START

0023441

Meeting Minutes Transmittal and Approval
RCRA Groundwater Monitoring Program
ETC-1, Room 42
Richland, Washington
June 16, 1992

Approval: M. J. Furman Date: 8 18 92
M. J. Furman, U.S. Department of Energy
Richland Field Office

Approval: K. Kowalik Date: 8/25/92
K. Kowalik, State of Washington
Department of Ecology

Attendees

U.S. Department of Energy-Richland Field Office

M. J. Furman A5-60

State of Washington Department of Ecology

K. Kowalik

Westinghouse Hanford Company

J. E. Auten L4-58
F. N. Hodges H5-29
R. L. Jackson H4-56
J. F. Keller L4-78
A. J. Knepp H4-56
K. D. Reynolds H5-29
R. R. Thompson L4-88
B. A. Williams H4-56

United States-General Administrative Office

Trope Curry A1-80
Chris Abraham A1-80

Distribution

Attendees
M. R. Adams H4-55
K. R. Fecht H4-56
D. G. Horton H4-56
R. E. Lerch B2-35
M. Marratt H4-56
S. M. Price H4-57
W. H. Price N3-05
R. A. Ruck III H4-57
D. S. Takasumki L4-78
R. D. Wojtasek L4-92
EDMC H4-22

Meeting minutes are attached. Meeting minutes are comprised of the following:

Attachment 1 - Summary Meeting Minutes
Attachment 2 - Agenda
Attachment 3 - RCRA Drilling Status
Attachment 4 - NRDWL Landfill Groundwater Monitoring Program
Attachment 5 - Status on ODEX Drilling
Attachment 6 - Proposed RCRA Drilling CY 1993

SEP 1992
RECEIVED
EDMC

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SUMMARY MEETING MINUTES

June 16, 1992 Meeting

1. **Agenda** Refer to Attachment 2 for the agenda of the meeting. The primary purpose of this meeting was to:

   - Provide an overview of the Nonradioactive Dangerous Waste Landfill (NRDWL) groundwater monitoring program in order to justify well locations for CY 92 drilling
   - Provide a status on ODEX drilling
   - Provide progress on well drilling associated with Tri-Party Agreement Milestone M-24-00
   - Provide proposed well locations for CY 1993.

2. **Calendar Year 1991 Drilling Status** - Mr. B. A. Williams provided the drilling status. The following progress has been made towards RCRA monitoring well installation (see Attachment 3).

   CY 1992 RCRA drilling milestone status (as of June 16, 1992):

   - Milestone M-24-19, install 10 wells at LLBG-Six wells are sample ready, three wells are ready for well development, and one well is waiting on surface pad and posts.
   - Milestone M-24-20, install two wells at Grout Treatment Facility-One well is waiting on pad and posts, and the remaining well is being drilled.
   - Milestone M-24-21, Install two wells at 1301-N Crib-Both wells are waiting on development.
   - Milestone M-24-22, install one well at 1324-N Cribs-Well has been staked.

DOE-RL: [illegible] 8/25/92
Ecology: K.S. 8/25/92

9 2 1 2 6 6 2 1 2 8 9

- Milestone M-24-23, install one well at S-10 Pond and Ditch-Well, is ready to be drilled.
- Milestone M-24-24, install two wells at B-63 Trench-Both wells are completed and waiting on pad and posts.
- Milestone M-24-25, install two wells at A-29 Ditch-Well locations have been staked.
- Milestone M-24-26, install two wells at Non-Radioactive Dangerous Waste Landfill (NRDWF)-Wells have been staked. The groundwater monitoring plan is being finalized.
- Milestone M-24-27, install two wells at B-Pond-Wells have been staked.
- Milestone M-24-28, Install two wells at Single Shell Tanks-Wells have been staked. Drilling should commence this week.

ACTION: Ms. Kowalik requested that the U.S. Department of Energy (RL) provide a drilling schedule to her by July 7, 1992.

3. Calendar Year 1992 RCRA Well Locations

NRDWL - Mr. F. N. Hodges presented the groundwater monitoring program for the NRDWL (see Attachment 4). Presently the groundwater monitoring network consists of three upgradient wells and four downgradient wells. Two additional wells are planned to insure adequate detection and to separate potential groundwater effects of the NRDWL and from the adjacent Solid Waste Landfill. Due to anticipated long-tern groundwater level declines of more than 15 ft in this area, Westinghouse proposes using 35 ft screen length rather than the standard 15 ft as required by Tri Party Agreement Milestone M-24-00.

ACTION: Ms. Kowalik will review the proposed locations and provide concurrence prior to drilling.

Westinghouse Hanford Company will prepare letter justifying longer well screens for the NRDWL location.

DOE-RL: 8/26 92 [illegible]
Ecology: 8/25/92 [illegible]

9 2 1 2 6 6 2 1 2 9 0

4. Calendar Year 1993 Proposed Locations

Mr. R. L. Jackson discussed the proposed well locations for the CY 1993 M-24-00 Milestone. Wells are planned at the 1325-N Area (2), Low Level Burial grounds (2), and Grout Treatment Facility (3) (see Attachment 5). The reduced number of wells is attributed primarily to essentially reaching completion of the shallow monitoring network around 20 TSD facilities.

> **ACTION: The RL will prepare a change request reflecting CY 1993 drilling for Ecology's review and comment.**

5. ODEX Drilling

Mr. K. D. Reynolds provided preliminary results on ODEX air rotary drilling (see Attachment 6). ODEX was tested on three RCRA-compliant groundwater monitoring wells at the Low Level Burial Grounds and Grout Treatment Facility. Preliminary results indicate significant costs saving will be incurred by using ODEX for the installation of RCRA wells under Tri Party Agreement Milestone M-24-00.

Plans are underway to:

- Continue evaluation of the technology in accordance to performance criteria as defined the ODEX test plan
- Develop new sampling techniques
- Adapt technology to larger diameter wells for pump and treat
- Configure drill rig for deeper drilling (eg. greater than 600 ft).

6. Tri Party Agreement Milestone Change Requests

The need to formalize change request M-24-91-4 was discussed.

> **ACTION: Formal agreement of interim milestones as defined in change request M-24-91-4 will be finalized by RL and concurred by Ecology.**

The RL has received public comments on change request M-24-91-6. This change request was initiated to allow flexibility in the number of wells to be drilled per year.

DOE-RL: MJT 8/25/92
Ecology: 8/25/92 R.E.

9 2 1 2 6 6 2 1 2 9 1

ACTION: RL is preparing letter addressing public comments on change request M-24-91-6. Public comments did will not affect the overall content of the change request.

Ecology agreed that four TBD wells defined in change request M-24-91-6 will be deferred until CY 93 with the provision that the all eleven remaining wells are completed prior to exercising the option to delay.

7. Well Variance Protocol

The RL reiterated their commitment to comply with the well variance protocols defined by Ecology (see reference letter: T. M. Michelena (Ecology) to M. Furman (RL), "Variance Procedure for Drilling Activities at Hanford Site," February 25, 1992).

8. Next Meeting

The next monthly meeting will be held in Richland on July 29, 1992.

DOE-RL: MJF 8/25/92
Ecology: K. Kanhi 8/25/92

9 2 1 2 6 5 2 1 2 9 2

06/04/92

AGENDA

RCRA GROUNDWATER MONITORING PROJECT

U. S. Department of Energy-Richland Operations Office
Washington State Department of Ecology
Westinghouse Hanford Company

June 16, 1992, 08:00A

ETC-1, Room 42
Richaland, Washington

- Opening Remarks-K. Kowalik (WDOE)/M. J. Furman (DOE-RL)
- Groundwater Monitoring Program for the Non-Radioactive Dangerous Waste landfill-F. N. Hodges
- Status on the ODEX Drilling Methodology-K. D. Reynolds/J. E. Auten
- RCRA Groundwater Drilling Status-B. A. Williams
- Status on Approval of Change Requests #4 and #6-K. Kowalik/M. J. Furman
- Planning for CY 93 Drilling-R. R. Thompson/R. L. Jackson
- Well Variance Reporting Status-K. Kowalik
- Facility Groundwater Monitoring Network Review-K. Kowalik
- Action Items and Next Meeting-K. Kowalik/M. J. Furman

92126521293

RY

F. N Hodges	WHC-GG	6-4627	H5-29
JOHN E. AUTEN	WHC-PROJECTS	6-9931	L4-78
		6-9780	H4-56
Ronald L. Jackson	WHC-		
M. J Furman	DOE-RL		
KRYSTYNA KOWALIK	ECOLOGY	(206)438-7526	LACEY
JOHN F. KELLER	WHC	2-0239	L4-78
R. Rex Thompson	WHC	6-9988	L4-88
KD Reynolds	WHC	2-0540	H5-29
Duane Curry	US-GAO	6-9354	
Chris Abraham	US-GAO	6-8336	A1-80
A. J. Knepp	WHC	6-3398	H4-56
B.A. WILLIAMS	WHC	6-3416	

CY 1992 RCRA WELL DRILLING AND INSTALLATION SUMMARY
June 16, 1992

Twenty six well locations identified and staked. State may select four additional locations for a total of thirty.

Three Odex test wells have been drilled and completed. RCRA wells W6-11, W6-12 and E25-44 were successfully completed utilizing the Odex rotary equipment.

Nine RCRA wells are waiting on development. Purge water truck shortages account for the delay. Development of these nine wells will complete milestones for LLBG, 1301-N, and B-63.

Scheduled for June is the drilling of the two SST wells. Expected approval of the Odex will allow Projects to proceed with one or two rigs for the remaining nine locations. Projects has indicated that Cable tool rigs will be available as needed.

CY 92 TPA MILESTONE WELLS	30
SAMPLE READY WELLS	6
COMPLETED WELLS	9
WELLS TO BE DRILLED	15

MILESTONE STATUS

LLBG (10)(M-24-19)

Sample ready wells-E34-11, E34-12, E32-10, W6-9, W6-10, and W11-31

W10-19	Waiting on pads and posts
W18-32	Waiting on development
W6-11	Waiting on development
W6-12	Waiting on development

9 2 1 2 6 6 2 1 2 9 4

1301-N Crib(2)(M-24-21)

N-75	Waiting on development
N-76	Waiting on development

B-63 Trench (2)(M-24-24)

E27-18	Waiting on pads and posts
E27-19	Waiting on pads and posts

Grout Treatment Facility(2)(M-24-20)

E25-44	Waiting on pads and posts
E25-45	Starter casing installed, Odex start this week

SST(2)(M-24-28)

W22-45	Cable tool start this week
E25-46	Cable tool will start after resolution of excavation problems

A-29 DITCH(2)(M-24-25)

E25-47	Not drilling
E25-48	Not drilling

B-Pond(2)(M-24-27)

699-41-42	Not drilling
699-44-39B	Not drilling

1324-N (1)(M-24-22)

N-77	Not drilling

S-10 Pond and Ditch (1) (M-24-23)

W27-2	Not drilling

NRDWL(2)(M-24-26)

699-25-34B	Not drilling
699-25-34D	Not drilling

TBD (4)

9 2 1 2 6 6 2 1 2 9 5

9 2 1 2 6 6 2 1 2 9 6

THE NONRADIOACTIVE DANGEROUS WASTE LANDFILL

UNIT MANAGERS MEETING

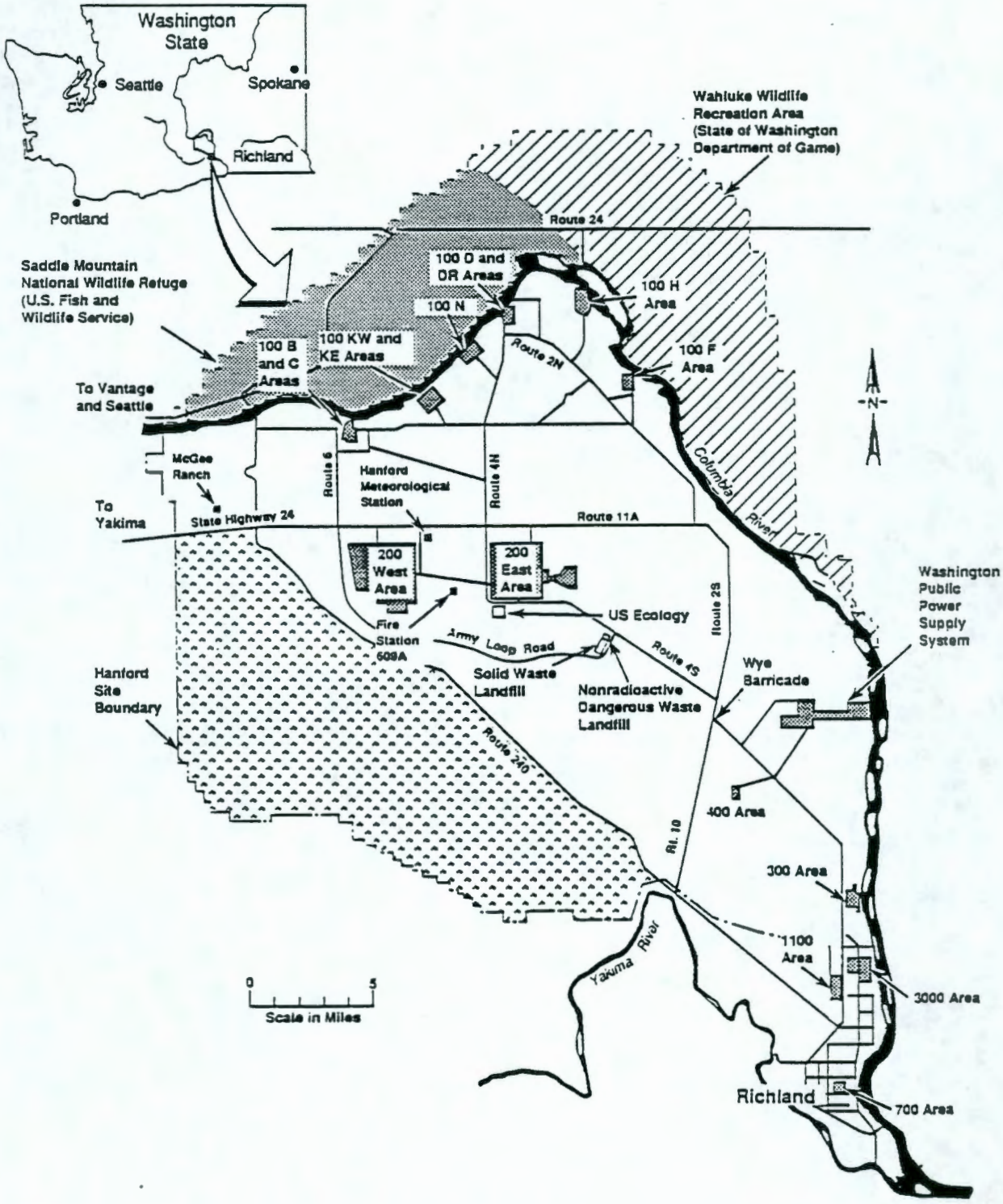
JUNE 16, 1992

FLOYD N. HODGES

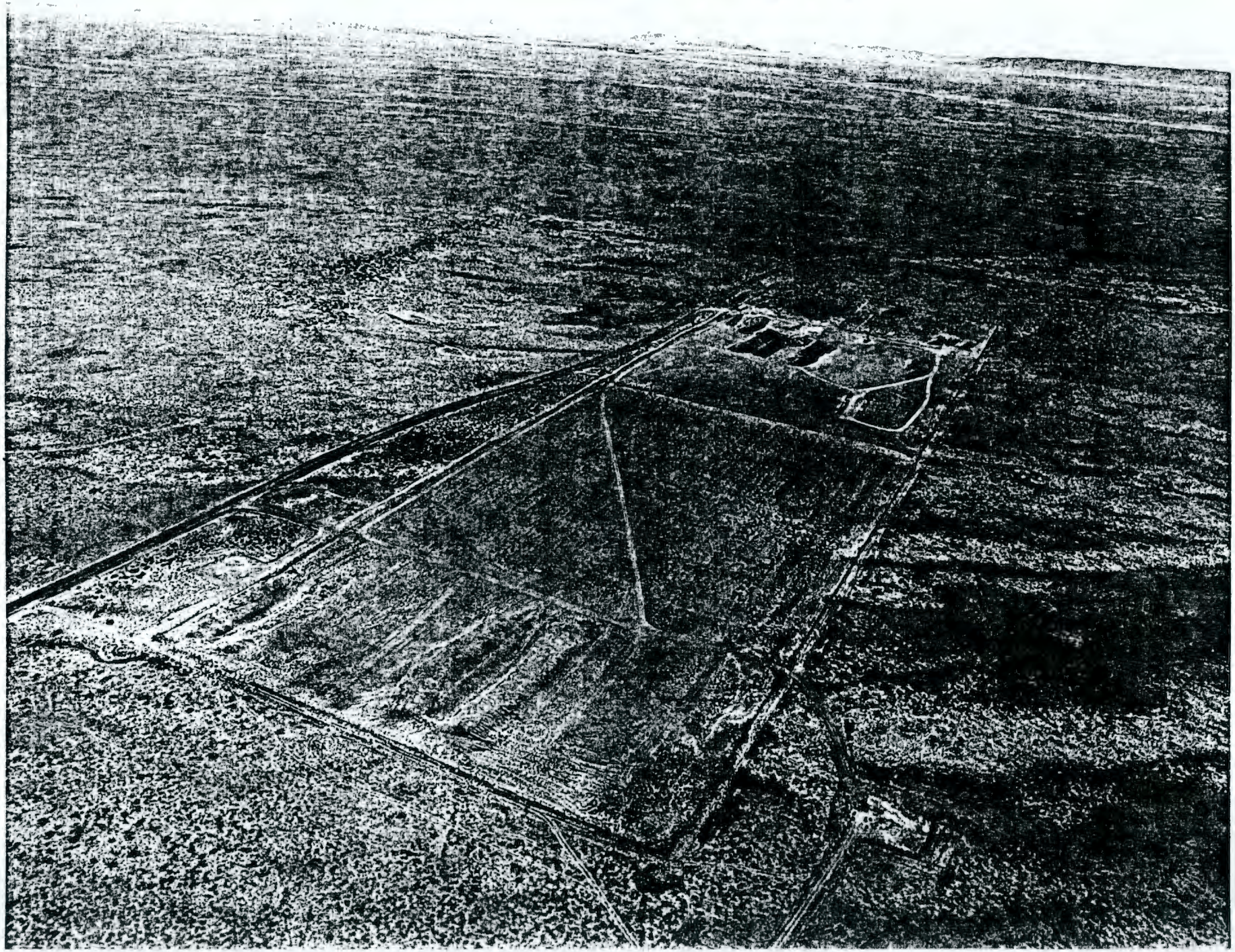
GEOSCIENCES

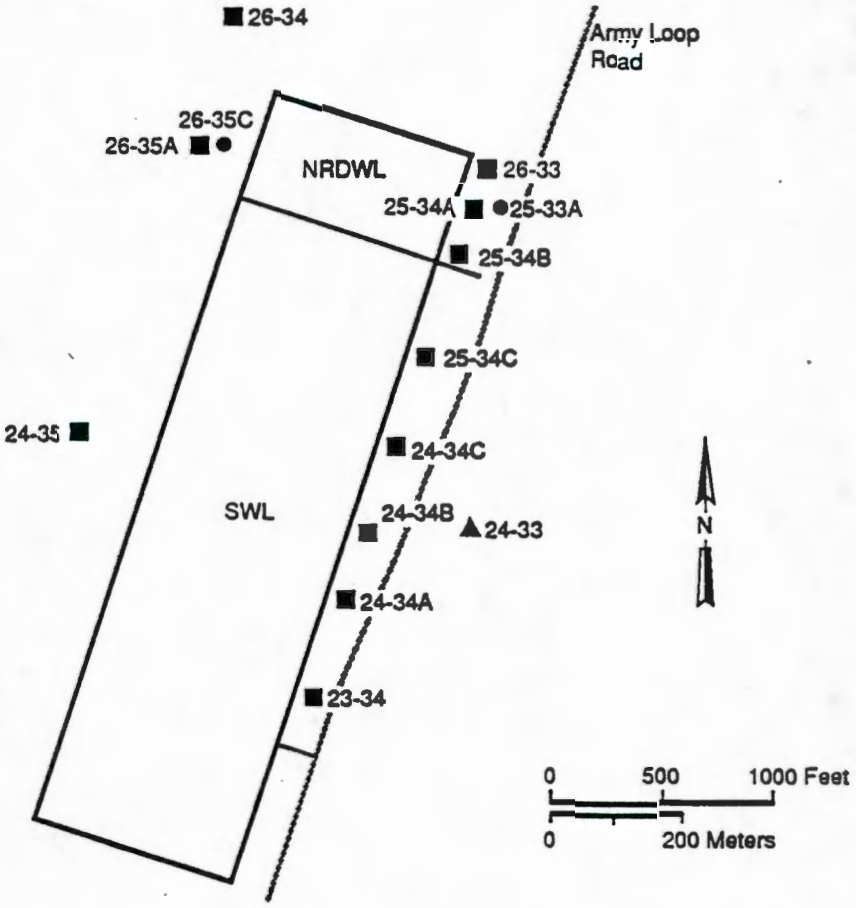
WESTINGHOUSE HANFORD COMPANY

Attachment 4


Washington State
Seattle
Spokane
Richland
Portland
Wahluke Wildlife Recreation Area (State of Washington Department of Game)
Route 24
Saddle Mountain National Wildlife Refuge (U.S. Fish and Wildlife Service)
100 D and DR Areas
100 N
100 H Area
100 B and C Areas
100 KW and KE Areas
Route 2N
100 F Area
To Vantage and Seattle
N
McGee Ranch
Route 6
Hanford Meteorological Station
Route 4N
Columbia River
To Yakima
State Highway 24
Route 11A
200 West Area
200 East Area
Washington Public Power Supply System
US Ecology
Route 2S
Fire Station 609A
Army Loop Road
Route 4S
Wye Barricade
Solid Waste Landfill
Nonradioactive Dangerous Waste Landfill
Hanford Site Boundary
Route 240
400 Area
Rt. 10
300 Area
1100 Area
Yakima River
3000 Area
0
5
Scale in Miles
Richland
700 Area

H9009031.1





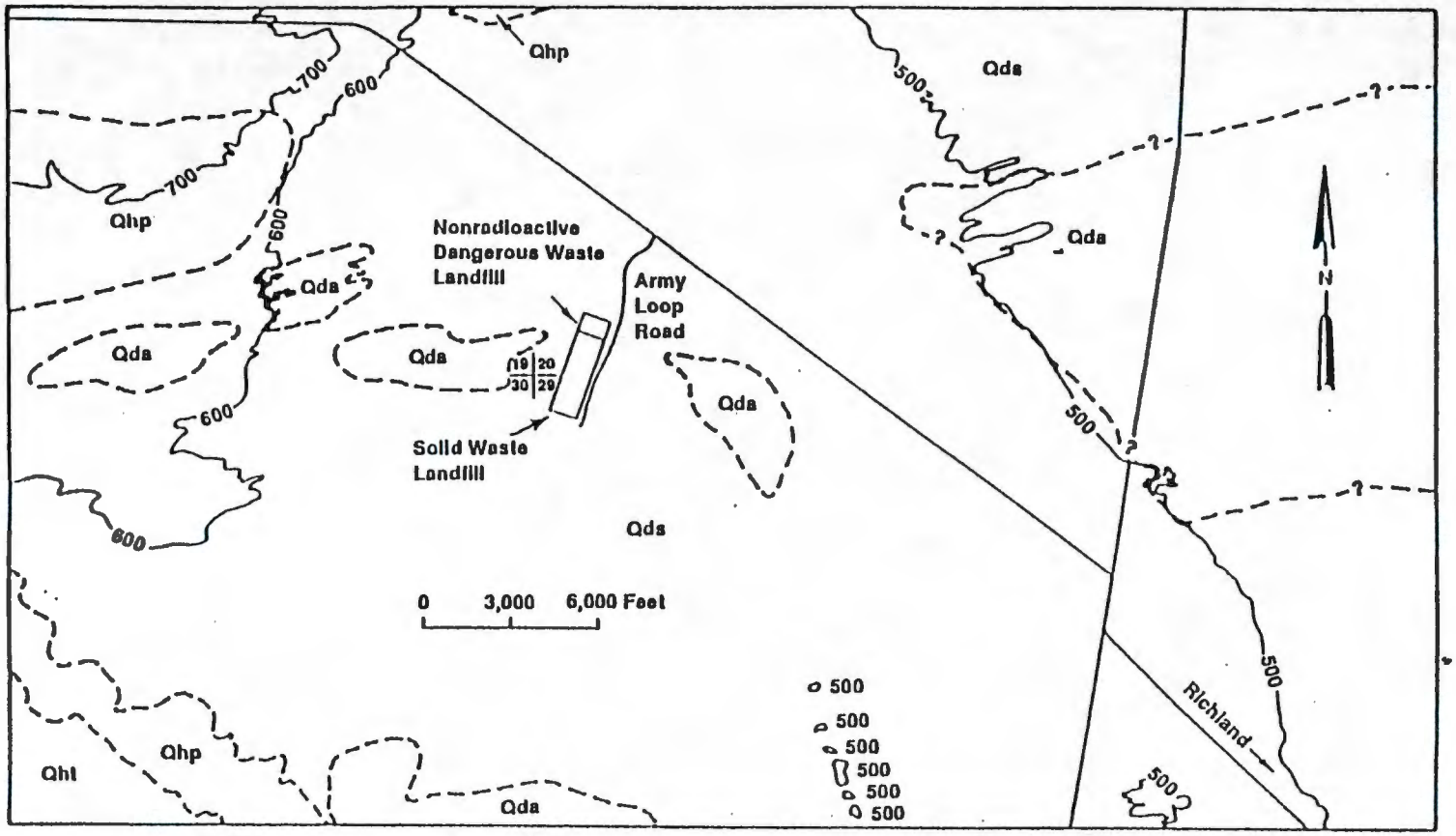
■ Well completed at the top of the unconfined aquifer
● Well completed in the upper Ringold Formation
▲ Well not constructed to RCRA specifications
NRDWL Nonradioactive Dangerous Waste Landfill
SWL Solid Waste Landfill

All wells prefixed by 699-

H9012007.95

9 2 1 2 6 6 2 1 2 9 9

- RECEIVED NONRADIOACTIVE DANGEROUS WASTE 1975 TO 1985
- CONTINUED TO RECEIVE ASBESTOS WASTE UNTIL 1988
- COVERED UNDER 1986 ECOLOGY COMPLIANCE ORDER
- DETECTION LEVEL GROUNDWATER MONITORING PROGRAM INITIATED IN 1986-87
- COVERED UNDER TRI-PARTY AGREEMENT
- CLOSURE PLAN SUBMITTED TO ECOLOGY IN AUGUST 1990

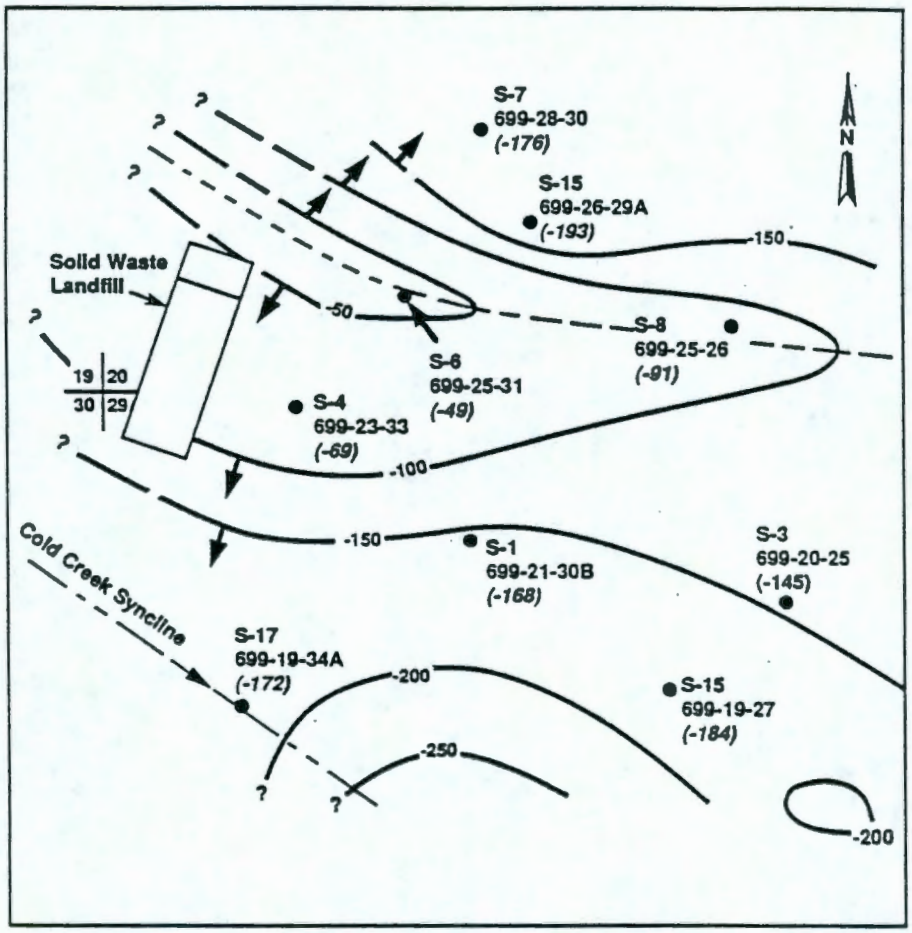


Qda	Active Sand Dunes (Holocene) - chiefly medium-to-fine grained quartz sand
Qds	Stabilized Sand Dunes (Holocene) - chiefly medium-to-fine grained sand
	Hanford Formation (Pleistocene)
Qhl	Touchet Beds - rhythmically bedded silt with stringers of coarse-grained sand and gravel
Qhp	Pasco Gravels - sorting and texture variable, includes sand to boulders

- - - - ?	Contact (question mark where contact indistinct)
—700—	Surface Elevation Contour Line (feet above mean sea level)
———	Road
19 20 / 30 29	Section Corner

3K8102-1 16

PS-90-220



S-6
699-25-31
(-49)

Location and Number of Skagit/Hanford Nuclear Project Drillhole

Elevation (in feet below MSL) of Top-of-Basalt in Parentheses

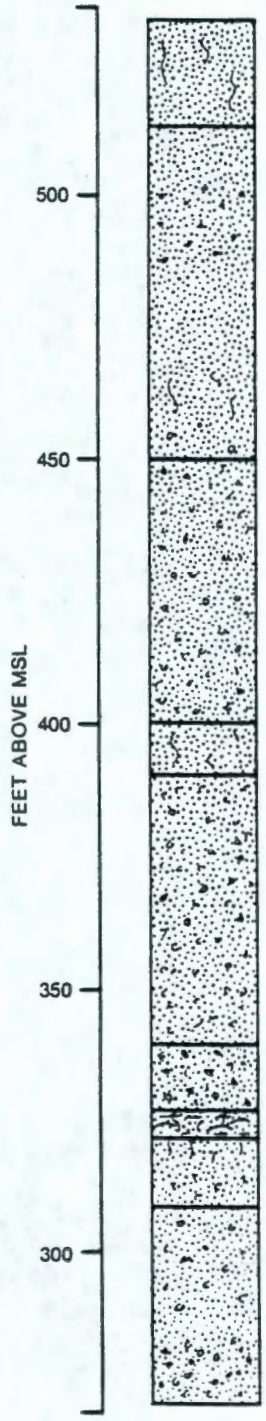
Contour Line; Dashed Where Inferred (Arrow Indicates Dip of Basalt)

Axis of Structure (Arrow Indicates Plunge of Axis)

0 1,000 2,000 Feet

79003151.6

9 2 1 2 6 6 2 1 3 0 2



LITHOLOGY	AGE	STRATIGRAPHIC UNIT	
SAND: Slightly silty. Light Brown. Dominantly quartzose. Variable thickness.	HOLOCENE	DUNE SAND	
SAND: Dominantly basaltic. Gravelly zones present. Thin silty beds with calcite cement occasionally. Ice-rafted boulder encountered in one drillhole.	PLEISTOCENE	PASCO GRAVELS	HANFORD FORMATION
Silty sandy GRAVEL to GRAVEL: Highly variable gravel content. Mostly basalt with subordinate quartzites, granites, and volcaniclastics. Sand lenses common. Cobbles up to 9 inches.			
SAND: Silty. Mostly basalt. Throughout site.			
Gravelly SAND to sandy GRAVEL: Highly variable sand, silt, and gravel content. Mostly basalt gravel with zones of nonbasalt dominance. Lithology similar to gravel above. Minor discontinuous silt lens present.			
Slightly silty gravelly sand to SAND: Thin gravel zones. Quartzose sand. Variable. Mica present	LATE MIOCENE TO EARLY PLIOCENE	UPPER	RINGOLD FORMATION
Clayey SILT: Olive. Hard. Gravel top on west side of Landfill.			
Silty SAND to silty gravelly SAND: Rusty. Micaceous.			
Gravelly silty SAND to sandy GRAVEL: Very rusty quartz common. Variable silt. Predominately nonbasaltic gravel, clasts are basalt, granites, quartzites, and volcaniclastics. Mica common. Cemented.		MIDDLE	

2K8703-1.5

9 2 1 2 6 6 2 1 3 0 3

Well Designation SM-2

Hanford Well Number 699-26-34

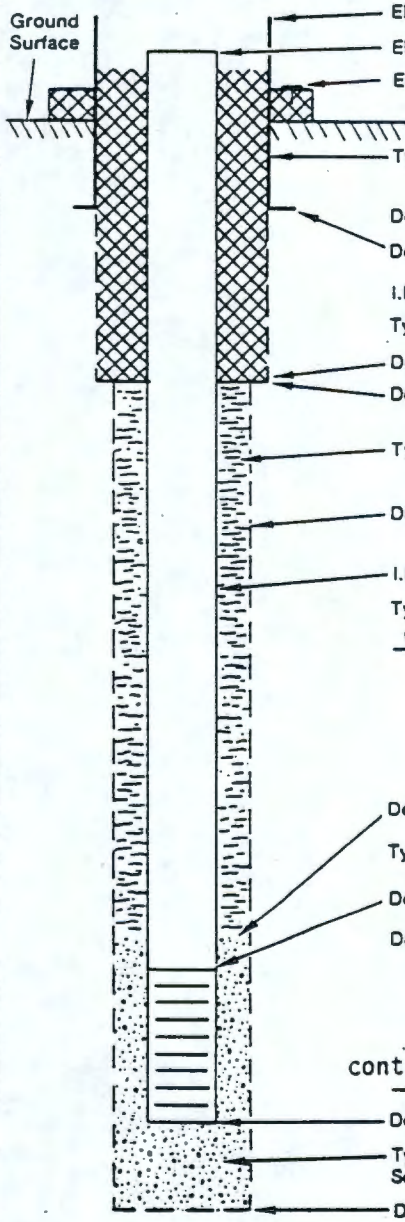
Hanford Coordinates N26,162.95 W24,483.26

Lambert Coordinates N431,376.37 E2,260,774.69

Date Completed 7/3/86

Well Construction Summary

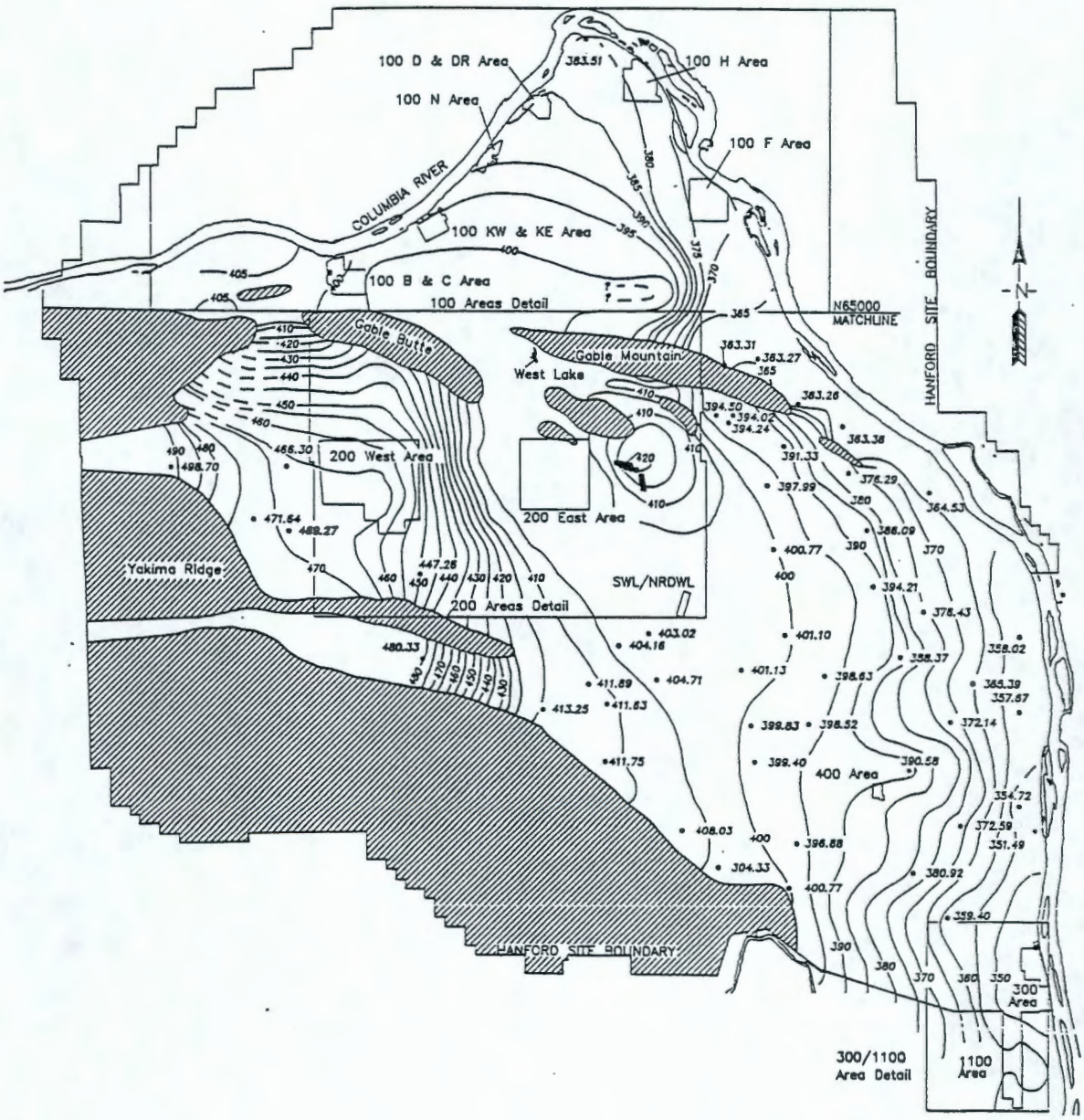
All depths are from ground surface (no scale given)

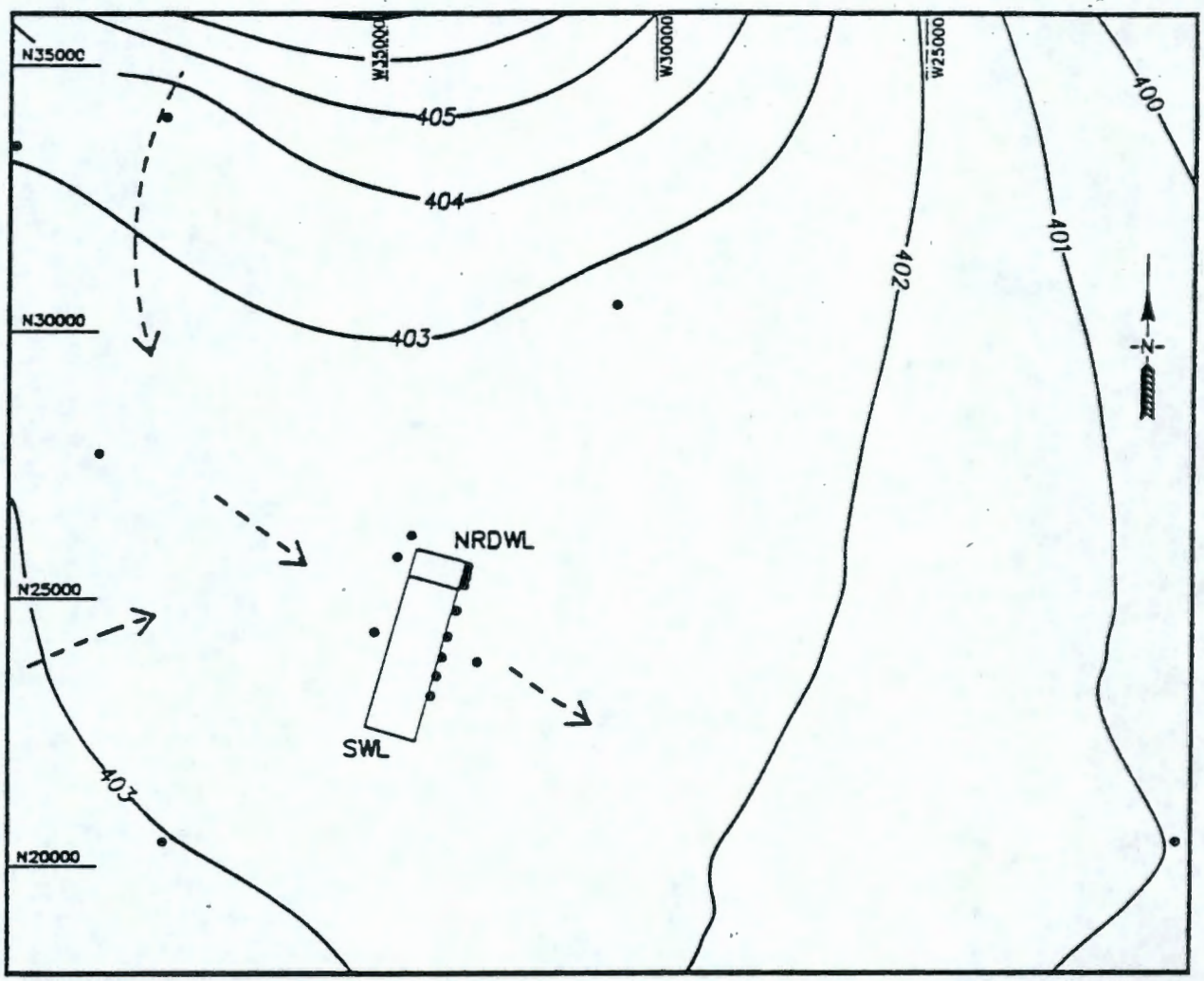


Elevation of surface casing	528.60'
Elevation of reference point	528.12'
Elevation of surveyor's pin	526.39'
Ground surface elevation	525.82'
Type of surface seal: Cement grout w/5% bentonite	
Depth of surface seal	20'
Depth of surface casing	17'
I.D. of surface casing	10"
Type of surface casing: Schedule 40 carbon steel	
Depth of original starter casing	20'
Depth of filler (seal)	20'
Type of filler: Granular bentonite	
Diameter of borehole	8"
I.D. of riser pipe	5"
Type of riser pipe: Schedule 40 carbon steel with vented locking cap	
Depth of top of sand pack	114.21'
Type of sand pack: Monterey crystal sand	
Depth of top of screen	117.25'
Description of screen	
Length: 20' I.D. of screen section	5"
Slot size: Upper 10' is #20, Lower is #25	
Screen construction: type 304 stainless steel continuous slot w/ss plate welded on bottom	
Depth of bottom of screen	137.25'
Type of filler below Screen: Monterey crystal sand	
Depth of bottom of borehole	130.0'

2K8609-25.11

9 2 1 2 6 6 2 1 3 0 4


100 D & DR Area
100 N Area
100 H Area
100 F Area
COLUMBIA RIVER
100 KW & KE Area
100 B & C Area
100 Areas Detail
N65000
MATCHLINE
HANFORD SITE BOUNDARY
Gable Butte
Gable Mountain
West Lake
200 West Area
200 East Area
Yakima Ridge
SWL/NRDWL
200 Areas Detail
400 Area
HANFORD SITE BOUNDARY
300 Area
300/1100
Area Detail
1100
Area



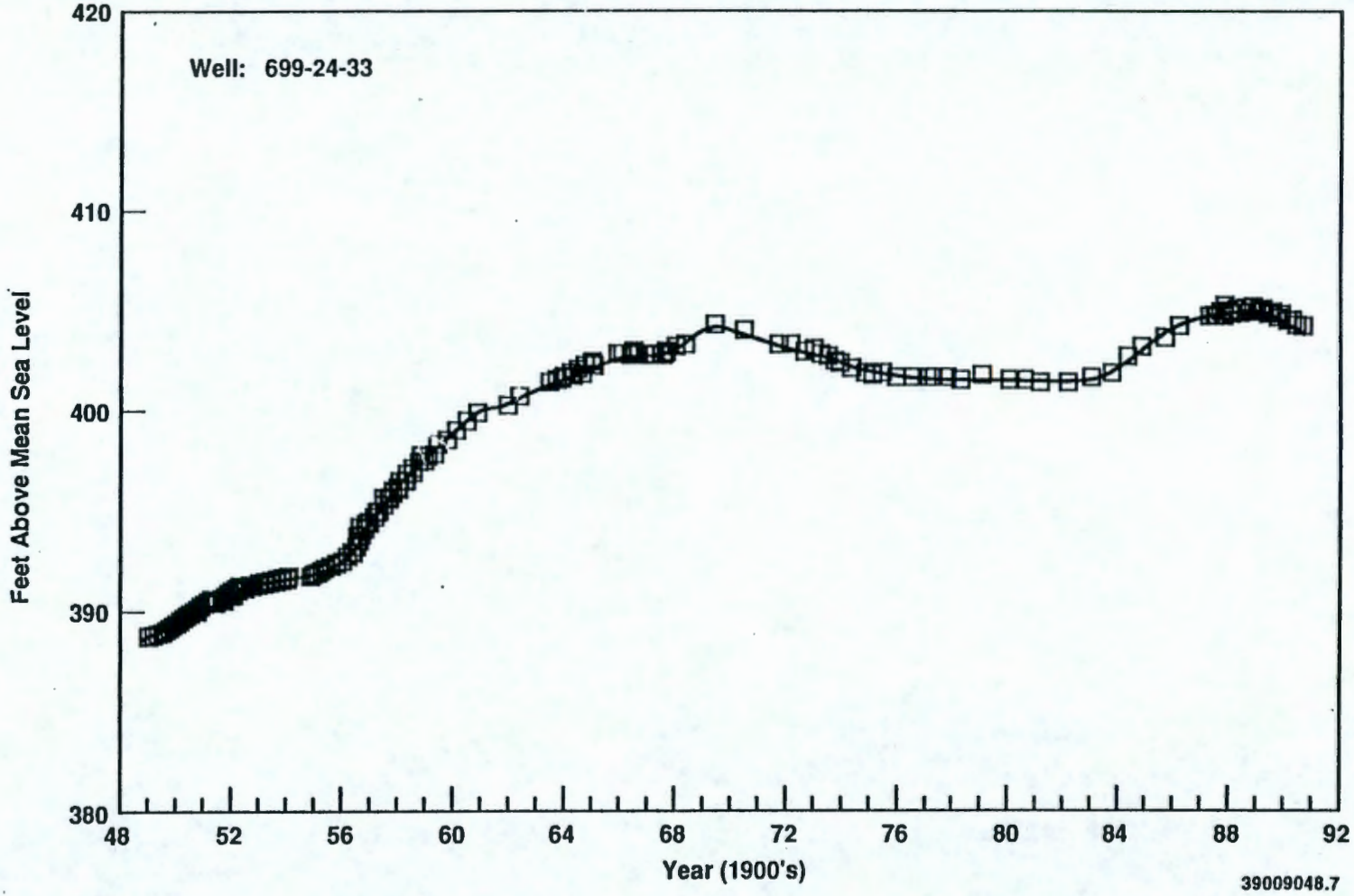
RCRA-AR\010192-R

- • Groundwater Monitoring Well Location
- 405 Water Table Contour, Feet Above Mean Sea Level
- → Generalized Flow Direction
- NRDWL Nonradioactive Dangerous Waste Landfill
- SWL Solid Waste Landfill

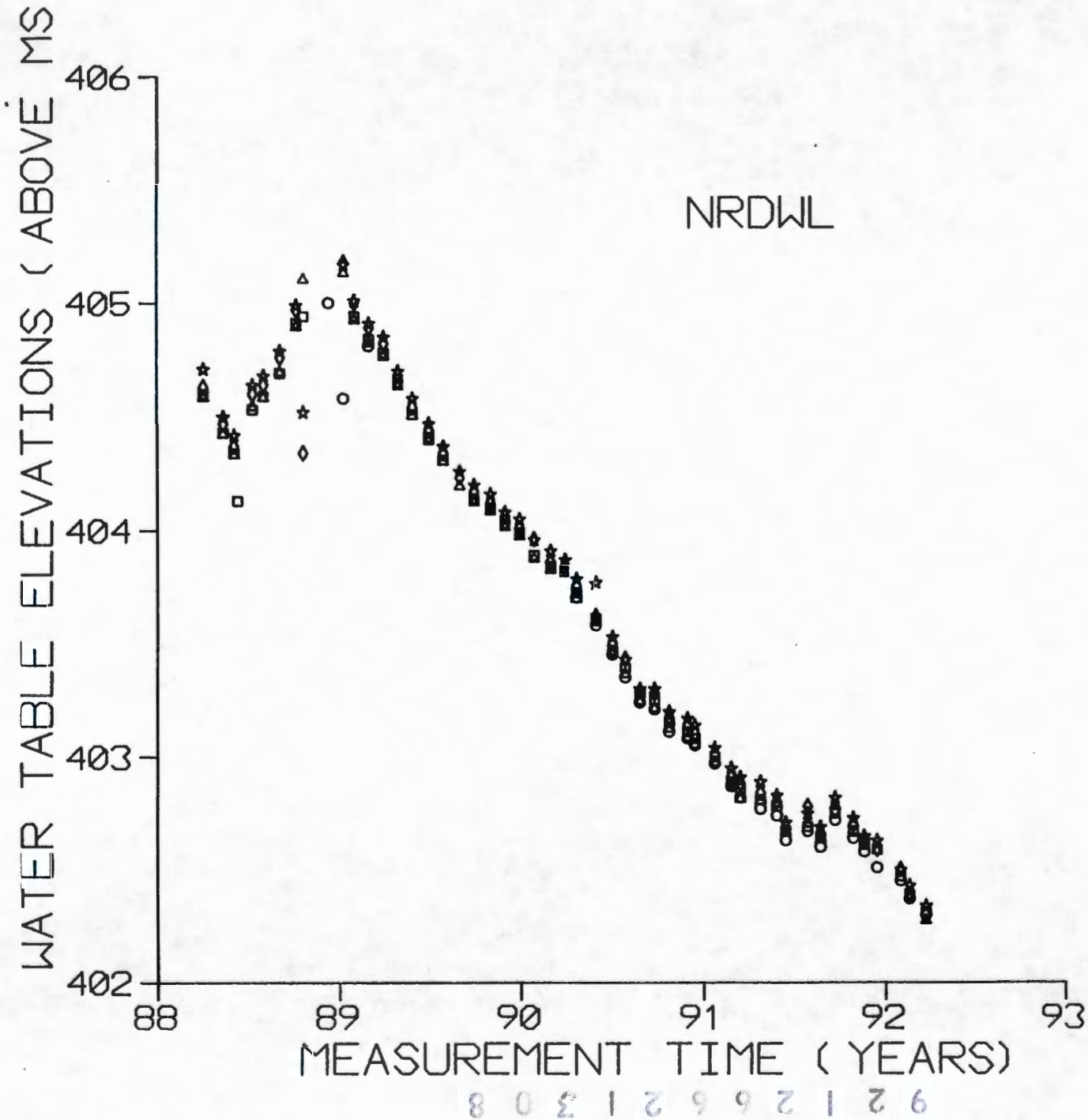
0 1/2 1 Mile

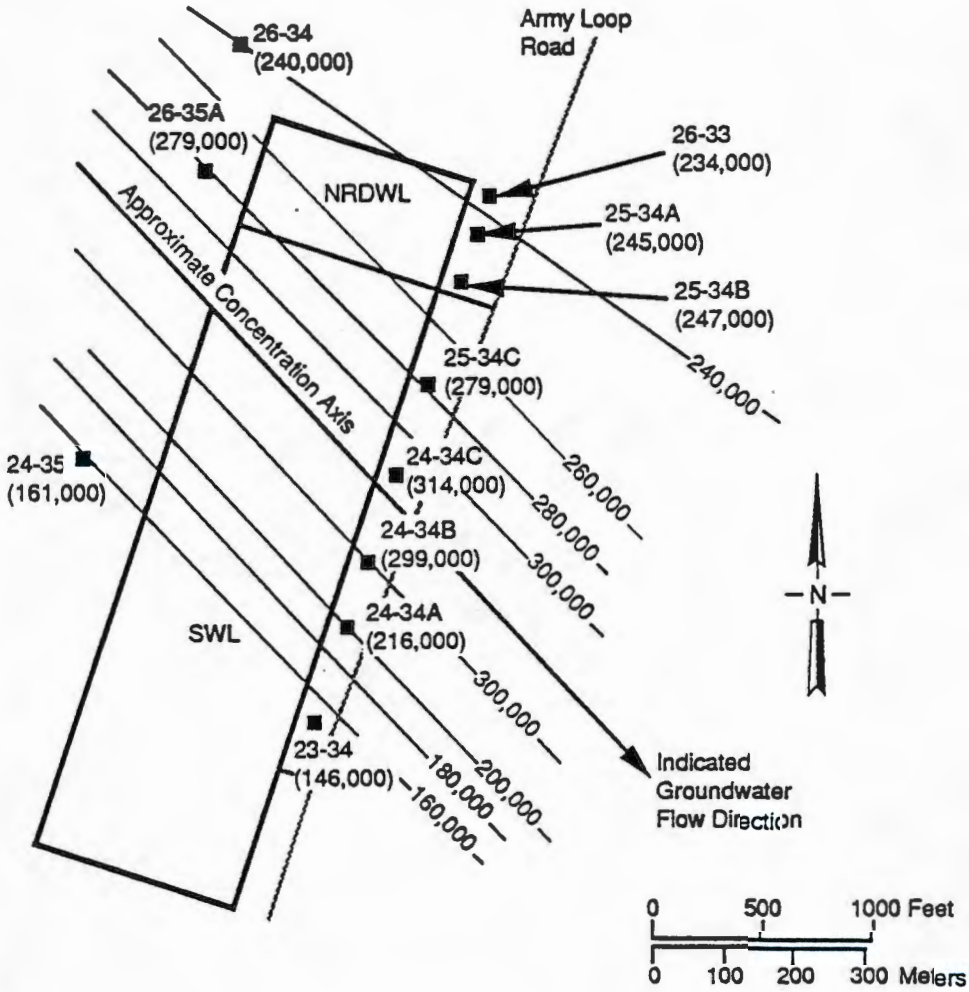
0 1000 Meters

9 2 1 2 6 6 2 1 3 0 6



9 2 1 2 6 6 2 1 3 0 7


NRDWL
WATER TABLE ELEVATIONS (ABOVE MS
406
405
404
403
402
88
89
90
91
92
93
MEASUREMENT TIME (YEARS)



■ Well Completed at the Top of the Unconfined Aquifer

NRDWL Nonradioactive Dangerous Waste Landfill

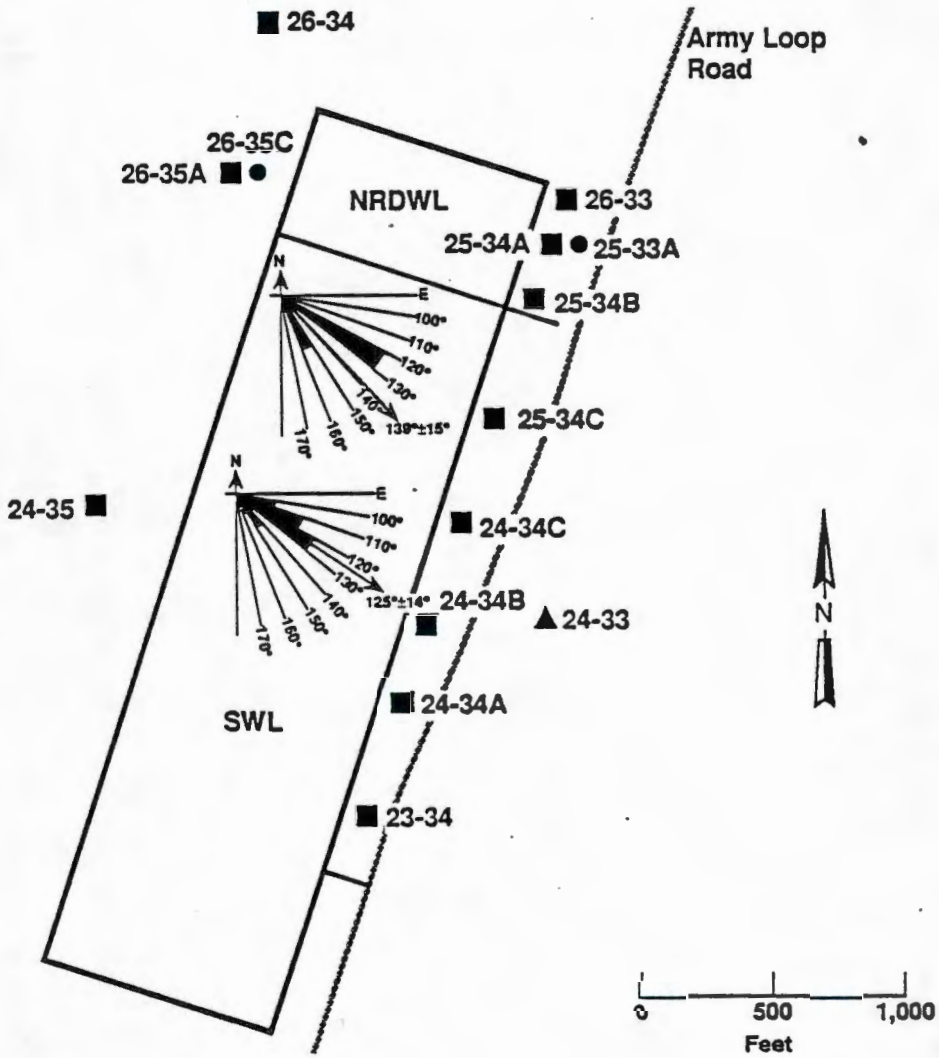
SWL Solid Waste Landfill

(161,000) Tritium Concentrations in Picocuries/Liter (pCi/L)

— 300,000 — Contours of Tritium Concentrations (pCi/L)

All Wells Prefixed by 699-

H9012007.106a



Legend

■ = Well completed at the top of the unconfined aquifer

● = Well completed in the upper Ringold Formation

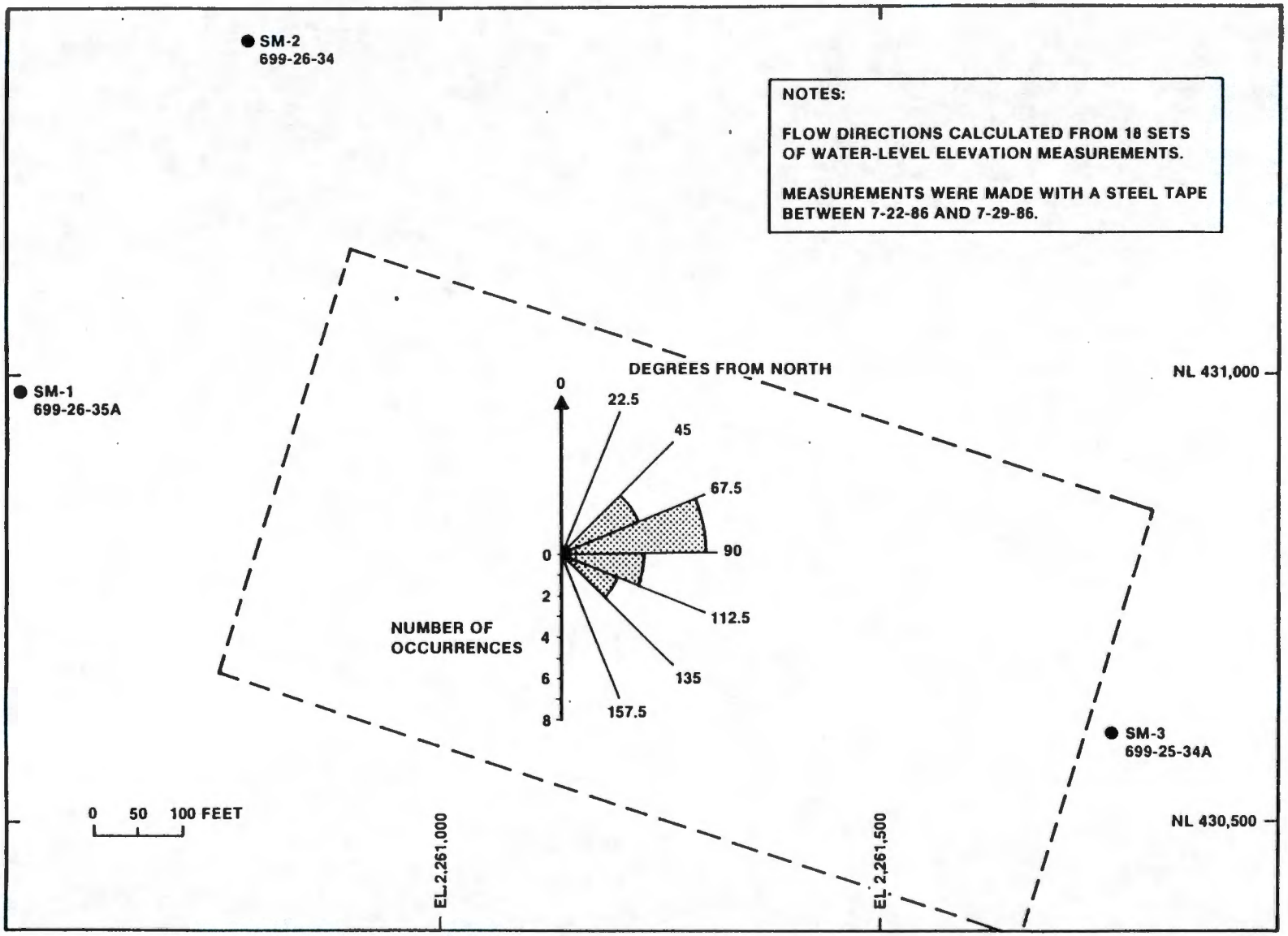
▲ = Non-Resource Conservation and Recovery Act-compliant well, used for indication only

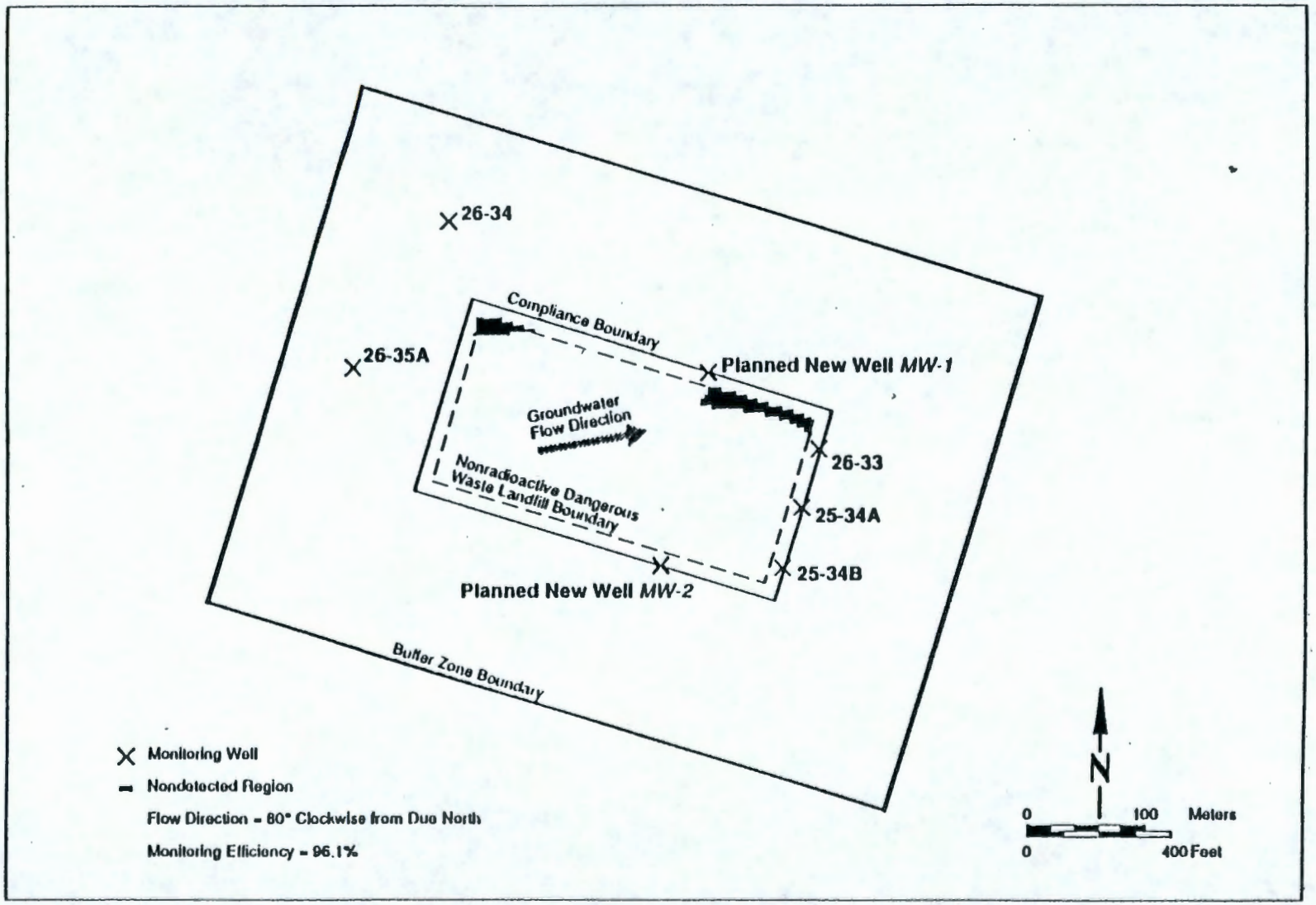
NRDWL = Nonradioactive Dangerous Waste Landfill

SWL = Solid Waste Landfill

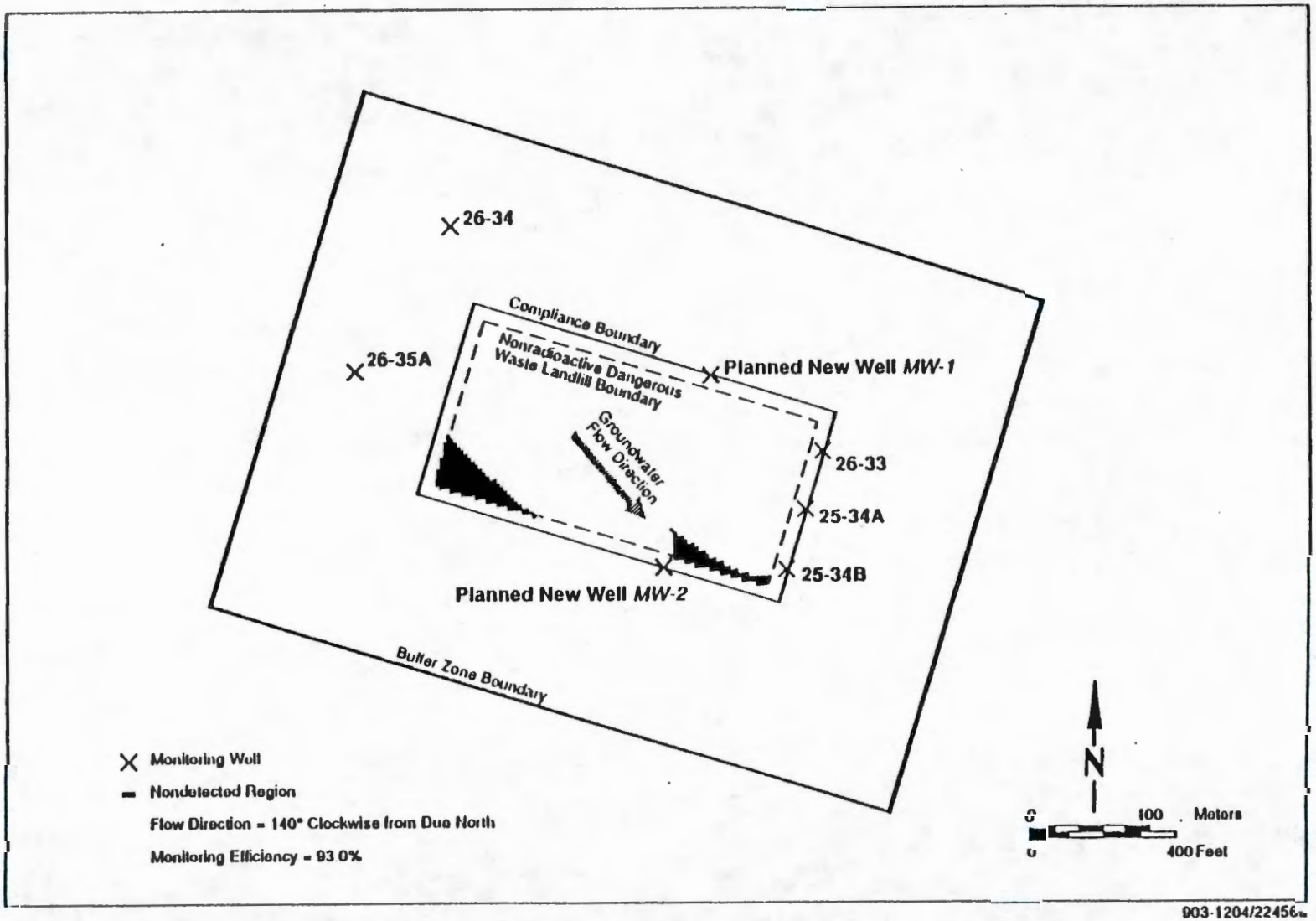
Note: All wells prefixed by 699-

39009085.6a


SM-2
699-26-34
NOTES:
FLOW DIRECTIONS CALCULATED FROM 18 SETS OF WATER-LEVEL ELEVATION MEASUREMENTS.
MEASUREMENTS WERE MADE WITH A STEEL TAPE BETWEEN 7-22-86 AND 7-29-86.
SM-1
699-26-35A
DEGREES FROM NORTH
0
22.5
45
67.5
90
112.5
135
157.5
NUMBER OF OCCURRENCES
0
2
4
6
8
NL 431,000
SM-3
699-25-34A
0 50 100 FEET
EL 2,261,000
EL 2,261,500
NL 430,500
2K8703-8.25



903-1204/22455a



903-1204/22456

CONCLUSIONS

TWO NEW SHALLOW MONITORING WELLS ARE NEEDED TO INSURE ADEQUATE DETECTION AND TO SEPARATE POTENTIAL GROUNDWATER EFFECTS OF THE NRDWL AND SWL

THE SCREEN LENGTHS SHOULD BE 35 FEET TO ALLOW FOR EXPECTED DROPS IN THE LOCAL WATER TABLE

6/15/92

PROPOSED RCRA DRILLING

CY 1993

TPA MILESTONE M-24-00

TSD FACILITY	WELLS	DOCUMENTATION
1325N	2	ECN
LLBG	2	ECN
GROUT FACILITY	3	ECN
TOTAL	7	

ODEX DRILLING

A JOINT PROJECT

with

WHC Projects, Geosciences and Kaiser Engineers Hanford

J. E. Auten and K. D. Reynolds

Agenda

- Purpose for the ODEX test
- Methodology of ODEX
- Testing Program
- Objectives
  - Criteria
  - Field Testing
- Interim results
- Future

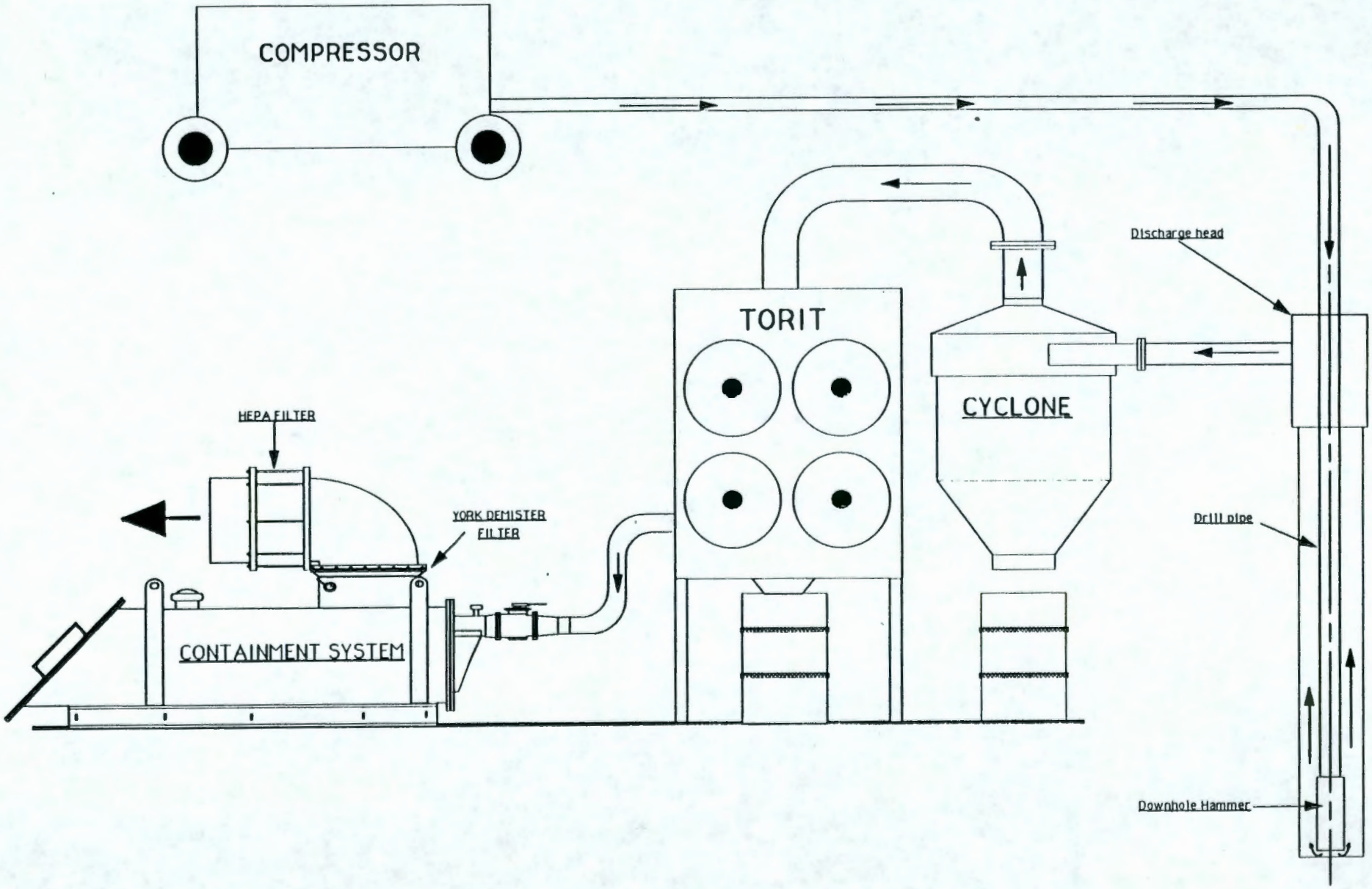
Purpose:

Testing of the ODEX driven by the need for new techniques for drilling at Hanford based on:

- Technical acceptability
- Improved drilling efficiency

ODEX Drilling Method

- Air rotary
- Cases the hole as drilling proceeds
- Under-reaming bit
- Downhole hammer


COMPRESSOR
TORIT
CYCLONE
Discharge head
Drill pipe
Downhole Hammer
HEPA FILTER
YORK DEMISTER FILTER
CONTAINMENT SYSTEM

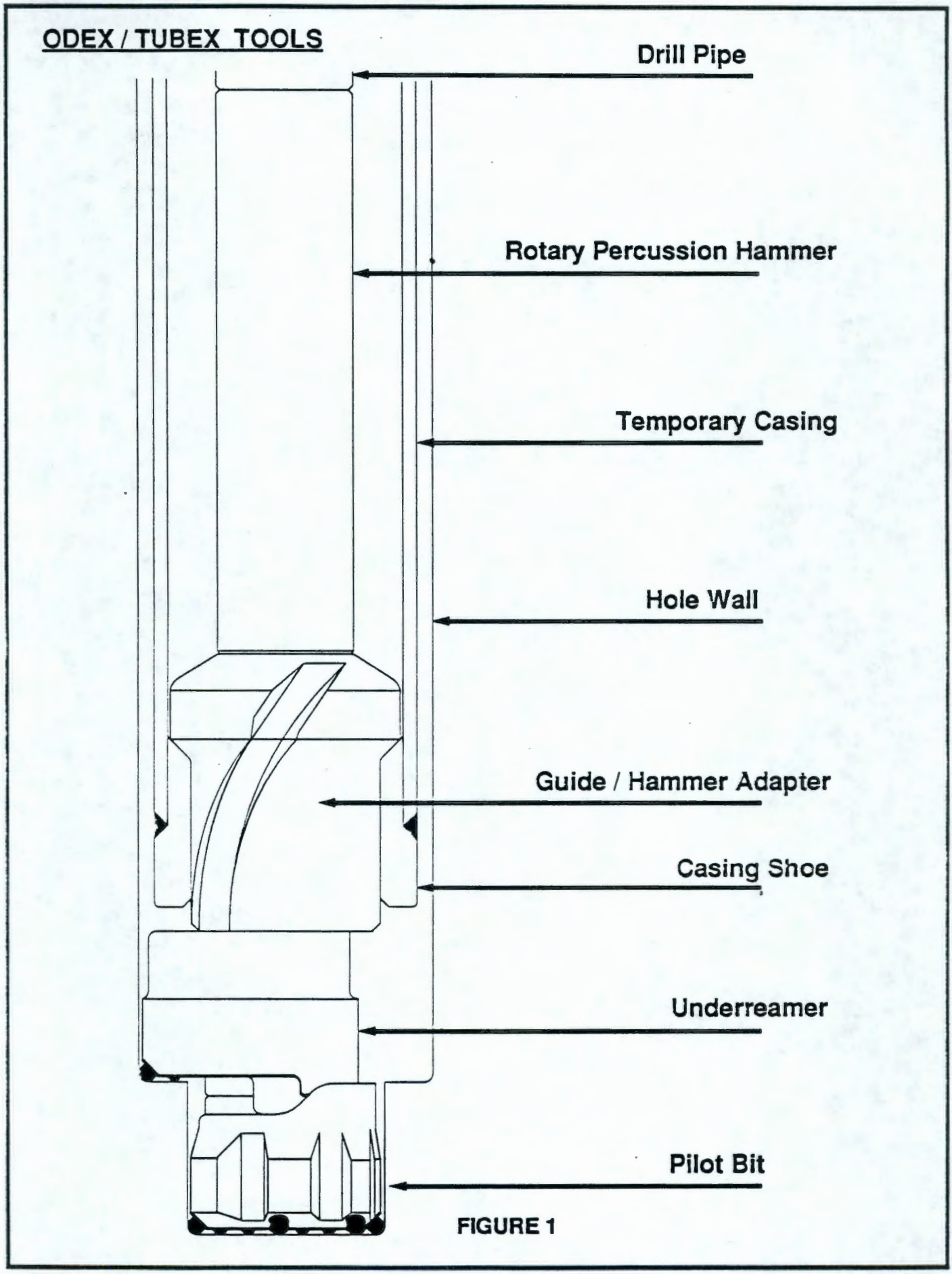


FIGURE 1

9 2 1 2 6 5 2 1 3 2 1

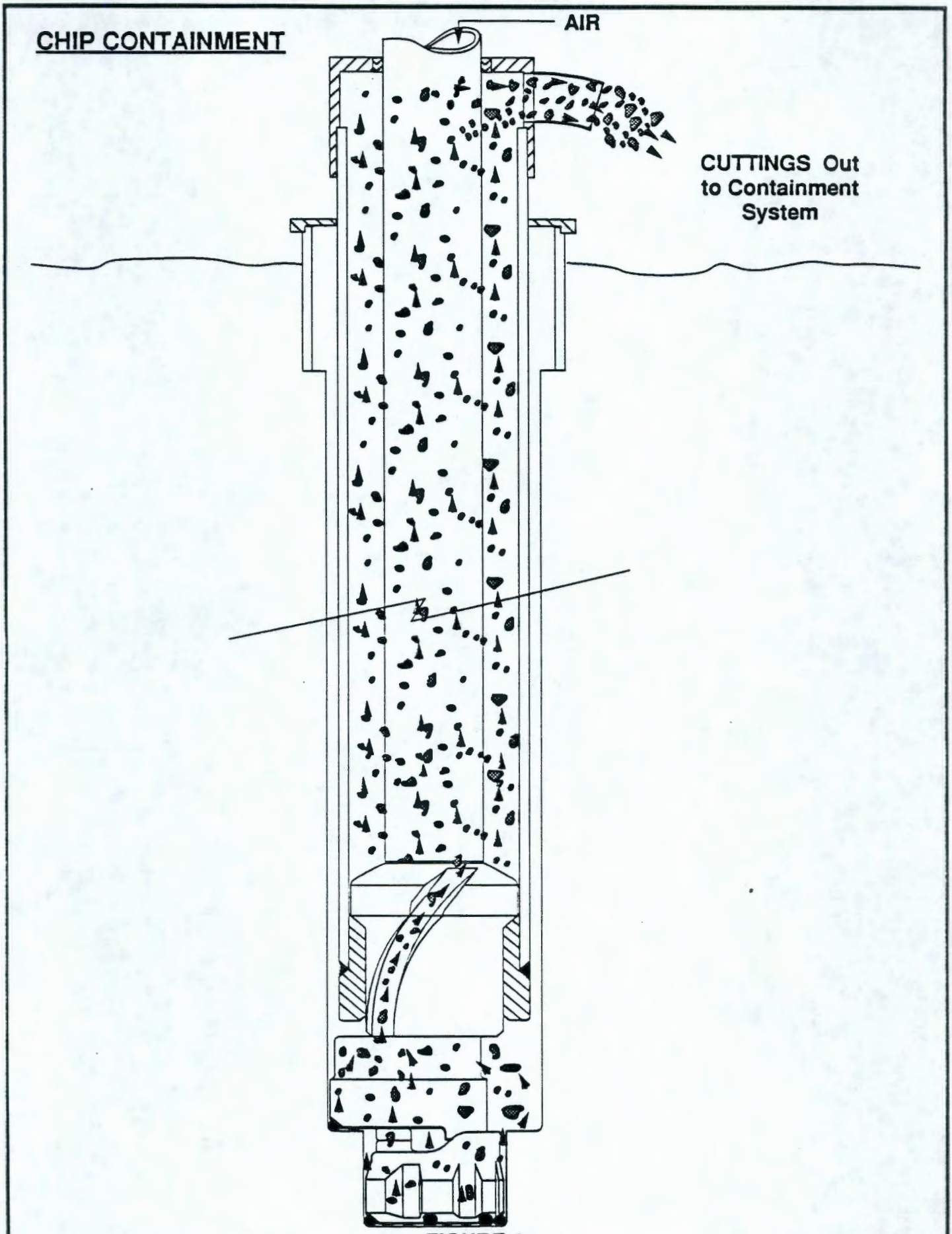


FIGURE 4

History

- J. E. Auten (Projects) began research early 1991 on applicable drilling alternatives for Hanford
- Geoscience prepared a plan for drilling 3 RCRA wells in early 1992
- KEH procured the ODEX contract in early 1992

Test Plan Objectives

- To demonstrate that ODEX could be used on site to install RCRA compliant wells
- To demonstrate that significant economic savings were possible

Basic Criteria as Outlined in Test Plan

- Ability to physically penetrate Hanford Site formations with minimum disturbance to in-situ soils (e.g., minimize overproducing cuttings)
- Ability to penetrate at an acceptable drilling rate
- Ability to construct well to desired depth/diameter and to install standard RCRA well components and assemblies
- Ability not to over-drill more than 2 ft. below design depth

Basic Criteria as Outlined in Test Plan (Cont.)

- Ability to segregate perched water or contaminated intervals by sealing and/or downsizing casing (e.g., to prevent cross contamination between aquifers)
- Ability to identify lithologies of all formations
- Ability to obtain representative sediment samples to determine physical and chemical soil hydrogeological parameters (e.g., grain size distribution, water content, calcium carbonate content and possibly sediment contamination) at intervals of 5 ft., or at changes in lithology
- Ability to perform geophysical logging

Basic Criteria as Outlined in Test Plan (Cont.)

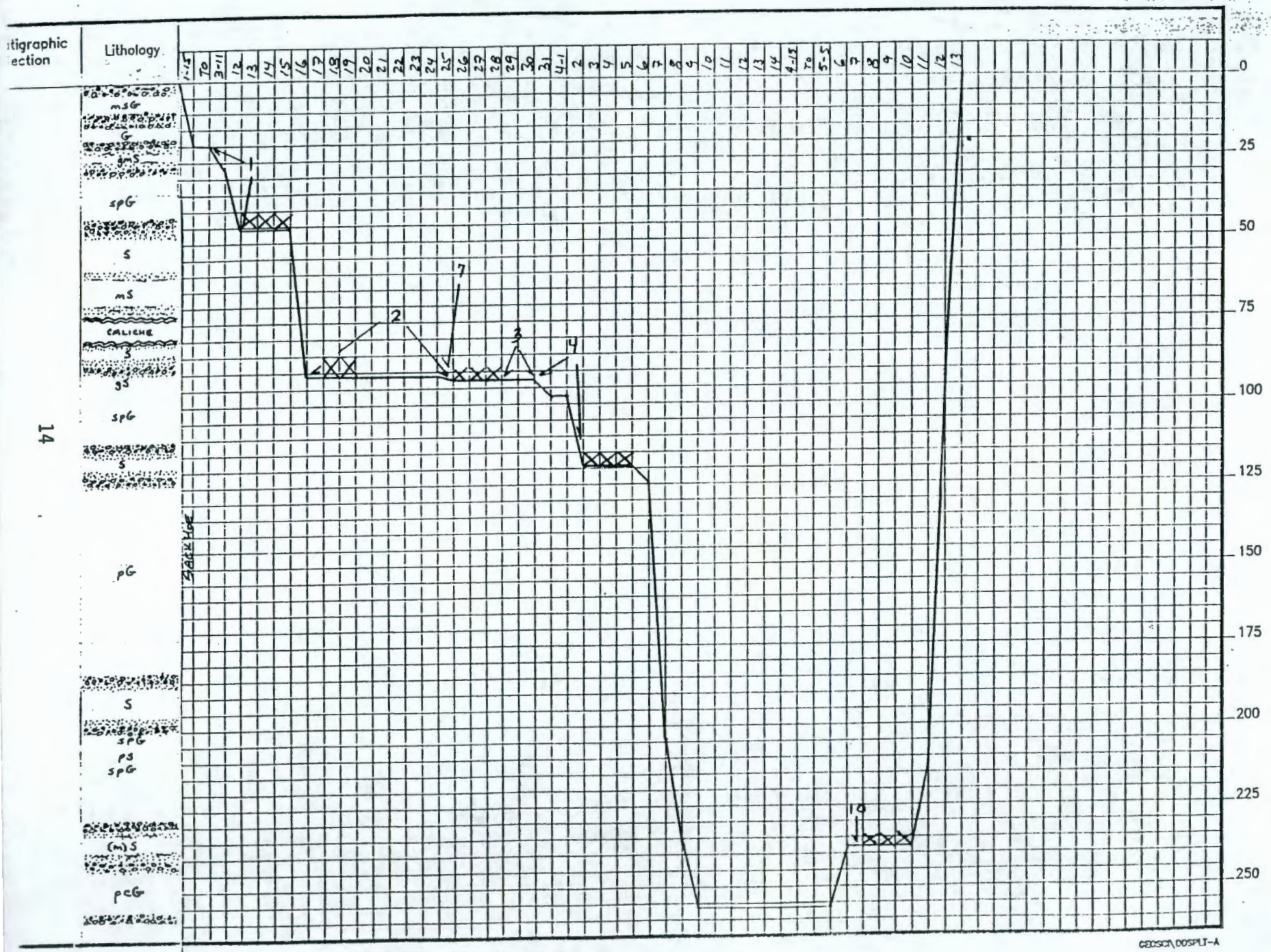
- Ability to contain formation fluid and drill cuttings
- Ability to minimize fluid losses and gains to and from the formation
- Ability to prevent potential contaminants entrained in the compressor air from contaminating the groundwater and soil
- Ability to measure water levels during drilling
- Ability to remove all temporary casing and shoes

Field Testing

- Testing consisted of 3 wells
- 2 wells in LLBG-200W
- 1 well at Grout Facility - 200E

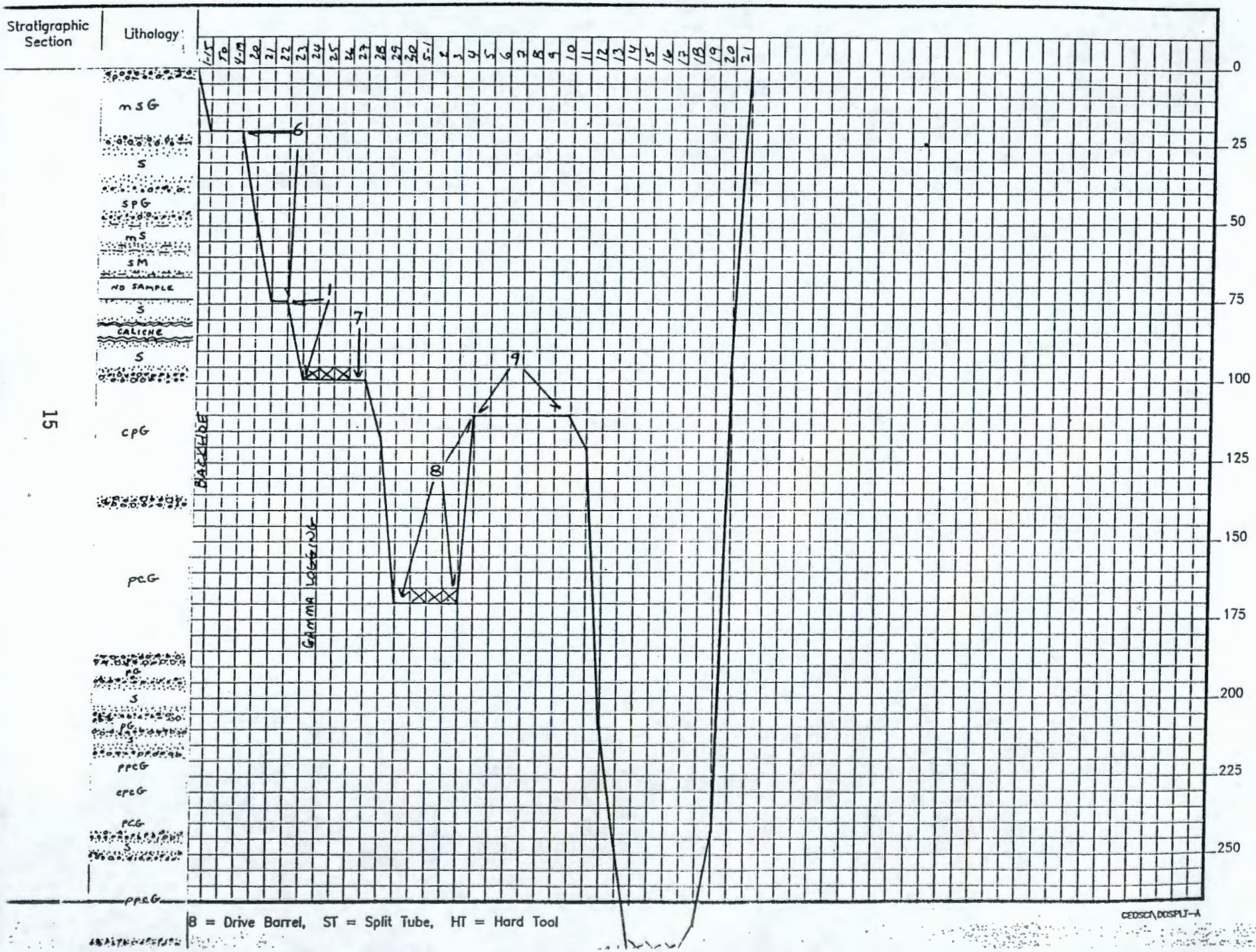
9 2 1 2 6 6 2 1 3 2 9

Monitoring Well 299-W6-12
Drilling Data Sheet



9 2 1 2 6 6 2 1 3 3 0

Monitoring Well 299-W6-11
Drilling Data Sheet



Monitoring Well

Drilling Data Sheet

9 2 1 2 6 5 2 1 3 3 1

Stratigraphic Section	Lithology
	S
	S
	S
	S
	pG to pcG
	S

5-6, 7a, 5-20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 6-1, 2, 3, 4

BASELIDE

0, 25, 50, 75, 100, 125, 150, 175, 200, 225, 250

DB = Drive Barrel, ST = Split Tube, HT = Hard Tool

298.3'

GEOSCI\DOSPLT-A

KEY

DRILLING:

1. Technical drilling problems - various down times - sampler plugged, broken lines, diverter seals, etc.

2. Fish for bit - wait on tools

3. Dust control filter problems - change cyclone system - filter system

4. Compressor problems - air loss

5. Non-work days (xx) - weekends - Fridays

6. Attempt to use reverse circulation - system failure - improper cuttings removal

7. Casing downsizing

8. Pulling casing to retrieve bit and tools stuck in casing

9. Change out drill pipe trying to larger diameter pipe

COMPLETION:

10. Plug in pipe

LITHOLOGY:

m = silt/clay
sm = sandy silt
s = sand
ms = silty sand
gs = gravelly sand
ps = pebble sand
msg = silty sandy gravel
gms = gravelly silty sand
G = gravel
spG = sandy pebble gravel
cpG = cobble pebble gravel
pcG = pebble cobble gravel
pG = pebble gravel
ppcG = pebble to pebble cobble gravel
() = slightly

92126521332

Results:

- Advantages:
  - Penetration rates average in excess of 40 ft/hr
  - Continuous sampling
    - Instantaneous lithology change identification
  - No additives to the wellbore
  - Less drummed waste left on location
  - Able to more accurately interpret geology than is possible when hard tooling with cable tool
  - Backpulling/completion ease
  - Significantly reduced drilling costs

Disadvantages

- Geology/characterization is done by interpretation of cuttings
- Presently have a need to improve cuttings containment and handling
- Presently restricted to non-hazardous sites
- Mobilization/demobilization times are not efficient
- Ratio between drilling and welding times is not acceptable

Plans

- Resume drilling mid-week on a 9 well contract
- Expanded area of operations
- Continue evaluation of performance criteria
- Develop new sampling techniques
  - longer split tubes for intact sampling
  - Coring
  - Larger diameter production type wells
- Deeper groundwater wells. Configure rig for deeper groundwater wells i.e. uppermost basalt units and lower Ringold formation