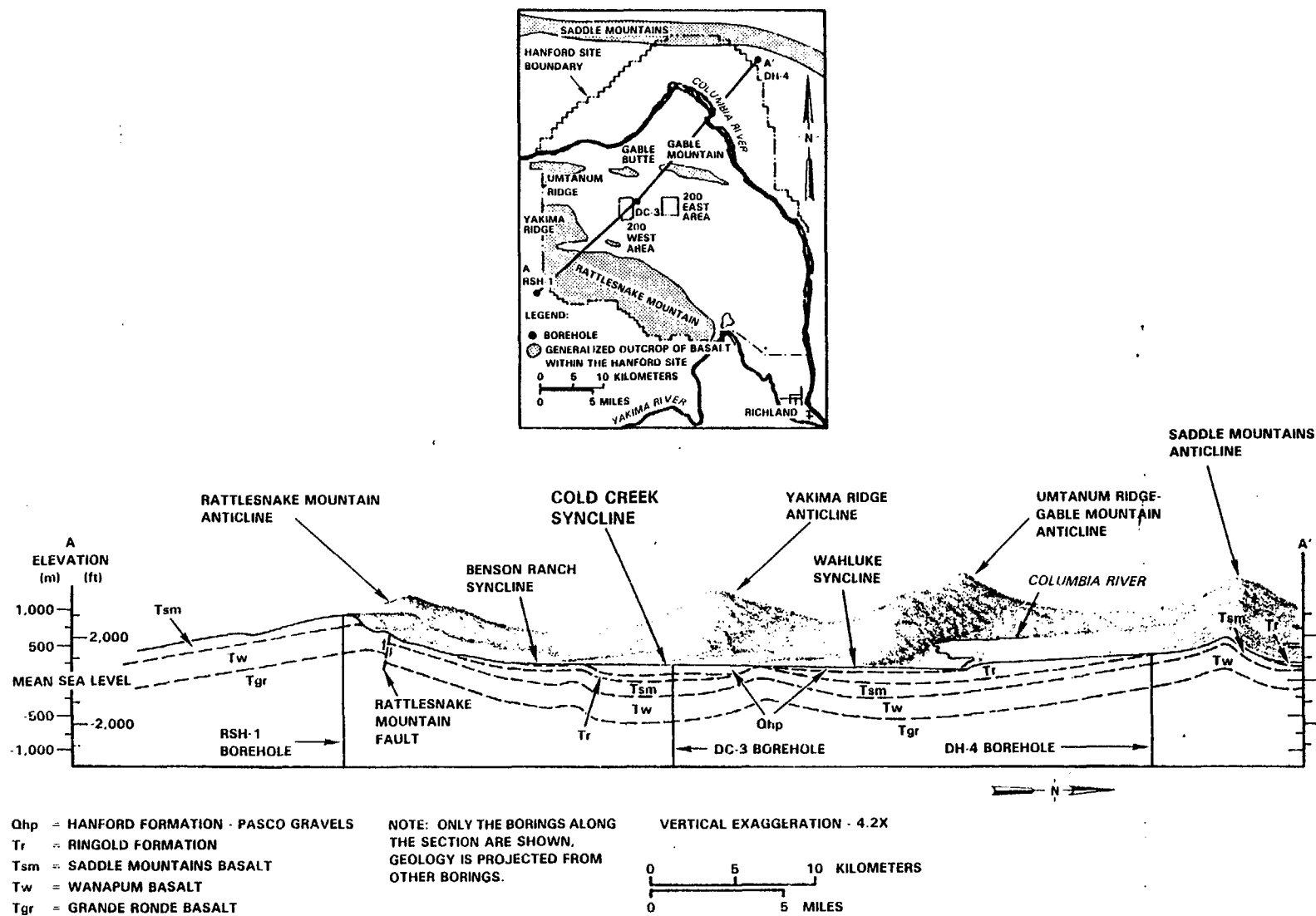
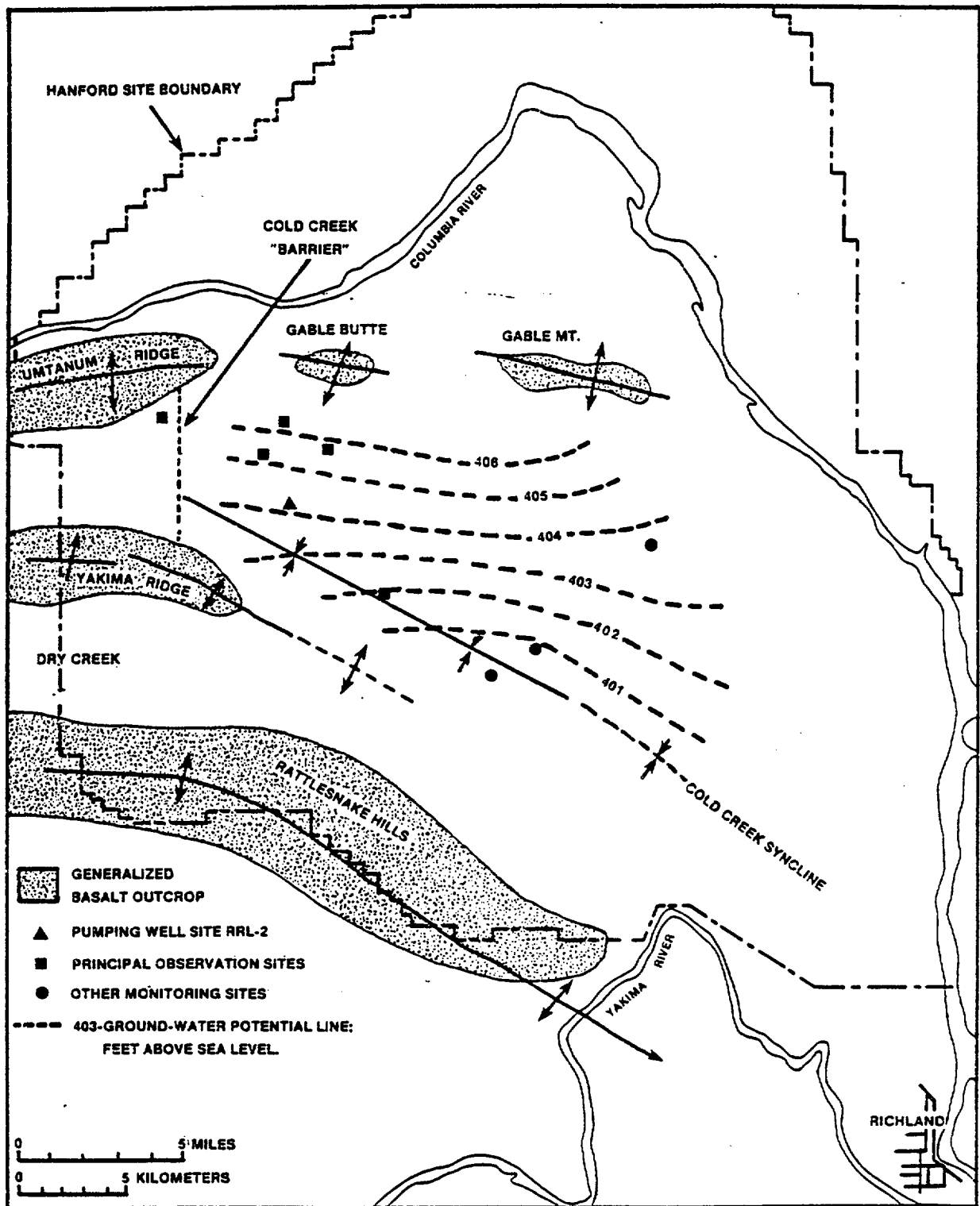
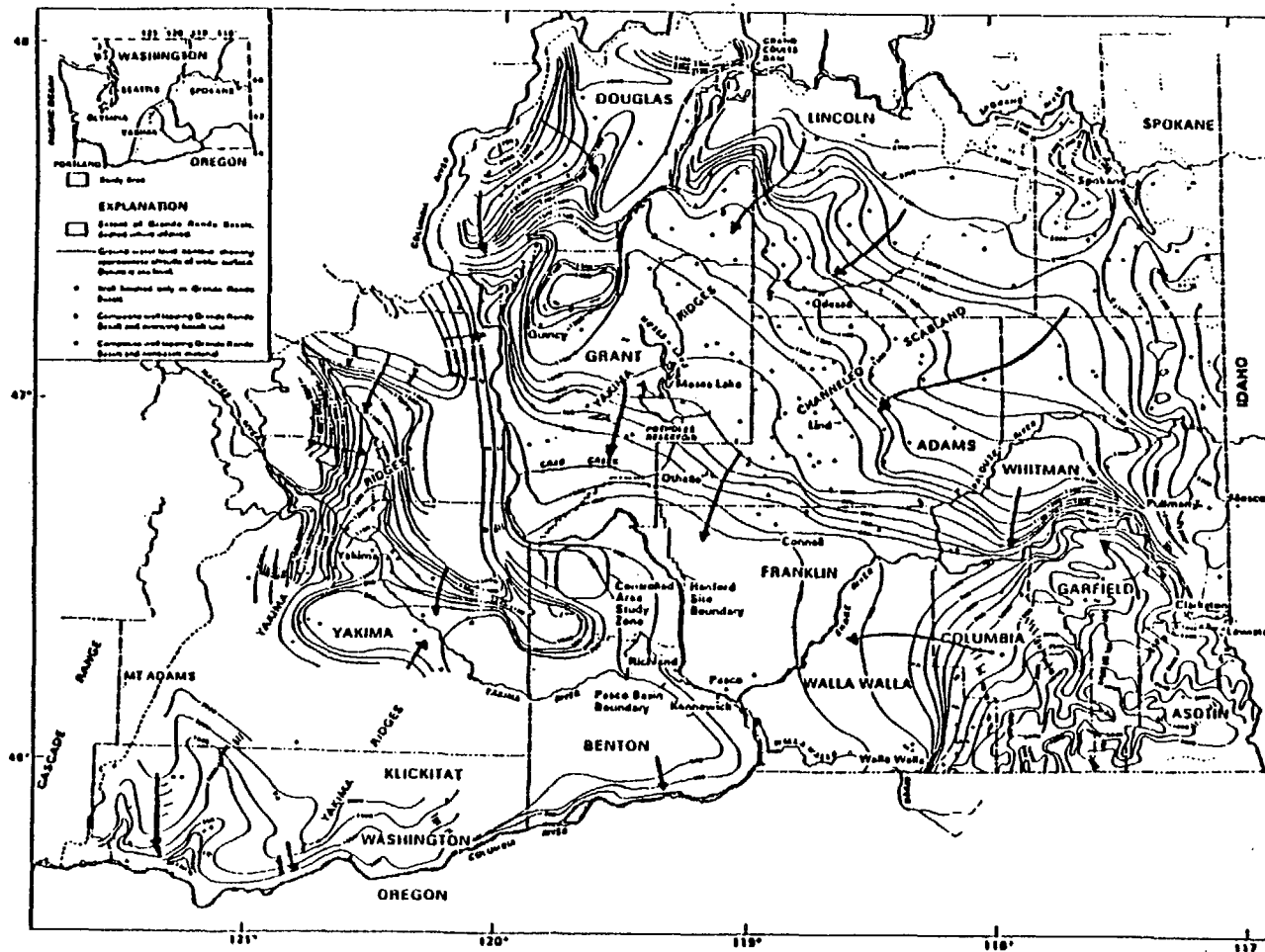


FIGURE 1-5. Generalized Cross Section Through the Pasco Basin.

RCP8207-5A

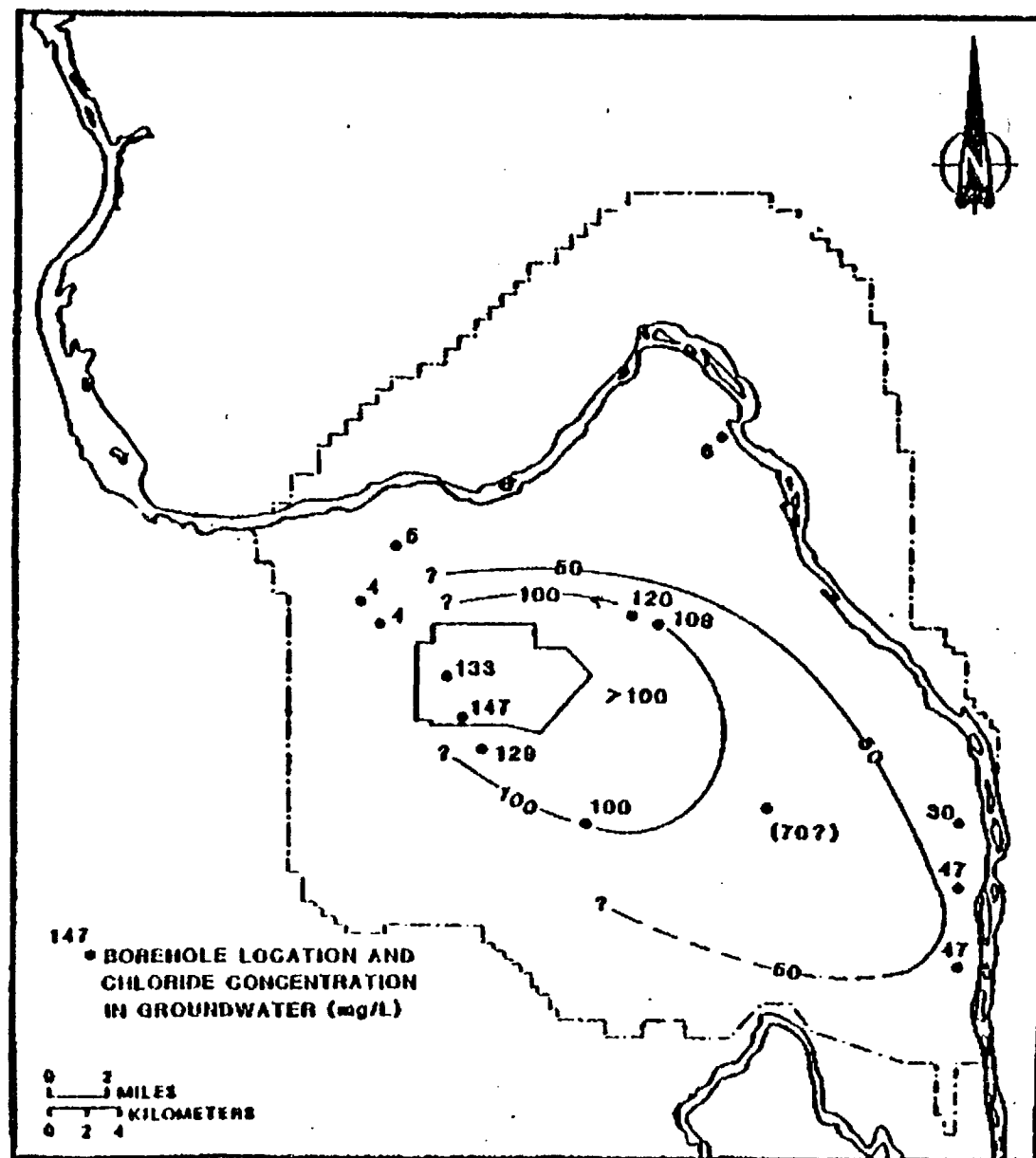


**CONCEPTUALIZED POTENTIOMETRIC SURFACE NEAR TOP OF
GRANDE RONDE BASALT, COLD CREEK SYNCLINE,
FALL 1986 WATER LEVELS**



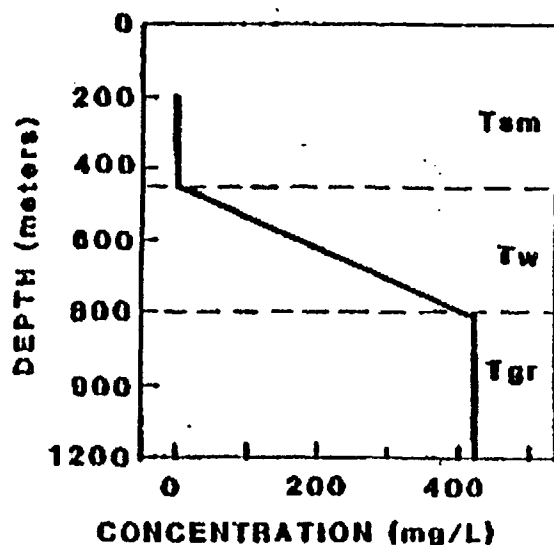
**GENERALIZED AREAL GROUNDWATER FLOW PATHS
IN THE GRONDE RONDE BASALT WITHIN THE
COLUMBIA PLATEAU**

CHLORIDE IN UPPER WANAPUM GROUNDWATERS



WP6510-43

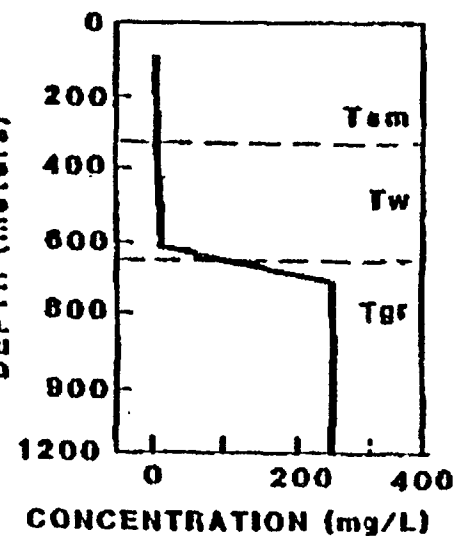
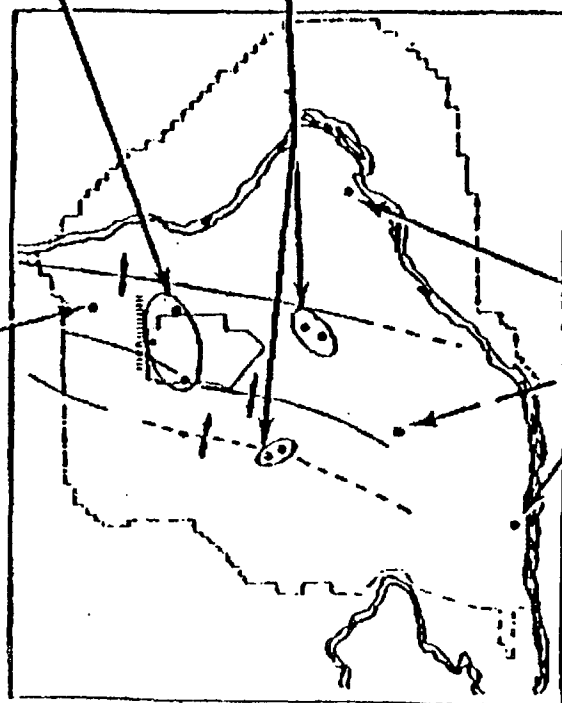
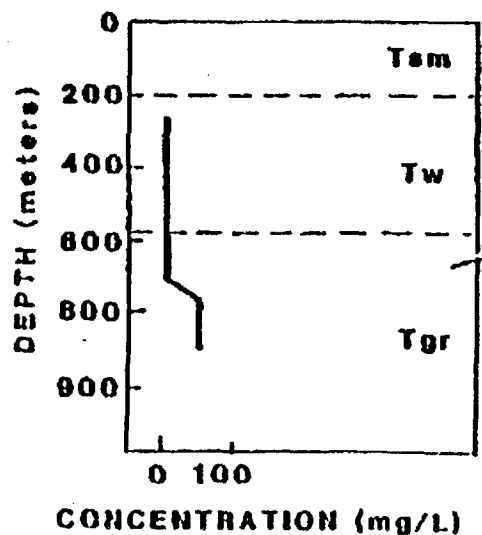
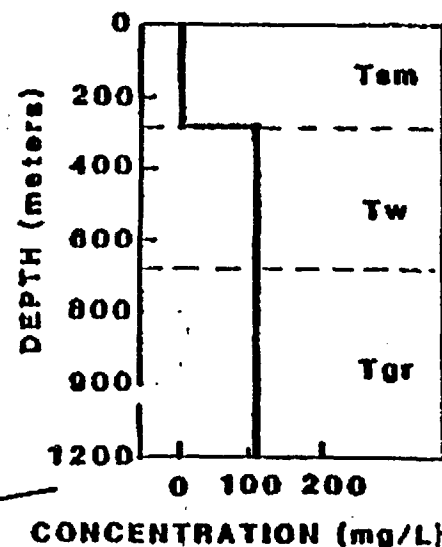
SCHEMATIC CONCENTRATION-DEPTH PROFILES FOR CHLORIDE IN GROUNDWATERS FROM SELECTED HANFORD BOREHOLES

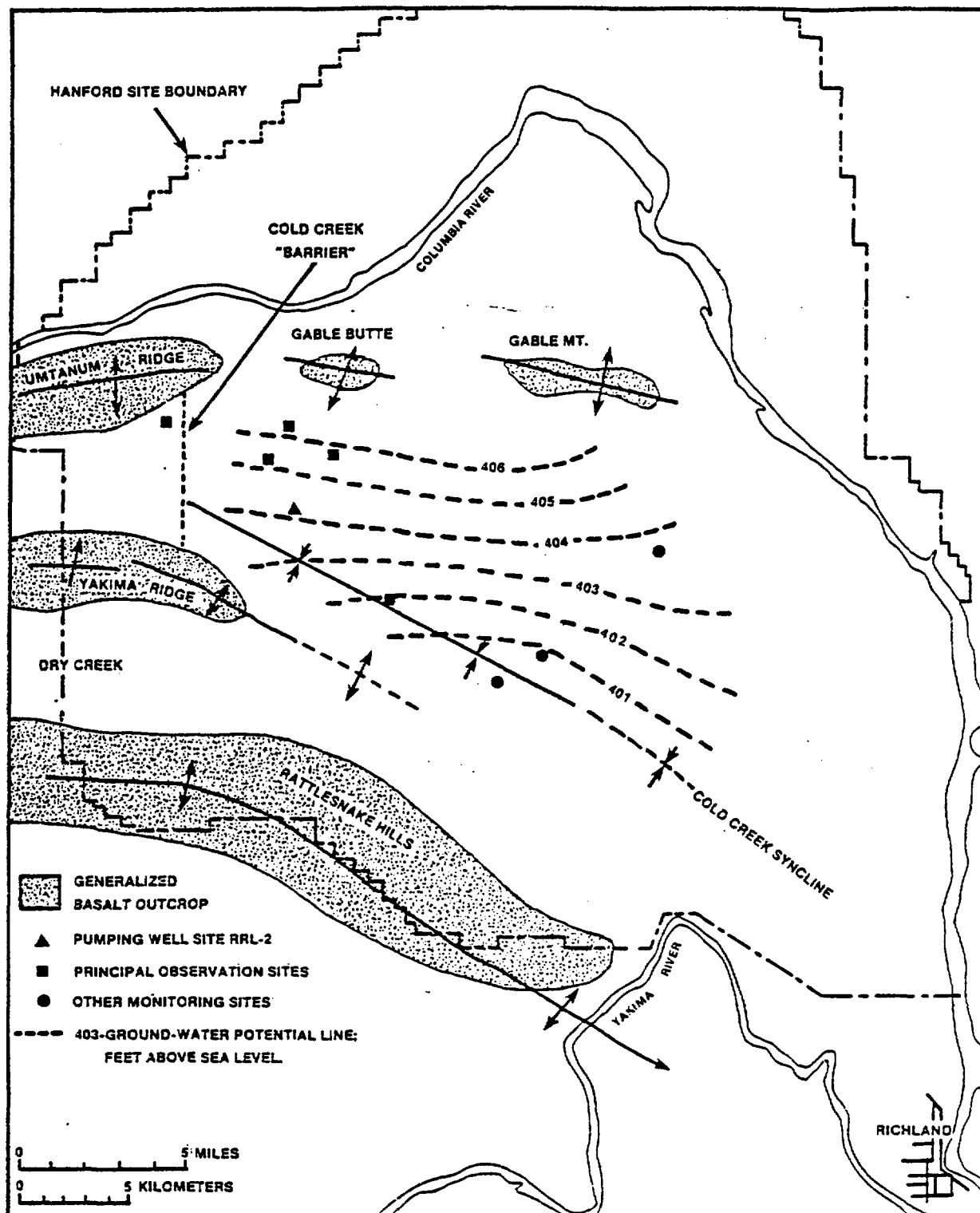


Tsm: SADDLE MOUNTAIN
BASALT

Tw: WANAPUM BASALT

Tgr: GRANDE RONDE
BASALT



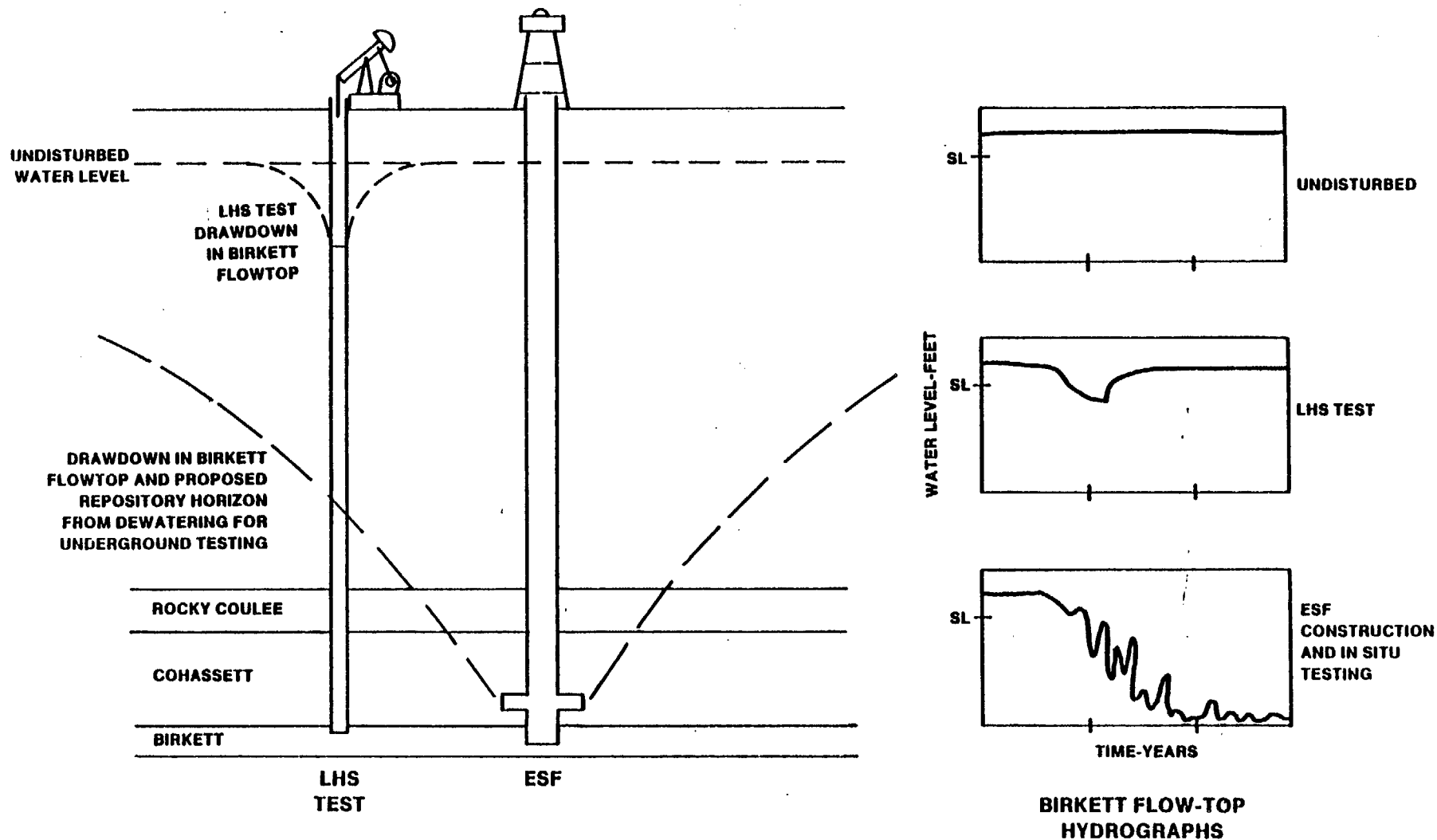


**CONCEPTUALIZED POTENTIOMETRIC SURFACE NEAR TOP OF
GRANDE RONDE BASALT, COLD CREEK SYNCLINE,
FALL 1986 WATER LEVELS**

Approach

JUSTIFICATION FOR PRE-ES TESTING PROGRAM

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 the start of ESF construction. Given this circumstance, it is necessary 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.



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

STEPS TAKEN TO PLAN A PRE-ES GEOHYDROLOGIC TESTING PROGRAM

- Organized a small working group of geosciences specialists consisting of two or three representatives each from DOE Headquarters, Roy F. Weston, DOE Richland Operations, and Rockwell International.
- Working group identified all issues from the Issues Hierarchy that require hydrologic testing to meet relevant information needs.
- Identified information needs for each geohydrology related issue and the parameters and tests needed to meet the information needs.
- Determined what tests must be run before and what ones can wait until after the first Exploratory Shaft is started.
- Developed a set of pre-Exploratory Shaft Geohydrologic Testing Program options.
- Recommended an option for implementation.
- Reviewed options with independent consultants.

OBJECTIVES OF PRES-ES TESTING PROGRAM

- 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 a disqualifying condition.
- 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.

Issues Containing Hydrologic Testing and Disqualifying Conditions

<u>Issue</u>	<u>Hydrologic Testing</u>	<u>Disqualifying Condition</u>
1.1 Release to A.E.	Y	N
1.2 Individual Protection	Y	N
1.3 Ground Water Protection	N	-
1.4 Performance Objectives- Containment	Y	N
1.5 Performance Objective- Engineered Barriers	Y	N
1.6 Ground-Water Travel Time	Y	Y
1.7 Performance Confirmation	Y	N
1.8 Favorable and Adverse Conditions	Y	N
1.9.0 Postclosure Guidelines	Y	N
1.9.1 Postclosure Geohydrology	Y	Y
1.9.2 Postclosure Geochemistry	Y	N
1.9.3 Postclosure Rock Characteristics	Y	N
1.9.4 Postclosure Climate	Y	N
1.9.5 Postclosure Erosion	Y	N
1.9.6 Postclosure Dissolution	N	-
1.9.7 Postclosure Tectonics	Y	N
1.9.8 Postclosure Human Interference	Y	N
1.10 Waste Package Design (Postclosure)	N	-
1.11 Repository Design (Postclosure)	Y	N
1.12 Seals Design (Postclosure)	Y	N
2.1-2.5 Radiation Safety	N	-
2.6 Waste Package Design (Preclosure)	Y	N
2.7 Repository Design (Preclosure)	Y	N
2.8-2.11 Characterization Issues	N	-
4.1.0 Performance Issues		
4.1.1 Ease and Cost	Y	N
4.1.2 Surface Characteristic	Y	N
4.1.3 Rock Characteristic	Y	N
4.1.4 Preclosure Hydrology	Y	Y
4.1.5 Preclosure Tectonics	N	-

LICENSING ISSUES RELATED TO GEOHYDROLOGY

- 1.1 Release to the accessible environment**
- 1.2 Individual protection**
- 1.4 Waste-package life**
- 1.5 Release rates**
- 1.6 Ground-water travel time**
- 1.7 Performance confirmation**
- 1.8 Favorable and adverse conditions**
- 1.9 Postclosure guidelines**
- 1.11 Repository design**
- 1.12 Seals postclosure**
- 2.6 Waste package design preclosure**
- 2.7 Repository design preclosure**
- 4.1.1 Ease and cost of construction**
- 4.1.3 Rock characteristics**
- 4.1.4 Preclosure hydrology**
- 4.2 Repository design: nonradiological worker safety**
- 4.4 Repository design: adequate technology for repository construction, operation, closure, decommissioning**
- 4.5 Repository design: cost of waste package and repository**

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

<u>Issue</u>	<u>Information Needs</u>	<u>Parameters</u>	<u>Tests</u>	<u>Timing Need</u>	<u>Comments</u>
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

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	$T_1 > 5\text{m/yr}$ nb	
		• 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	$K'v \leq 10^{-8} \text{ m/s}$	
		• 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: $H-3 \leq 0.2\text{TU}$ $C-14 \leq 80\% \text{ modern}$ $I-129 \leq 10^{-8} \text{ pCi/L}$	Sampling and analysis
		• Radioisotope concentrations		

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 Cohasset dense interior <ul style="list-style-type: none"> • Vertical hydraulic conductivity • Specific storage b. Hydraulic properties of adjacent flow tops <ul style="list-style-type: none"> • Transmissivity • Storativity • Head distribution c. Gas content of groundwater <ul style="list-style-type: none"> • Gas concentration 	$K'v \geq 10^{-9}$ m/s N.A. $CH_4 \geq 1200\text{mg/L}$	LHS test in Birkett flow top Estimated from tests core samples LHS test in flow tops LHS test in flow tops Spatial and temporal distribution of hydraulic head Sampling and analysis

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

PRE-AND POST-ES GEOHYDROLOGIC TESTS

PRE-ES

Baseline head monitoring

LHS Tests RRL-2B

Pulse Tests RRL-2B

Convergent Tracer Tests

Hydrochemical sampling and
analysis

POST-ES

Multi-well tracer tests
(several locations)

Lab tests on rock samples

LHS Tests (non RRL-2)
(several)

Borehole cluster tests in ESF

Single-well tests for hydraulic
properties

Dual well hydraulic & tracer
tests

Hydrochemical sampling and
analysis

Drill and tests piezometer
installations

Porthole tests in ES

Various in-situ ESF tests

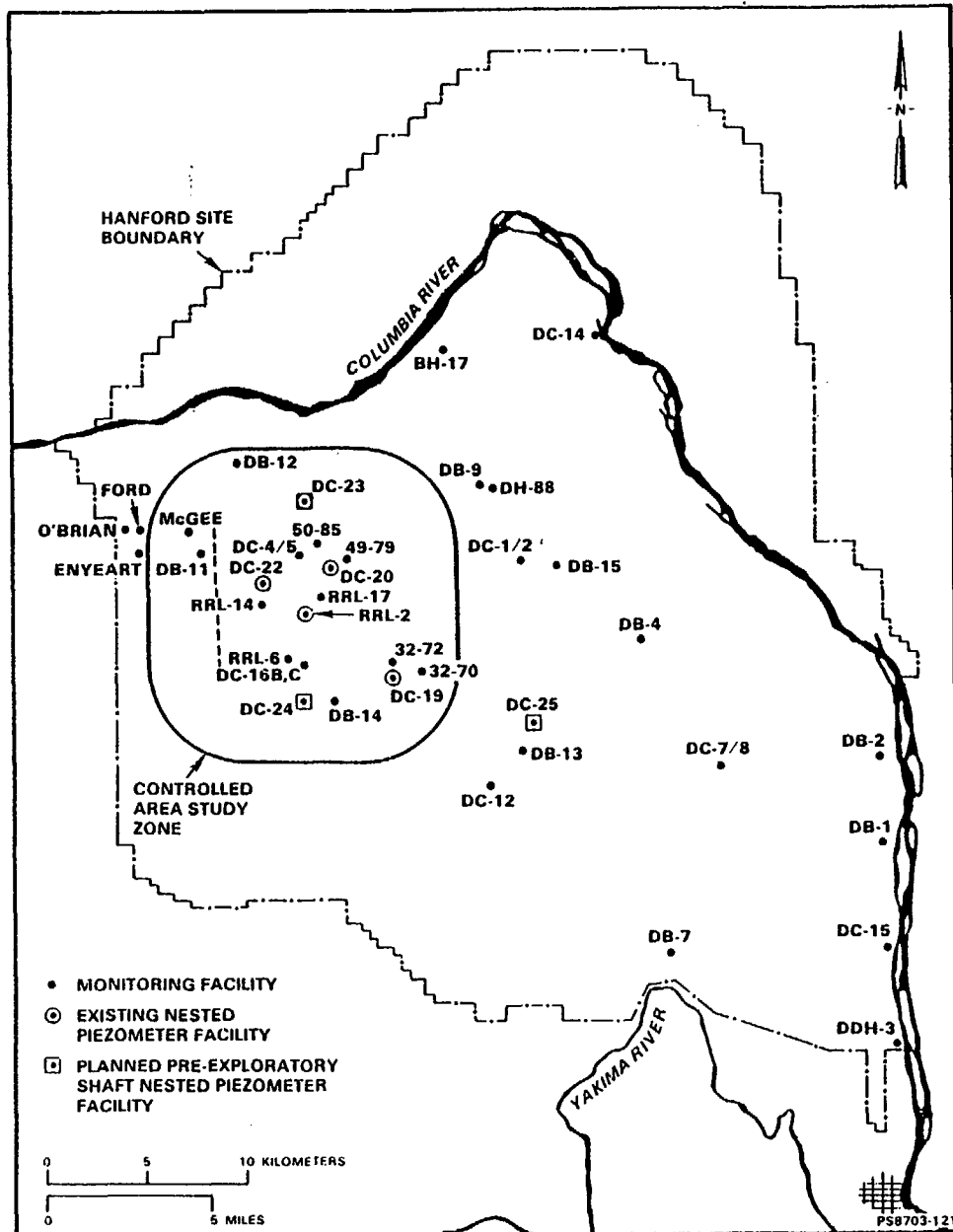
Hydraulic stress and tracer
tests on well and shaft seals

Options

OPTIONS CONSIDERED FOR THE PRE-ES
GEOHYDROLOGY TESTING PROGRAM

- A. Baseline hydraulic-head
- B. Baseline hydraulic-head and LHS testing of one flow top (Rocky Coulee) with hydrochemical sampling and tracer tests
- C. Baseline hydraulic-head and LHS testing of one flow top (Birkett) with hydrochemical sampling and tracer tests
- D. Baseline hydraulic-head and LHS testing in multiple horizons at the RRL-2 location with hydrochemical sampling and tracer tests
- E. Baseline hydraulic-head and LHS testing in multiple horizons at multiple locations with hydrochemical sampling and tracer tests

**OPTION A--Establish a hydraulic-head baseline only
Drill and equilibrate DC-24, -25**



Pros

- Minimal schedule disruption on start of ES
- Least cost impact
- Yield data on perishable head conditions

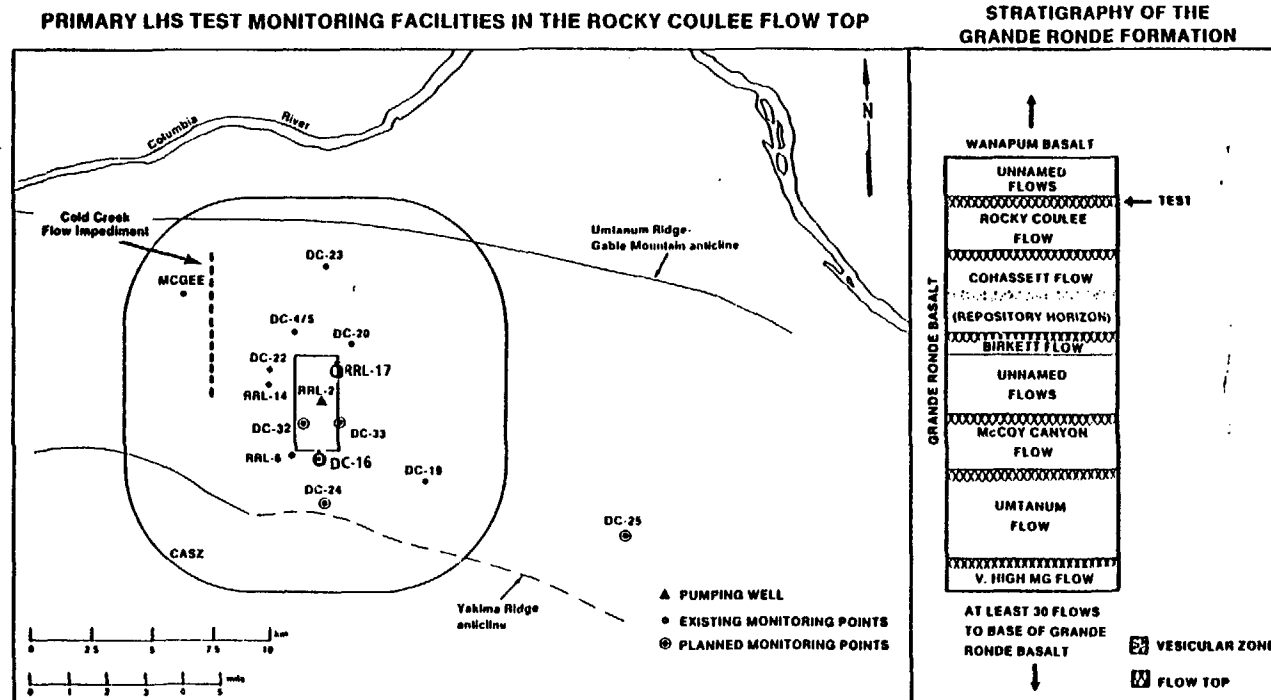
Cons

- Provide 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
- Provide little or no information on hydraulic boundaries

— OPTION B —

Establish hydraulic-head baseline and test Rocky Coulee flow top

- Drill and equilibrate DC-24,-25
- Drill DC-32,-33
- Pump RRL-2B
- Collect water samples (hydrochemistry)
- Conduct tracer tests



Pros

- 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

Cons

- Provides little information to support engineering design
- Provides little information on impact of ESF on future tests
- May not be credible with technical community
- Provide little or no information on hydraulic boundaries

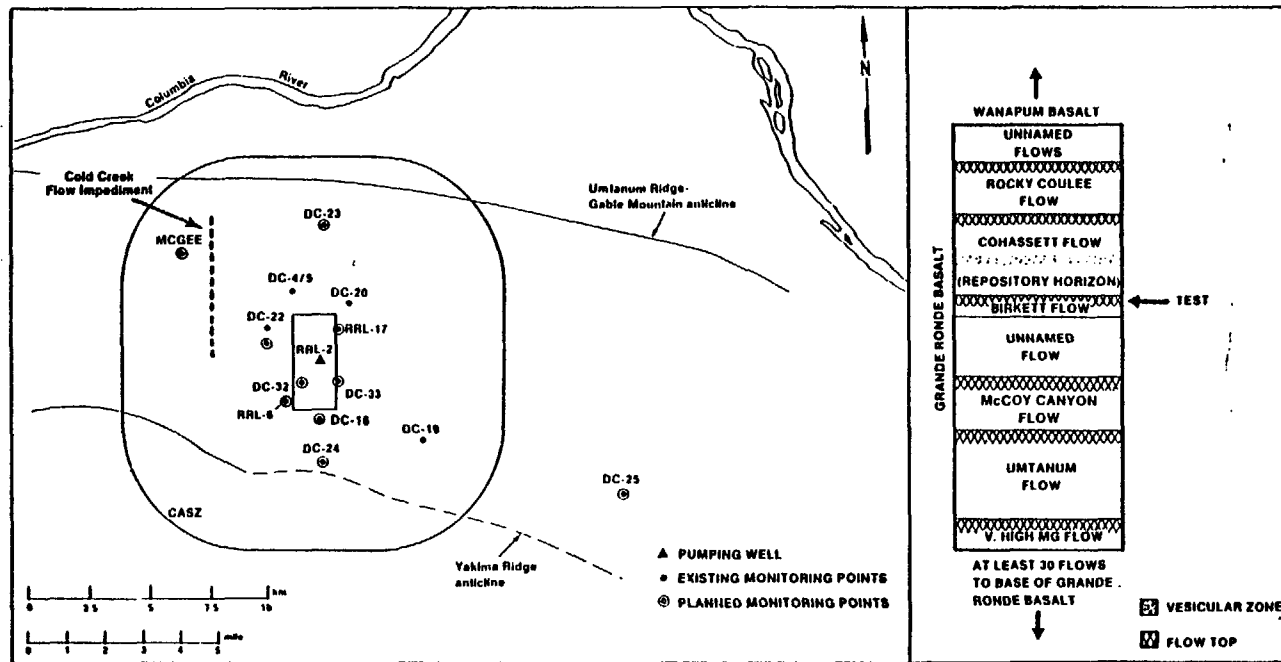
— OPTION C —

Establish hydraulic-head baseline and test Birkett flow top

- Drill and equilibrate DC-24,-25
- Drill DC-32,-33
- Pump RRL-2B
- Collect water samples (hydrochemistry)
- Conduct tracer tests

PRIMARY LHS TEST MONITORING FACILITIES IN THE BIRKETT FLOW TOP

STRATIGRAPHY OF THE GRANDE RONDE FORMATION



0210 002408 3/10/07

Pros

- Provides some information for engineering design
- Yields data on perishable hydraulic properties and conditions of Birkett flow top and Cohasset interior
- Provides some information on disqualifying conditions
- Provides some information on impacts of ESF on future tests

Cons

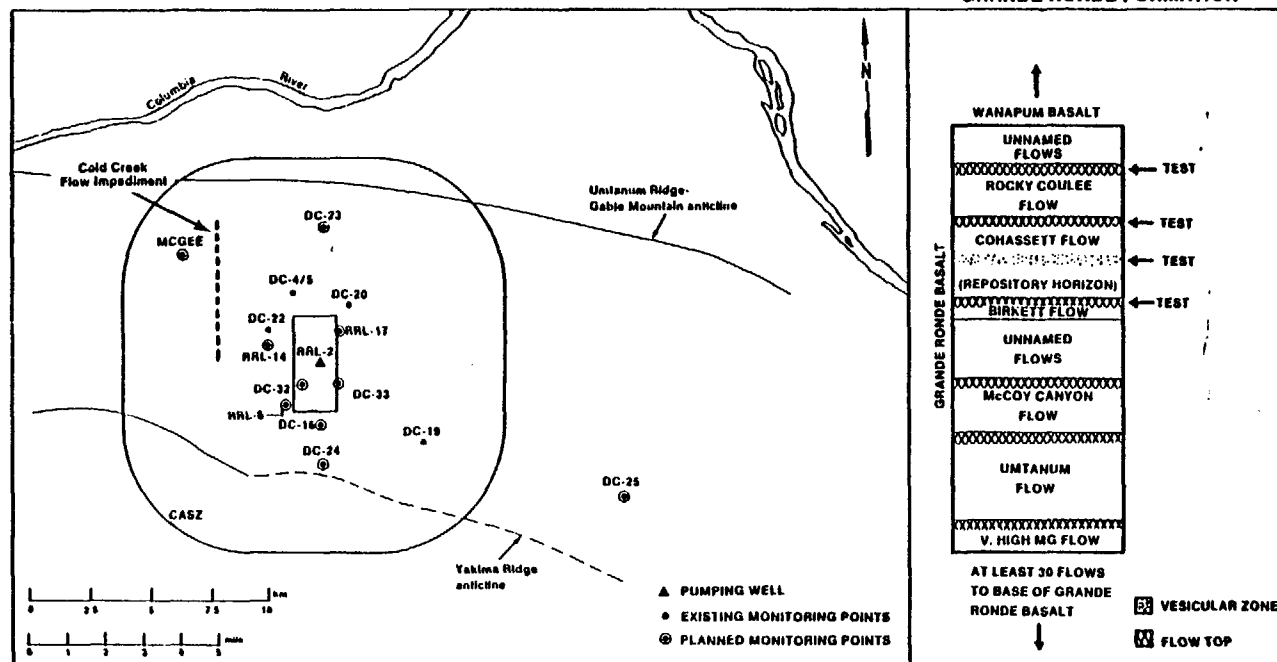
- Limited credibility with technical community
- May delay ES construction schedule
- Requires modification to pumping well and additional monitoring facilities
- Some reprogramming required
- Provide little or no information on hydraulic boundaries

— OPTION D —

Establish hydraulic-head baseline and test multiple flow tops (Rocky Coulee, Cohasset, and Birkett and Cohasset vesicular zone)

- Drill and equilibrate DC-24, -25
- Drill DC-32, -33
- Pump RRL-2B
- Collect water samples (hydrochemistry)
- Conduct tracer tests

PRIMARY LHS TEST MONITORING FACILITIES IN MULTIPLE FLOW TOPS



Pros

- 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
- Provide baseline information to predict impacts of ES on future geohydrologic tests

Cons

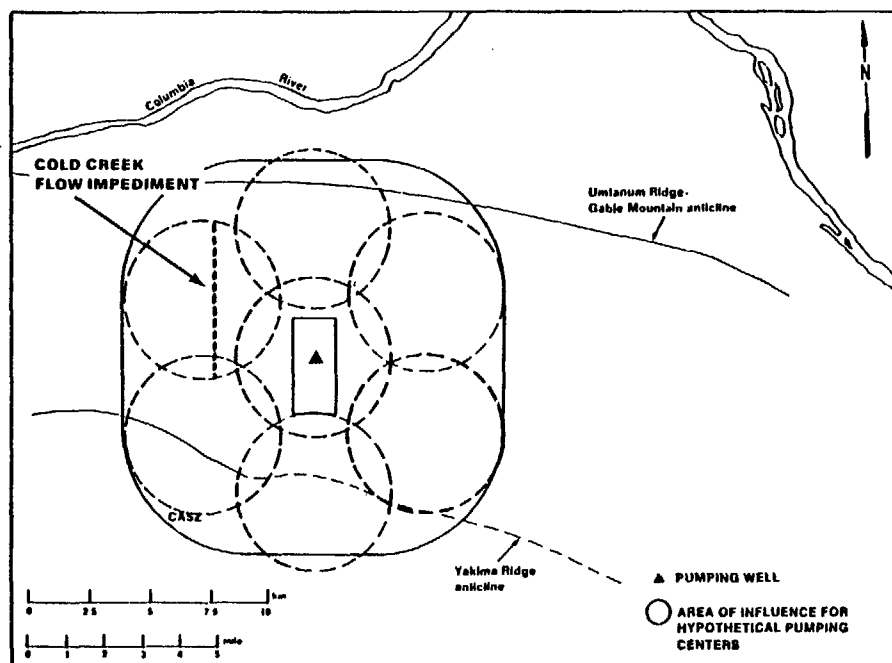
- Delays ES construction schedule
- Near-term site costs increase
- Requires additional monitoring facilities
- Reprogramming required
- Provide little or no information on hydraulic boundaries

— OPTION E —

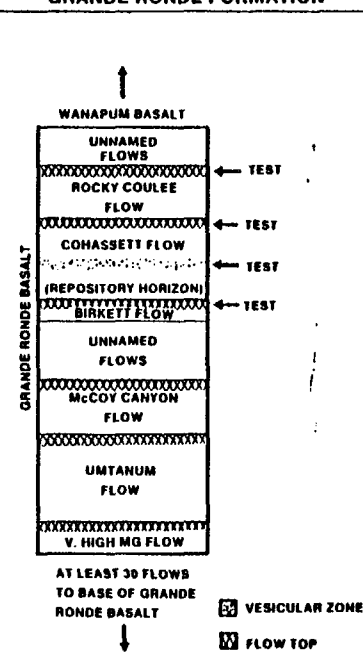
Establish hydraulic-head baseline and test multiple flow tops (Rocky Coulee, Cohassett, and Birkett) and Cohassett vesicular zone at several additional pumping centers and monitoring wells

- Drill and equilibrate DC-24, -25
- Drill DC-32, -33
- Pump RRL-2B
- Drill and pump other pumping centers and monitoring wells
- Collect water samples (hydrochemistry)
- Conduct tracer tests

CONCEPTUAL LHS TEST PUMPING CENTERS IN MULTIPLE FLOW TOPS



STRATIGRAPHY OF THE GRANDE RONDE FORMATION



Pros

- 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
- Avoids interference from ESF activities and attendant interpretation problems
- High credibility with technical community

Cons

- Major delays in ES construction schedule
- Near-term site costs increase substantially
- Major reprogramming required
- Requires considerable monitoring and pumping facilities

RECOMMENDATION

-OPTION D-

Top-down large-scale hydraulic stress (LHS) testing of the Rocky Coulee flow top, the Cohasset flow top, the Cohasset vesicular zone, and the Birkett flow top.

- Pre-emplacement hydraulic-head baseline monitoring
- Large-scale hydraulic stress tests at RRL-2B
- Ground-water sampling for hydrochemistry
- Radial-convergence tracer tests

Planned Pre-ES Testing Program

**Proposed
Option D
Pre-exploratory shaft
Test Program**

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 geohydrologic system and on subsequent geohydrologic tests**
- **To collect data on geohydrologic conditions that may affect the design of the ESF or the repository**

PRE-ES SURFACE BASED PROGRAM CONTENT

- o Install Required Monitoring Facilities**
- o Establish Potentiometric Baseline**
- o Perform Hydraulic Tests at RRL-2B**
 - Rocky Coulee Flow Top**
 - Cohassett Flow Top**
 - Cohassett Vesicular Zone**
 - Birkett Flow Top**
- o Perform Adjunct Tests**
 - Radial-Convergent Tracer Tests with LHS Tests**
 - Hydrochemical Samples of Pump Test Discharge**

MONITORING FACILITIES

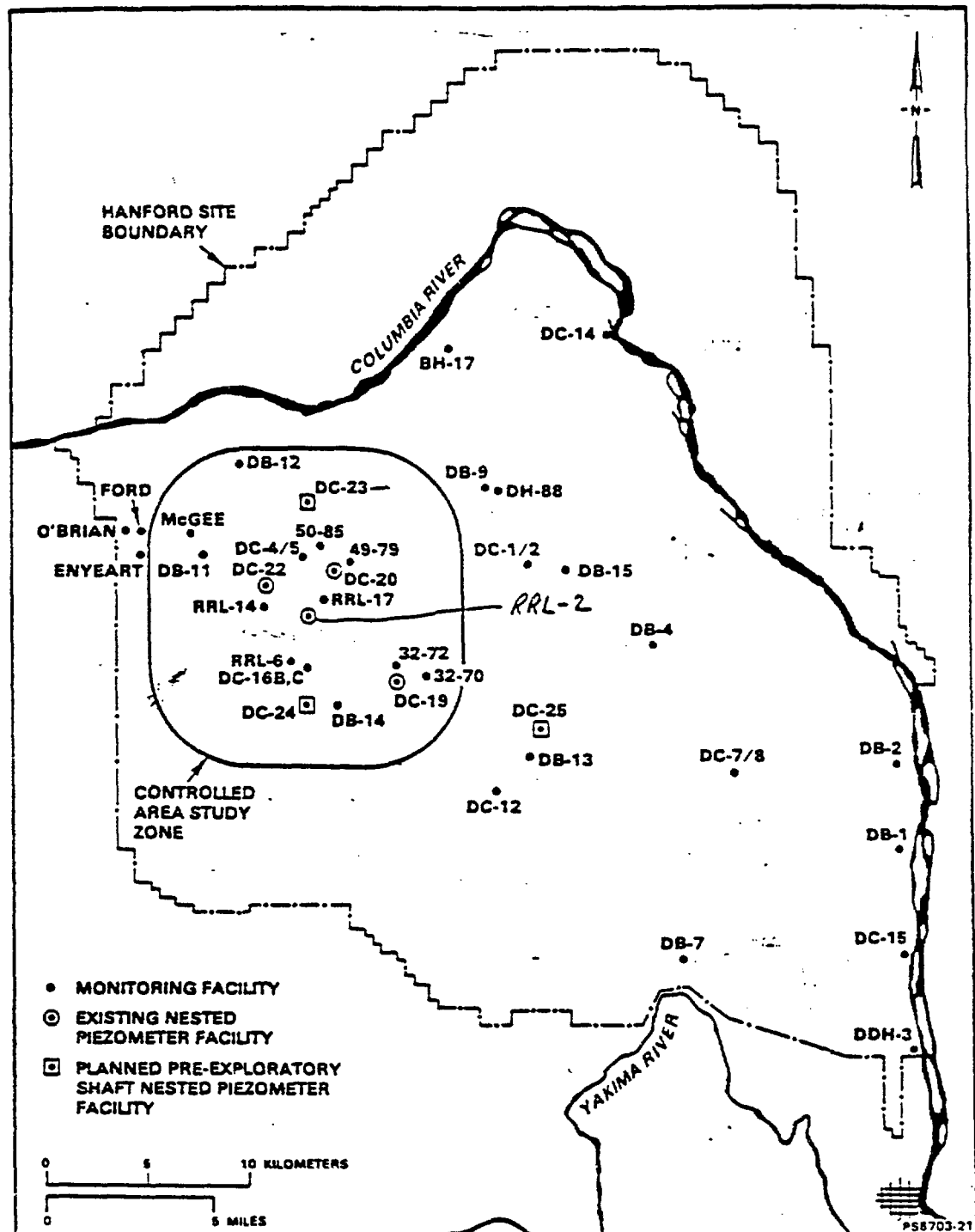
BASIS OF FACILITY LOCATION

- o **Conceptual Flow Model Discrimination**
 - **SW Throughgoing Flow**
 - **Flow Convergence to Syncline**
- o **LHS Test Monitoring**
 - **Intermediate Zone Monitoring**
 - **Boundary Tests (Post-ES)**
- o **Lack of Head Data on South Side of Syncline**
- o **Need for Eastern Constant Head Boundary**
- o **Vertical Head Distribution Away From Recharge Mounds**

HYDRAULIC BASELINE

- o Seven nested piezometers primary data sources**
- o 35 mostly single piezometer boreholes - secondary data sources**
- o Three years of data at DC-19, DC-20, DC-22**
- o Two years of data at RRL-2**
- o Install three additional nested piezometers**
- o Baseline termination based on acceptance criteria and Technical Review**

5



HYDRAULIC-HEAD
MONITORING FACILITIES
FOR OPTION - D

	ROSALIA	SENTINEL GAP	GINKGO	VANTAGE INTERBED	GRANDE RONDE-2	ROCKY COULEE FLOW TOP	ROCKY COULEE DENSE INT.	COHASSETT FLOW TOP	COHASSETT VES. ZONE	COHASSETT DENSE INT.	BIRKETT FLOW TOP	BIRKETT DENSE INT.	UMTANUM FLOW TOP	LOW MG. FLOW TOPS
I. Existing Boreholes														
A. Multi-level														
DC-19C	X	X	X			X		X					X	
DC-20C	X	X	X			X		X					X	
DC-22C	X	X	X					X					X	
DC-23W	X	X	X											
RRL-2C						X	X	X		X	X	X		
B. Single-level														
DB-1	X													
DB-11	X													
DB-12	X													
DB-14	X													
FORD	X													
ENYEART	X													
O'BRIAN	X													
DC-18			X											
DDH-3			X											
DC-1													X	
DC-14														X
C. Composite														
DB-2 (Rosalia-Roza)														
DB-15 (Wanapum)														
DC-1 (Wanapum)														
DC-7 (Grande Ronde)														
DC-12 (Grande Ronde)														
DC-15 (Grande Ronde)														
II. Planned Boreholes														
A. Multi-level														
DC-23 GR						X		X			X		X	
DC-24	X	X	X			X		X			X		X	
DC-25	X	X	X			X		X			X		X	
DC-32	X	X	X			X		X			X		X	
DC-33	X	X	X			X		X			X		X	
III. Reconfigured Boreholes														
A. Multi-level														
DC-4/5						X					X			
RRL-2A						X		X	X		X			
RRL-6						X					X			
RRL-14						X					X			
RRL-17						X					X			
B. Single-level														
DC-16A											X			

HYDRAULIC HEAD BASELINE

<u>PURPOSE</u>	<u>ACCEPTANCE CRITERIA</u>	<u>CURRENT STATUS</u>
1. Pumping Response	Verified water-level recovery prediction for the period of pump test in wells affected by pump test	Trends are predictable for LHST duration DC-19, 20, & 22
2. Gradient for velocity field estimates (horizontal & vertical)	Verify predicted recovery trend at DC-23, 24, 25 to estimate equilibration	Established at DC-19,20, & 22
3. Conceptual Model/System Dynamics	Identify role of Baseline data in development or use of conceptual model. Technical review required	Being evaluated

PRE-ES HYDRAULIC TESTS

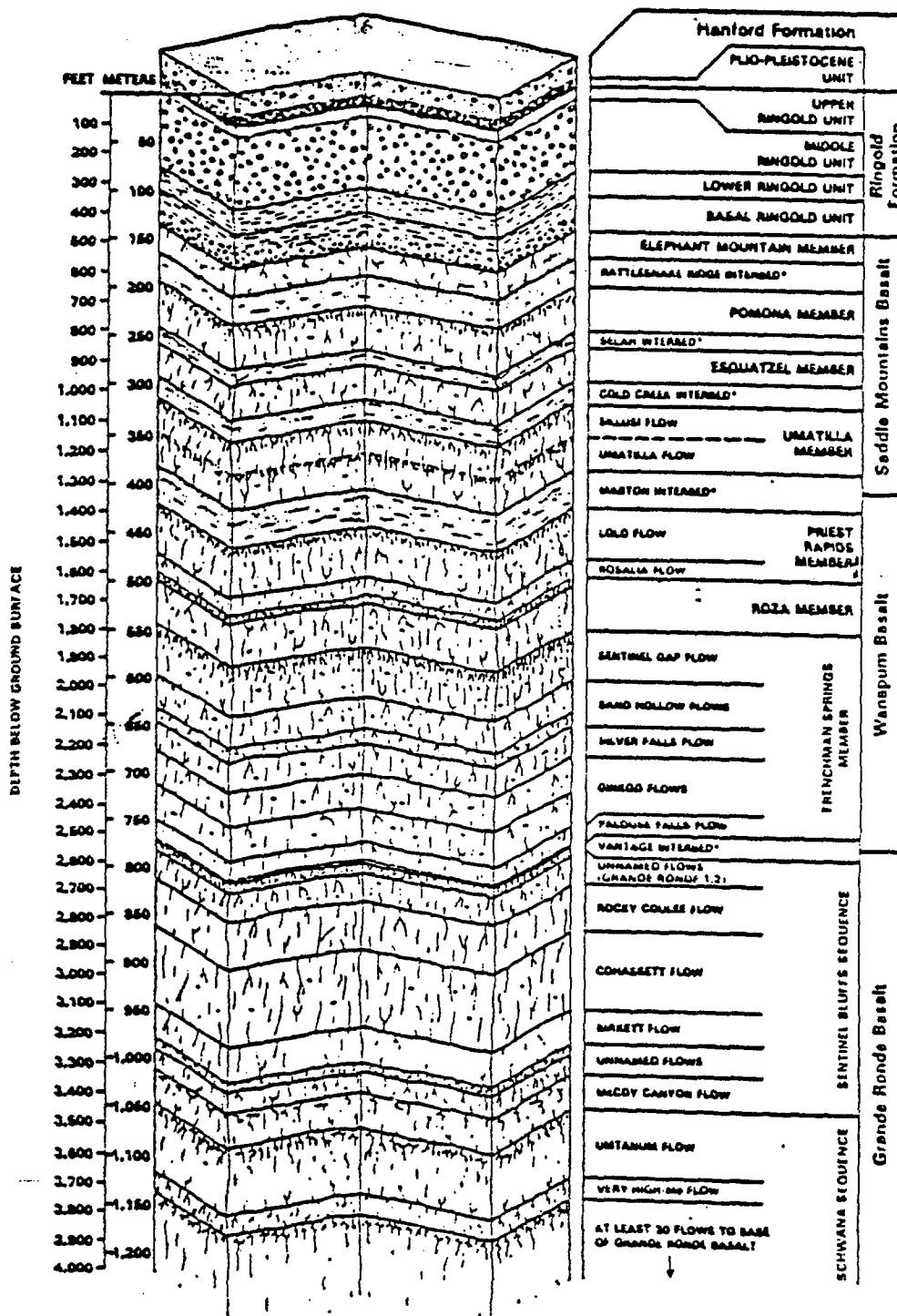
PROGRAM CONTENT

- o Test four zones - sequentially, top to bottom
 - Rocky Coulee Flow Top - LHST
 - Cohassett Flow Top - Pulse (pump if possible)
 - Cohassett Vesicular Zone - Pulse (pump if possible)
 - Birkett Flow Top - LHST

FACILITIES

- o Pump from RRL-2B
- o Monitoring Wells
 - Nine Nested Piezometers
 - Thirty-Five Monitoring Wells
 - Reconfigure selected wells for Rocky Coulee and Birkett Tests RRL-6, RRL-14, DC-4, DC-5, RL-17, McGee
 - Configure DC-16 for Birkett Monitoring

STRATIGRAPHIC UNITS FOUND WITHIN RRL-2



*INTERBEDS ARE STRATIGRAPHICALLY CONTAINED IN THE ELLENSBURG FORMATION

ROCKY COULEE & BIRKETT FLOW TOP LHS

TESTS

OBJECTIVES

- o Stress across repository area**
 - Hydraulic properties (Transmissivity & Storativity)**
 - Assess potential presence of discontinuities**
- o Induce sufficient drawdown to assess vertical conductivities in dense interiors**
- o Assess leakage from dense interiors into flow top**
- o Provide data to assist in determining representativeness of existing data**
- o Adjunct Tests**

PLANNING ASSUMPTIONS IN DEFINING OBJECTIVES

- o Bounding anticlinal structures and Cold Creek syncline flow impediment boundaries will be tested from other pumping centers subsequent to ES construction**
- o Full data base for range and distribution of hydraulic parameters will be obtained in post-ES testing program**

LHS TEST

INITIATION / TERMINATION

- o **Re-establish testing purpose baseline prior to each test**
- o **Test termination will be predicated on acceptance criteria that are based on test objectives**

FACTORS under consideration include:

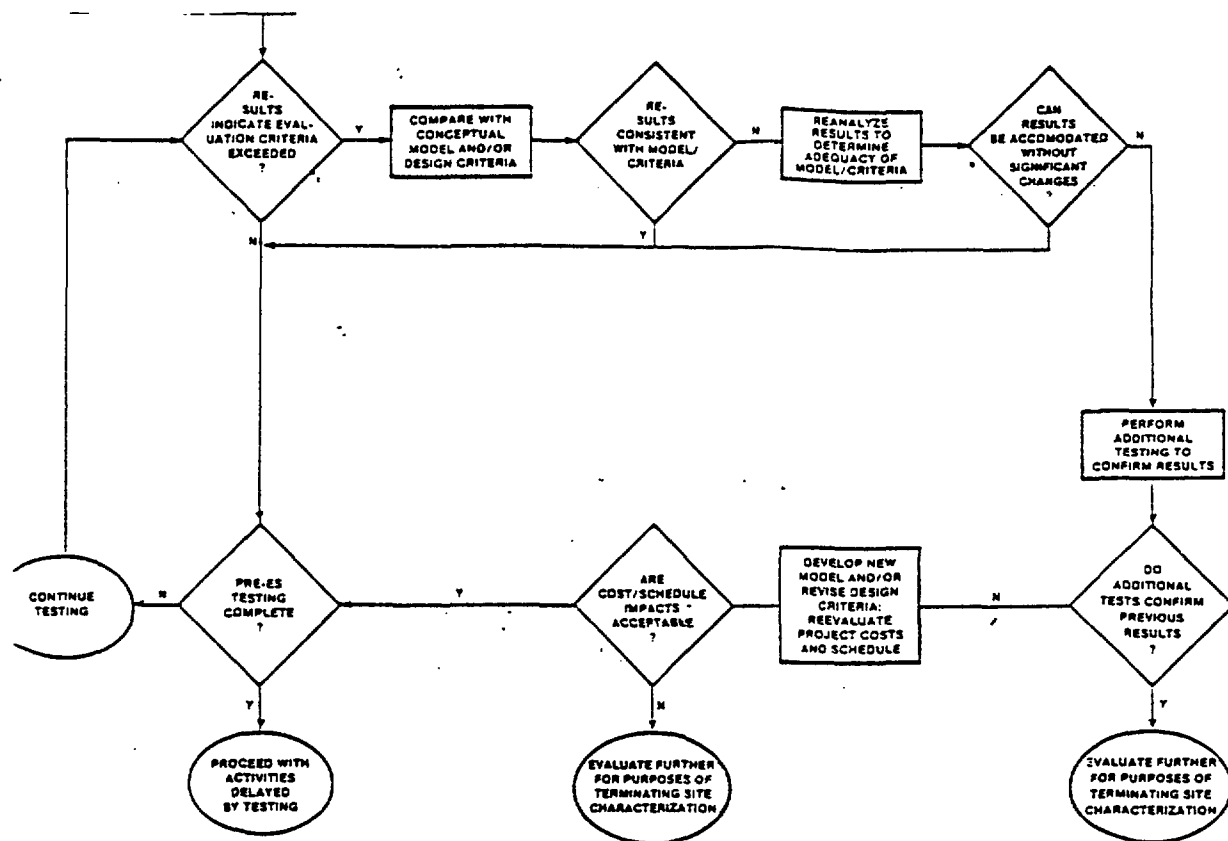
- **Reaching Quasi-steady state conditions**
- **Observation well data match to type curves (T, S & Leakance)**
- **Analysis of propagation of pressure response**
- **Measurable drawdown at DC-32, 33, 20 & 22**
- **Vertical response to estimate Kv**

ASSUMPTIONS

- **Expected duration of pumping is 30 days, with 60 days of recovery**
- **Hydraulic objectives will be met prior to injecting tracers - option of injecting tracers prior to start of test is being considered**

TERMINATION OF PRE-ES TESTING PROGRAM (OPTION PAPER LOGIC)

ROCKY COULEE TEST
COHASSETT TESTS
BIRKETT TEST



ADJUNCT TESTS

- o Hydrochemistry sampling**
- o Tracer Tests**

COHASSETT FLOW TOP AND VESICULAR

ZONE SMALL-SCALE TESTS

OBJECTIVES

- o Determine if zone can yield sufficient water to sustain a pumping test
- o Small-scale hydraulic parameters

COHASSET FLOW TOP / VZ

TESTING

- o Isolate test interval**
- o Establish Pre-test trend**
- o Small-scale test(s)**
 - Pulse**
 - Constant head injection**
- o Evaluate testing results**
- o Determine if transmissivity is high enough for LHS testing**
- o Conduct LHS test if sufficient transmissivity exists, otherwise, drill to next test interval**

Program Implementation

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

TABLE 1	
ITEMS IDENTIFIED AND QUALITY ASSURANCE LEVEL ASSIGNMENT	
ITEM	QA LEVEL
<u>Site Evaluation and Preparation (BHL-001)</u>	
Site Excavation	3
Survey Borehole Coordinates	1
<u>Drilling (BHL-002)</u>	
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
<u>Piezometer (BHL-003)</u>	
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
<u>Geologic/Geophysical Logging (BHL-004)</u>	
Open and Cased Hole Logs	1
Developmental Logs	3
Borehole Geologic Logs	3

Geohydrology Program Overview

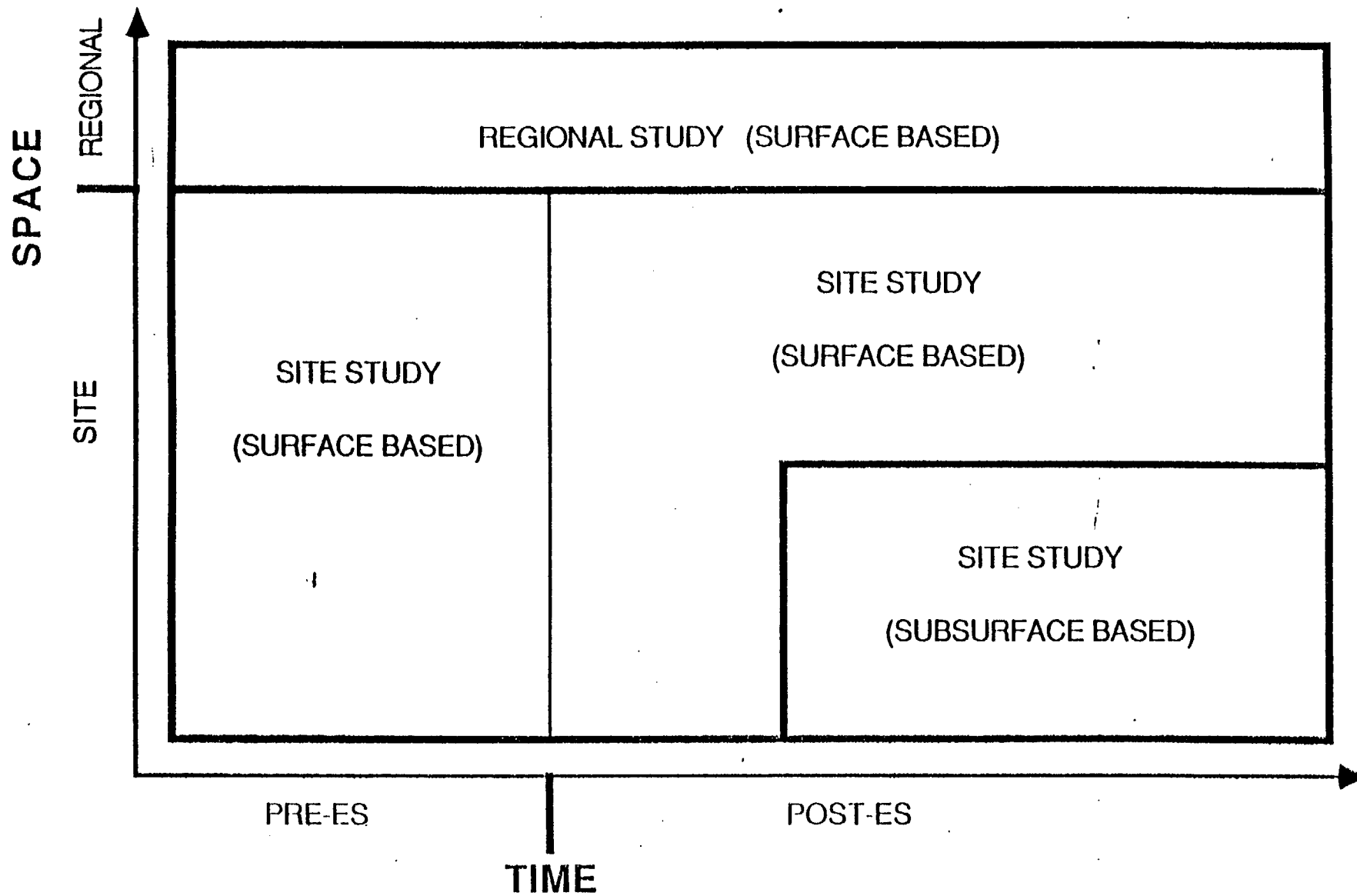
GEOHYDROLOGY PROGRAM OVERVIEW

- o Planning Logic**
- o Pre-Exploratory Shaft Surface-Based Testing**
- o Post-Exploratory Shaft Surface-Based Testing**
- o Regional Program**
- o Subsurface Testing Program**
- o Geohydrology Program Integration**

GEOHYDROLOGY PROGRAM

PLANNING LOGIC

- 1. Develop Issue Resolution Strategies**
- 2. Identify Geohydrologic Parameters Required by the Issue Resolution Strategies**
- 3. Develop Testing Program to Provide Estimates of Parameter Values at the Appropriate Level of Confidence**
- 4. Identify Program Components**
 - o Pre-Exploratory Shaft Surface-Based Testing**
 - o Post-Exploratory Shaft Surface-Based Testing**
 - o Subsurface Testing**
 - o Regional Testing / Data Collection**



TIME-SPACE RELATIONSHIP BETWEEN THE SITE
AND REGIONAL GEOHYDROLOGIC STUDIES

Pre-ES Surface-Based Testing

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 geohydrologic system and on subsequent geohydrologic tests**
- To collect data on geohydrologic conditions that may affect the design of the ESF or the repository**

TESTING PROGRAM DESCRIPTION

- Pre-Emplacement Groundwater Level Baseline**
- Large-Scale Hydraulic Stress Tests at RRL-2**
- Radial-Convergent Tracer Tests in Conjunction with each Large-Scale Hydraulic Stress Test**
- Hydrochemical Sampling of Discharge During Large-Scale Hydraulic Stress Testing**

Post-ES Surface-Based Testing

TENTATIVE OBJECTIVES

- o Obtain Hydraulic Property Range and Distribution in the Controlled Area Study Zone (Hydraulic Conductivity, Specific Storage, Effective Porosity, Dispersivity)**
- o Determine the Hydraulic Significance of Geologic Features Affecting Groundwater Flow in the Controlled Area Study Zone**
- o Obtain Groundwater Samples for Hydrochemical Characterization**

Post-ES Surface-Based Testing

(continued)

Testing Program Description

- o Large-Scale Hydraulic Stress Test Series in and Near the Controlled Area Study Zone for**
 - Nature and Extent of Boundaries**
 - Range and Distribution of Large-Volume Hydraulic Properties**

- o Small-Scale Hydraulic Testing for**
 - Range and Distribution of Hydraulic Properties**

- o Tracer Testing for**
 - Range and Distribution of Transport Parameters**

- o Groundwater Sampling for**
 - Hydrochemical Characterization**

Regional Study

OBJECTIVE

- o **Evaluate Regional Geohydrologic Conditions that might effect Site Groundwater Flow Conditions**

TESTING PROGRAM DESCRIPTION

- o **Regional Flow Model Development vis**
 - **Geology**
 - **Regional Groundwater Levels**
 - **Hydraulic Properties**
 - **Recharge**
 - **Hydrochemistry**
 - **Climatology**
- o **Sensitivity Analysis of Regional Hydrologic Changes from**
 - **Climatic Changes**
 - **Man-Induced Changes**
 - **Flow System Geometric Changes**

Subsurface-Based Testing

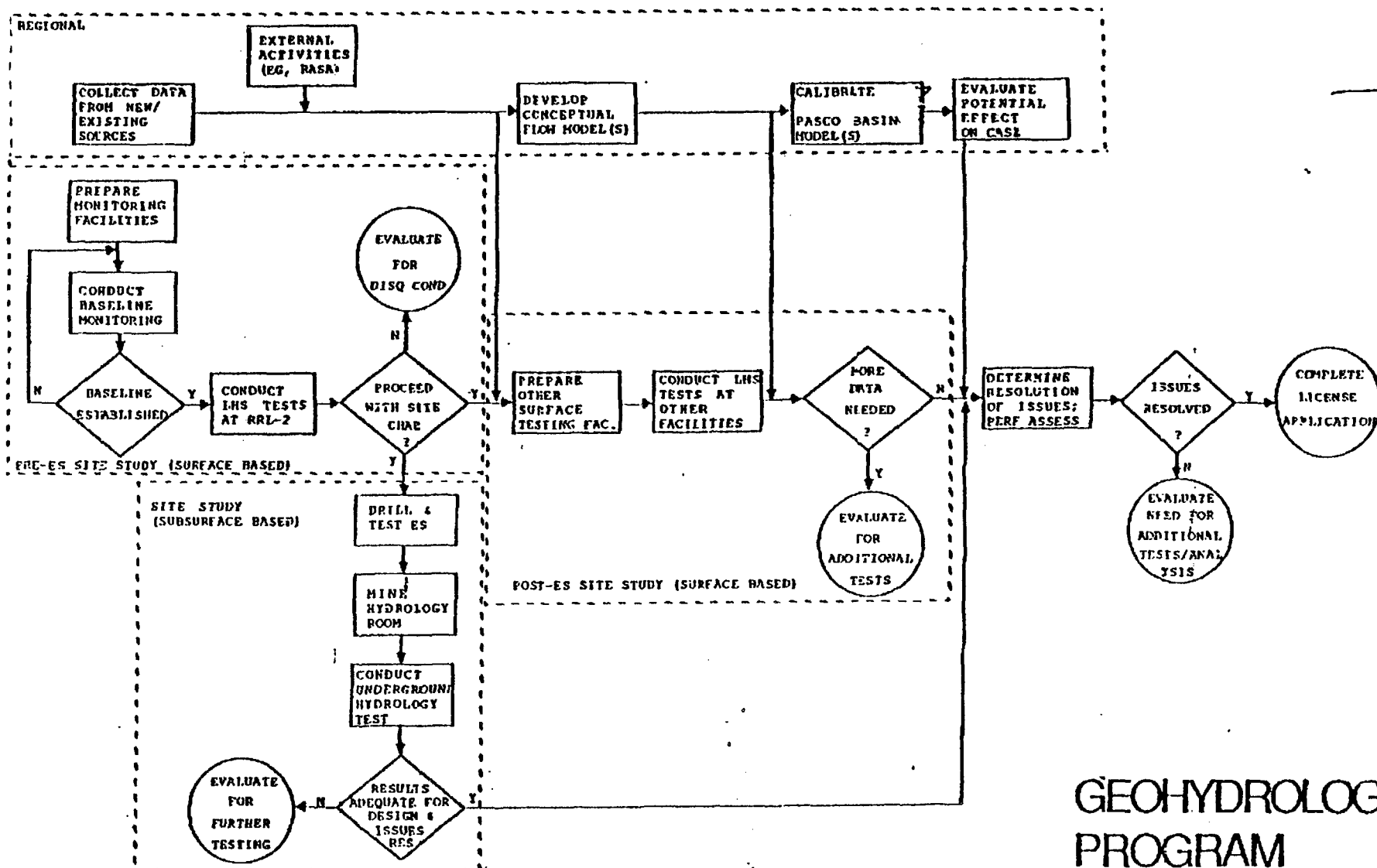
Objective

- To Obtain Estimates of Hydraulic Parameters within the Cohasset Flow Interior

Testing Program Description

- Single Borehole Tests for
 - Safety
 - Disturbed Rock Hydraulic Properties
- Chamber Tests for
 - Hydraulic Conductivity of Dense Interior
- Cluster Borehole Test for
 - Small-Scale Hydraulic Properties of the Dense Interior
- Cluster Tracer Test for
 - Effective Porosity and Dispersivity of Dense Interior

Geohydrology Program Integration



GEOHYDROLOGY PROGRAM INTEGRATION

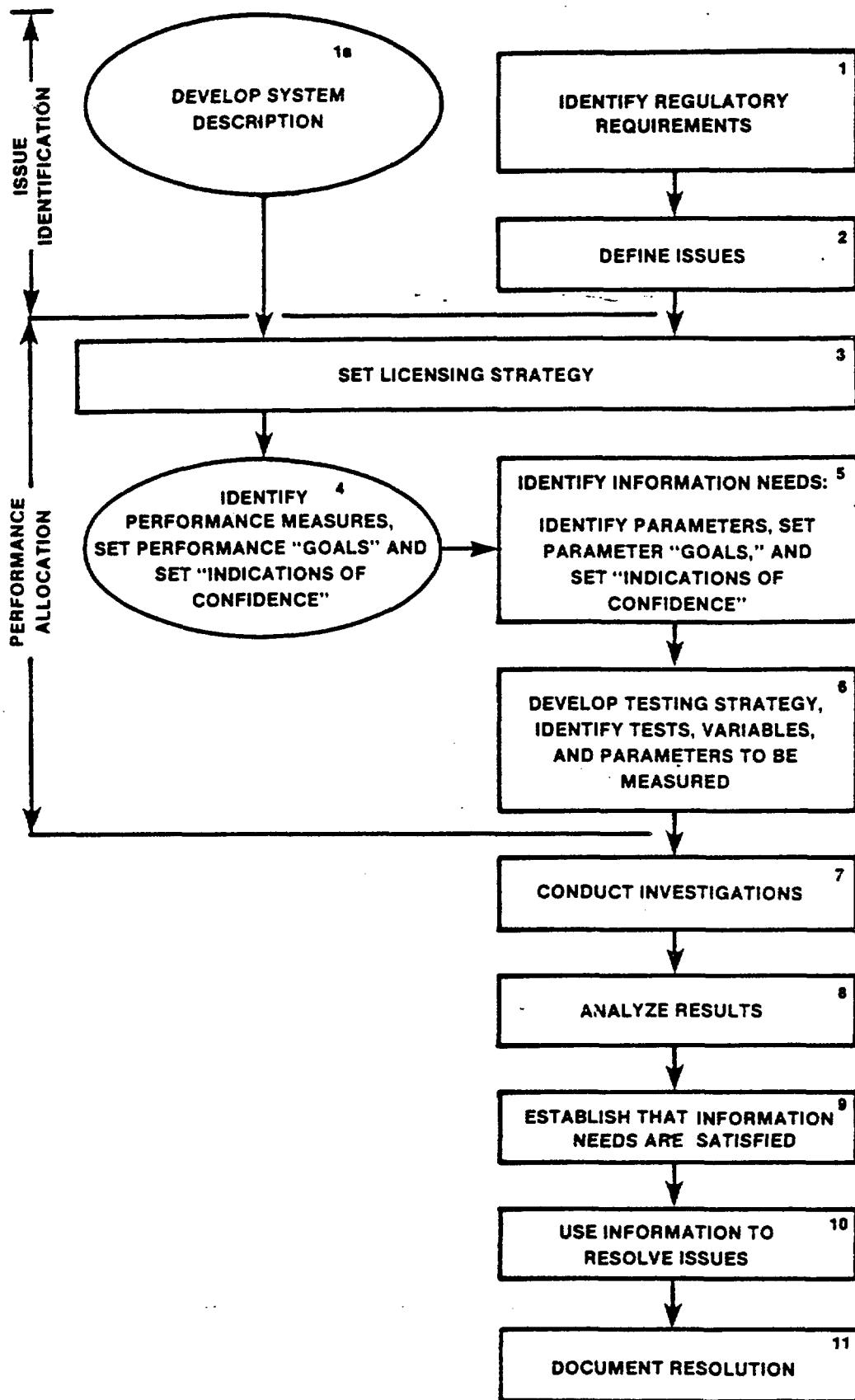


Figure 5. Issue resolution strategy.

SCP ORGANIZATION FOR THE HANFORD GEOHYDROLOGY PROGRAM

Chapter 8.0 Site Characterization Program

8.1 Rationale for the Planned Site-Characterization Program

8.2 Issues to be Resolved and Information Required During Site Characterization

8.3 Planned Investigations

8.3.1.3 Hydrology

8.3.1.3.1 Introduction

8.3.1.3.2 Surface Water Investigation

8.3.1.3.2.1 Purpose and Objective

8.3.1.3.2.2 Rationale

8.3.1.3.2.3 Description

8.3.1.3.2.3.1 Surface Water System Study

8.3.1.3.2.3.2 Site Flooding Study

8.3.1.3.3 Groundwater Investigation

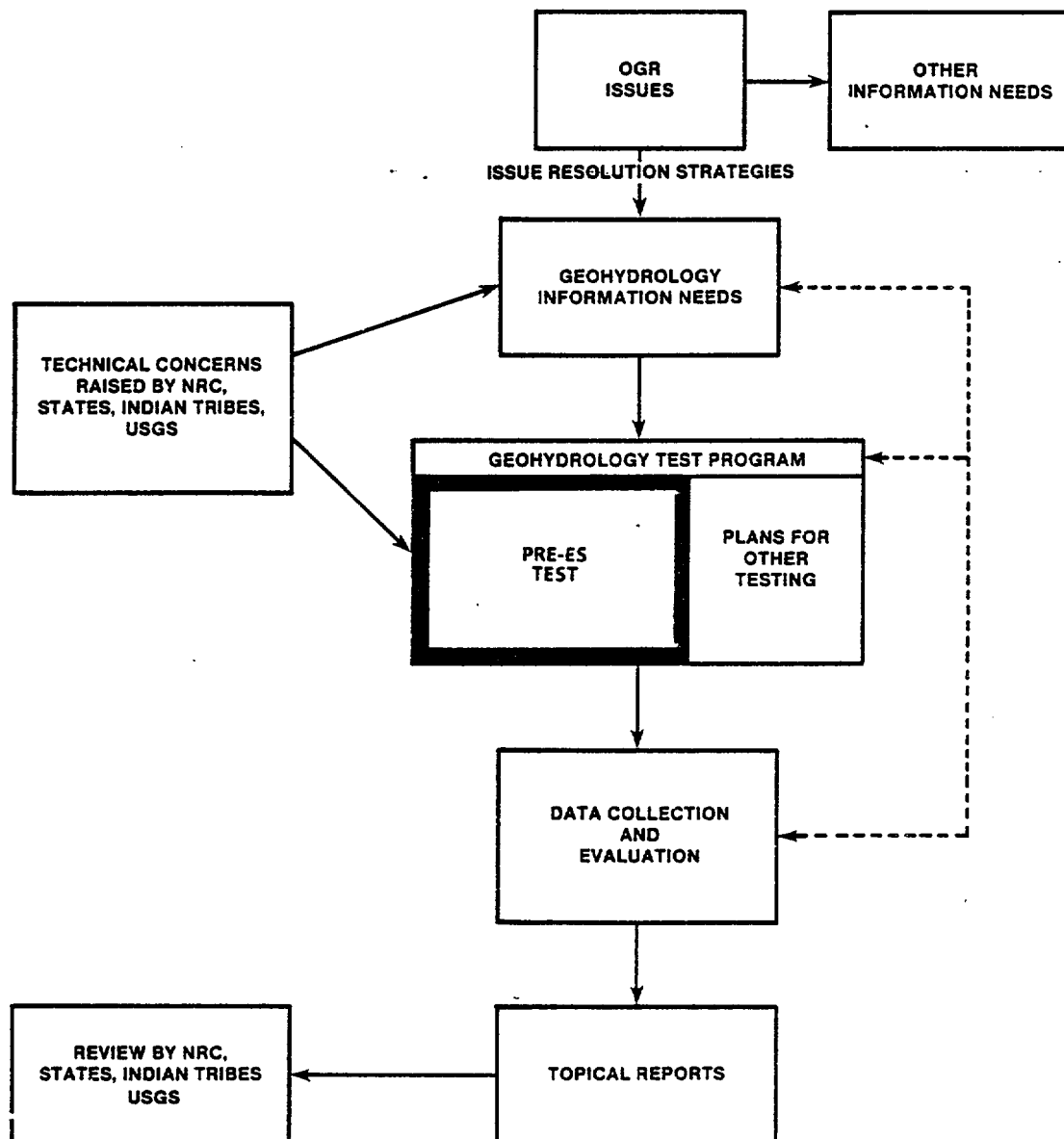
8.3.1.3.3.1 Purpose and Objectives

8.3.1.3.3.2 Rationale

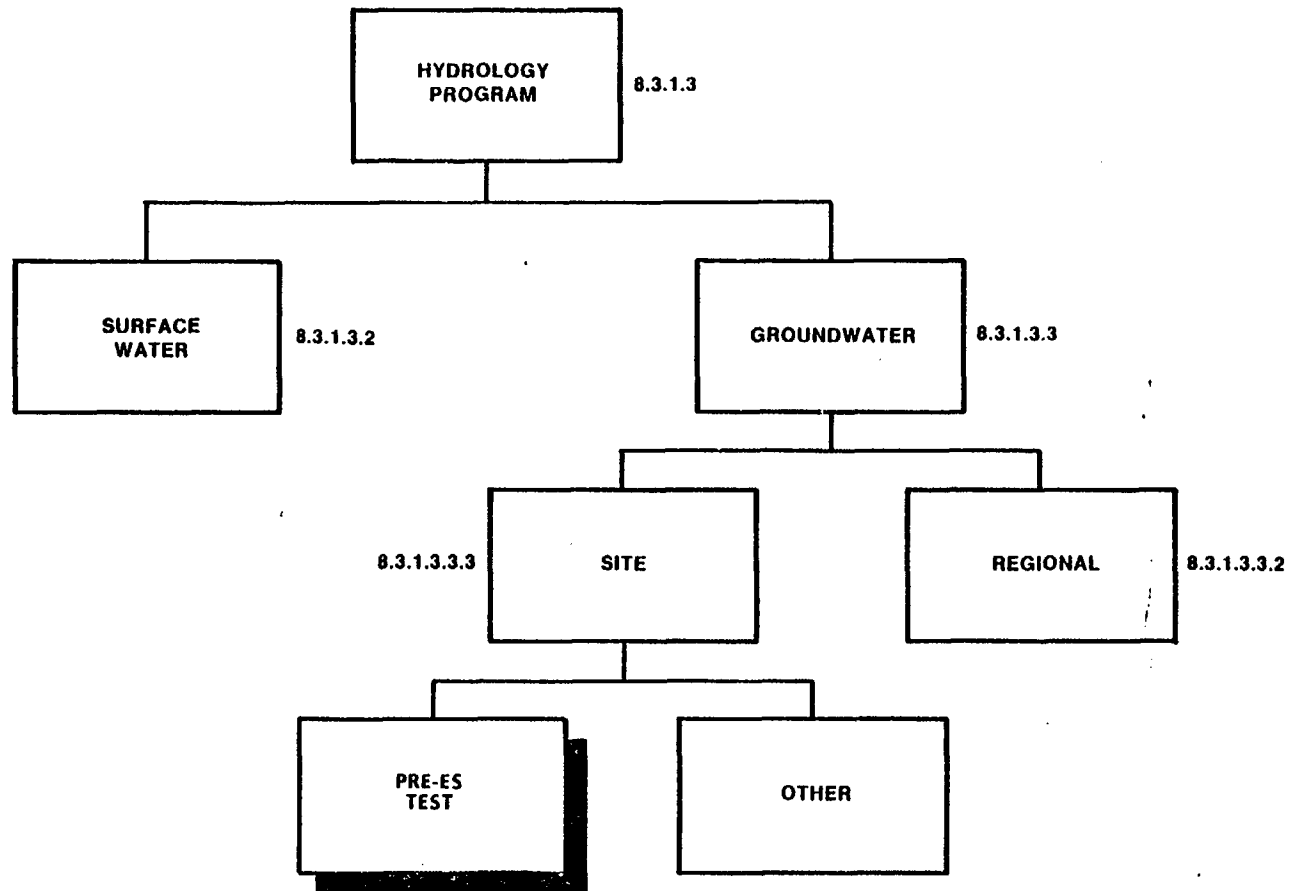
8.3.1.3.3.3 Description of Studies

8.3.1.3.3.3.1 Regional Groundwater Study

8.3.1.3.3.3.2 Site Groundwater Study



RELATIONSHIPS OF PRE-EXPLORATORY SHAFT TESTING PROGRAM TO ISSUE RESOLUTION STRATEGIES



**RELATIONSHIP OF PRE-EXPLORATORY SHAFT TESTING PROGRAM
TO OVERALL HYDROLOGY PROGRAM IN SCP**

NRC Response Assignments

<u>Comment No.</u>	<u>Description</u>	<u>Assignment</u>
1	Monitoring Locations and Frequencies	P. D. Thorne
2	Cement Effects on RRL-2A and RRL-6	P. D. Thorne
3	Borehole Interflow	P. M. Rogers
4	Monitoring Facilities for the Ratio Test	P. M. Rogers
5	Grout Permeability and Piezometer Performance	S. M. Baker
6	Westbay Installation	S. M. Baker
7	LHS Testing Focus	K. M. Thompson
8	Pump Selection	P. M. Rogers
9	Criteria for LHS Testing	L. S. Leonhart
10	Development of RRL-2B	P. D. Thorne
11	Mechanical Effects	P. D. Thorne
12	Vesicular Zone Testing	P. D. Thorne
13	Convergent Tracer Test	L. S. Leonhart
14	Perturbations to Hydrologic Baseline	L. S. Leonhart
15	Hydrochemical Sampling	S. H. Hall
16	Data Release	K. M. Thompson

Monitoring Locations and Frequencies

NRC Concerns

- Uneven Distribution of Monitoring Facilities Around RRL-2
- Lack of Monitoring Points at “Intermediate Scale”
- Lack of Birkett Monitoring Points
- Comprehensive Assessment of Monitoring Adequacy

DOE Response

Monitoring Locations

- Five New Multi-Level Piezometers
- Eight Boreholes Planned for Modification
- Packers Used at Seven
- One Permanent Modification
- Uneven Distribution Filled In
- Two Permanent and One Multi-Use Facility at “Intermediate Scale”
- Birkett Monitoring Points Added

Monitoring Locations and Frequencies

DOE Response (cont.)

Monitoring Frequencies

- Frequency will be Increased as Necessary During Testing

Comprehensive Monitoring System Assessment

- Analyses Started but not Complete. Plans for Completion Presented in Site Groundwater Study Plan

Proposed Status

Open

LOCATION OF MULTIPLE-LEVEL PIEZOMETER FACILITIES

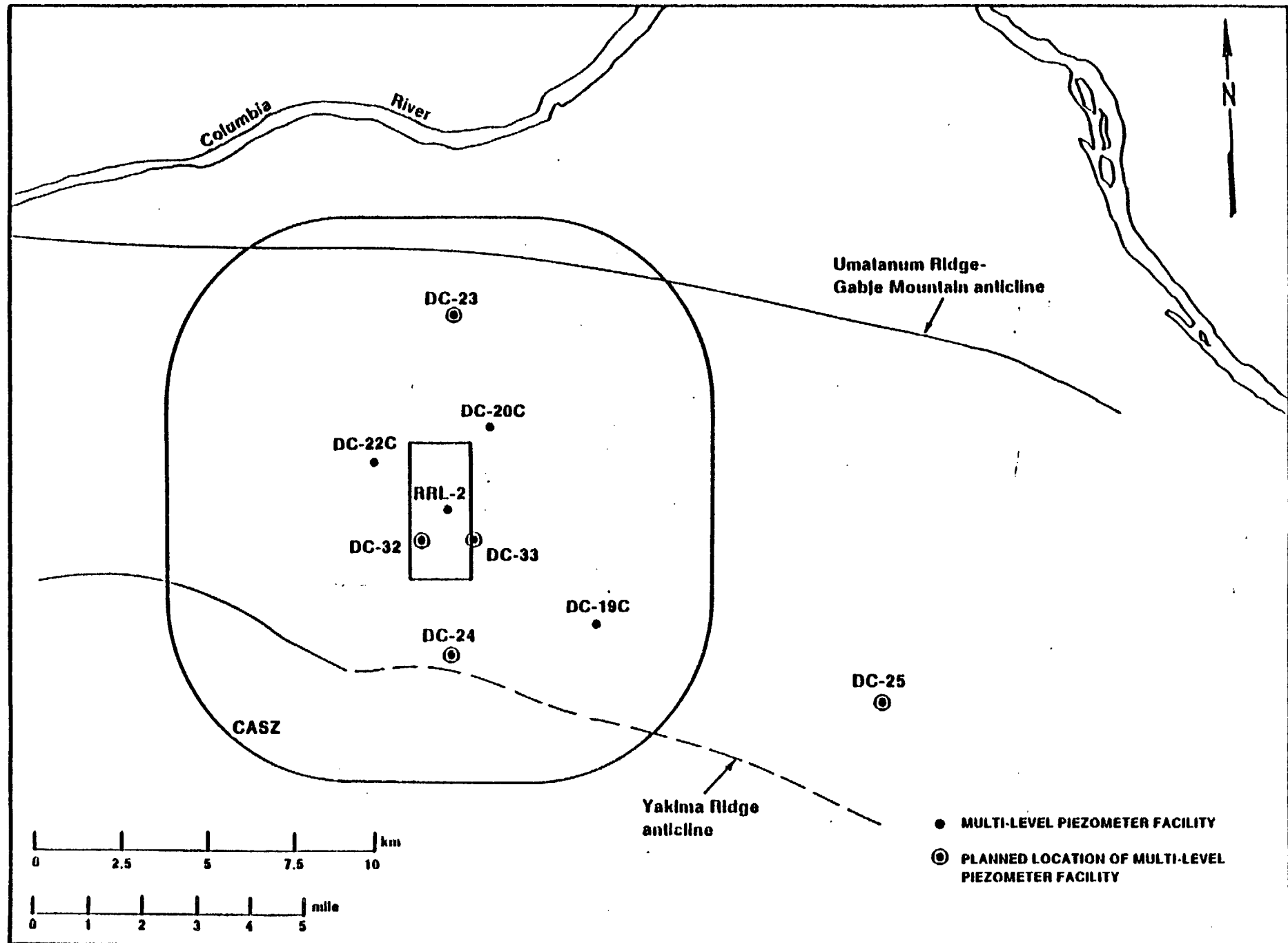


FIGURE 1

Cement Effects

NRC Concern

- BWIP did not Document the Basis for Concluding that Cementing of the Rocky Coulee Flow Top at RRL-2A and RRL-6 During Construction does not Significantly Inhibit Hydraulic Communication

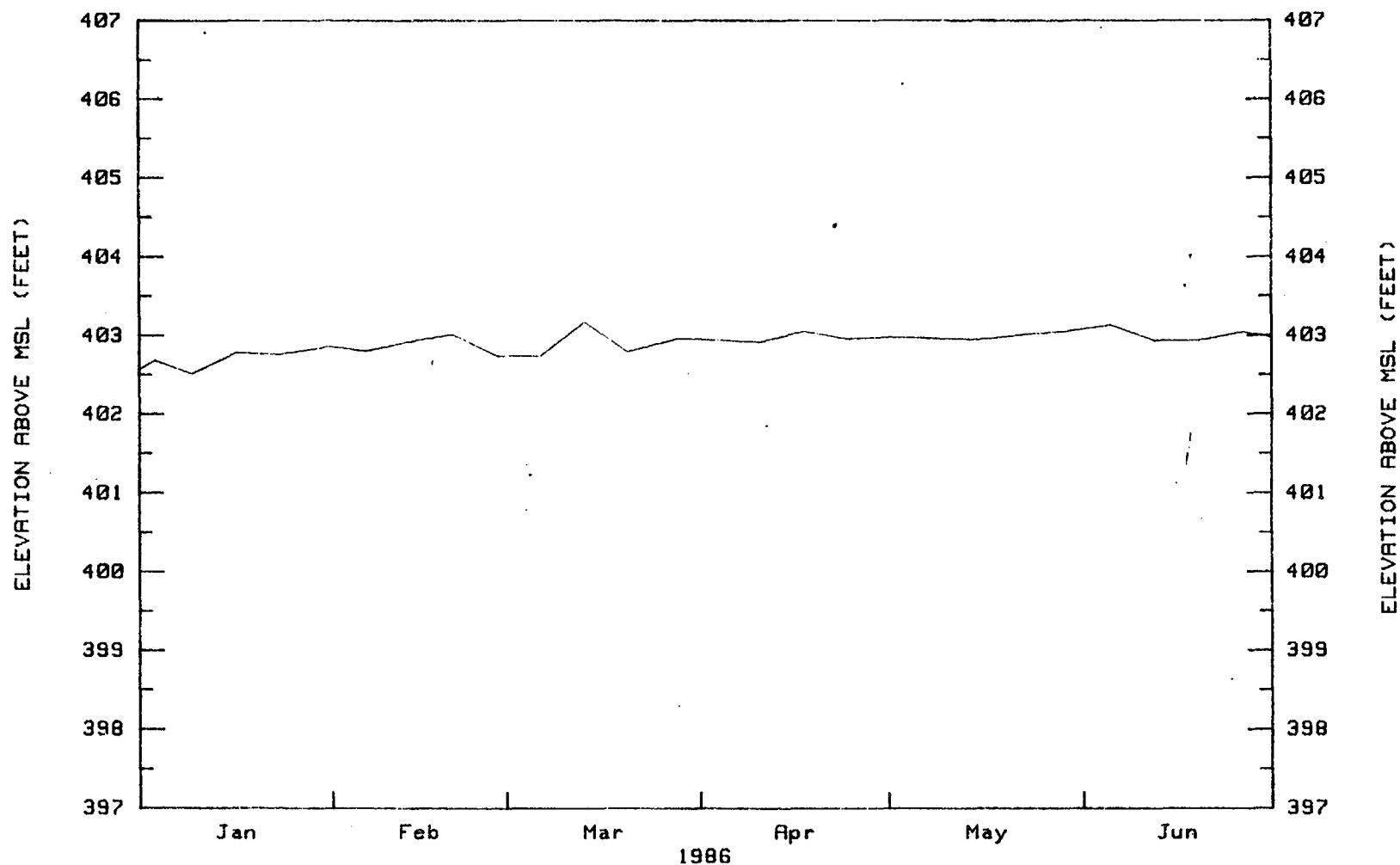
DOE Response

- BWIP has Provided the Requested Documentation
- Spot Cementing of Rocky Coulee Flow Top at RRL-2A had Minimal Effect on Hydraulic Properties
 - Transmissivity Estimates for Hydraulic Test Performed Pre- and Post-Cementing are of Similar Magnitude
 - Dynamic Temperature Logs Indicate Water Production from the Rocky Coulee Flow Top
- Cementing Effects on Hydraulic Properties of the Rocky Coulee Flow Top at RRL-6 not as Well Known
 - Time-Series Water-Level Data from Subsequent Monitoring are Consistent with Data from Other Rocky Coulee Flow Top Observation Points
 - Addition of Monitoring at DC-32 Makes Measurements at RRL-6 Less Critical

Proposed Status

Closed

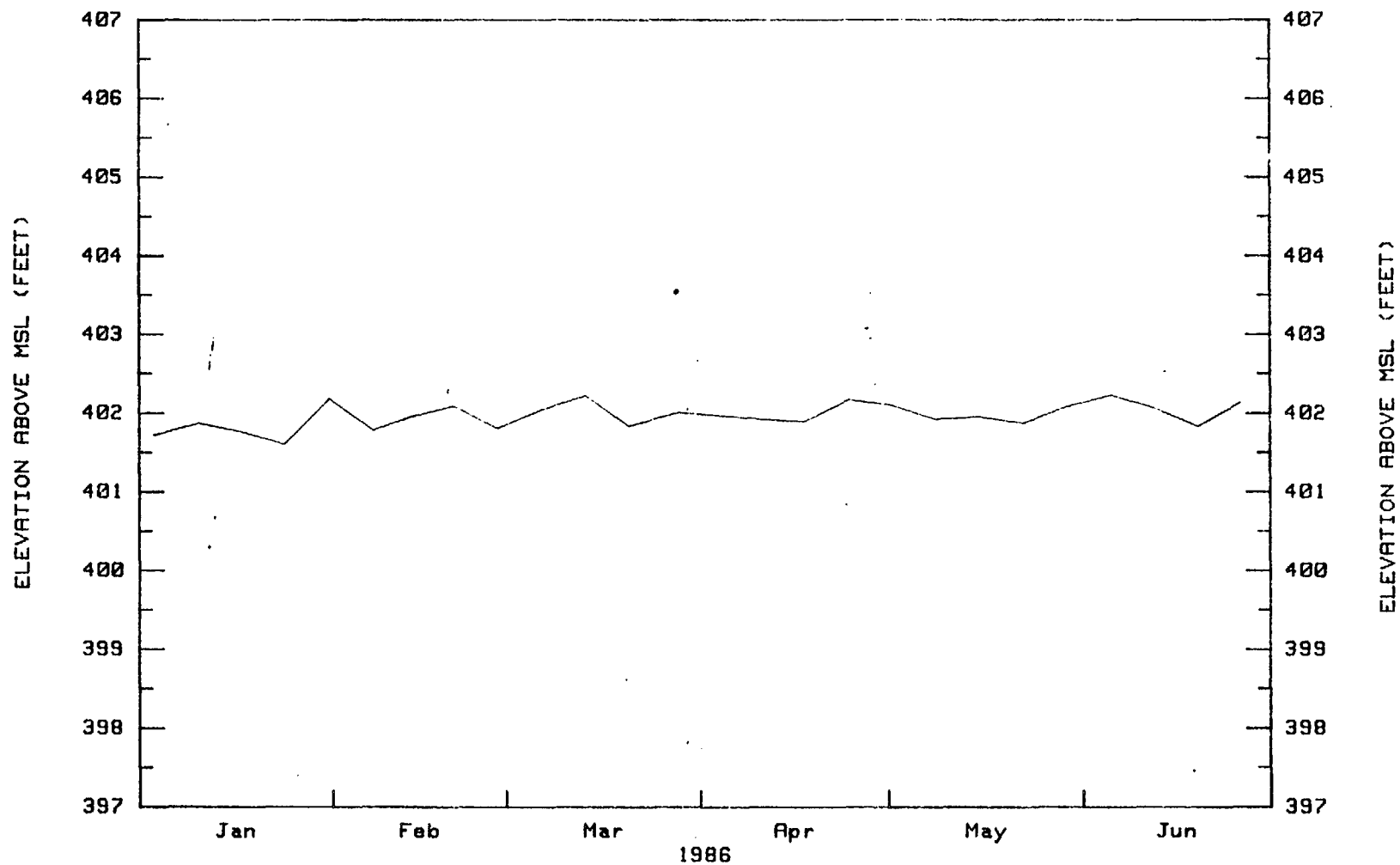
BOREHOLE: RRL-06B HYDROGEOLOGIC UNIT: ROCKY COULEE FLOW TOP
LOCATION: N 438,580 E 2,206,413 DATUM ELEVATION: MEAN SEA LEVEL
NOT ADJUSTED FOR ATMOSPHERIC EFFECTS



Program WHYDAT Rev 6.3 FILE: RRL_6BGRG
Produced on: 6 Apr 1987 12:29

BOREHOLE: DC-19C HYDROGEOLOGIC UNIT: ROCKY COULEE FLOW TOP
LOCATION: N 433,933 E 2,225,012 DATUM ELEVATION: MEAN SEA LEVEL

NOT ADJUSTED FOR ATMOSPHERIC EFFECTS



Program WHYDAT Rev 6.3 FILE: ROCKYTEMP
Produced on: 6 Apr 1987 12:43

Borehole Interflow

NRC Concerns

- Borehole Interflow Above Straddle Packers Might Interfere with Large-Scale Hydraulic Stress (LHS) Test Interpretation
- BWIP Should Perform Analyses to Evaluate this Effect

DOE Response

- Planned Test Sequence Calls for "Top-Down" Testing
- Removal of Bridge Plugs will also be "Top-Down," Following the Testing
- Borehole Interflow Effects are not Expected to be Significant at Horizons and Locations Other than Where the Interflow Occurs Based on Limited Analyses Performed to Assess the Effect of Interflow Between Flow Tops above the Test Flow Top at DC-16
- Additional Analyses (Modeling) will be Performed Prior to Testing to Estimate Borehole Interflow Effects

Proposed Status

Open

Monitoring Facilities for the Ratio Test

NRC Concerns

- **Lack of Monitoring Point Above the Rocky Coulee Precludes Determination of Diffusivity for the Flow Interior Above the Rocky Coulee Flow**
- **Piezometer Compliance Might Cause Non-conservative Estimates of Hydraulic Diffusivity**

DOE Response

- **Several Approaches will be Used to Estimate Flow Interior Diffusivity**
- **The Diffusivity of the Flow Overlying the Rocky Coulee (Grande Ronde #2) Cannot be Estimated with the Ratio Method with the Current Instrumentation Because Piezometer(s) have not been Completed in the Dense Interior of the Grande Ronde #2**
- **The Diffusivity of Selected Regions of Flow Interiors of the Rocky Coulee, Cohasset, and Birkett Flows will be Estimated with the Ratio Method**
- **Time Lag of Head Response due to Compressibility of Water and Sand Pack in the Monitored Dense Interior will be Estimated Prior to Testing**

Proposed Status

Open

Grout Permeability

NRC Concerns

- **BWIP Should Present Its Analyses of Grout Permeability and Piezometer Seal Integrity to NRC**

DOE Response

- **Grout Tested in Laboratory**
 - **Permeability Comparable to Basalt Dense Interior**
 - **Hydraulic Conductivity Less Than 8.0×10^{-11} Meters per Second**
 - **Results Reported in Completion Report for RRL-2B/C (Jackson et al. 1986, pp. 44-45)**
- **Piezometer Integrity Testing**
 - **Individual Tubes Pumped to Check for Response in Other Tubes**
 - **Thermal Response Prevents Test Interpretation**
 - **Other Types of Local Integrity Tests Being Considered**
 - **Large-Scale Hydraulic Stress (LHS) Tests Designed to Quantify Vertical Continuity Near Piezometers**

Grout Permeability

DOE Response (cont.)

- Vertical Isolation Observed Between Some Monitored Flow Tops (Wilson, 1987 p. 29)
- Vertical Connections Observed
 - Distributed Leakage in Upper Wanapum
 - Discrete Vertical Connection Between Rocky Coulee and Cohasset Near DC-20
 - Most Likely to be Natural
 - Could be Faulty Piezometer Seal
- Numerical Modeling of the Data will be Performed to Evaluate Significance

Proposed Status

Open

Westbay Installation

NRC Concerns

- Time Required to Complete a Pressure Profile of all Ports
- Installation in Additional Boreholes

DOE Response

- Significant Time (Hours) Required to Complete a Groundwater Pressure Profile
 - Tests are Long-Term (Months)
 - RRL-14 is a Significant Distance (About 1.5 Miles) from the Pumping Well RRL-2B
 - RRL-14 is Close (About 1,800 Feet) to DC-22
- Equipment was Installed for Development Purposes
- Original Packer Material Failed
- Manufacturer is Replacing Packer Material for Another Equipment Test
- Use of Westbay Systems at Other Sites will be Considered if Demonstrated Feasible at RRL-14

Proposed Status

Open

LHS Testing Focus

NRC Concerns

- **Approach to Repository Performance Assessment Appears to be Inconsistent with "Real Focus of Large-Scale Hydraulic Testing in the Grande Ronde Basalt at the RRL-2 Site is the Cohasset Flow Interior"**
- **LHS Testing Should Develop a Far-Field Perturbation in Response to Controlled Stress, Which can Best be done in the Units of Highest Transmissivity**
- **Determine the Appropriate Focus of LHS Testing at RRL-2 with Respect to its Approach for Performance Assessment and the Objectives for LHS Testing**
- **Evaluate LHS Testing of the Cohasset Flow Top**

DOE Response

- **The BWIP Hydrology Testing Strategy has Evolved Resulting in a Four Part Geohydrologic Characterization Program which will Provide Hydraulic Data to Support Licensing Assessment of Repository Performance**
 - **Pre-ES Surfaced-Based Testing Program**
 - **Post-ES Surface-Based Program**
 - **Regional Program**
 - **Subsurface Program**

LHS Testing Focus

DOE Response (cont.)

- **The Pre-ES Testing Program (See Options Paper for Objectives) Consists of Five Tests:**
 - **Establish a Groundwater Level Baseline Before Potential Disturbance of LHS Testing and ES Construction**
 - **LHS Test of the Rocky Coulee Flow Top**
 - **Small-Scale Test of the Cohassett Flow Top (LHS Test will be Performed if Transmissivity Sufficient to Support a LHS Test is Encountered at RRL-2B)**
 - **Small-Scale Test of the Cohassett Vesicular Zone (LHS Test will be Performed if Transmissivity Sufficient to Support a LHS Test is Encountered at RRL-2B)**
 - **LHS Test of the Birkett Flow Top**

Proposed Status

Closed for Pre-ES Testing

Pump Selection

NRC Concerns

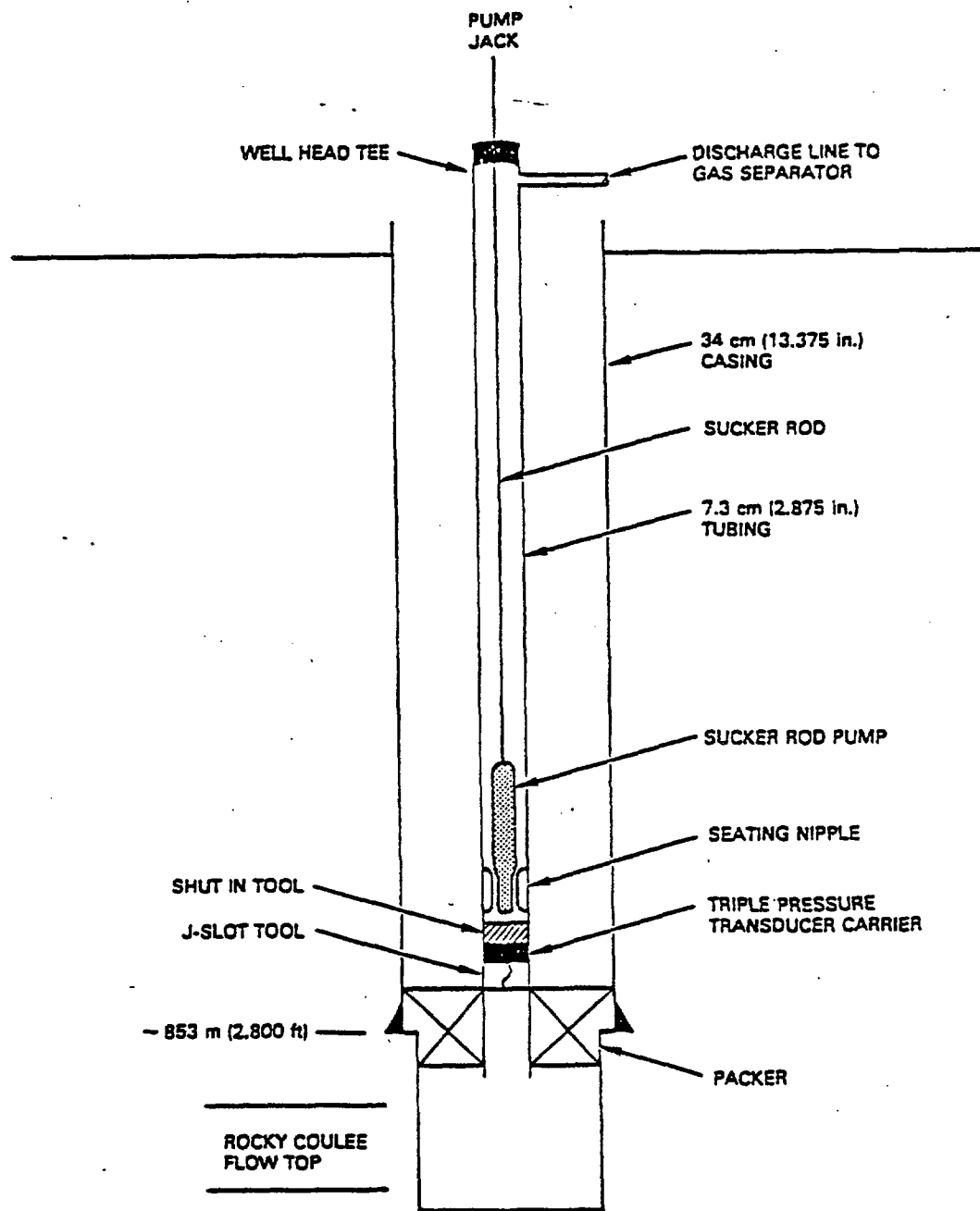
- Pressure Fluctuations in the Pumping Well and Nearby Observation Wells RRL-2C and RRL-2A Complicate Test Interpretation
- Changes in Pumping Rate are Difficult to Accomplish

DOE Response

- Hydraulic Head Fluctuation at Nearby Observation Points is not Expected to have an Adverse Effect on the Interpretation of the Test
- Data from the Pumping Well During the Drawdown Part of the Test is not Regarded as Particularly Useful Because of Frictional Losses Near the Well Bore
- Use of the Positive Displacement Pumping System is Expected to Mitigate Problems such as Gas Lock Associated with Submersible Centrifugal Pumping Systems
- Test must be Stopped to Change Discharge Rate
- Dry Run Checks will Afford Opportunity to Check Pump Operation Prior to LHS Test

Proposed Status

Open - Pending Results of Dry Run(s)



2K8510-16.31

Configuration of well RRL-2B for testing the Rocky Coulee basalt flow top.

Criteria for LHS Testing

NRC Concerns

- **Premature Termination of Pumping may Limit the Ability of the Test to Fulfill Its Objective**
- **Objective Criteria Should be Developed in Greater Detail to:**
 - **Determine When Pumping Should be Terminated**
 - **Determine When Transient Responses Caused by LHS Testing have Sufficiently Subsided to Allow Subsequent LHS Tests to Begin**
 - **Determine When Pressure Trends have been Reestablished After the First Tracer has been Injected but Before the Transducer is Pulled Out of the Second Piezometer**

Criteria for LHS Testing

DOE Response

- **Criteria will be Established Prior to LHS Testing and Presented in the Site Groundwater Study Plan (and Subordinate Documents) for the Following:**
 - **Hydraulic Head Baseline Acceptance**
 - **Initiating Pumping Tests**
 - **Terminating Pumping Tests**
 - **Initiating Tracer Tests**
 - **Terminating Tracer Tests**
- **Problems Associated with Tracer Injection Procedure Presented at the December 1985 Workshop are Mitigated (See Response to NRC Comment 13)**

Proposed Status

Open

Development of Pumping Well RRL-2B

NRC Concerns

- The LHS Test Plan Discussed December 1985 did not Discuss Development of RRL-2B
- Cleanup Using Air-Lift Pumping Might give a Better Basis for Selecting LHS Pumping Rate than Planned Pulse Testing
- Hydrochemical Sampling Should be used to Support Cleanup

DOE Response

- RRL-2B was Developed (Jackson et al., 1986, p. 39)
 - Development Involved Circulating Hanford System Water Followed by Air-Lift Pumping of Approximately 1,000 gal Then Flush Again with Approximately 48,000 gal
 - Video Survey Indicates Only Minor Amounts of Suspended Particals in Borehole

Development of Pumping Well RRL-2B

DOE Response (cont.)

- Rocky Coulee at RRL-2B is not Transmissive Enough to be Developed Only by Air Lift Pumping Only - Transmissivity Estimate was Obtained During Pumping that was Performed
- Hydrochemical Sampling is and will Continue to be a Primary Source of Cleanup Information

Proposed Status

Closed

Mechanical Effects

NRC Concern

- Stress Due to Large Drawdown may Cause Anomalous Head Responses Near the Pumping Well

DOE Response

- Agree that an Effect may be Observed at the Pumping Well
- Drawdown Data from the Pumping Well will not be as Useful as Data from Observation Wells
- Expected Drawdown at the Nearest Observation Well is Less than 100 m.

Proposed Status

Closed

Vesicular Zone Testing

NRC Concern

- BWIP Should Consider Large-Scale Hydraulic Stress (LHS) Testing of the Cohasset Vesicular Zone

DOE Response

- Expected Transmissivity is Very Low (10^{-5} m²/d Measured at RRL-2A)
- Small Scale, Single Borehole Tests will be Conducted to Estimate Transmissivity at RRL-2B
- Pumping Test will be Conducted if Transmissivity is Sufficiently High

Proposed Status

Closed

Convergent Tracer Tests

DOE Response (cont.)

- **Lateral Component of Dispersion**
 - **Not an Objective of the Tests**
 - **Not Considering Lateral Dispersion is Conservative**
- **Steep Hydraulic Gradients**
 - **Tests will be Performed at Several Gradients (Post-ES)**
 - **The Approach to Analyses of Effects of High Gradient on Test Interpretation will be Discussed in Updates to the Site Groundwater Study Plan**
- **Porous Medium Assumption**
 - **Validity will be Assessed by Comparing Test Predictions with Test Results**
- **Spatial Variability**
 - **Tests will be Conducted at Several Locations During Subsequent Stages of Site Characterization as Described in the Site Groundwater Study Plan**

Proposed Status

Open

Perturbations to Hydrologic Baseline

NRC Concern

- **Drilling, Construction and Testing may Perturb Hydraulic Heads, Delaying Pre-
emplacement Groundwater Flow System Characterization**

DOE Response

- **The Project has been Rescheduled so that Perishable Pre-emplacement Data are
Obtained Prior to Unnecessary Additional Disturbance**

Proposed Status

Closed

Hydrochemical Sampling

NRC Concerns

- Objectives for Sampling
- Method for Measuring Carbonate and Bicarbonate

Sampling Objectives

- Test Groundwater Flow Concepts
 - Flow Paths (Distributions of Major Hydrochemical Parameters)
 - Velocities (Radionuclide/Helium Accumulation Age Determination)
- Identify Geochemical Environment
 - Effect on Released Radionuclides (Redox, Solubility)
 - Stability of Repository/Waste Package Materials of Construction
- Environmental Baseline for Future Performance Monitoring

ROLE OF THE
YAKIMA INDIAN NATION
IN THE LHST MEETING

RUSSELL JIM
PROGRAM MANAGER

- I. THE YAKIMA NATION WILL RELEASE DOCUMENTS DESCRIBING TECHNICAL REVIEWS AND ASSESSMENTS OF THE DOE AND NRC WORKS. THE GOAL IS TO ESTABLISH A GOOD FAITH COOPERATION AND CONSULTATION.
- II. IN CONJUNCTION WITH POINT I ABOVE, THE YAKIMA NATION IS REQUESTING TECHNICAL INTERFACING MEETINGS BETWEEN THE DOE/SUBCONTRACTORS AND YIN TO DISCUSS STANDING ISSUES RELATED TO LHST.
- III. THE YAKIMA NATION WILL ESTABLISH A MUTUAL UNDERSTANDING WITH THE DOE CONCERNING THE ROLE OF YIN.

**HISTORIC AND CURRENT
INVOLVEMENT OF THE YIN
IN THE HYDROLOGIC INVESTIGATION
AT HANFORD**

Jack Wittman

ISSUES OF CONCERN

ACCESS AND UTILITY OF RECENT DATA/DOCUMENTS/CODES REQUEST

1. BACKGROUND INFORMATION

- * NOVEMBER 13, 1986: LETTER TO MR. JACK KEATING OF BWIP
REQUEST FOR WATER LEVEL AND WATER PRESSURE INFORMATION FOR
HYDROLOGIC BASELINING.

- * DECEMBER 2, 1986: LETTER TO MR. K. M. THOMPSON OF DOE.
REQUEST FOR COMPUTER PROGRAM HEADCO.

- * DECEMBER 2-5, 1986: NRC/DOE DATA REVIEW MEETING
REQUEST FOR (1) DATA/DOCUMENTS PRESENTED AT THE MEETING,
(2) BWIP QA PROCEDURES CONCERNING DATA/
DOCUMENTS/MAPS RELEASE
(3) QUALITY ASSURANCE/QUALITY CONTROL DOCUMENTS
CONCERNING
 - (a) INTERNAL/TECHNICAL/PEER REVIEW
 - (b) INTERNAL MECHANISMS TO RECORD DISSENTING
OPINIONS,
 - (c) STEP-BY-STEP PROCEDURE SUPPORTING JOINT
MANAGEMENT/TECHNICAL DECISION MAKING
PROCESS,
 - (d) RECORD KEEPING PRACTICES FOR PRE-SIGNED OFF
OR DRAFT DOCUMENTS (AND RECORDS)

2. DOE RESPONSES

- * JANUARY 9, 1987: BWIP MEMO ACKNOWLEDGING THE THREE DATA REQUESTS**
- * MARCH 2, 1987: RELEASE OF DISK CONTAINING HEADCO TO YIN ALONG
WITH THE DOCUMENT (RHO-BW-ST-71P) DESCRIBING THE CODE**
- * MARCH 12, 1987: RELEASE OF THREE BOXES OF DATA/DOCUMENTS REQUESTED BY
YIN DURING THE NRC/DOE DATA REVIEW MEETING.**

3. STATUS

3.1. A LIST OF BWIP/DOE HYDROLOGIC DATA (WATER LEVEL AND PRESSURE MEASUREMENTS WERE NOT RECEIVED

3.2. CONCERNING THE CONFINED AQUIFERS, WATER-LEVEL DATA AT PRIMARY MONITORING FACILITIES, ADJUSTED FOR ATMOSPHERIC PRESSURE WERE NOT RECEIVED

3.3 SEVERAL DOCUMENTS REQUESTED WERE NOT RECEIVED

3.4 NONE OF THE QUALITY ASSURANCE PROCEDURES REQUESTED DURING THE NRC/DOE DATA REVIEW MEETING HAVE BEEN RECEIVED

4. ISSUES

4.1 AVAILABILITY OF REFERENCES FOR SCP REVIEW

4.2 AVAILABILITY OF DATA FOR INDEPENDENT ANALYSIS DURING AND AFTER TESTING

4.3 QUALITY ASSURANCE/QUALITY CONTROL PROCEDURES FOR RELEASE OF DATA/ DOCUMENTS (THAT HAVE BEEN REQUESTED AND NOT RECEIVED BY YIN)

4.4 PROPRIETRY COMPUTER CODES

*** YIN PARTICIPATION IN COMPUTER CODE GROUP THAT THE DOE/NRC ARE
GOING TO CREATE**

4.5 REVIEW AND INTERACTION BASED ON SITE GROUNDWATER STUDY PLAN (SD-BWI-047) EXPECTED TO BE RELEASED BY JULY 1987

*** THIS DOCUMENT IS CONSIDERED TO BE A KEY DOCUMENT FOR THE TECHNICAL
ASSESSMENT OF THE DOE ANALYSIS OF THE DATA COLLECTED DURING LHST**