Atlantic Richfield Hanford Company

To Neil Coleman MS 62355

[redacted]

Date: March 16, 1976

To: F. R. Dornheim

From: R. A. Deju

Subject: PROPOSAL FOR EVALUATION OF LEVELS OF CONTAMINATION IN GROUND WATER NEAR GABLE MOUNTAIN POND

'87 MAR -2 P12:24
WM DOCKET CONTROL CENTER

Our studies of the geology underlying the pond areas and detail gravity work in this area have revealed the possibility of breaching of the basalts just under the subject pond. Figures 1 and 2 show two cross-sections through Gable Mountain Pond. Figure 3 shows the location of the wells used in making the cross-sections.

Recent studies on contamination of Gable Mountain Pond, West Lake, and the confined aquifers in the vicinity of these water bodies have revealed the presence of ^{129}I, ^{60}Co, ^{106}Ru, and other radiocontaminants in these waters. Table 1 (attached) shows a summary of the levels of contamination thus found and compares the results to levels found in the Columbia River.

In view of the potential disposal of Purex wastes to Gable Mountain Pond once the plant is restarted, I would recommend conducting a study to determine whether or not any contaminants from previous disposal operations into the pond have reached the confined aquifers. I also recommend determining how far below the surface of West Lake we find the Mabton Interbed Aquifer and whether or not this aquifer is connected to West Lake. The importance of this interbed lies in the fact that this is the aquifer used in most irrigation operations. I propose that we sample the structures shown in Figure 4 for the constituents listed in Table 2. I also propose that we drill a new core well near West Lake down to the Mabton Formation. Since we presently have a coring rig working at Hanford, I recommend that the existing coring contract be expanded to cover this additional well. Table 3 outlines the cost of conducting the additional work. The total cost

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WM Record File 101

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for the project would be approximately $28,000. Utilizing some funds out of existing budgets, it would require additional funding in the order of $21,000. The project can be completed within two calendar months of your authorization to start work.

RAD:tj

Att.

encl. to Proposal for evaluat. of Levels of Contamination in ground Water Near Gable Mountain Pond
dtd. 3/16/76 - rec'd 3/2/86

TABLE 1A

CUMULATIVE DECAYED RADIONUCLIDE ACTIVITY DISCHARGED TO GABLE MOUNTAIN POND

NUCLIDE GROUP	CUMULATIVE DECAYED ACTIVITY	
Plutonium	422	grams
Total Beta	1,710	curies
^{90}Sr	373	curies
^{106}Ru	3.84	curies
^{137}Ce	286	curies
^{60}Co	17.2	curies
Uranium	670	curies
^{233}U	459	curies

TABLE 1B

MEAN VALUES OF RADIONUCLIDE CONCENTRATIONS OF RECENT GABLE MOUNTAIN POND AND WEST LAKE WATER SAMPLES

RADIONUCLIDE	WEST LAKE	GABLE MOUNTAIN POND	UNCONTAMINATED COLUMBIA RIVER	DRINKING WATER STANDARD
Uranium	1075	5	—	30
Total Alpha	171			
Total Beta	267			
Plutonium	.06	.04		5
^{90}Sr		.32		.3
^{129}I		.87	5×10^{-5}	6

03/17/76
RAD:tj

TABLE 2

PROPOSED ANALYTICAL PROGRAM

All samples will be submitted blindly to the laboratory.

All samples are in duplicate following procedures of ARH-LD-116.

CONSTITUENT	NUMBER OF SAMPLES
Tritium/Deuterium Ratio	14
Carbon-14	14
Iodine-129	14
Gamma Scan	14
Plutonium	7
Americium	7
Uranium	14
Oxygen-15/Oxygen-16 Ratio	14
Total Organics and Inorganics	14

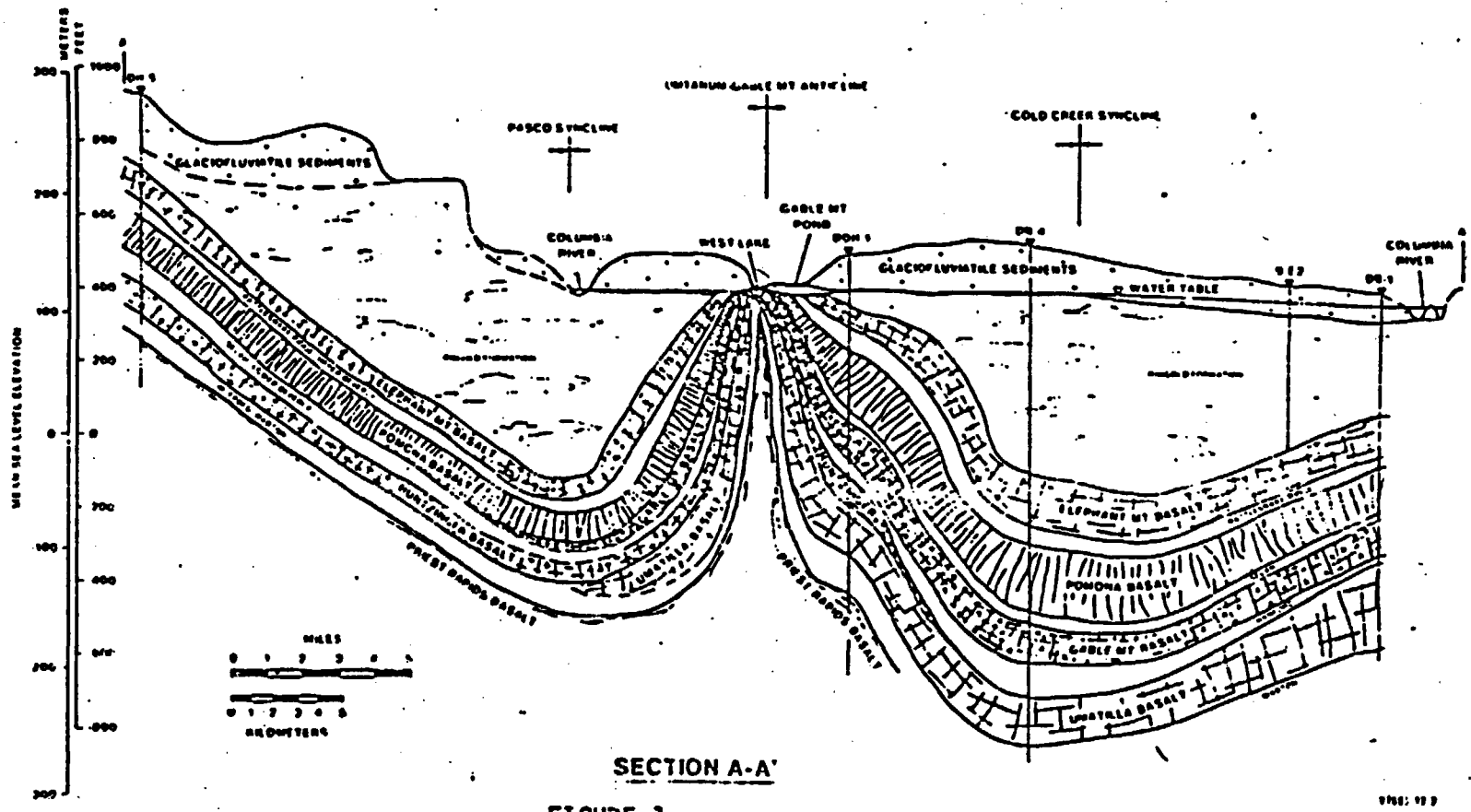
03/17/76
RAD:tj

TABLE 3

ESTIMATED COSTS

Analysis of Input to Ponds	---
Core Drilling	$ 7,000
Analyses	$21,000
Interpretation	---
TOTAL	$28,000

03-17/76
RAD:tj



SECTION A-A'

FIGURE 1

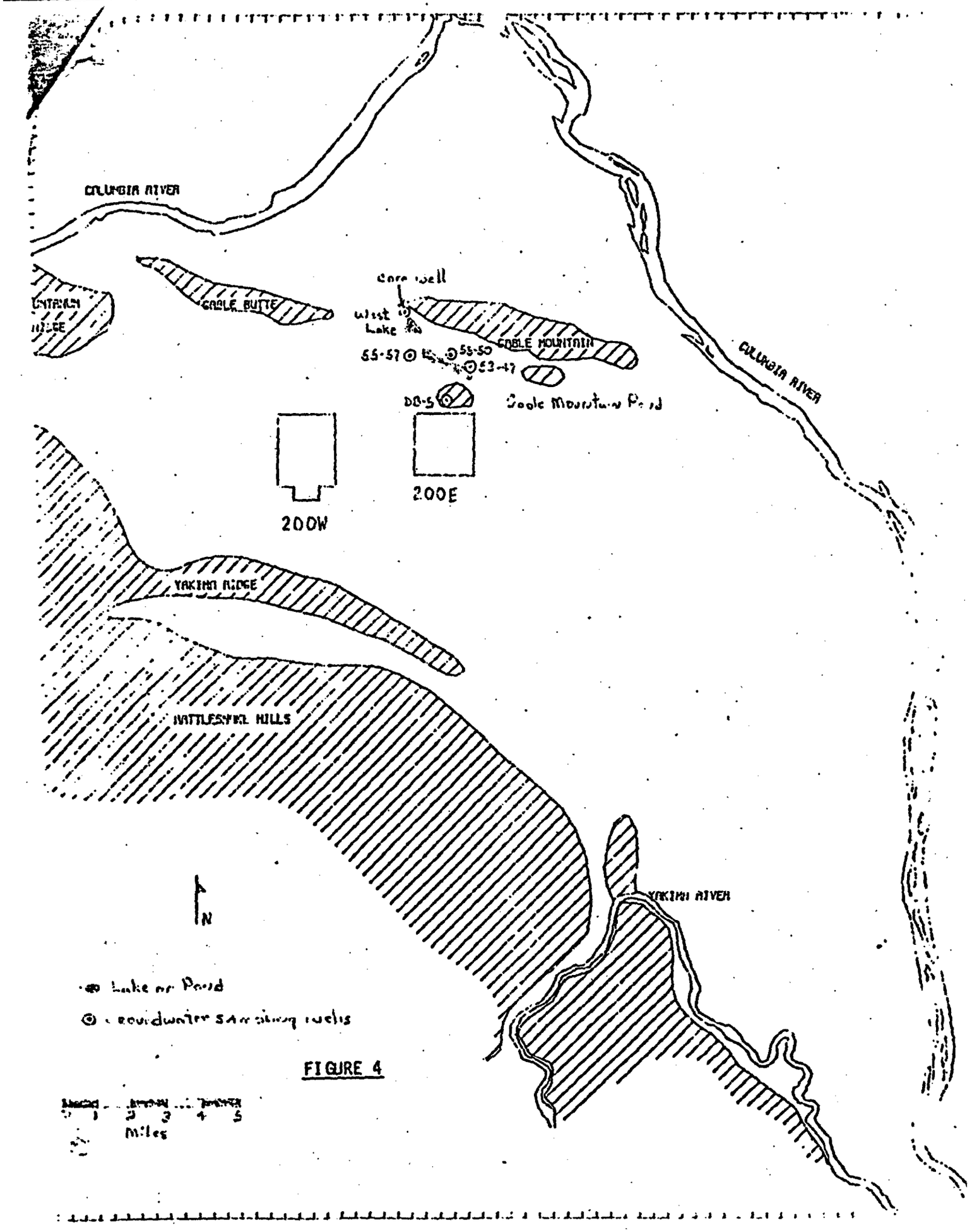

COLUMBIA RIVER
CABLE BUTTE
CABLE MOUNTAIN
COLUMBIA RIVER
55-57
55-50
53-47
DB-5
200W
200E
YAKIMA RIDGE
RATTLESNAKE HILLS
YAKIMA RIVER
N
Miles

FIGURE 4

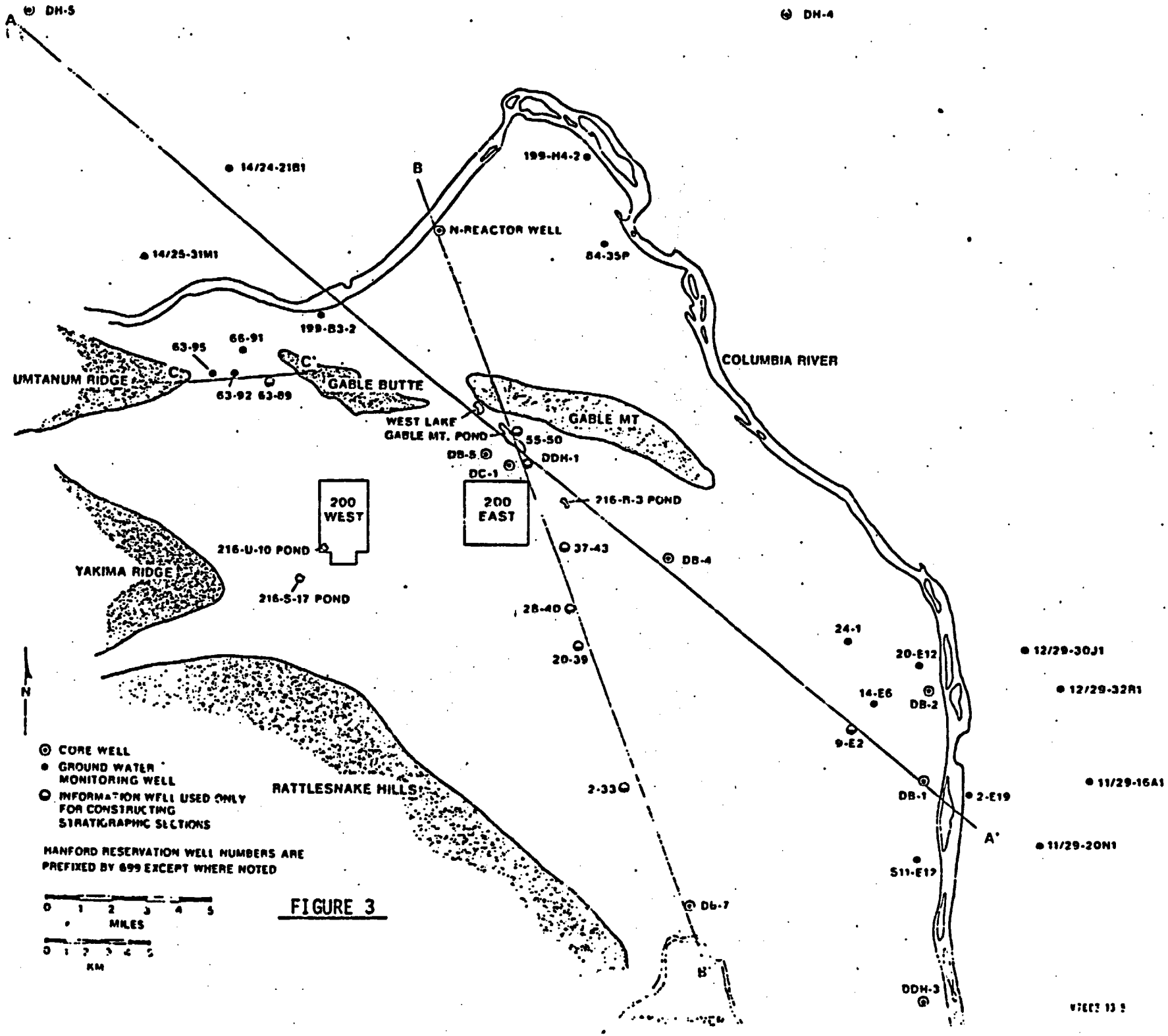
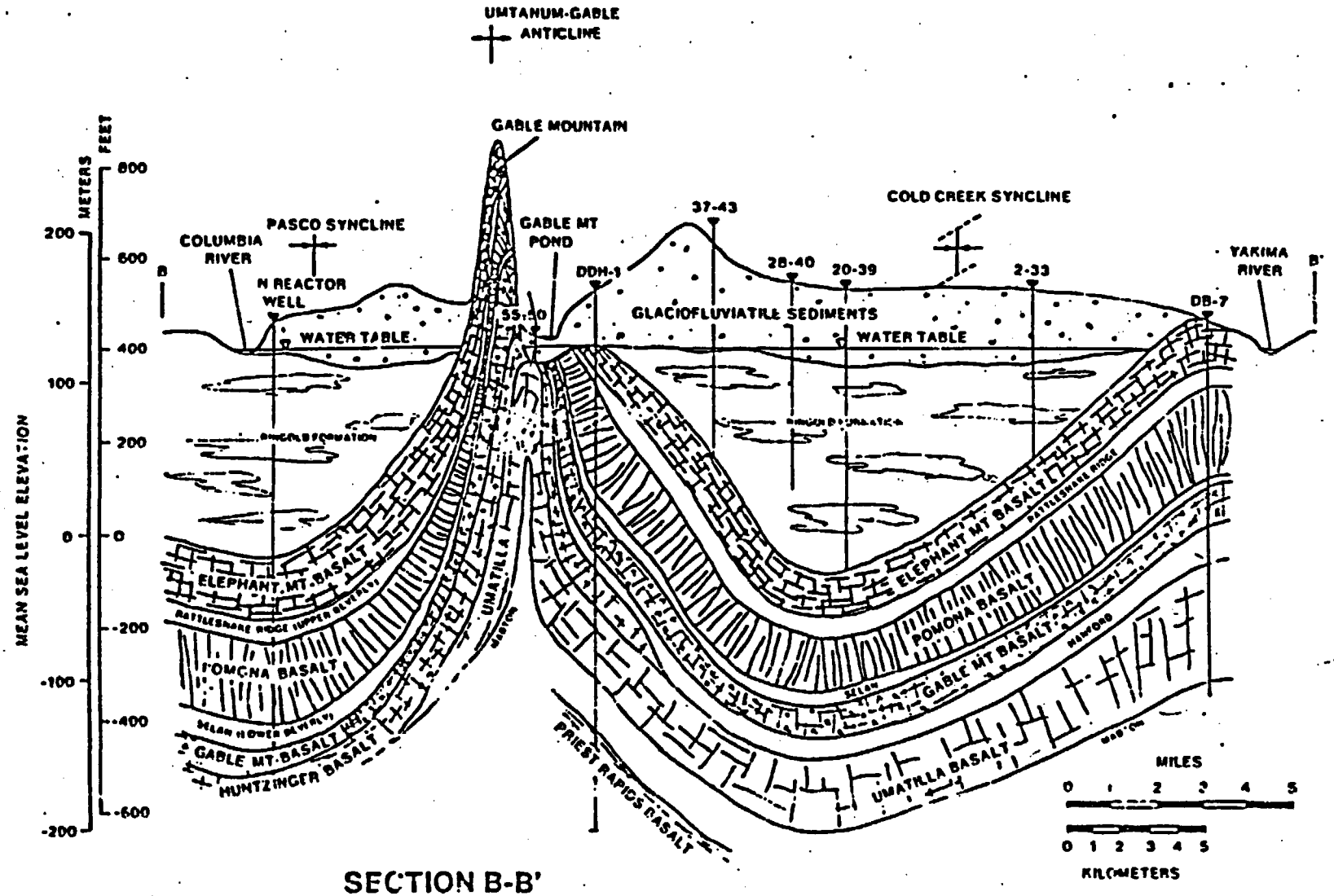

A
DH-5
DH-4
14/24-21B1
B
199-H4-2
N-REACTOR WELL
14/25-31M1
84-35P
199-B3-2
66-91
63-95
C
C'
UMTANUM RIDGE
63-92 63-89
GABLE BUTTE
COLUMBIA RIVER
WEST LAKE
GABLE MT. POND
GABLE MT
55-50
DB-5
DDH-1
DC-1
200 WEST
200 EAST
216-R-3 POND
216-U-10 POND
37-43
DB-4
YAKIMA RIDGE
216-S-17 POND
28-40
24-1
20-39
20-E12
12/29-30J1
14-E6
DB-2
12/29-32R1
N
9-E2
CORE WELL
GROUND WATER MONITORING WELL
INFORMATION WELL USED ONLY FOR CONSTRUCTING STRATIGRAPHIC SECTIONS
RATTLESNAKE HILLS
2-33
DB-1
2-E19
11/29-16A1
A'
11/29-20N1
HANFORD RESERVATION WELL NUMBERS ARE PREFIXED BY 699 EXCEPT WHERE NOTED
S11-E17
DB-7
0 1 2 3 4 5
MILES
0 1 2 3 4 5
KM
B'
DDH-3

FIGURE 3



SECTION B-B'

FIGURE 2

To: Neil Coleman MS 623SS

GROUNDWATER MANAGEMENT SECTION

1. Program Off-Site Migration	3. Contract or Work Order No.
2. Task Confined Aquifer Chemistry Study	4. Task No. B09T3-B1 and Y2D16-D5
5. Responsible Organization BNW - J. R. Raymond	6. Liason at ARHCO P. A. Eddy

7. Objectives (Use additional sheets as needed)

1. To design analytical procedures and quality assurance criteria for low-level water analyses.
2. To ~~access~~ the chemical characteristics of the ~~uppermost~~ confined aquifers ~~in selected well structures.~~ underlying Hanford.

8. Scope (Use additional sheets as needed)

1. Obtain water from the wells listed on the ~~Samples waters as per~~ attached chart, using ~~following~~ specified collection procedures and ~~with agreed upon~~ quality assurance criteria.
2. Conduct accurate chemical analyses on the water samples collected.

9. Justification (Use additional sheets as needed)

This program is needed to determine the concentration and ultimate fate of any radionuclides in the confined aquifer underlying the Hanford Reservation so as to assure isolation of these wastes from any users of water from these aquifers outside and adjacent to the Hanford Reservation.

10. Date of Beginning	11. Termination Date	12. Total Budget
~~July 1, 1976~~ October 1, 1976	September 30, 1977	B09T3 - $10,000 Y2D16 - $11,000

13. Budget Breakdown

(By Objectives)		(By Categories)	
1.	$ 1,500	Manpower	$ 3,000
2.	$ 19,500	Computer Costs	$ --
3.	$	Other Water Analyses	$ 18,000
4.	$		$
5.	$	Overhead (___%)	$
TOTAL	$ 21,000	TOTAL	$ 21,000

14. Milestones (Indicate specific milestone and date of achievement)

~~Submit procedures and quality assurance criteria to ARHCO liaison by August 1, 1976.~~

Submit ~~all~~ analytical results to ARHCO liaison ~~by September 15, 1976.~~ Quarterly

15. Final Results Format and Date of Submission

Data transmitted ~~via~~ by letter to ARHCO liaison by September ~~15~~ 30, ~~1976~~ 1977.

16. Budget and Task Description was prepared by R. A. Deju/J. R. Raymo

Date ~~May 28, 1976~~ Sept. 15, 1977 Title

To be filled by ARHCO Liaison:

Contract or work order above should be: _____ approved subject to attached constraints

_____ disapproved

ARHCO Liaison Date

~~WELLS TO BE ANALYZED~~ SES AND WELLS TO BE SAMPLED

WELL NO.	TOTAL ORG/IN.	TRITIUM	C-14	I-129	GAMMA SCAN	^{239}Pu 50 LIT.	Am 50 LIT.	018/016 RATIO
DB-1	D	D ~~400~~	1	D	D	1	1	D
DB-7	D	D	1	D	D	1	1	D
DDH-3	D	D	1	D	D			D
DB-4	D	D	1	D	D			D
DH-~~5~~2	D	D	1	D	D			D
DH-8	D	D	1	D	D	1	1	D
Total Samples	~~8~~ 12	~~8~~ 12	~~4~~ 6	~~8~~ 12	~~8~~ 12	~~8~~ 3	~~8~~ 3	~~8~~ 12

D = Sample run in duplicate counts as two samples.

CONSTRAINTS

1. Requirements of ARH-LD-116 apply including all phases of sampling, analysis, reporting and quality assurance.

2. Blind sampling is required.

3. All sampling procedures and laboratory analysis procedures must be submitted to the Manager, Groundwater Management Section for approval prior to initiation of the work.

Dr. Neil Coleman

WORK NARRATIVE

1. PROGRAM MS62355 Offsite Migration	3. CONTRACT OR WORK ORDER NO.
2. TASK Confined Aquifer Chemistry Study	4. TASK NO. KW5T3
5. RESPONSIBLE ORGANIZATION BNWL PRINCIPAL INVESTIGATOR Fred P. Bauer	6. LIASON AT ARHCO Paul A. Eddy SECTION Groundwater Management

7. OBJECTIVES (ABSTRACT)

① To analyze the radiological chemical characteristics of water samples obtained from the confined aquifer underlying the Hanford site.

② To have other than BNWL Laboratories perform analyses on C-14, O18/O16 Radio, HTO, Metals and Inorganic materials.

(USE ADDITIONAL SHEETS AS NEEDED)

8. SCOPE (ABSTRACT)

① Conduct accurate radiological analyses on the specific water samples as listed on the attached chart using specified analytical methodology.

② To oversee accurate analyses conducted by other laboratories.

(USE ADDITIONAL SHEETS AS NEEDED)

9. JUSTIFICATION (ABSTRACT)

There is a need to determine the concentration and ultimate fate of any radionuclides in the confined aquifers underlying the Hanford Site and if present isolate the wastes from any users of water from this aquifer.

(USE ADDITIONAL SHEETS AS NEEDED)

10. DATE OF BEGINNING	11. TERMINATION	12. TOTAL BUDGET
October 1, 1976	September 30, 1976	KW5T3 $46,200

A-6300-065 (5-76)

13. BUDGET BREAKDOWN

(BY OBJECTIVES)		(BY CATEGORIES)	
1.	$ 36,200	MANPOWER	$
2.	$ 10,000	COMPUTER COSTS	$
3.	$	OTHER 21 well analyses @ $2200 each	$
4.	$		$ 46,200
5.	$	OVERHEAD (%)	$ —
TOTAL	$ 46,200	TOTAL	$ 46,200

14. MILESTONES (INDICATE SPECIFIC MILESTONES AND DATE OF ACHIEVEMENT)

Submit analytical results to ARHCO Liason three time a year.

15. REPORTING SCHEDULE AND GUIDELINES

A. INTERIM REPORT REQUIREMENTS

Data reported by letter to ARHCO Liason and J.R. Raymond within 60 days after the samples have been collected. Costs will also be submitted with data report

B. FINAL REPORT (FORMAT, SUBMISSION DATE)

16. BUDGET AND TASK WAS PREPARED BY	NAME	
	P.A. Eddy / J.R. Raymond	
DATE	TITLE	ORGANIZATION
September 30, 1976		

TO BE FILLED OUT BY ARHCO LIAISON:

CONTRACT OR WORK ABOVE SHOULD BE: ☒ APPROVED SUBJECT TO ATTACHED CONSTRAINTS ☐ DISAPPROVED

ARHCO LIAISON		DATE

A-6300-065R (5-76)

~~WELLS TO BE~~ ANALYZED AND
WELLS [illegible]

WELL NO.	TOTAL ORG/IN.	TRITIUM	C-14	I-129	GAMMA SCAN	^{239}Pu 50 LIT.	Am 50 LIT.	018/016 RATIO
DB-1	D	D ~~4 ml~~	1	D	D	1	1	D
DB-7	D	D	1	D	D	1	1	D
DDH-3	D	D	1	D	D			D
DB-4	D	D	1	D	D			D
DB-5 2	D	D	1	D	D			D
DH-S	D	D	1	D	D	1	1	D
Total Samples	~~8~~ 12	~~8~~ 12	~~4~~ 6	~~8~~ 12	~~8~~ 12	~~2~~ 3	~~2~~ 3	~~8~~ 12

D = Sample run in duplicate counts as two samples.

~~WELLS TO BE~~ ANALYZED AND
WELLS SAMPLED

WELL NO.	TOTAL ORG/IN.	TRITIUM	C-14	I-129	GAMMA SCAN	^{239}Pu 50 LIT.	Am 50 LIT.	018/016 RATIO
DB-1	D	D ~~400C~~	1	D	D	1	1	D
DB-7	D	D	1	D	D	1	1	D
DDH-3	D	D	1	D	D			D
DB-4	D	D	1	D	D			D
DB-52	D	D	1	D	D			D
DH-9	D	D	1	D	D	1	1	D
Total Samples	~~8~~ 12	~~8~~ 12	~~4~~ 6	~~8~~ 12	~~8~~ 12	~~2~~ 3	~~2~~ 3	~~8~~ 12

D = Sample run in duplicate counts as two samples.

WORK NARRATIVE

1. PROGRAM Offsite Migration	3. CONTRACT OR WORK ORDER NO.
2. TASK Confined Aquifer Chemistry Study	4. TASK NO. KW5T3
5. RESPONSIBLE ORGANIZATION BNWL	6. LIASON AT ARHCO Paul A. Eddy
PRINCIPAL INVESTIGATOR John R. Raymond	SECTION Groundwater Management

7. OBJECTIVES (ABSTRACT)

① To collect water samples from selected well structures in order to analyze the chemical characteristics of the confined aquifers underlying the Hanford Site.

② Review Analyses

(USE ADDITIONAL SHEETS AS NEEDED)

8. SCOPE (ABSTRACT)

1. Obtain water samples from selected wells listed on the attached chart using specified collection procedures and quality assurance criteria.

2.

(USE ADDITIONAL SHEETS AS NEEDED)

9. JUSTIFICATION (ABSTRACT)

There is a need to determine the concentration and ultimate fate of any radionuclides in the confined aquifers underlying the Hanford Site and if present isolate the wastes from any users of water from this aquifer.

(USE ADDITIONAL SHEETS AS NEEDED)

10. DATE OF BEGINNING	11. TERMINATION	12. TOTAL BUDGET
October 1, 1976	September 30, 1976	KW5T3 $7,800

A-6300-065 (5-76)

13. BUDGET BREAKDOWN

(BY OBJECTIVES)		(BY CATEGORIES)	
1.	$ 6,600	MANPOWER	$
2.	$ 1,200	COMPUTER COSTS	$
3.	$	OTHER	$
4.	$		$
5.	$	OVERHEAD (%)	$
TOTAL	$ 7,800	TOTAL	$

14. MILESTONES (INDICATE SPECIFIC MILESTONES AND DATE OF ACHIEVEMENT)

① Collect water samples three times a year
② Review analyses

15. REPORTING SCHEDULE AND GUIDELINES

A. INTERIM REPORT REQUIREMENTS

B. FINAL REPORT (FORMAT, SUBMISSION DATE)

Will contain recommendation on sampling frequency of future analyses and locations where addition data are required.

16. BUDGET AND TASK WAS PREPARED BY	NAME: P.A. Eddy / J.R. Raymond	
DATE: September, 1976	TITLE	ORGANIZATION

TO BE FILLED OUT BY ARHCO LIAISON:

CONTRACT OR WORK ABOVE SHOULD BE: ☒ APPROVED SUBJECT TO ATTACHED CONSTRAINTS ☐ DISAPPROVED

ARHCO LIAISON	DATE

A-6300-065R (5-76)

INTRODUCTION

Over the past years a large number of wells have been drilled in the Hanford site. These wells varied in use, type of construction, depths and reason for drilling. As a result some confusion was brought about as to why the large number of wells. In an effort to establish an understanding, the following is presented.

PURPOSE

The purpose of the drilling and sampling programs is to monitor the possible offsite migration of radioactive contaminants. There exists under the Hanford site two primary aquifers, the unconfined and the confined. For many years wells have been used with varying success with a large number of ~~many~~ wells being drilled into the unconfined aquifer and few into the confined. As data were collected it became apparent that a computer was necessary to handle the large amounts of information. A computer was put into service and has since produced workable results. However, by placing the data into the computer and reviewing the output it showed a need for information at various locations and depths. In an attempt to acquire this needed information for the computer programs, additional wells are being proposed to supplement the well inventory and to define recharge and discharge points.

The proposed locations of new wells are based on four criteria:

- areas where data are presently lacking,
- access into the area,
- type rock to be drilled, and
- existing shallow wells which can be deepened.

DISCUSSION

The four ~~three~~ programs (computer modeling, unconfined and confined aquifer drilling and testing, and the installation of piezometers) are very closely correlated programs. Each ~~program is dependent upon the~~ other. When data are needed under the computer program, an attempt is made under the ~~two~~ support programs to gather the information from

existing wells. If the current well inventory is insufficient a new well is proposed with testing to give the needed additional data. If a well is present but not of adequate depth, the program proposes to enter the existing well and deepen it to the required depth. If data are needed from various aquifers, the programs are adjusted such that duplicate drilling is not done by installing piezometers at various depths in existing or newly drilled well. After a well has been constructed for information on the unconfined aquifer, the same well will be entered under the offsite migration program for deepening and testing of the confined aquifers. Piezometers will then be installed to monitor both the confined and unconfined

When adequate data has been collected for complete computer modeling ~~which will~~ including the work outlined for this Fiscal Year, much confusion will be eliminated and a better understanding of the subsurface migration of radionuclides and hydraulic parameters of the aquifers will exist.

C 83470

WORK ORDER

* SERVICING/ COST CENTER	* CUSTOMER/ SUPPORT CODE	SUB-ACCOUNT/ ACCT. CLASS	REF. NO. W/O	AUTH. FUNDS	AREA	BLDG.	(1)
				46,200.	3,000	PSL	

START DATE	TERM. DATE	OVERHEAD CODES	PROJECT NO.
10/1/76	9/30/77		

RESPONSIBLE ORG.	QA LEVEL	QA REVIEW	FY FUNDS	PR. NO.	SYSTEM
3,6,1,3,0,0					

DESCRIPTION: Offsite Migration -- Confined Aquifers Quality Study -- Perform work as described in attached Work Narrative. Submit results to JR Raymond and the ARCO Liaison every four months.

ASSIGNED TO: Fred P Brown

FM. NO.:

ESTIMATED COST (INCLUDES REFERRAL ORDERS)

HOURS	
LABOR & IME	
MATERIAL	
OTHER	
TOTAL	46200
LINE OR COST ACCOUNT	

FACILITIES CHANGE NOTICE - ☐ YES ☐ NO

ISSUED BY	DATE	PHONE	ACCEPTED BY
RA Deju	Sept 30, 1976		

APPROVED BY	DATE	COMPLETED - FMN	DATE

* FIRST DIGIT COMPANY INDICATOR: B - ARNCO, D - BNW, F - CSC, H - UNI, K - VITRO, M - HENF, T - JAJ, V - HEDL, S - ERDA

(1) FOR INTERNAL CONTRACTOR USE ONLY

Pioneer Business Forms

03725

SERVICING FINANCIAL

54-3000-338 (5-75)

C 83470

WORK ORDER

* SERVICING/ COST CENTER	* CUSTOMER/ SUPPORT CODE	SUB-ACCOUNT/ ACCT. CLASS	REF. NO. W/O	AUTH. FUNDS	AREA	BLDG.	(1)
				7,800	3,000	PSL	

START DATE	TERM. DATE	OVERHEAD CODES	PROJECT NO.
10/1/76	9/30/77		

RESPONSIBLE ORG.	QA LEVEL	QA REVIEW	FY FUNDS	PR. NO.	SYSTEM
3,6,1,3,0,0					

DESCRIPTION: Offsite Migration -- Confined Aquifers Quality Study -- Perform work as described in Work Narrative. Submit a review of the analyses every four months.

ASSIGNED TO: J.R. Raymond

FM. NO.:

ESTIMATED COST (INCLUDES REFERRAL ORDERS)

HOURS	
LABOR & IME	
MATERIAL	
OTHER	
TOTAL	7,800
LINE OR COST ACCOUNT	

FACILITIES CHANGE NOTICE - ☐ YES ☐ NO

ISSUED BY	DATE	PHONE	ACCEPTED BY
RA Deju	Sept 30, 1976		

APPROVED BY	DATE	COMPLETED - FMN	DATE

* FIRST DIGIT COMPANY INDICATOR: B - ARNCO, D - BNW, F - CSC, H - UNI, K - VITRO, M - HENF, T - JAJ, V - HEDL, S - ERDA

(1) FOR INTERNAL CONTRACTOR USE ONLY

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03725

SERVICING FINANCIAL

54-3000-338 (5-75)

F 4/78

	I129	GAMMA SCAN	PU-AM	C14	016/018	ORG/IN	HTO
First run (Dec)	4 wells 8 samples $6400	5 wells 10 samples $2000	3 wells 3 samples $3300	4 wells 4 samples $1400	4 wells 4 samples $160	5 wells 10 samples $1250	5 wells 5 samples $1500
Second run (Apr)	4 well 8 samples $6400	4 well 8 samples $1600	1 well 1 sample $1100	1 well 1 sample $350	1 well 1 sample $40	4 well 8 samples $1000	1 well 1 sample $300
Third run (Jul)	11 wells 22 samples $17600	11 wells 22 samples $4400	2 wells 2 samples $2200	4 wells 4 samples $1400	4 wells 4 samples $160	11 wells 22 samples $2750	9 wells 9 samples $2700
Total $	$30400	$8000	$6600	$3150	$360	$5000	$4500

$45000 — $58010 — $13010

I129 at $800/analysis Gamma Scan at $200/analysis Pu & Am at $1100/analysis C14 at $350/analysis
016/018 at $40/analysis HTO at $300/analysis org./in. at $125/analysis

Dr. Neil Coleman MS 623SS

HYDROLOGY PROGRAM REVIEW
(First Quarter Fiscal Year 1977)

I PROGRAMS
- Groundwater Hydrology (KW5T2)
- Offsite Migration (KW5T3)
- Radionuclide Migration in Groundwater (KR213)
- Long-Term Groundwater Management (KR215)

II BUDGET
- Expenditure
- Variance
- Projection
- Reduction

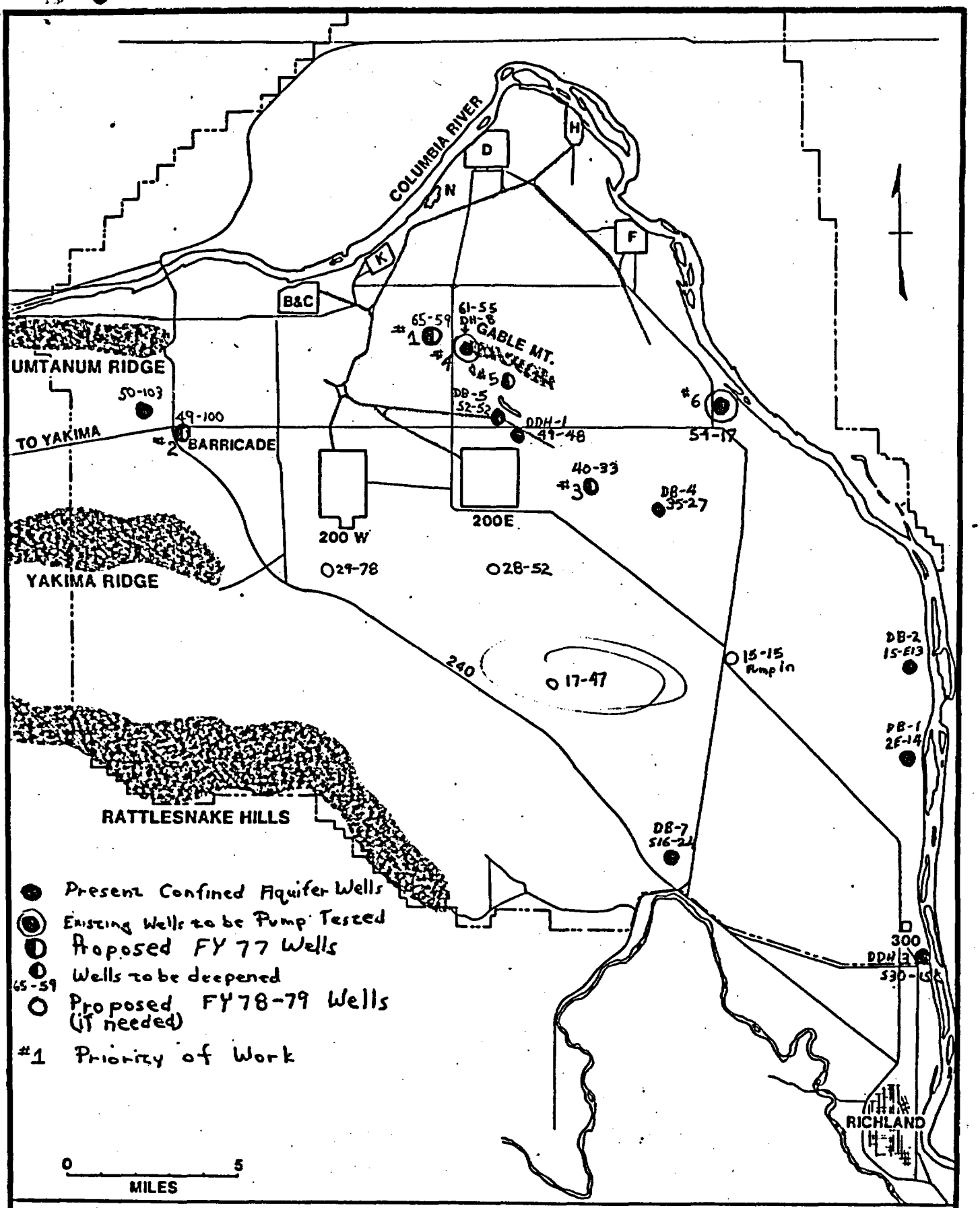
III FIRST QUARTER PROGRESS
- Field Research
- Modeling
- Problem Areas
- Documents Issued

IV SECOND QUARTER PROJECTION
- Field Research
- Modeling
- Documents to be Issued

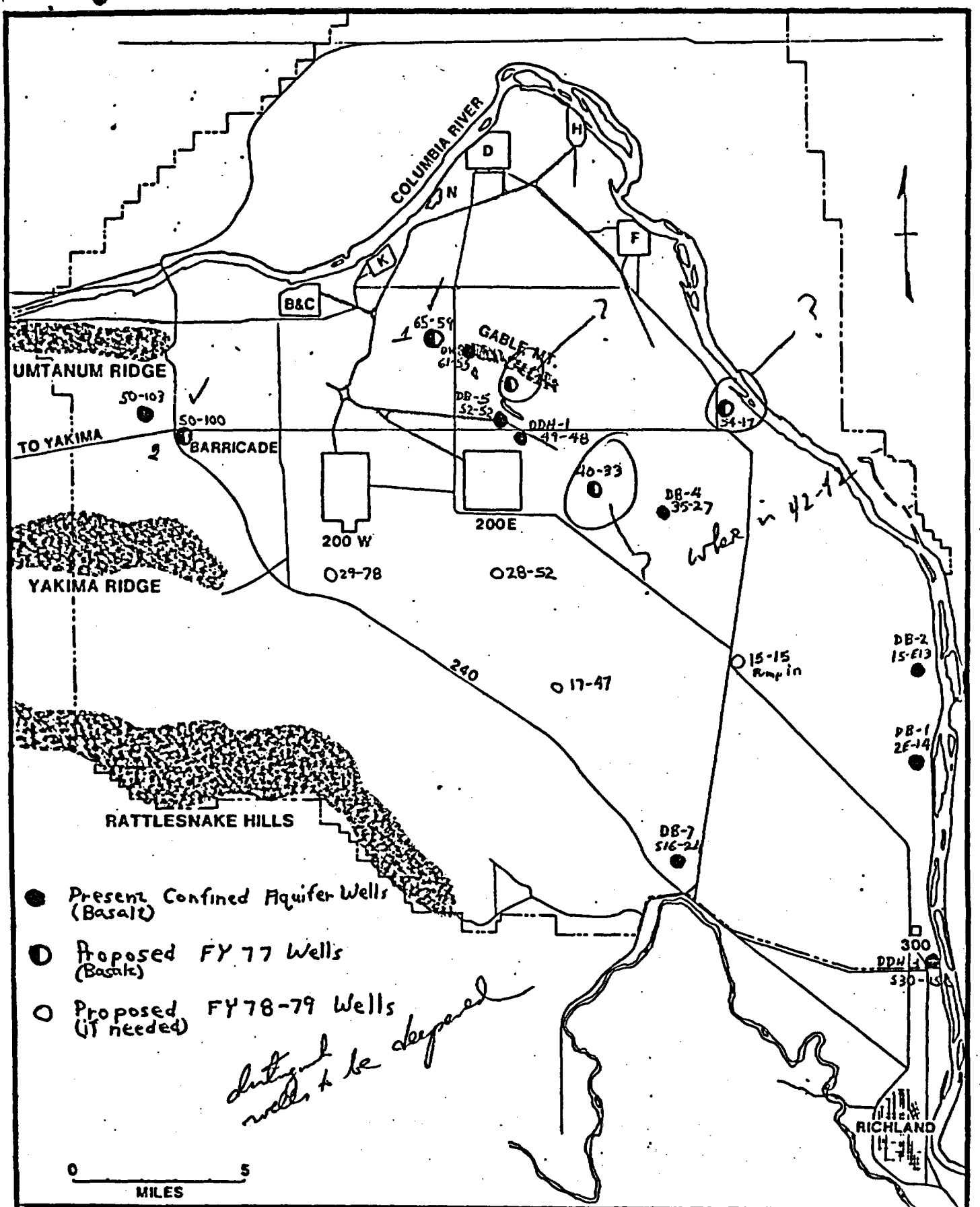
V PROGRESS TOWARD FIVE-YEAR MILESTONES

VI STAFF INCREASES

January 28, 1977
Roy E. Gephart

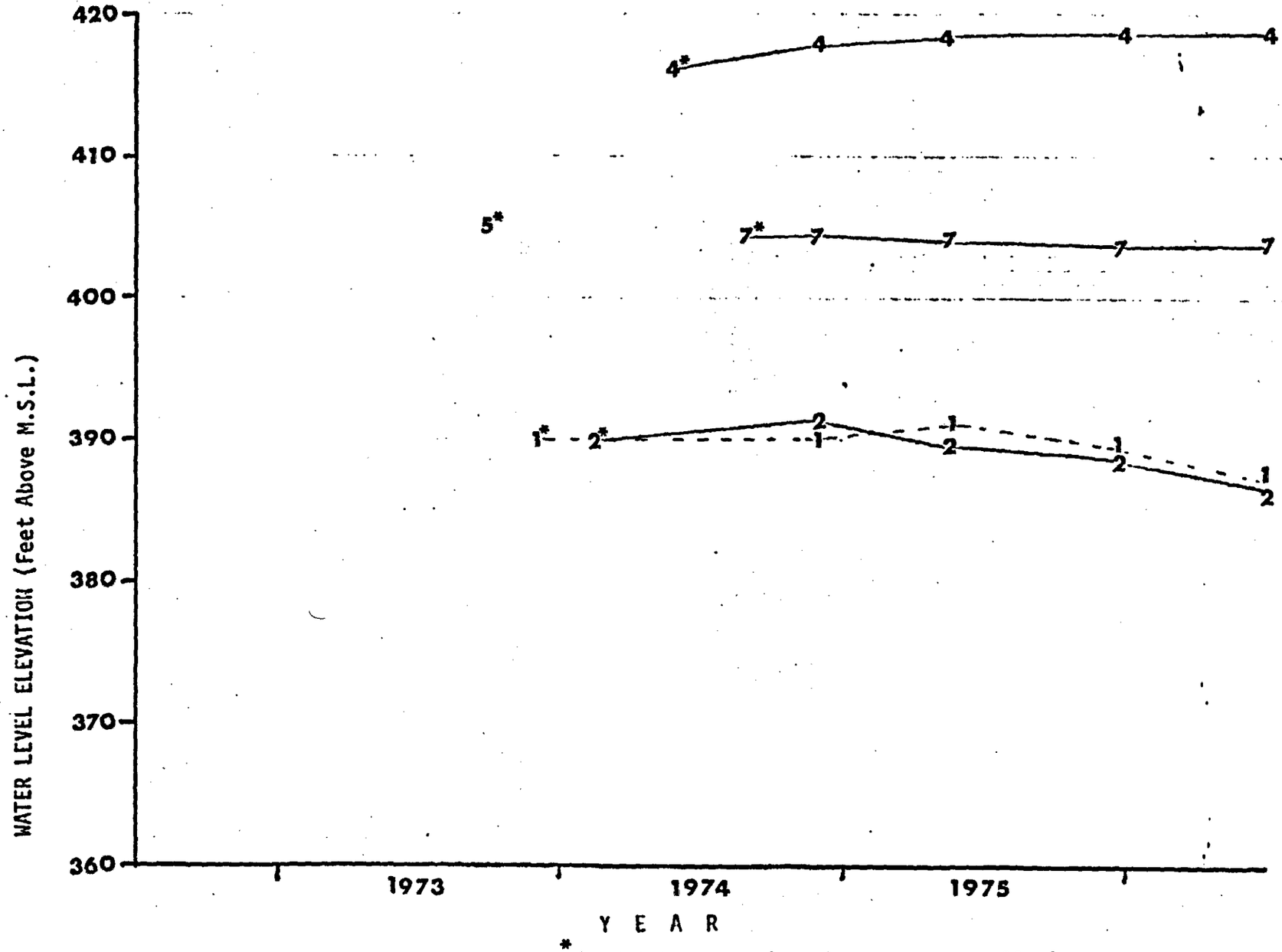


HANFORD AREA MAP

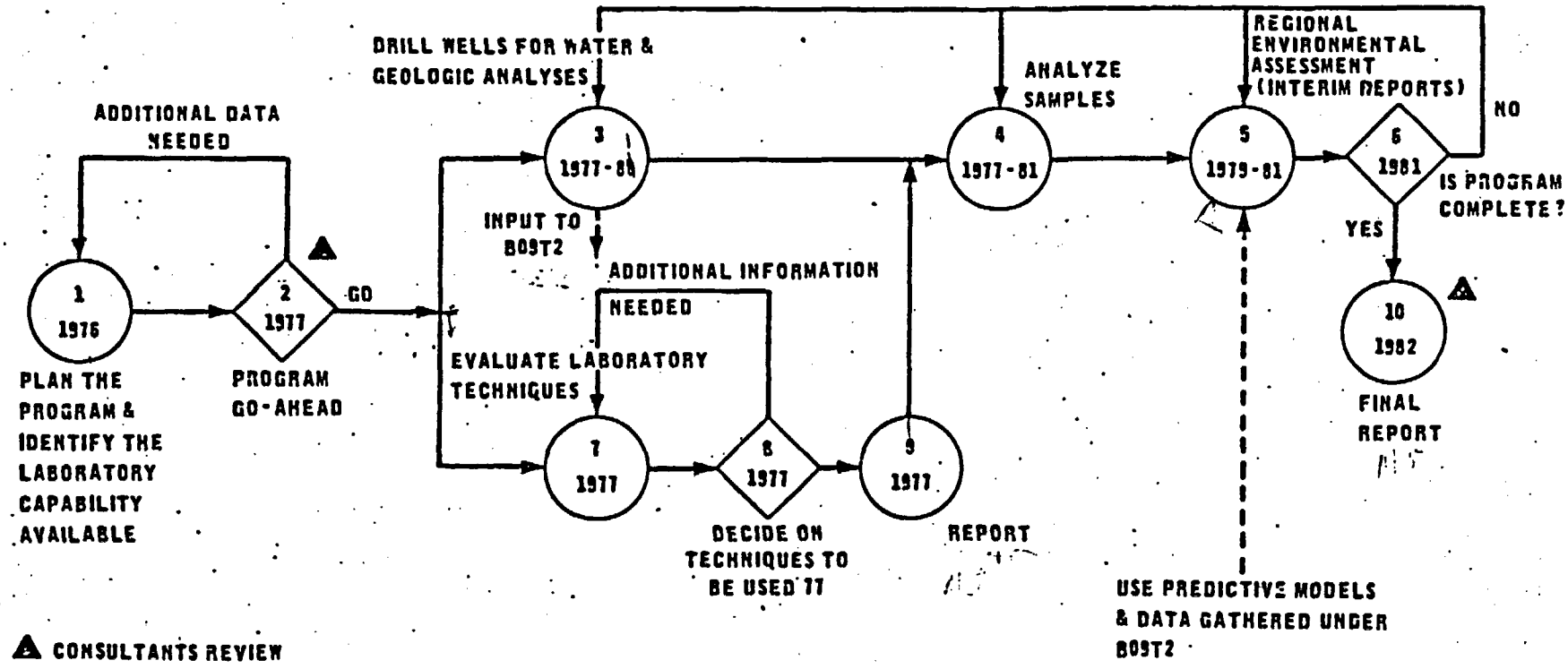


HANFORD AREA MAP

DB Core Hole Hydrographs (Mabton Confined Aquifer)



*As drilled head (DB-5 has pump installed)



OFFSITE MIGRATION
(BO9T3)

PREVIOUS MAINTENANCE

'ell #	Tubes Removed	Bridge Plug	Perfo-rated	Swabbed Brushed	Bailed	Air Lift	Screen	Hours
4-1			X	X	X			17 1/2
5-12			X		X			6
8-3					X			20
5-1			X		X			21 1/2
5-3				X	X			9 1/2
5-4			X		X			19
5-6			X		X			23
7-1			X		X			23
-11			X		X			24 1/2
-19				X	X		X	46 1/2
-20					X			13
-22					X		X	43
-4	X	X	X		X			32
10-E15A						X		5
9-12			X		X			18
7-E14			X		X			17 1/2
4-19					X			12 1/2
9-E13		X		X	X	X		13
9-11			X		X			23
8-E2	X					X		26 1/2
4-20	X					X		23
2-3			X		X			28
2-29	X			X		X		28
-19			X		X			22
-E14A	X			X		X		24 1/2
-E4C	X					X		44
-E12		X			X			6
-3			X		X			21
-33	X	X	X	X		X		56 1/2
-45			X		X			11 1/2
-17					X			6

ell #	Tubes Removed	Bridge Plug	Perfo-rated	Swabbed Brushed	Bailed	Air Lift	Screen	Hours
8-25				X		X		11 1/2
8-32			X		X		X	32
9-E2		X	X		X			21
)-E12	X			X		X		30
l-45A					X			8 1/2
',Q,R,S,T						X		6
l-38	X	X	X	X		X		50 1/2
i-15A	X	X			X			117 1/2
,-26				X		X		13 1/2
-5			X		X		X	49
-47								14
-43					X			5 1/2
-47A					X			8 1/2
-58								16
,Q,R,S,T								2 1/2
-E12								10
-20		X			X			13 1/2
-39	X			X		X		128
-70	X					X		26 1/2
),R,S,T						X		3 1/2
-33			X		X			26
46			X			X		42 1/2
70	X			X		X		39
15			X		X			22
8		X	X	X	X		X	40
40	X					X		33
55			X		X			14
31	X		X	X	X	X		168
53B	X		X		X			74
55						X		17
12				X	X			5 1/2
13				X	X			6 1/2
52	X	X			X	X		44 1/2

Well #	Tubes Removed	Bridge Plug	Perfo-rated	Swabbed Brushed	Bailed	Air Lift	Screen	Hours
32-70			X		X			35
32-72	X			X		X		44
32-77		X		X		X		15 1/2
33-42					X		X	50
33-56					X			12
34-39				X	X			7
34-41				X	X			4 1/2
34-42				X	X			9 1/2
34-51			X		X			40
35-9			X		X			16
35-66		X	X	X	X			30 1/2
35-70			X		X		X	52 1/2
35-78		X		X		X		26
6-46P,Q,R,S						X		9 1/2
36-61A		X			X			13
36-61B	X			X		X		59
37-43	X	X		X		X		99
37-82A	X	X	X		X			48
38-65	X			X		X		84
38-70	X			X		X		48
39-39					X			8
39-79	X	X			X			31 1/2
40-1		X			X			9 1/2
40-33			X		X			27 1/2
40-62			X		X			28
41-23			X	X	X		X	42 1/2
42-42	X	X		X		X		32
43-42					X			8
44-64	X		X	X		X		54
45-42		X		X	X			13 1/2
45-69			X		X			23
47-35A			X	X	X			10
47-46				X	X			4 1/2
48-71			X		X			12

ll #	Tubes Removed	Bridge Plug	Perfo-rated	Swabbed Brushed	Bailed	Air Lift	Screen	Hours
49-28					X			23
49-55					X		X	28 1/2
49-57		X		X	X			5 1/2
49-79			X		X			12 1/2
50-28B					X			6
50-30			X	X	X			29 1/2
50-42	X			X	X	X		18 1/2
50-53			X		X			22 1/2
50-85	X			X	X	X		201
51-63		X		X	X			3 1/2
51-75	X			X		X		30
53-47			X		X			8
53-55A	X			X		X		50 1/2
54-37A					X		X	30 1/2
54-37B					X			39 1/2
54-42		X		X	X			16
54-45					X			7
54-57				X	X			15 1/2
55-50C		X		X	X			7
55-70	X	X	X	X	X	X		23
57-25					X			16
57-29A					X			5 1/2
52-43F			X		X			16
53-25A			X		X			13
54-27			X		X			21
55-59	X		X		X			23 1/2
55-72			X		X			20
56-39			X		X			6 1/2
56-103					X			25
57-51	X			X	X	X		29
57-86		X			X			18 1/2
58-105			X		X			30
'1-30					X			3
'2-88			X		X			9

Well #	Tubes Removed	Bridge Plug	Perfo-rated	Swabbed Brushed	Bailed	Air Lift	Screen	Hours
74-48	X				X			14 1/2
73-61					X		X	64
78-62					X		X	32
83-47	X			X		X		34 1/2
90-45					X		X	34 1/2
96-49	X			X		X		17
AN.-6			X		X			55
AN.-19					X			16
AN.-24			X		X			23

Atlantic Richfield Hanford Company

COST CENTER CODE: 61300 TITLE: Scientific Programs

SUPPORT CODE: KWSTZ TITLE: Groundwater Hydrology

BUDGET INPUT FORM A

FISCAL YEAR 1977

PREPARED BY: R. Gephart

DATE: 2/17/77

ACCOUNT CLASS TITLE	ACCT. CLASS	FY 77 OCT.	10 THS	FY 77 NOV.	10 THS	FY 77 DEC.	10 THS	FY 77 JAN.	10 THS	FY 77 FEB.	10 THS	FY 77 MAR.	10 THS	FY 77 APR.	10 THS	FY 77 MAY	10 THS	FY 77 JUNE	10 THS	FY 77 JULY	10 THS	ACCT. CLASS	RT	FY 77 AUG.	10 THS	FY 77 SEPT.	10 THS
EXEMPT PERSONNEL	01																					01	8				
NONEXEMPT PERSONNEL	00																					00					
EXEMPT OVERTIME	02																					02					
NONEXEMPT OVERTIME	03																					03					
EXEMPT ISOLATION	0A																					0A					
NONEXEMPT ISOLATION	04																					04					
EXEMPT SHIFT	0B																					0B					
NONEXEMPT SHIFT	05																					05					
TOTAL MANMONTHS	bb	7																				bb	9				
DIRECT AND APPL MTL	10	2																				10	4				
NON-DURABLE TOOLS	13																					13					
OFFICE SUPPLIES	14																					14					
SHOP AND LAB SUPPLIES	15																					15					
ESSENTIAL MATERIALS	1A																					1A					
TRAVEL AND LIVING	20																					20					
TRADE & PROF SOC	2D																					2D					
CONTRACTS AND FEES	21																					21					
ELECTRICITY	22																					22					
OTHER MISC. INCURRED	23																					23					
TELEPHONE	25																					25					
HEDL	3F																					3F					
BNW	3D																					3D		(1000)		(1000)	
BCS	3F																					3F					
UNI	3H									400		400		400		400		400				3H					
VITRO	3K																					3K					
HEMF	3M																					3M					
JAJ	3T																					3T					
TOTAL DOLLARS	bb	3								400		400		400		400		400				bb	5	(1000)		(1000)	

Dr. Neil Coleman M.S. 6235S

EARLIEST DATE - COMMENCED

PHE

A PROPOSED PROGRAM PLAN TO DEFINE GROUND-WATER QUALITY IN THE UPPER CONFINED AQUIFERS ON THE HANFORD SITE

STATUS OF GROUND-WATER QUALITY IN THE UPPER CONFINED AQUIFER(S)

A number of attempts have been made in the past to determine the presence (or absence) of contaminants in the ground water of the upper confined aquifers beneath the Hanford Site that could be attributed to radioactive waste disposal activities. The potential exists for such contamination due to geohydrologic considerations and location of the waste disposal sites.(1) However, none of the previous attempts have accomplished the objective of defining degree and extent of confined aquifer contamination for one or more of the following reasons:

see last page. 5'

comments.

1. Lack of sampling structures (location and/or completion methods)
2. Inadequate investigative program
3. Inadequate analytical methods
4. Insufficient sampling techniques

Although it was recognized that water-bearing zones in the lower Ringold (and below) occurred under confined or partially confined conditions, few wells were completed solely in these zones. The wells were usually drilled as multiple use structures for geologic and hydrologic data acquisition as well as water quality monitoring information, and project funding did not permit the luxury of costly, special purpose well structures or utilization of more sophisticated well completion methods. Likewise,

it seemed that the bulk of the contaminants that reached ground water was moving in the upper part of the unconfined water table aquifer--an assumption that essentially appears valid today.

Most of the previous attempts to detect contaminants in the upper confined aquifers were designed primarily to test equipment, instruments, sampling techniques or analytical methods and were thus inadequate in time and/or areal extent to conclusively resolve the contaminent issue. Also, ~~most~~ many of the tests were not documented.

Analytical methods were either unavailable for low level detection of potential contaminants or lacked adequate sensitivity. Some of the most mobile contaminants in the ground-water system such as Tritium, Iodine-129 and Technetium-99 were not recognized as occurring in significant amounts in the disposed wastes. Detection of these elements at near-background levels in ground water is still difficult and costly and is not ~~accomplished~~ done under the ongoing routine monitoring programs on the Hanford Reservation.

A review of all available existing analytical data was made under an HT program sponsored by Atlantic Richfield Hanford Corp. (ARHCO) to attempt definition of water quality in the confined aquifers. Table I shows the analytical results from the only studies that were considered adequate in both aquifers sampled and analytical parameter and level. These results were compiled from essentially two studies,(2),(3) and unpublished analyses obtained by ARHCO on DB and DH wells (Figure 1). Even a cursory examination indicates that the data do not clearly define the status or the confined aquifer water quality with regard to contamination

Figure 1 shows location of DB & DH holes

TABLE I. Confined Aquifer Water Quality

(see Figure 1 for Well Locations)

Background Data

^{129}I - ~ 1.3×10^{-5} pci/l (699 53-103 - McGee)

^{3}H - ~ 5 pci/l to < 2 pci/l

NO_3 - < 1 mg/l

Well Number & Date	^{129}I (pci/l)	^{3}H (pci/l)	NO_3 (mg/l)	Aquifer Sampled
DB1 (699 2-E 14)				Mabton
12/14/73	$8.0 \times 10^{-6} \pm 1.3 \times 10^{-6}$	47 ± 2[a]		
	$9.2 \times 10^{-6} \pm 1.4 \times 10^{-6}$			
	$8.2 \times 10^{-6} \pm 1.7 \times 10^{-6}$			
	$1.6 \times 10^{-5} \pm 2.5 \times 10^{-6}$			
DB-2 (699 15-E13)				Mabton
2/25/74	$5.7 \times 10^{-6} \pm 1.2 \times 10^{-6}$	49 ± 2[a]		
	$4.0 \times 10^{-6} \pm 7.4 \times 10^{-7}$			
	$4.9 \times 10^{-6} \pm 3.9 \times 10^{-7}$			
	$5.7 \times 10^{-6} \pm 8.0 \times 10^{-7}$			
	$1.7 \times 10^{-6} \pm 2.0 \times 10^{-6}$			
	$1.0 \times 10^{-5} \pm 1.5 \times 10^{-6}$			
	$9.7 \times 10^{-6} \pm 1.4 \times 10^{-6}$			
	$6.6 \times 10^{-6} \pm 1.3 \times 10^{-6}$			

Well Number & Date	^{129}I (pci/l)	^{3}H (pci/l)	NO_3 (mg/l)	Aquifer Sampled
DB-4 (699 35-27)				Mabton
5/14/74	$2.9 \times 10^{-5} \pm 1.3 \times 10^{-6}$	$35 \pm 2^{(a)}$		
	$4.2 \times 10^{-5} \pm 2.0 \times 10^{-6}$			
	$8.2 \times 10^{-5} \pm 4.1 \times 10^{-6}$			
DB-5 (699 52-52)				Mabton
3/22/74?	$2.6 \times 10^{-5} \pm 4.4 \times 10^{-6}$	$203 \pm 8^{(a)}$		
	$9.2 \times 10^{-6} \pm 5.1 \times 10^{-7}$			
	$1.6 \times 10^{-5} \pm 2.7 \times 10^{-6}$			
	$1.8 \times 10^{-5} \pm 1.3 \times 10^{-6}$			
	$7.4 \times 10^{-6} \pm 3.7 \times 10^{-6}$			
	$3.4 \times 10^{-5} \pm 5.1 \times 10^{-6}$			
	$4.5 \times 10^{-5} \pm 6.6 \times 10^{-6}$			
4/26/74		$17 \pm 2^{(a)}$		
		$4 \pm 0.3^{(b)}$		
4/29/74		$22 \pm 2^{(a)}$		
		$3.5 \pm 0.3^{(b)}$		
5/1/74		$17 \pm 2^{(a)}$		
		$3.4 \pm 0.3^{(b)}$		
DB-7 (699 S16-24)				Mabton
8/16/74	$1.4 \times 10^{-4} \pm 5.1 \times 10^{-6}$			
	$2.4 \times 10^{-4} \pm 9.1 \times 10^{-6}$			
	$2.3 \times 10^{-4} \pm 7.2 \times 10^{-6}$			

Well Number & Date	^{120}I (pci/l)	^{3}H (pci/l)	NO_3 (mg/l)	Aquifer Sampled
699 S31-1P				Lower Ringold
8/30/68		$182 \pm 38^{(d)}$	<1	
699 S11-E12P (flowing well)				Lower Ringold
3/5/64	$2.1 \times 10^{-5} \pm 1.5 \times 10^{-5}$			
8/26/68		$611 \pm 29^{(d)}$ $9.7 \pm 2.6^{(d)}$	<1	
699 S18-E2P[c]				Lower Ringold
8/29/68		$83 {}^{+29}_{-19}{}^{(d)}$	3	
699 14-E6P				Rattlesnake Ridge
8/28/68		$608 \pm 77 \pm 35^{(d)}$	<1	
699 14-38P[c]				Lower Ringold?
1964	1.6×10^{-4}	$288 \pm 48^{(d)}$	<1	
699 20-E5P				Rattlesnake Ridge?
8/29/68		$166 \pm 29^{(d)}$	<1	
699 20-39P				Lower Ringold
3/24/69		$166 \pm 29^{(d)}$		
699 24-1				Lower Ringold?
4/5/71 ("S" piez.)	$8.1 \times 10^{-6} \pm 1.8 \times 10^{-6}$			
6/7/71 " "	$9.1 \times 10^{-6} \pm 3.5 \times 10^{-6}$			

Well Number & Date	^{129}I (pci/l)	^{3}H (pci/l)	NO_3 (mg/l)	Aquifer Sampled
8/29/68 ("P" piez.)		438 ± 64[d]	<1	
699 36-46P				Lower Ringold
9/9/68		114 ± 296[d] 7 ± 2[d]	<1	

(a) Analyses made by Teledyine isotopes

(b) Analyses made by University of Miami

(c) Leak suspected - may have caused cross contamination

(d) Analyses made by Washington State University

from Hanford waste disposal activities. Referring to Table I, water in the Mabton interbed at DB-1 and DB-2 sites appear uncontaminated as reflected by the ^{129}I background levels. Idodine-129 appears ubiguitous as a contaminant from Hanford waste disposal operations, is highly mobile in the environment and, with a very long life, serves as an excellent tracer. The recent analytical developments in low level detection of ^{129}I provide for apparently accurate and reliable (though costly) tracing of this isotope. The ^{3}H contents appear anomalously high. It is felt that the Teledyne and W. S. U. tritium analyses are unreliable in the lower concentration levels, and this is supported by comparison of tritium analyses of water from DB-5 run by Teledyne and the University of Miami.

Water in the Mabton at the site of DB-4, DB-5 and DB-7 appear to contain low level contamination attributed to Hanford operations as indicated by the ^{129}I analyses.

The rest of the data are inconclusive, but suggest that water in the Lower Ringold probably contains low level contamination for some distance southeast of the 200 East area.

There are sufficient positive analytical results (and variance in results) to justify and require a definitive program to assess the status of the upper confined aquifer(s).

Recommended Sampling Sites

which

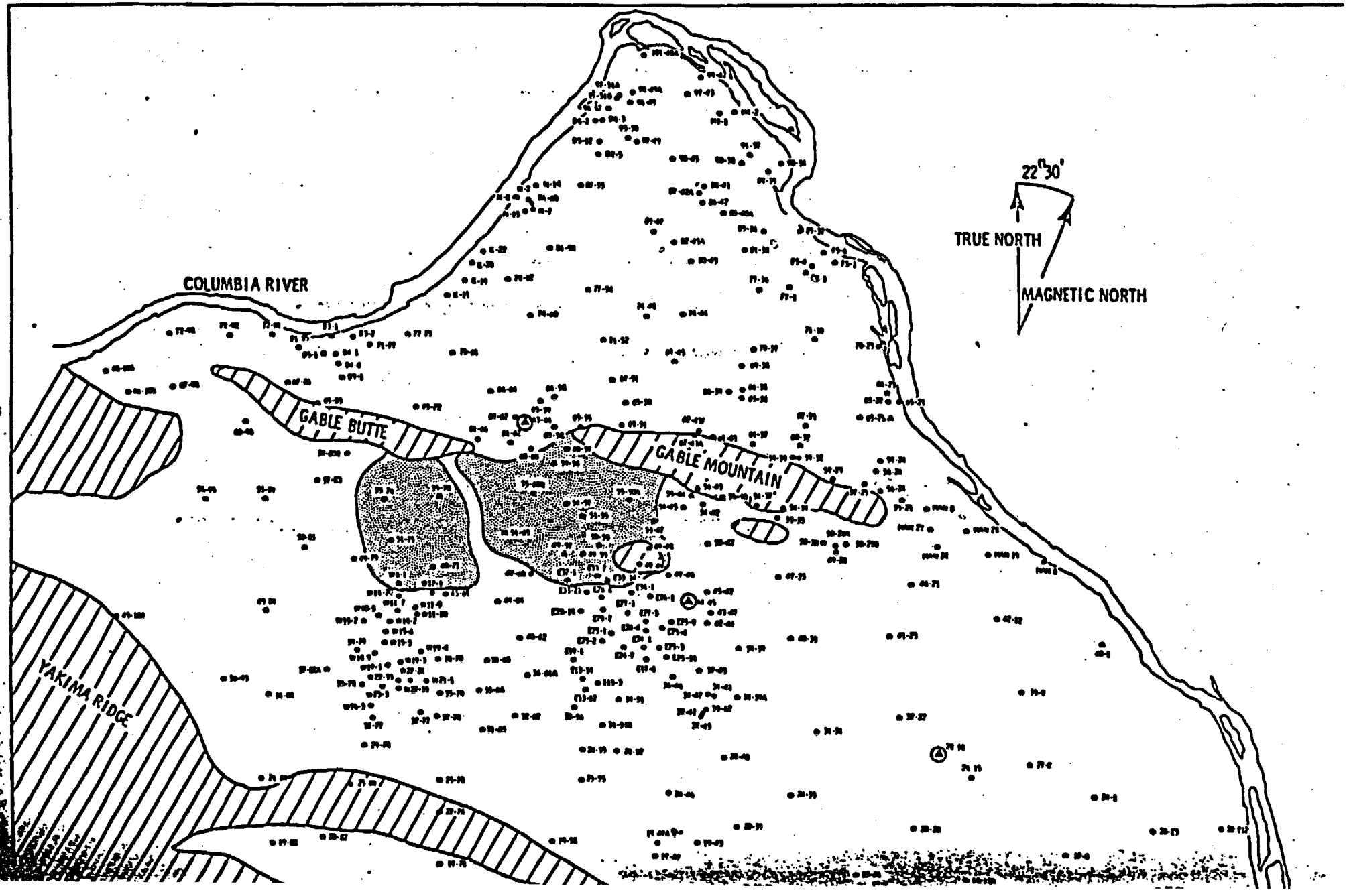
In addition to the several existing well locations applicable for sampling water from the upper confined aquifers, three additional sites are recommended for location of proposed wells to obtain additional data on water quality and contamination status of ground water in the upper confined aquifers (in these cases, the Lower Ringold Formation and the Rattlesnake Ridge Interbeds). Recommended locations (Hanford site coordinates) are: N28,000-W18,000; N44,000-W45,000 and N63,000-W61,000. The sites were selected by evaluation of contamination data from the "DB" series wells (completed in the Mabton Interbed) and the location of possible areas where hydraulic continuity may exist between the water table aquifer and the upper confined aquifers as shown by data contained in ARH-SA-253 and other sources.[4] Figure 1, shows the location of these proposed wells and the area where hydraulic continuity may exist between the water table aquifer (or liquid waste) and the upper confined aquifers).

Show on Figure 2 explanation ?

Recommended Analyses

Analysis needs of the proposed confined aquifer program have been considered. Recommendations and information on proposed analytical methodology follow:

1. Types of Analyses: It is recommended that most of the initial analysis effort should be confined to contaminants which have


COLUMBIA RIVER
GABLE BUTTE
GABLE MOUNTAIN
YAKIMA RIDGE
22°30'
TRUE NORTH
MAGNETIC NORTH

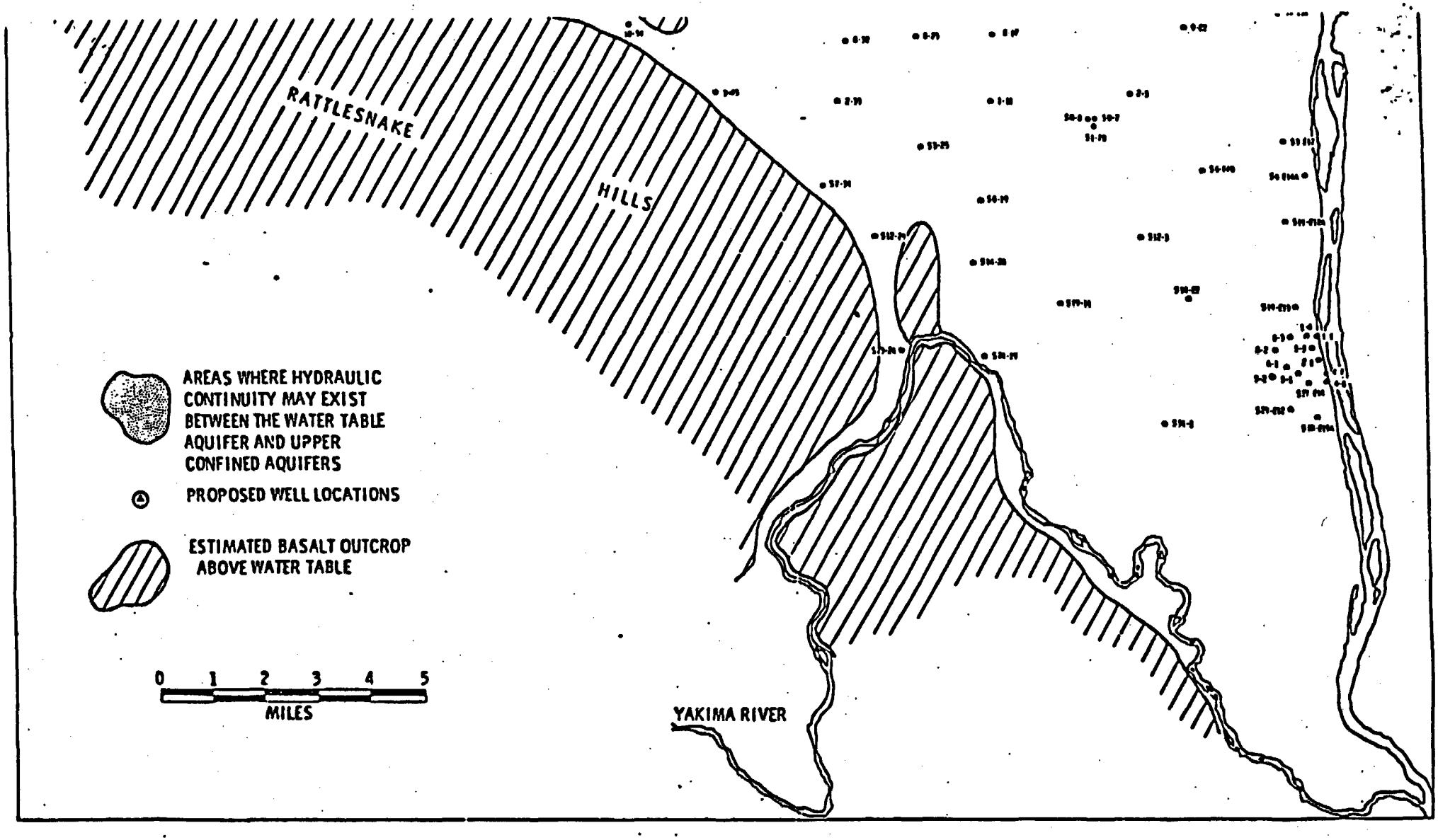


FIGURE 1. Location of Proposed Wells and Areas of Possible Hydraulic Continuity Between the Water Table Aquifer and Upper Confined Aquifers

been found to migrate the greatest distance in the unconfined aquifers and for which analysis technology is well established. This should include low-level gamma-ray spectrometric, tritium, ^{129}I analyses on very large volume water samples and/or ion exchange concentrated samples.

Good analytical methods exist for ^{90}Sr, U, Pu and Am and a few analysis should be performed to establish low levels. Based on unconfined aquifer data, these nuclides are not expected to be the major contaminants in the confined aquifers and a large number of analyses are not warranted.

Analytical methods exist for ^{14}C in ground water. Data on levels in the confined and unconfined aquifers are needed. A few analyses should be run to establish the presence of ^{14}C as a major ground water contaminant. If relatively high levels of ^{14}C are detected in the unconfined aquifers a number of confined aquifer samples should be analyzed.

Migration of ^{99}Tc in the ground water is expected but few data are available. The current low-level β- counting method has limited sensitivity. A more sensitive method is being developed and should be completed before extensive ^{99}Tc analyses are initiated. When a sensitive method is available, the same strategy as recommended for ^{14}C analyses is suggested.

Other analyses have been useful in investigations of ground water contamination but additional literature studies are needed to determine

those applicable to the current problem. These include measurements of the $^{39}Ar/^{85}Kr$ ratio and differences in the stable hydrogen, oxygen, carbon, nitrogen, sulfur and zenon isotope ratios. These ratios have been used to characterize the origin of water and of gaseous, organic or mineral material in the water. Thus for example, evaporated water is depleted in deuterium and ^{18}O with respect to surface water.

Measurement of stable element concentration is needed. The use of specific ion electrodes or atomic absorption measurements where applicable are recommended for rapid, economical analyses.

Several needed analyses require analytical development. Many of the ion-exchange sampling and analysis methods will not detect organic or organic bound materials. Methods for separation and analysis of trace organics especially separation plant-organic residues in large volume water samples are required. Some additional study of concentration methods for inorganic species are also required especially studies of field ion-exchange sampling reliability.

a) Gamma Radioactivity

Sample required: 50 liters in polyethylene carboy for each analysis.

Method: Acidify sample and evaporate to small volume, or dryness, measure individual radionuclides by Ge(Li) and multiparameter coincidence gamma-ray spectrometric methods. Total α and β-

counts can be taken on evaporated aliquots of the sample. β^- -γ concidence spectrometry can also be used.

Detection Limit: 0.1 to 1.0 pCi depending on radionuclide and radionuclide matrix.

Status: Capability available at PNL.

Estimated Cost: $50/analysis for evaporation.
$50/analysis for γ spectrometry
$50/analyses for β-γ spectrometry
$25/analyses for total α and β- counts.

References:

W. L. Nicholson, J. E. Schlosser and F. P. Brauer, "The Quantitative Analysis of Sets of Multicomponent Time Dependent Spectra from Decay of Radionuclides," Nuclear Instruments and Methods, vol 25, 45-66, 1963.

F. P. Brauer, J. H. Kaye and R. E. Connally, "X-ray and Beta-Gamma Coincidence Spectrometry Applied to Radiochemical Analysis of E vironmental Samples," Radionuclides in the Environment, American Chemical Society, Washington, DC, pp 231-355, 1970.

R. E. Connally, W. A. Mitzlaff and F. P. Brauer, "Four-Input Multiplexer for Two-Dimensional Gamma-ray Spectrometry," IEEE Trans. on Nucl. Sci. NS-17, 3, pp 440-445, 1970.

F. P. Brauer, J. H. Kaye, J. E. Fager, W. A. Mitzlaff and H. G. Rieck, Jr., "A Dual Ge(Li)-Dual NaI(Tl) Gamma-ray Spectrometer Spectrometer," Nucl. Instr. and Meth. 102, pp 223-235, 1972.

F. P. Brauer, R. E. Connally, H. G. Rieck, Jr., "An Anticoincidence Shielded Multiple-Coincidence Gamma-Ray Scintillation Slectrometer," Trans. Am. Nucl. Soc., vol 15, p 153, 1972.

F. P. Brauer, J. E. Fager and W. A. Mitzlaff, "Evaluation of a Large Ge(Li) Detector for Low-Level Radionuclide Analysis," IEEE Trans. on Nucl. Sci., vol NS-20, pp 57-64, 1973.

F. P. Brauer, J. H. Kaye and J. E. Fager, "NaI(Tl)-Ge(Li) Coincidence Gamma-Ray Spectrometry for Radionuclide Analysis of Environmental Samples," IEEE Trans. on Nucl. Sci., NS-22, pp 661-670, February 1975.

b) ^{60}Co, ^{106}Ru, ^{129}I

Sample Required: 50 to 400 liters in polythylene tank or over 400 liters through field anion-exchange sampler.

Method: Add iodine spike, concentrate sample by anion-exchange, gamma spectrometric measurement of ^{60}Co, ^{106}Ru and any other gamma absorbed on resin, remove iodine from resin by oxidation and measure ^{129}I and natural iodine by neutron activation analysis.

Detection Limit:	^{60}Co	0.1 pCi
	^{106}Ru	1.0 pCi
	^{129}I	10^{-5} pCi

Status: Capability available at PNL.

Estimated Cost: $400/analysis including ion-exchange concentration.

$300/analysis for ^{129}I analysis of ion-exchange resin.

References:

F. P. Brauer, H. G. Rieck, Jr., "^{129}I, ^{60}Co and ^{106}Ru Measurements on Water Samples from the Hanford Project Environs," BNWL-SA-4478, Battelle-Northwest, 1973.

F. P. Brauer and N. E. Ballou, "Isotopic Ratios of Iodine and Other Radionuclides as Nuclear Power Pollution Indicators," Isotope Ratios as Pollutant Source and Behaviour Indicators, IAEA-SM-191/20, International Atomic Energy Agency, Vienna, 1975.

F. P. Brauer and H. Tenny, "^{129}I Analysis Methodology," BNWL-SA-5287, April 1975.

F. P. Brauer, and J. H. Kaye, "Detection Systems for the Low-Level Radiochemical Analysis of Iodine-131, Iodine-129 and Natural Iodine in Environmental Samples," IEEE Trans. on Nucl. Sci., NS-21 p 496, 1974.

c) HTO

Sample required: 500 ml in sealed glass bottle for each analysis

Method: Purify by distillation, enrich tritium by electrolysis, conversion to gas and count in internal gas proportional counter.

Detection Limit: 0.1 TU (0.32 pCi/l)

Status: Equipment on hand at PNL, about $10,000 required to set up, test and calibrate system. A limited number of analyses can be performed by the Tritium Laboratory (H. G. Östlund) at Rosenstiel School of Marine and Atomospheric Science, University of Miami, Miami, Florida.

Estimated Cost: $200/analysis at Miami.

References:

J. F. Cameron, Radioactive Dating and Methods of Low-Level Counting, IAEA-SM-87/25, Vienna (1967) 543-569.

H. G. Östlund, Tritium in the Physical and Biological Sciences, IAEA, Vienna (1962) 95-102, 333-338.

d) U, Pu, Am, ^{90}Sr

Sample required: 50 liters in polyethylene carboy for each set of analysis.

Method: Add carrier and spikes, concentrate sample by evaporation or co-precipitation, separate by ion-exchange, purify fractions by standard radiochemistry, measure uranium by isotope dilution mass-spectrometry, measure plutonium and americium by alpha energy analysis, measure ^{90}Sr by beta counting.

Detection Limit:	U	5 ng
	^{238}Pu & $^{239+240}Pu$	0.02 pCi
	^{90}Sr	2 pCi

Status: Capability available at PNL.

Estimated Cost:	U	$300/analysis including isotopic analysis
	Pu	$450/analysis
	Am	$500/analysis
	^{90}Sr	$550/analysis
	Pu & Am	$650/analysis
	Pu, Am & ^{90}Sr	$1100/analysis

References:

J. E. Gindler, The Radiochemistry of Uranium, NAS-NS-3050, (1962).

G. H. Coleman, The Radiochemistry of Plutonium, NAS-NS-3058, (1965).

IAEA Panel, Reference Method for Marine Radioactivity Studies II, IAEA Technical Report 169, Vienna (1975) 5-32, 69-86.

IAEA Panel, Reference Method for Marine Radioactivity Studies, IAEA Technical Report 118, Vienna (1970) 51-57, 93-118.

e) ^{14}C

Sample required: 50 to 100 liters in polyethylene carboy for each analysis.

Method: Acidify and heat to liberate CO_2, trap CO_2 as $SrCO_3$, convert to gas and count in internal gas counter.

g) <u>$^{18}O/^{16}O$ and D/H</u>

Sample required: 500 ml in full glass bottle for each analysis

Method: Mass spectrometry.

Detection Limit: $\pm 0.2\%$ differences can be detected for $^{18}O/^{16}O$, $\pm 2\%$ for D/H.

Status: Analysis capability for $^{18}O/^{16}O$ at Teledyne Isotopes, 50 Van Buren Ave., Westwood, New Jersey 07675. Contact D. Donald Schutz, (201) 664-7070. FTS 88-342-9500 for operator. There is no commercial D/H service available according to several contacts. Dr. Peter Deines of Penn State (FTS 88-445-7152, LD (814) 865-7152) would consider doing analyses for D/H and $^{18}O/^{16}O$ also maybe ^{14}C if it could be worked in as part of a masters degree research program. Would probably not be very expensive. He was recommended by L. Herzog (FTS 88-722-3311, (814) 238-0541) of Nuclide Corporation.

Estimated Cost: $40/analysis plus shipping for $^{18}O/^{16}O$ at Teledyne Isotopes.

References:

IAEA Working Group, "Guidebook on Nuclear Techniques in Hydrology," IAEA Technical Report 91, Vienna (1968) 5-6.

h) $^{15}N/^{14}N$ and Total Nitrogen

Sample Required: 500 ml sample in a glass bottle is recommended.

Method: Reductive pyrolysis is used to convert nitrogen species to ammonia, total nitrogen is measured by a conductivity detector and the $^{15}N/^{14}N$ ratio is measured by mass spectrometry.

Detection Limit: 20 μg of nitrogen and ±0.5% differences in $^{15}N/^{14}N$.

Status: Capability available at ORNL (R. L. Walker).

Estimated Cost: $50/analysis. (have not contacted)

References:

R. L. Walker, J. R. Walton, J. A. Carter, D. R. Matthews, "Measurement Systmes for Total N and $^{15}N/^{14}N$ in Plant Tissue, Soil, and Water," Isotope Ratios as Pollutant Source and Behavior Indicators, IAEA-SM-191/25, International Atomic Energy Agency, Vienna, 1975.

2. Sampling. Extreme care must be used to avoid contamination of ground water samples with surface waters and other surface materials. New or laboratory cleaned equipment should be used. Complete rinsing of sample containers with the water being sampled is recommended. Adequate identification to avoid laboratory cross-contamination of samples is required since the concentration differences between fractions can be very large. Specific sample size recommendation

are included in this note for the most significant analysis. Field filtering of samples may be desirable. Collodial material can cause analytical difficulties.

3. Accuracy and Precision. The precision for most radiochemical analyses is calculated from counting statistics. Since the levels of contaminants expected is very low to not detectable, the percentage errors are likely to be large. Generally the precision can be improved by larger sample sizes and longer counting times. The precision often does not adequately reflect the accuracy of the analysis. Even when radiochemical spikes are used the efficiency and recovery of the separation method is in doubt, especially for large volume samples. Replicate analyses serve to measure the reliability of the precision estimates (ramdom error) but may not detect procedure defects (systematic error). Separations by several different methods at the same or separate laboratories is required to assure a high degree of accuracy. The accuracy of measurement methods generally can be more easily checked with standards than can the reliability of separations and sampling procedures.

Analysis errors which result in high values for low contamination level water samples are considered more likely than errors which may result in low values. In order to save analytical costs it is recommended that a duplicate analyses only be run after a positive result (significantly above detection limit) is obtained on the confined aquifers. Positive values should be checked by more than one method when possible or by

analysis of different sample volumes and spiked samples. Thus sample concentration by boiling, ion-exchange and co-precipitation are all recommended where applicable.

Should duplicate or replicate analyses be desired, then the analysis selection should be designed to measure both the random errors and the systematic errors when possible. Thus duplicate analyses on homogenous sample fracitons using the same procedure can be used to estimate the random error. Estimation of the systematic error is more difficult and requires a separate evaluation for each sample and analysis type.

4. Costs. Analytical costs have been estimated for the expected major constituents. These estimates do not include "set-up" and method development costs or costs associated with quality control and analysis of standards and blanks.

In addition to the radiometric analyses, selected nonradioactive constituents should be determined and evaluated. These constituents are: Standard water quality analysis suite (pH, conductivity, Ca, M_g, Na, CO_3+ HCO_3, K, B. No_3, Cl, SO_4, and TDS); "Metals" (Al, Sb, Ba, Be, Cr, Co, Cu, Pb, Mn, Mo, Ni, Sr, Ti, Zn); organics (TOC) and Sio_2.

All of the analyses are conducted by United States Testing Co., Inc. Methods defined in "Space Standard Methods for the Examination of Water and Waste Water", 13th Edition, 1971 (APHA, AWWA, WPCF) are used for the standard water quality analysis. Analysis for "Metals" is routinely done by the straight atomic absorption method. Consideration should be given to lowering the detection limit for metals by use of the carbon rod

ANALYSIS

Major Constituents	$/analysis
Gamma radioactivity	100
$^{60}Co + ^{106}Ru + ^{129}I$	400
HTO	200
NO_3^-	?
^{14}C	150
^{99}Tc	500
$^{18}O/^{16}O$	40

Other Constituents	
U	300
Pu+Am+^{90}Sr	1100
D/H	?
Organics	?

furnace in conjuction with the atomic absorption spectrometer. Analysis for total organic carbon (TOC) is made by the infrared combustion method. Silica measurement is done by the molybdosilicate colorometric method.

Analytical costs are as follows (for batches of 10 samples or more):

Str. Water quality suite - $25.00 ea

Metals (average cost/element) - $4.00 ea

TOC - $25.00 ea

Silica - $6.00 ea

Recommended Sampling Frequency

The few applicable existing wells and the additional wells that will be completed under this proposed program should be sampled initially and samples analyzed for all of the parameters previously discussed. An evaluation of these results should be made to select the analyses that best indicate the water quality status of the confined aquifer. These parameters should be analyzed for samples taken quarterly over a period of one year to establish statistical validity of the sampling and analytical procedures. At the end of this sampling period, the data should permit determination of the contamination status of the confined aquifers. If contamination is confirmed, then the program should be expanded by additional sampling points (both in depth and areal extent) to delineate the extent of contamination, and sampling and analyses revised to indicate water

quality as defined by the expanded well network. If the confined aquifers are found to be free of contamination, the existing wells should be sampled at annual intervals to monitor water quality and provide baseline data.

REFERENCES

1. R. K. Ledgerwood, and R. A. Deju, "Hydrogelogy of the Uppermost Confined Aquifers Underlying the Hanford Reservation." ARH-SA-253, Atlantic Richfield Hanford Co., Richland, WA (March, 1976).

2. F. P. Brauer and R. M. McFadden, "^{129}I, ^{60}Co and ^{106}Ru Measurements on Water Samples from the Hanford Project Environs, 1962-1974." Battelle Pacific Northwest Laboratories Unpublished Report Draft, July 25, 1975.

3. Randall E. Brown and Fred B. Steele, "A Study of the Uppermost Confined Aquifer in the Basalt Sequence." Battelle Pacific Northwest Laboratories Unpublished Report Draft, July, 1970.

4. R. E. Brown - Personal Communications.

~~REG.~~ (P.A.E.)

Please prepare a letter report capable of being sent to ERDA - structure it as follows:

SUMMARY

INTRODUCTION

a one page or less summary of what has been done to date; a statement of the purpose of this report, that is, to set up a plan for gathering confined aquifer information.

EVALUATION OF CONFINED AQUIFER DATA

Chemical Contamination include data ring tests

Hydraulic Properties " " "

PLAN FOR ASSESSING PROPERTIES OF THE CONFINED AQUIFER AND EXTENT OF CONTAMINATION

loc. of drilling structures

Type of structures

put in an appendix the analytical methods & references

analyses to be done

cost figures & time for implementation

REFERENCES

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Dr. Neil Coleman MS 62355

HYDROLOGY

Groundwater Hydrology - R. A. Deju

This activity is aimed at obtaining the hydrologic data needed to characterize the Hanford groundwater flow regime, developing predictive models of groundwater flow, and developing management and control strategies to avoid groundwater contamination.

Water table measurements were taken in December 1976 and will be interpreted during January 1977. A map of the water level of the unconfined aquifer will be issued at that time. Information obtained from the water level monitoring program has been filed in our computer data bank.

Plans for drilling six research wells in the unconfined aquifer to test the hydrologic properties were laid out during fiscal year 1976. These plans were to be implemented during fiscal year 1977, but they have been posponed for a year due to lack of funding. Pump tests throughout the aquifer will be conducted at six existing sites to assess the aquifer's hydrologic conductivity and porosity. Three wells will be drilled into the deeper confined aquifers and pump tests conducted to assess the hydrologic properties of these aquifers.

As part of the geophysical logging program, the physical and hydrologic properties of selected core well samples were correlated with log responses. A range of hydrologic and physical properties are being assigned to each lithologic unit found to be significant in basinwide groundwater movement. A report is being prepared on the development of geophysical correlation techniques that can apply to the unconsolidated sediment underlying the Hanford Reservation.

Work continued in constructing preliminary isopack maps of the formations underlying the Hanford Reservation. Maps

of the top of the basalt, the bottom of the unconfined aquifer, and the sequences of clay layers are being prepared using driller logs and core sample descriptions.

In the mathematical modeling area, work was conducted to provide the methods necessary to extend arrival distribution concepts to practical Hanford hydrologic problems. It is expected that application for such functions in a man-computer interactive environment will permit rapid preparation of environmental assessments. A program has been developed to allow pump test data to be entered into the computer data file and a full hydrologic evaluation to be conducted by the computer. Work also continued on the evaluation of the Gupta three-dimensional groundwater model and the assessment of its application to Hanford.

The document, BNWL-2127, "MMT-DPRW Transport Model: Theory and Numerical Implementation," November 30, 1976, was received for review and will be published upon completion of the reviewing processes. All work to date is on schedule and all milestones during the quarter were met.

Offsite Migration - R. A. Deju

This activity is aimed at determining the concentration and ultimate fate of any radionuclides that may be present or could potentially contaminate the confined aquifers underlying the Hanford Reservation. This information is needed to assure isolation of Hanford radioactive wastes from any users of water from the confined aquifer outside of and adjacent to the Hanford Reservation.

A study to characterize the lithologic and hydrologic properties of interbeds found between flows of the Columbia River Basalt Group was completed during the quarter. A

draft of the report documenting the study has been reviewed and will be issued by January 31, 1977. This study concluded that these interbeds are extremely clayey and variable in their hydrologic properties. Geochemical information on the interbeds cannot be used for correlation purposes. Plans were drafted to sample additional wells in the confined aquifers and examine migration of contaminants offsite through these aquifers.

The first sampling period was in late December 1976. These samples will be analyzed and reported subsequently. The analytical program includes a series of quality assurance constraints. All work to-date is on schedule and all milestones during the quarter were met.

Radionuclide Migration in Groundwater - R. A. Deju

This activity is dedicated to definition of the main channels of radionuclide migration through the groundwater pathway and to reduction of radionuclide transport throughout these channels. Such objectives are obtained by conducting geological, geophysical, and geochemical studies.

The gravity program is continuing to determine the shape and location of the ancestral buried channels of the Columbia River. All gravity data collected during the summer of 1976 have been compiled as part of the three-dimensional modeling effort to plot the shape of the uppermost basalt surface and determine the depth to bedrock. A report on two-dimensional Talwani models is being completed. This report will discuss the variations in the anticlinal-synclinal framework of the Reservation and should point out areas of low density outwash which behave as rapid-traveling regions for radionuclide transport.

A contract has been prepared and released in December 1976 to prepare a report examining the three-dimensional variation in hydrologic properties of the Hanford groundwater regime.

Four sediment samples have been selected for use in the radionuclide sorption experiments. The samples were taken from cores in the saturated zone of two wells (299-W11-26 and 699-54-176). They can be classified as silty, sandy gravel; calcareous, sandy silt; and sandy silt. The sediment samples have been screened and separated into gravel, sand, and silt-clay fractions. Duplicate samples of each have been mounted in epoxy resin and polished for electron microprobe examination.

Laboratory equipment for experiments have been ordered. All work to-date is on schedule and all milestones during the quarter were met.

Long-Term Groundwater Management - R. A. Deju

This activity is aimed at identifying potential ways in which high-level wastes can come in contact with groundwater, and examining the potential impact to the groundwater regime of past and projected activities in the high-level waste storage areas.

Plans for the establishment of piezometers throughout the Hanford Reservation have been completed and contracts for their installation have been put out for bids. These piezometers furnish the means of detecting vertical, as well as horizontal, contamination from the 200 Areas. A study entitled "Geohydrologic Study of the West Lake Basin" summarizes the extent that the unconfined aquifer is affected by waters from Gable Mountain Pond and B Pond. This study

was issued in October 1976. A similar study is being prepared for U Pond. Mathematical models are being used to assess the environmental impact of these facilities.

A contract was released for pump testing wells in the Cold Creek Valley. This program is aimed at determining the amount of recharge into the Hanford Reservation throughout the confined aquifer that enters through the Cold Creek area. All work to-date is on schedule and all milestones during the quarter were met.

To: Neil Coleman MS 623SS

IODINE 129 WORKING GROUP • JANUARY 1987

FILE NUMBER	FILE TITLE	FILE CONTENT

0 INDEX AND CARD FILE LISTING

1 ARHCO TEST WELLS • RADIOCHEMICAL ANALYSIS

ARHCO Test Wells Radiochemical Analysis

2 BNWL Analytical Reports • 1970

12 Month Analytical Reports

3 BNWL Analytical Reports • 1971

12 Month Analytical Reports

4 BNWL Analytical Reports • 1972

12 Month Analytical Reports

5 BNWL Analytical Reports • 1974

12 Month Analytical Reports

6 BNW Iodine Analysis • IRA Reports 5 & 6

IRA Report 5 • BNW Iodine Analyses Results on Well Water Samples
Encloses Standard Error (Computer Run • 27 Pages)

IRA Report 6 • BNW Radiochemical Analysis on Well Water Samples
Encloses Standard Error (Computer Run • 19 Pages)

Also see RCR 1 on Bookcase

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Letter, July 14, 1972, G. R. Kiel to L. J. Kirby, "Groundwater Sampling and Analytical Schedule Atlantic Richfield Hanford Company"

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Subcontract No. ARHCO - SA-159"

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Sample Observations"

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Review of Suggestions Made by Charles Rosenoff

Letter, March 2, 1973, F. R. Vollert to W. P. Ingalls, "Structural Condition
of Building 120-F; The P-11 Facility"

Soil Sampling Chart - Arrowsmith from Wahluke Slope

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8 Groundwater Sampling & Analytical Schedule

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10 ATMOSPHERIC RELEASE

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11 ATTORNEY WORK PRODUCT

Letter, September 4, 1986, R. S. Gruhn to R. M. Carter/D. L. Sander "Protecting Work Done by Others as 'Attorney Work Product'" (Blank Cover Sheets)

12 BATTELLE COMPUTER RUNS

List of PNL Controlled Sampling Periods

13 PNL Water Data

Computer Runs - November 20, 1986

I-127/I-129 - I-127 Results on Well Water Samples as of 12/31/85

I-129 (10^{-6})pCi/l (Fred Brauer Data)

PNL Analyses of Well Water Samples Sorted By Well and Date, January 12, 1987

Battelle Iodine-129 Sample Result Data Base (Date Sort), (Formerly IRA Numbered Computer Runs), January 12, 1987

14 Computer Run Subsets to Rockwell

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Letter, October 10, 1986, F. P. Brauer to P. J. Mitchell, "Well Water Iodine-129 Analyses"

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17 BRAUER-McFADDEN, "I-129, Co-60, & Ru-106 MEASUREMENTS ON WATER SAMPLES FROM THE HANFORD PROJECT ENVIRONS 1962-1974"

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19 Early August 1975

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29 Confined Aquifer Radio-Isotope Data (Ash to Olson, Drafts and Letters)

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Letter, October 11, 1985, L. R. Fitch to O. L. Olson, "Response to Instructions From R. E. Browning, Director, Division of Waste Management, Nuclear Regulatory Commission, on Clarification of Iodine-129 Issues"

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31 Historical/Political

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31A Library Search

32 NRC Interface (Correspondence & Notes)

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35 Work Orders/Cost Estimates

Work Order, CD-6861, 5/29/86, "Prepare Technical Procedures for measurement of low-level fission products in BWIP groundwater samples and conduct associated personnel training.

36A CASP DATA (CORRESPONDENCE AND MISCELLANEOUS)

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