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State Waste Discharge Permit Application

400 Area Secondary Cooling Water

United States
Department of Energy
Richland, Washington

Approved for Public Release

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UC-630,721

State Waste Discharge Permit Application

400 Area Secondary Cooling Water

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FOREWORD

This document constitutes the Washington Administrative Code 173-216 State Waste Discharge Permit Application that serves as interim compliance as required by the Consent Order DE 91NM-177, for the 400 Area Secondary Cooling Water stream.

As part of the Hanford Federal Facility Agreement and Consent Order negotiations, the U.S. Department of Energy, Richland Operations Office, the U.S. Environmental Protection Agency, and the Washington State Department of Ecology agreed that liquid effluent discharges to the ground on the Hanford Site which affect groundwater or have to potential to affect groundwater would be subject to permitting under the structure of Chapter 173-216 (or 173-218 where applicable) of the Washington Administrative Code, the State Waste Discharge Permitting Program. As a result of this decision, the Washington State Department of Ecology and the U.S. Department of Energy, Richland Operations Office entered in to Consent Order DE 91NM-177.

The Consent Order DE 91NM-177 requires a series of permitting activities for liquid effluent discharges. Based upon compositional and flow rate characteristics, liquid effluent streams at the Hanford Site have been categorized into Phase I, Phase II, and Miscellaneous streams. This document only addresses the 400 Area Secondary Cooling Water stream, which has been identified as a Phase II stream and is listed on Table 3 of the Consent Order DE 91NM-177.

The 400 Area Secondary Cooling Water stream includes contributing streams from the Fuels and Materials Examination Facility, the Maintenance and Storage Facility, the 481-A Pump House, and the Fast Flux Test Facility Cooling Towers. The effluent is discharged to the 4608 Percolation Ponds B and C.

NOTE: The document number (DOE/RL-94-89, Rev. 0), foreword, table of contents, and glossary were added to this document to conform to DOE-RL document formatting requirements subsequent to the submittal of this document.

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GLOSSARY

Alum	aluminum sulfate
BAT/AKART	best available technology/all known and reasonable treatment
Btu	British Thermal Unit
CASS	computer automated surveillance system
CFR	Code of Federal Regulations
C.T.	cooling tower
DOE	U.S. Department of Energy
DOE/RL Office	U.S. Department of Energy Richland Operations
EPA	U.S. Environmental Protection Agency
gpm	gallons per minute
HEPA	high-efficiency particulate air
HEIS	Hanford Environmental Information System
HP	high pressure
HVAC	heating, ventilation, and air conditioning
H/X	heat exchanger
JGV	jet gang valve
LLW	low-level waste
M	million
Ma	million years
msl	mean sea level
N/A	not applicable
NPDES	National Pollutant Discharge Elimination System
ppb	parts per billion
psig	pounds per square inch gauge
RCRA	Resource Conservation and Recovery Act of 1976
SAP	sampling and analysis plan
SARA	Superfund Amendment and Reauthorization Act of 1986
SEPA	State Environmental Policy Act of 1971
SIC	standard industrial classification
SOW	statement of work
SWDP	state waste discharge permit
USGS	United States Geological Survey
WAC	Washington Administrative Code
Westinghouse Hanford	Westinghouse Hanford Company

METRIC CONVERSION CHART

If you know	Multiply by	To get
	INTO METRIC	
	Length	
inches	2.54	centimeters
feet	30.48	centimeters
	Volume	
gallons	3.786	liters
cubic feet	0.02832	cubic meters
	Temperature	
Fahrenheit	Subtract 32 then multiply by 5/9ths	Celsius
	Pressure	
inches water	1.87	mm Hg
inches water	249	pascal (Pa)
	OUT OF METRIC	
	Length	
centimeters	0.3937	inches
meters	3.28	feet
	Volume	
milliliters	1.247×10^{-3}	cubic feet
liters	0.264	gallons
cubic meters	35.31	cubic feet
	Temperature	
Celsius	Multiply by 9/5ths, then add 32	Fahrenheit
	Pressure	
mm Hg	0.5353	inches water
pascal (Pa)	4.02×10^{-3}	inches water

SECTION B. PRODUCT OR SERVICE INFORMATION

1. Briefly describe all manufacturing processes and products, and/or service activities. Provide the applicable Standard Industrial Classification (SIC) Code(s) for each activity.

   SIC No(s): N/A

   Description: See Attachment B and Attachment C

2. Include a production schematic flow diagram of the process and service activities described above on a separate sheet.

   See Attachment B

3. List raw materials and products: N/A

RAW MATERIALS	
Type	Quantity
PRODUCTS	

SECTION C. PLANT OPERATIONAL CHARACTERISTICS

1. Identify the waste stream for each of the production processes or activities described in Section B.1. Assign an identification number.

Process	Waste Stream Name	Batch or Continuous Process	Waste Stream ID #
Auxiliary Systems	400 Area Secondary Cooling	Continuous	23H
Cooling Water	Water		

2. On a separate sheet, describe in detail the treatment and disposal of all wastewaters as decribed above. Include a schematic flow diagram for all wastewater treatment and disposal systems. See Attachment C

3. Indicate treatment provided to each waste stream identified above.

No Treatment Performed

Waste Stream(s) ID #	Treatment	Waste Stream(s) ID #	Treatment
	Air flotation		pH correction
	Centrifuge		Ozonation
	Chemical precipitation		Reverse osmosis
	Chlorination		Screen
	Cyclone		Sedimentation
	Filtration		Septic tank
	Flow equalization		Solvent separation
	Grease or oil separation		Bio. treatment, type:
	Grease trap		Rainwater diversion or storage
	Grit removal		Other chem. treatment, type:
	Ion exchange		Other phys. treatment, type:

4. Describe any planned wastewater treatment improvements or changes in wastewater disposal methods:

Some floor and equipment drains in the Maintenance and Storage Facility and Fuels and Materials Examination Facility are planned to be either plugged or a dike will be constructed around them.

5. If production processes are subject to seasonal variations, provide the following information. Write "Yes" for each month each waste stream is produced.

Waste Stream ID #	MONTHS											
	J	F	M	A	M	J	J	A	S	O	N	D
23H*					Yes	Yes	Yes	Yes	Yes			

6. Shift Information:
   a. Number of shifts per work day: 3
   b. Number of work days per week: 7
   c. Average number of work days per year: 365
   d. Maximum number of work days per year: 365
   e. Number of employees per shift: / Shift start times

	Employees		Shift start times
1st	350	1st	0730 hrs
2nd	20	2nd	1530 hrs
3rd	18	3rd	2330 hrs

7. List all incidental materials like oil, paint, grease, solvents, soaps, cleaners, that are used or stored on-site. (Use additional sheets, if necessary.)

Material/Quantity Stored See Attachment D

8. Describe any water recycling or material reclaiming processes:

The water used in the cooling towers is recycled through the system 2.5 times or until the conductivity reading is too high (1200 umhos). The chemical containers for the cooling tower treatment are rinsed out and the rinsate is added to the cooling tower sump.

FFTF recycles some lubricants for heating oil.

9. Does this facility have:
- Spill Control and Containment Plan (per 40 CFR 112)? ☒ Yes ☐ No
- Emergency Response Plan (per WAC 173-303-350)? ☒ Yes ☐ No
- Runoff, spillage, or leak control plan (per WAC 173-216-110(f))? ☒ Yes ☐ No

SECTION D. WATER CONSUMPTION AND WATER LOSS

1. Water source(s):

   ☐ Public System (Specify) ______

   ☒ Private Well ☐ Surface Water

   a. Water Right Permit Number: N/A

   b. Legal Description:

   NE 1/4S, SW 1/4S, 18 Section, 11N TWN, 28E R

2. a. Indicate total water use: Gallons per day (average) 150,000

   Gallons per day (maximum) 277,400

   b. Is water metered? ☒ Yes ☐ No

3. Attach a line drawing showing the water flow through the facility. Indicate source of intake water, operations contributing wastewater to the effluent, and treatment units labeled to correspond to the more detailed descriptions in Item C. Construct a water balance on the line drawing by showing average flows between intakes, operations, treatment units, and outfalls. If a water balance cannot be determined (*e.g., for certain mining activities*), provide a pictorial description of the nature and amount of any sources of water and any collection or treatment measures.

   See Attachment E

SECTION E. WASTEWATER INFORMATION

1. Provide measurements for the parameters listed below, unless waived by the permitting authority. All analytical methods used to meet these requirements shall, unless approved otherwise in writing by Ecology, conform to the Guidelines Establishing Test Procedures for the Analysis of Pollutants Contained in 40 CFR Part 136.

Parameter/CAS No.	Concentrations Measured	Analytical Method	Detection Limit
pH J*	8.8 pH units	150.1	0.010 pH units
Conductivity J*	639 umhos/cm	120.1	1.0 umhos/cm
Total Dissolved Solids	536 ug/l	160.1	5.0 ug/l
Total Suspended Solids	16.0 ug/l	160.2	5.0 ug/l
BOD (5 day)	4.0 mg/l	307	2.0 mg/l
COD	30.0 ug/l	410.1	5.0 ug/l
Ammonia-N	0.10 mg/l	350.1	0.10 mg/l
TKN-N	1.06 mg/l	calculated est.	0.10 mg/l
Nitrate-N	0.96 mg-N/l	353.1	0.10 mg-N/l
Ortho-phosphate-P	2.5 mg/l	300.0	0.25 mg/l
Total-phosphate-P	0.86 mg/l	365.2	0.40 mg/l
Total Oil & Grease	5.5 mg/l	9070	5.0 mg/l
Calcium/7740-70-2	63,000 ug/l	200.7	5000 ug/l
Magnesium/7439-95-4	18,800 ug/l	200.7	5000 ug/l
Sodium/7440-23-5	72,700 ug/l	200.7	5000 ug/l
Potassium/7440-09-7	16,600 ug/l	200.7	5000 ug/l
Chloride	26.6 mg/l	300.0	5.0 mg/l
Sulfate	77.1 mg/l	300.0	2.5 mg/l
Fluoride	0.61 mg/l	300.0	0.50 mg/l
Cadmium/7440-43-9	<7.0 ug/l	200.7	7.0 ug/l
Chromium/7440-49-3	<10.0 ug/l	200.7	10.0 ug/l
Lead/7439-92-1	5.4 ug/l	239.1	3.0 ug/l
Mercury/7439-97-6	<0.20 ug/l	245.1	0.20 ug/l
Selenium/7782-49-2	<50.0 ug/l	270.1	50.0 ug/l
Silver/7440-22-4	<10.0 ug/l	200.7	10.0 ug/l
Copper/7440-50-8	<25.0 ug/l	200.7	25.0 ug/l
Iron/7439-89-6	178 ug/l	200.7	100.0 ug/l
Manganese	31.4 ug/l	200.7	15.0 ug/l
Zinc/7440-66-6	550 ug/l	200.7	20.0 ug/l
Barium/7440-39-3	<200 ug/l	200.7	200 ug/l
Total Coliform	8 total/100 ml	SM 9221B	2.0 total/100 ml

*This data has been validated. The (J) validation flag means sample is estimated positive.

See Attachment J and Attachment C

 ECY 040-179 (Rev. 4/92)

2. Wastewater characteristics for toxic pollutants.

The intent of this question is to determine which chemicals are or might be present in the process water or wastewater. For each chemical listed below:

a. Use the letter **A** in the **ABST** column if the chemical is not likely to be present because it is not used in the production process or used on site.

b. Use the letter **S** in the **ABST** column if the chemical may be present because it is used on site, but the chemical is not used in the production process.

c. Use the letter **P** in the **PRST** column if the chemical is likely to be present because it is used in the production process, but the effluent has not been tested.

d. Use the letter **K** in the **PRST** column if the effluent has been tested and found to be present.

Attach the analytical results.

Analytical Results
Wastewater Characterization for Toxic Pollutants

ABST	PRST	CONSTITUENT/CAS No.	ABST	PRST	CONSTITUENT/CAS No.
A		Acrylamide/79-06-1	A		1,2 Dichloropropane/78-87-5
A		Acrylonitrile/107-13-1	A		1,3 Dichloropropene/542-75-6
A		Aldrin/309-00-2	A		Dichlorvos/62-73-7
A		Aniline/62-53-3	A		Dieldrin/60-57-1
A		Aramite/140-57-8	A		3,3' Dimethoxybenzidine/119-90-4
A		Arsenic/7440-38-2	A		3,3 Dimethylbenzidine/119-93-7
A		Azobenzene/103-33-3	A		1,2 Dimethylhydrazine/540-73-8
S		Benzene/71-43-2	A		2,4 Dinitrotoluene/121-14-2
A		Benzidine/92-87-5	A		2,6 Dinitrotoluene/606-20-2
A		Benzo(a)pyrene/50-32-8	A		1,4 Dioxane/123-91-1
A		Benzotrichloride/98-07-7	A		1,2 Diphenylhydrazine/122-66-7
A		Benzyl chloride/100-44-7	A		Endrin/72-20-8
A		Bis(chloroethyl)ether/111-44-4	A		Epichlorohydrin/106-89-8
A		Bis(chloromethyl)ether/542-88-1	A		Ethyl acrylate/140-88-5
A		Bis(2-ethylhexyl) phthalate/ 117-81-7	A		Ethylene dibromide/106-93-4
	K	Bromodichloromethane/75-27-4	A		Ethylene thioureae/96-45-7
A		Bromoform/75-25-2	A		Folpet/133-07-3
A		Carbazole/86-74-8	A		Furmecyclox/60568-05-0

ABST / PRST		CONSTITUENT/CAS No.	ABST / PRST		CONSTITUENT/CAS No.
A		Carbon tetrachloride/56-23-5	A		Heptachlor/76-44-8
A		Chlordane/57-74-9	A		Heptachlor epoxide/1024-57-3
A		Chlorodibromomethane/124-48-1	A		Hexachlorobenzene/118-74-1
A		Chloroform/67-66-3	A		Hexachlorocyclohexane (alpha)/ 319-84-6
A		Chlorthalonil/1897-45-6	A		Hexachlorocyclohexane (tech.)/ 608-73-1
A		2,4-D/94-75-7	A		Hexachlorodibenzo-p-dioxin, mix/ 19408-74-3
A		DDT/50-29-3	A		Hydrazine/hydrazine sulfate/ 302-01-2
A		Diallate/2303-16-4	A		Lindane/58-89-9
A		1,2 Dibromoethane/106-93-4	A		2 Methylaniline/100-61-8
A		1,4 Dichlorobenzene/106-46-7	A		2 Methylaniline hydrochloride/ 636-21-5
A		3,3' Dichlorobenzidine/91-94-1	A		4,4' Methylene bis(N,N-dimethyl)aniline/101-61-1
A		1,1 Dichloroethane/75-34-3	S		Methylene chloride (dichloromethane)/75-09-2
A		1,2 Dichloroethane/107-06-2	A		Mirex/2385-85-5
A		Nitrofurazone/59-87-0	A		O-phenylenediamine/106-50-3
A		N-nitrosodiethanolamine/ 1116-54-7	A		Propylene oxide/75-56-9
A		N-nitrosodiethylamine/55-18-5	A		2,3,7,8-Tetrachlorodibenzo-p-dioxin/ 1746-01-6
A		N-nitrosodimethylamine/62-75-9	A		Tetrachloroethylene/127-18-4
A		N-nitrosodiphenylamine/86-30-6	A		2,4 Toluenediamine/95-80-7
A		N-nitroso-di-n-propylamine/ 621-64-7	A		o-Toluidine/95-53-4
A		N-nitrosopyrrolidine/930-55-2	A		Toxaphene/8001-35-2
A		N-nitroso-di-n-butylamine/ 924-16-3	A		Trichloroethylene/79-01-6
A		N-nitroso-n-methylethylamine/ 10595-95-6	A		2,4,6-Trichlorophenol/88-06-2
A		PAH/NA	A		Trimethyl phosphate/512-56-1
A		PBBs/NA	A		Vinyl chloride/75-01-4
S		PCBs/1336-36-3			

Facility: 400 Area Secondary Cooling Water

SECTION F. STORMWATER

1. Do you have a stormwater NPDES permit? ☐ Yes ☒ No

2. Have you applied for a stormwater NPDES permit? ☐ Yes ☒ No

3. Are you covered or have you applied for coverage under a general or group stormwater permit? ☒ Yes ☐ No

4. Describe the size of the stormwater collection area.
   a. UnpavedArea 5,840,000 sq. ft.
   b. PavedArea 975,000 sq. ft.
   c. OtherCollectionAreas(Roofs) 753,000 sq. ft.

5. Describe the stormwater management systems.

Stormwater is disposed to the ground via roof drain downcomers and dry well. There is no sheet flow which comes out of the 400 Area.

6. Attach a map showing stormwater drainage/collection areas, disposal areas and discharge points.

See Attachment F

SECTION G. OTHER INFORMATION

1. Describe liquid wastes or sludges being generated that are not disposed of in the waste stream(s).

   Waste lubricant oil
   Low level radioactive waste

2. Describe storage areas for raw materials, products, and wastes.

   The radioactive liquid waste is discharged to below ground 5,000 gallon tanks. When the tanks are full, the liquid waste is transferred via railcar to the 204 AR Facility in the 200 West Area.
   Waste oil is divided into non-spec and waste oil. Non-spec is burned on-site in accordance with a Washington state permit, waste oil is packaged for disposal.

3. Have you designated your wastes according to the procedures of Dangerous Waste Regulations, Chapter 173-303 WAC? ☒ Yes ☐ No

4. Waste hauled off-site by: ☐ Wastehauler; ☒ Self; ☐ Other (identify) ________

Name	Name
Address	Address
City/State	City/State
Telephone	Telephone

5. Have you filed a SARA Title 313 disclosure? ☒ Yes ☐ No

Facility: 400 Area Secondary Cooling Water

SECTION H. SITE ASSESSMENT

1. Give the legal description of the land treatment site(s). Give the acreage of each land treatment site(s). Attach a copy of the contract(s) authorizing use of land for treatment.

   SE 1/4, NW 1/4, Sec. 18. T11N, R28F (46-26'-23 9" Lat., 119 21' 23 1" Long)

   0.23 acres (10.000 sq. feet).

2. List all environmental control permits or approvals needed for this project; for example, septic tank permits, sludge application permits, or air emissions permits.

   Hanford Site Radioactive Air Emissions Permit FF-01

3. Attach a topographic map with contour intervals used by USGS. Show the following on this map: See Attachment G
   a. Location and name of internal and adjacent streets
   b. Surface water drainage systems
   c. Water supply and other wells within 500 feet of the site
   d. Surface water diversions within 500 feet of the site
   e. Chemical and product handling and storage facilities
   f. Infiltration sources, such as drainfields, lagoons, dry wells, and abandoned wells within 500 feet of the site
   g. Wastewater and cooling water discharge points with ID numbers (See Section C.1)
   h. Other activities and land uses with 1/4 mile of the site

4. Identify all wells within 500 feet of the site. Attach well logs when available and any available water quality data.

   500 feet from percolation ponds - 699-2-7. Within 400 Area

   499-S0-8, 499-S0-7, 499-S1-8L, 499-S1-8J

   See Attachment H

5. Describe soils on the site using information from local soil survey reports. (Submit on separate sheet.)

   See Attachment I

6. Describe the regional geology and hydrogeology within one mile of the site. (Submit on separate sheet.) See Attachment I

7. List the names and addresses of contractors or consultants who provided information and cite sources of information by title and author.

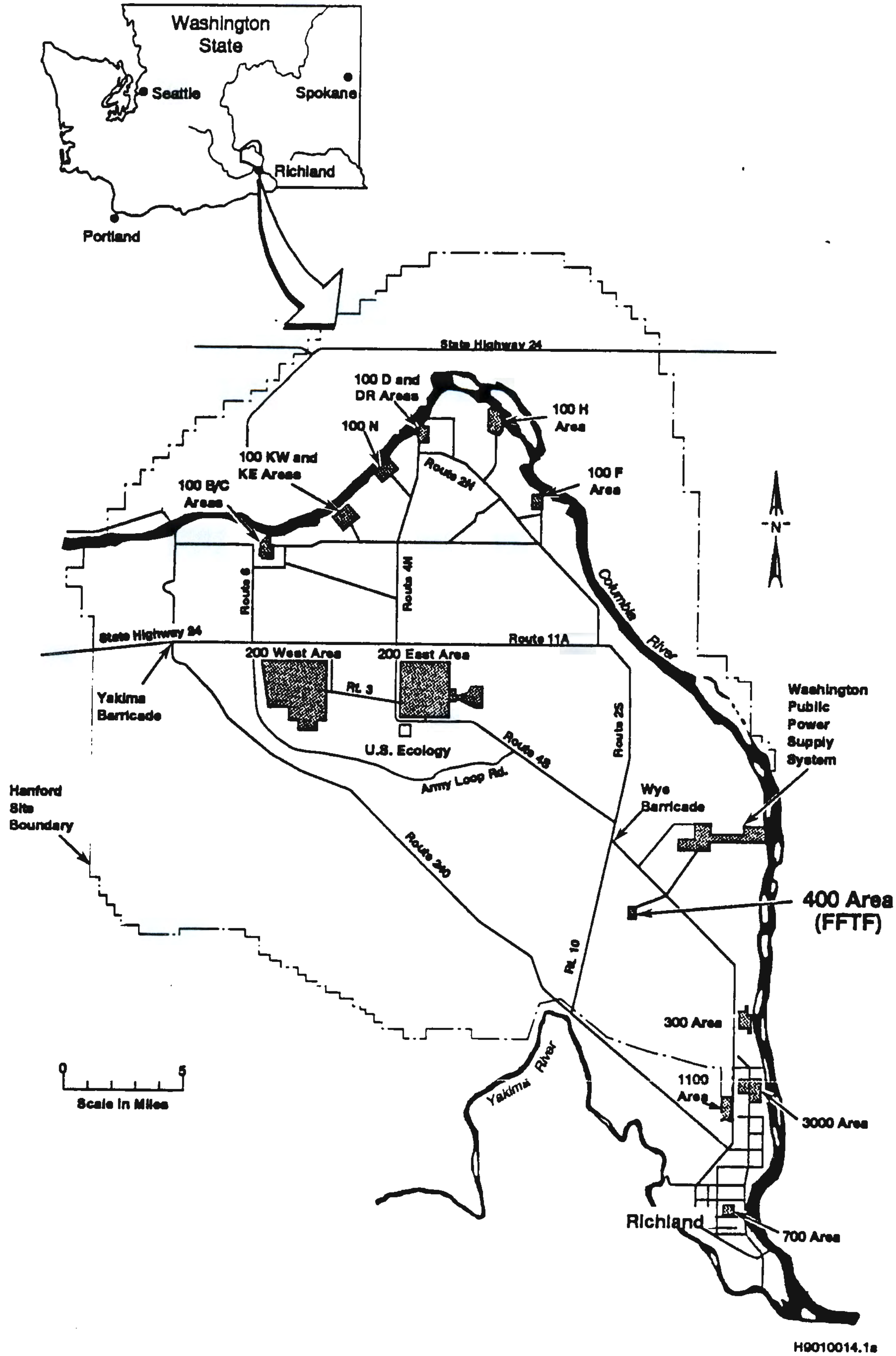
   See Attachment K

END — END — END

ATTACHMENT A

Hanford Reservation Site Map
Section A - Item 3

9613449.0940



Hanford Site Map with 400 Area Location

ATTACHMENT B

400 AREA FACILITIES
Section B - Item 1

ATTACHMENT B

The 400 Area Secondary Cooling Water waste stream is located in the 400 Area. The 400 Area contains the Fast Flux Test Facility (FFTF) and a number of buildings which support the FFTF operation (Figure 1). The FFTF is a sodium-cooled test reactor used for nuclear research (HEDL-400, 1980). There is no designated SIC Code for nuclear research. There are four facilities in the 400 Area which contribute to the 400 Area Secondary Cooling Water (400 Area Process Sewer). The four contributors are described below:

1. FAST FLUX TEST FACILITY (FFTF)

The FFTF is a sodium-cooled test reactor used for nuclear research. The reactor's high neutron flux level and neutron energies allow accelerated testing of fuels and materials. The reactor operated from 1980 to April 1, 1990, when it was ordered into standby status by the Department of Energy. The reactor may be started in 1996 for the manufacture of Pu-238. Materials used in the reactor would not significantly change for this production.

The process which contributes to the 400 Area Secondary Cooling Water is the auxiliary system cooling towers. The cooling towers reduce the heat generated in the equipment supporting the FFTF auxiliary systems, such as the heating, ventilation, and air conditioning (HVAC). There is no contact between the piping of the cooling towers and that of any radioactive liquid discharge, wastes or nuclear materials in the reactor. Adjacent to the cooling tower pad is a building which contains the water treatment equipment, water quality monitoring instrumentation, and the process control for blowdown valves associated with the cooling towers. This system is adjacent to the facility's reactor containment and service buildings within the 400 Area Protected Area.

2. FUELS AND MATERIALS EXAMINATION FACILITY (FMEF)

The FMEF was designed and constructed as a secure, multistoried structure with the capability to handle low and high exposure radioactive materials. Due to program and funding changes, most of the specialized equipment has never been installed and radioactive material has never been introduced to the facility. The facility is used for administrative personnel offices at this time.

The processes which contribute to the 400 Area Secondary Cooling Water are the auxiliary systems cooling towers, floor drains, and equipment drains from the FMEF. The FMEF cooling towers are used to cool the auxiliary systems of the FMEF in the same manner as the FFTF cooling towers. The cooling system at the FMEF is also a non-contact cooling water system.

3. MAINTENANCE AND STORAGE FACILITY (MASF)

The MASF facility, located in the 400 Area Protected Area, consists of a main building and a two story service wing. The purpose of this facility is to provide maintenance, repair, and storage facilities for radioactive or specialized maintenance equipment used in support of the FFTF. The MASF currently functions for its intended purposes.

The contributors to the 400 Area Secondary Cooling Water are floor and equipment drains.

4. 481-A WATER PUMPHOUSE

The 481-A Water Pumphouse was constructed to provide space for a diesel fire pump and two sanitary water pumps. An equipment drain associated with sanitary water pump packing leakage contributes to the 400 Area Secondary Cooling Water.

9613449.0944

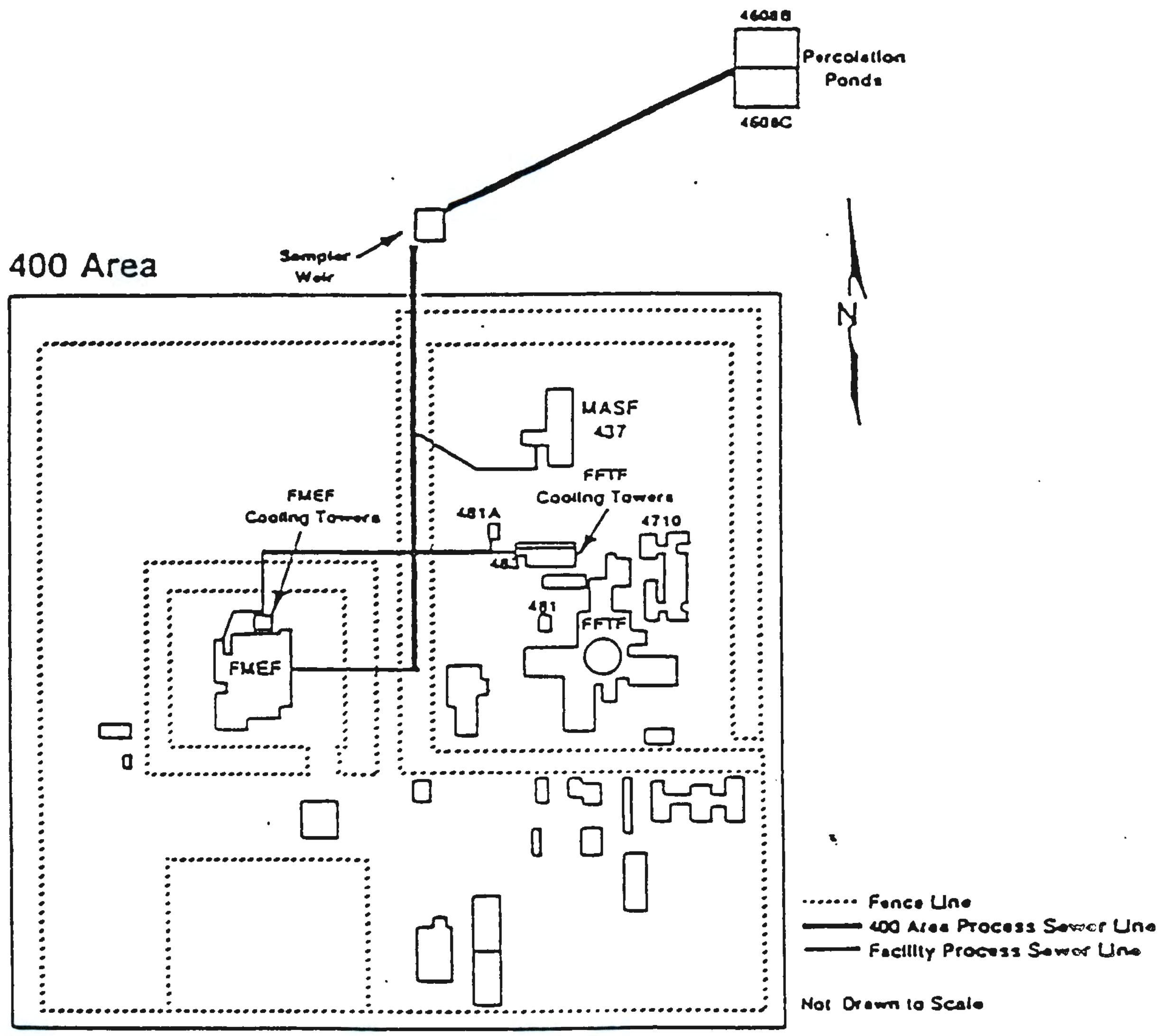


Figure 1. 400 Area and 400 Area Secondary Cooling Water (400 Area Process Sewer) Schematic Map

ATTACHMENT C

400 Area Secondary Cooling Water
Effluent Stream Description
Section C - Item 2

ATTACHMENT C

The 400 Area Secondary Cooling Water has 74 potential points of entry, which are listed in the 400 Area Secondary Cooling Water Sampling and Analysis Plan (SAP) (WHC, 1992a). Of the 74, there are nine routine contributors, which contribute greater than 99% of the wastewater. The 400 Area Secondary Cooling Water is composed of 85% cooling water from FFTF and FMEF cooling towers, and 15% from the FMEF, MASF, and 481-A Pumphouse equipment and floor drains, and auxiliary cooling systems. There are 65 infrequent contributors to the effluent stream: 59 in FMEF, 3 in MASF, and 3 in 481-A Pumphouse. These infrequent contributors consist of electric water coolers (drinking fountains), sinks, floor drains and equipment drains.

The 400 Area Secondary Cooling Water system (400 Area Process Sewer) consists of a 12 inch main pipe, located approximately in the center of the 400 Area. Five-6 inch pipes discharge process water from the four facilities into the main pipe; two pipes from the FMEF and one pipe from the other three facilities. The main pipe discharges to the 400 Area Percolation ponds, which are located approximately 2000 ft north-northeast of the 400 Area's northern fence line (Fig. 1). A sample weir, located just north of the northern fence line, monitors the 400 Area Secondary Cooling water for pH and conductivity. A composite sample is also collected monthly at the sample weir.

As noted above, the cooling tower operations account for 85% of the 400 Area Cooling Water effluent. The cooling tower operations at FFTF (Fig. 2) and FMEF are essentially the same, but differ in their demand. The FMEF cooling towers are drained from October to March. The FFTF and FMEF cooling towers are non-contact cooling water systems. The cooling towers at both facilities are galvanized steel closed loop evaporation cooling towers. The cooling systems circulate a 40% ethylene glycol solution from the buildings through cooling coils in the cooling towers. Water is sprayed over the coils as air is blown up through the cooling towers by fans. The evaporation of the spray water provides the cooling effect which is transferred through the cooling coils to the recirculated ethylene glycol solution. The eight cooling towers at FFTF and the three cooling towers at FMEF each have a sump capacity of 2,000 gallons. The water going through the cooling towers is chemically treated to control: 1) biological growth within the tower, and 2) to protect the tower from the effects of scale formation.

Biological growth within the towers is controlled by adding a biocide (Dearborn 702)[1] and a microbiocide (sodium hypochlorite) to the cooling tower water. The control is accomplished by adding the biocide (Dearborn 702) to the sump water at a 25 ppm concentration on a regular basis. The biocide is added to the FFTF cooling water continuously through a metering pump into the makeup water. At FMEF, the biocide is added daily through a metered pump into a recirculated stream of water from each cooling tower sump. The microbiocide (sodium hypochlorite) is added weekly to the system at FMEF in the same manner as described above. At FFTF, the microbiocide is added manually to "shock" the tower only when maintenance requires personnel to physically enter the cooling towers. This is normally done during the spring and summer months. The concentration of the microbiocide in the FFTF cooling towers during shock treatment is 5 ppm and 0.6-0.8 ppm during operations using only the biocide (Dearborn 702).

The MASF (Fig. 4) has one routine contributor to the 400 Area Secondary Cooling Water, which is cooling water from the Process Equipment Room air compressor. The three infrequent contributors are floor drains. The floor drain located between the Decon 1 Area and the Craft Decontamination and Maintenance Facility (CDMF) (Fig. 4) will either be plugged or a dike will be constructed around it because it does not have a designated use.

The 481-A Pumphouse (Fig. 5) has one routine contributor and three infrequent contributors. The routine contributor is a drain associated with the leaky fire water pump. The other floor drains have moats constructed around them. A moat around the diesel fuel tank has been proposed and is to be constructed in the near future.

Potentially hazardous or dangerous materials are stored away from points of entry. The majority of the points of entry, as mentioned above, are infrequently used and account for $<1\%$ of the 400 Area Secondary Cooling Water waste stream.

The 400 Area Secondary Cooling Water is not treated prior to discharge to the percolation ponds. The BAT/AKART report (WHC, 1992b) confirms that the effluent is not a dangerous waste. The BAT/AKART report (WHC, 1992b) also recommends that the effluent stream remain discharging to the 400 Area percolation ponds in its current status.

1. Dearborn is a Trademark of W. R. Grace & Co., Lake Zurich, IL. It is the company that currently has the contract for supplying the chemicals for water treatment and testing at FFTF. This contract periodically comes up for rebid. There is the possibility, if a new contract is awarded, that wherever Dearborn is mentioned in this application an equivalent chemical brand could be used.

Scale formation protection is required due to the increasing concentration of naturally occurring salts (typically calcium carbonate) resulting from the evaporation process of the cooling towers. The electrical conductivity of the water in the sumps is monitored at FFTF and FMEF to protect the system. When the conductivity approaches 1200 micromhos, automatic valves open to discharge the water. Discharging the sump water allows fresh water to enter the system. Discharge is continued until enough fresh water has been added to the system to bring the conductivity down to approximately 900 micrmhos.

A scale inhibitor (Dearborn 878) is added to the towers to a concentration of between 50 ppm and 75 ppm in order to prevent the formation of scale. Scale concentration control at FFTF is accomplished by metering the chemical into the makeup water at a rate of approximately 40 ppm. Evaporation in the towers helps bring the concentration to the desired range mentioned above. At FMEF, control is accomplished by metering the chemical directly into the tower when the conductivity control system opens the valve which blows down the sump water. A chemical analysis is performed in the field by the operator to ensure a proper balance is maintained between addition to and discharges from the cooling towers.

The chemical testing for scale inhibitor concentration involves the use of the following Dearborn Products:

Dearborn Code 595	Hydrochloric Acid Solution
Dearborn Code 904	Thorium nitrate Solution
Dearborn Code 550	Sodium Thiosulfate/Borate Solution
Dearborn Code 562	Xylenol Orange Indicator
Dearborn Code 899	Beryllium Sulfate Solution

The resultant solution from the test (approximately 50 ml per test) is not designated a dangerous waste since the beryllium concentration (0.00095%) is <0.01%, the reportable concentration level. Trace quantities of these products enter the 400 Area Secondary Cooling Water from washing gloves, glassware, equipment and hands after each test via sinks in the cooling tower water treatment building.

The FMEF facility has 63 potential points of entry, 59 of which are inactive or infrequently used. The four routine contributors from the FMEF are two from the FMEF cooling towers, one from the Entry Wing computer room air conditioning unit, and one from the pressure relief valve drain of the process water supply system in the Mechanical Equipment Room (Fig. 3). At this time, the majority of the infrequent points of entry are to be plugged, or rubber dikes are being installed around the floor and equipment drains. The points of entry would not come in contact with any radioactive material if it was introduced to the facility. Thirty-two of the 59 infrequent points of entry at the FMEF discharge to the Liquid Retention System. The Liquid Retention System is composed of two 6,000 gallon tanks. The effluent is held in the tanks, where samples can be taken to determine if there is a potential for contaminants to have been introduced to the water. At present, the FMEF Liquid Retention System releases effluent to the 400 Area Secondary Cooling Water randomly once or twice a year when a tank is full.

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400 Area Secondary Cooling Water
Attachment C

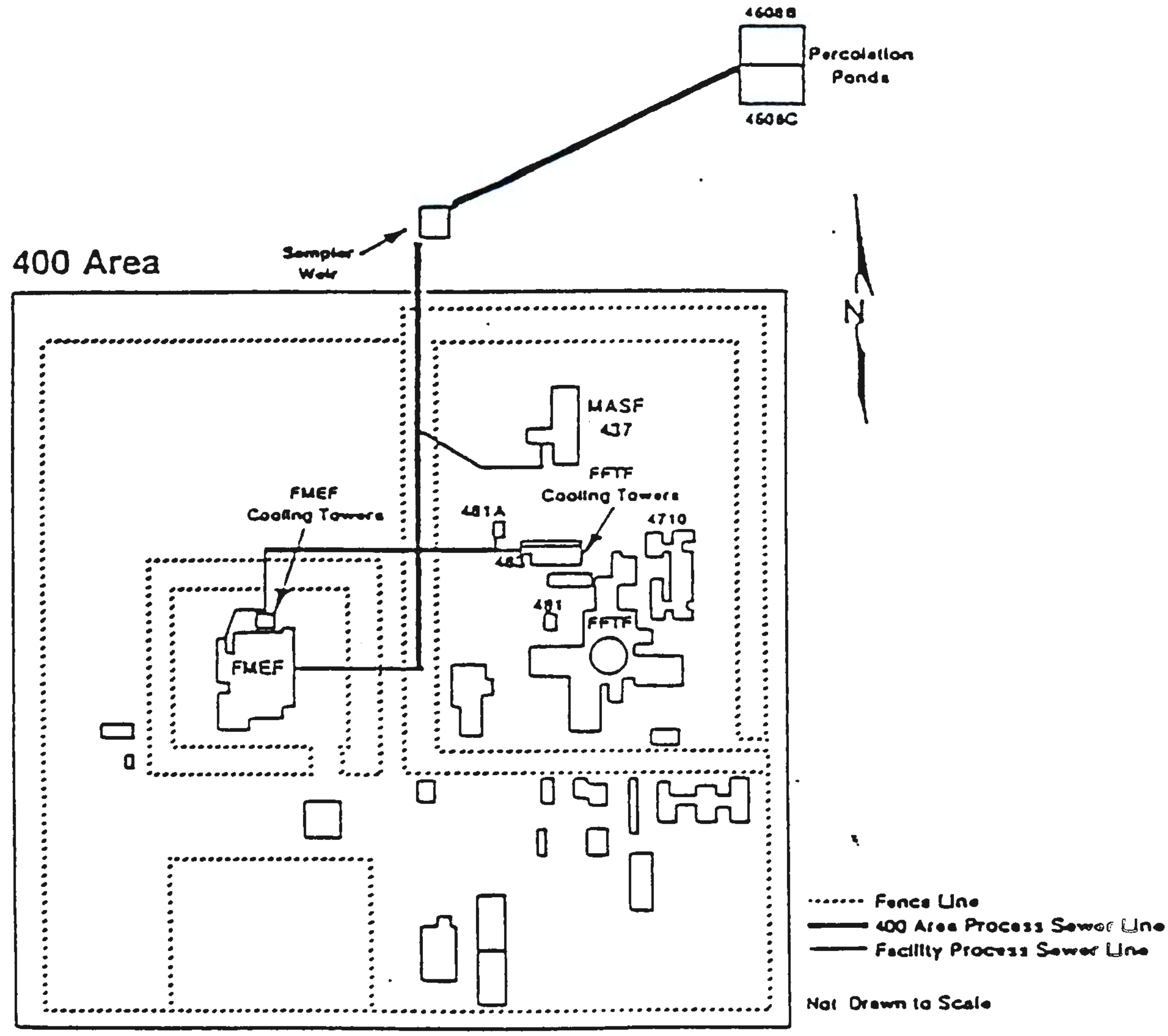

Figure 1. Schematic Map of the 400 Area Secondary Cooling Water (400 Area Process Sewer)

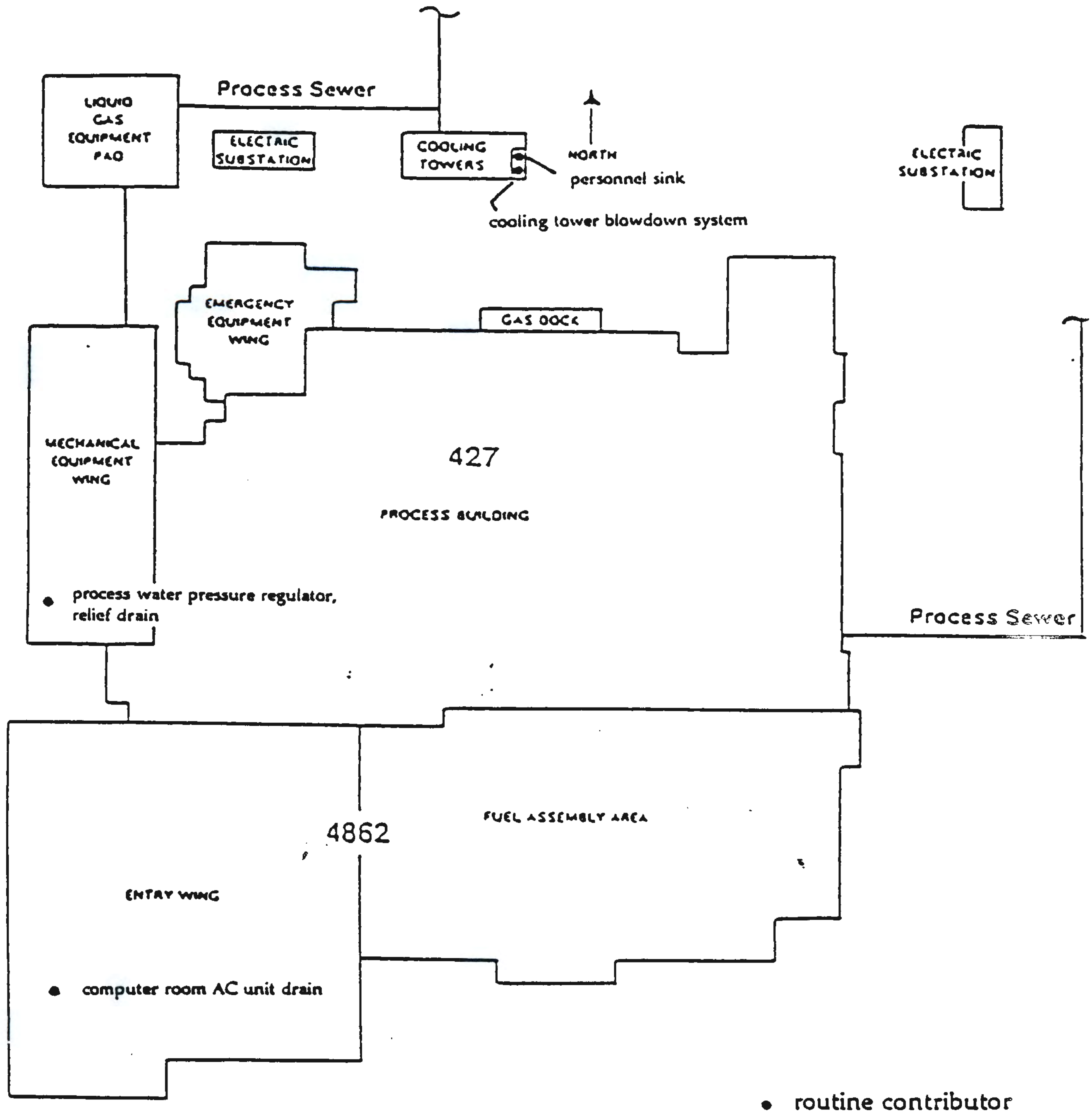

Figure 3. Location of the FMEF facility's routine contributors to the 400 Area Secondary Cooling Water. (WHC, 1990).

9613449.0951

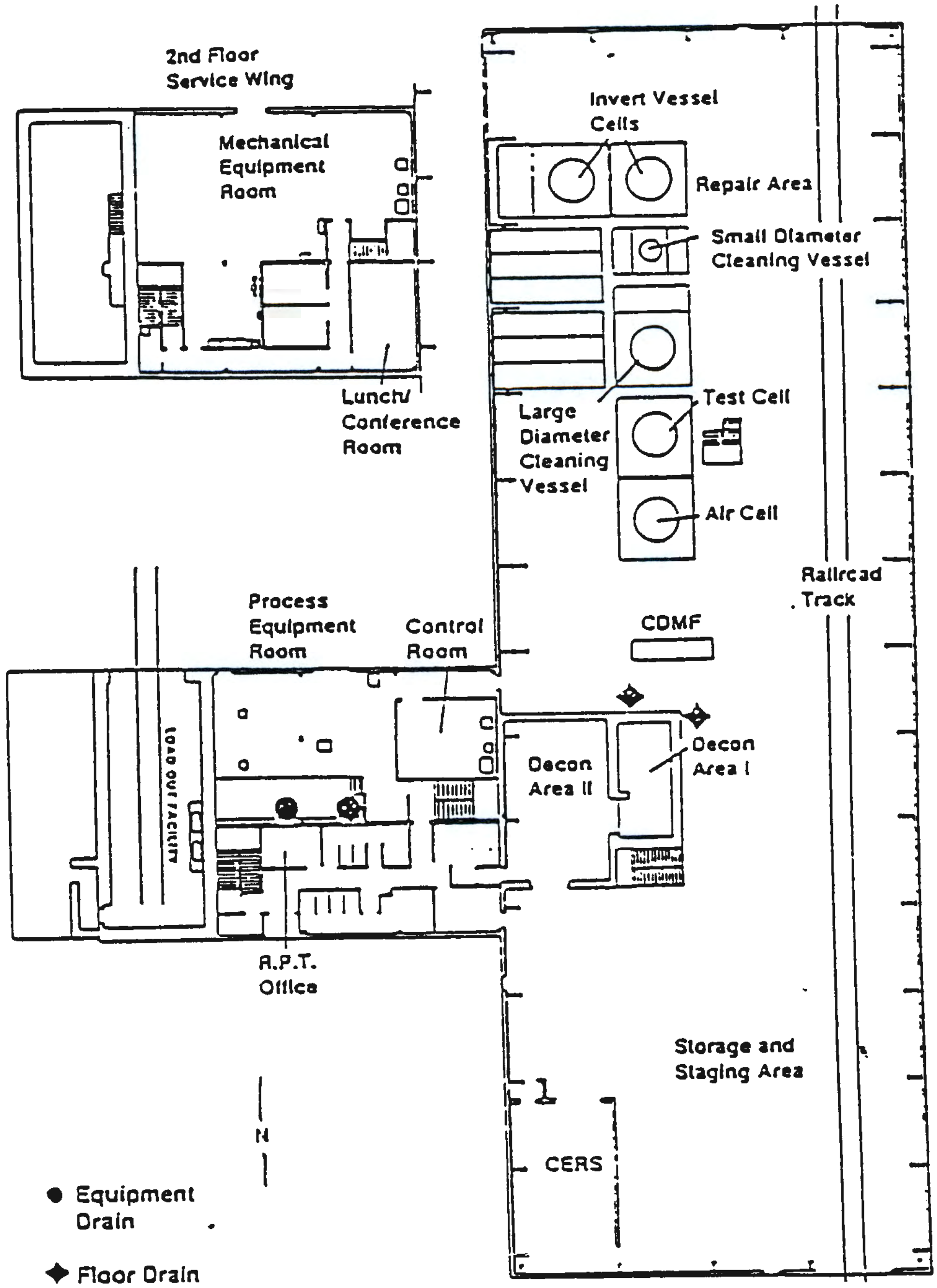

Figure 4. Location of the MASF facility's contributors to the 400 Area Secondary Cooling Water (WHC, 1990).

9613449.0952

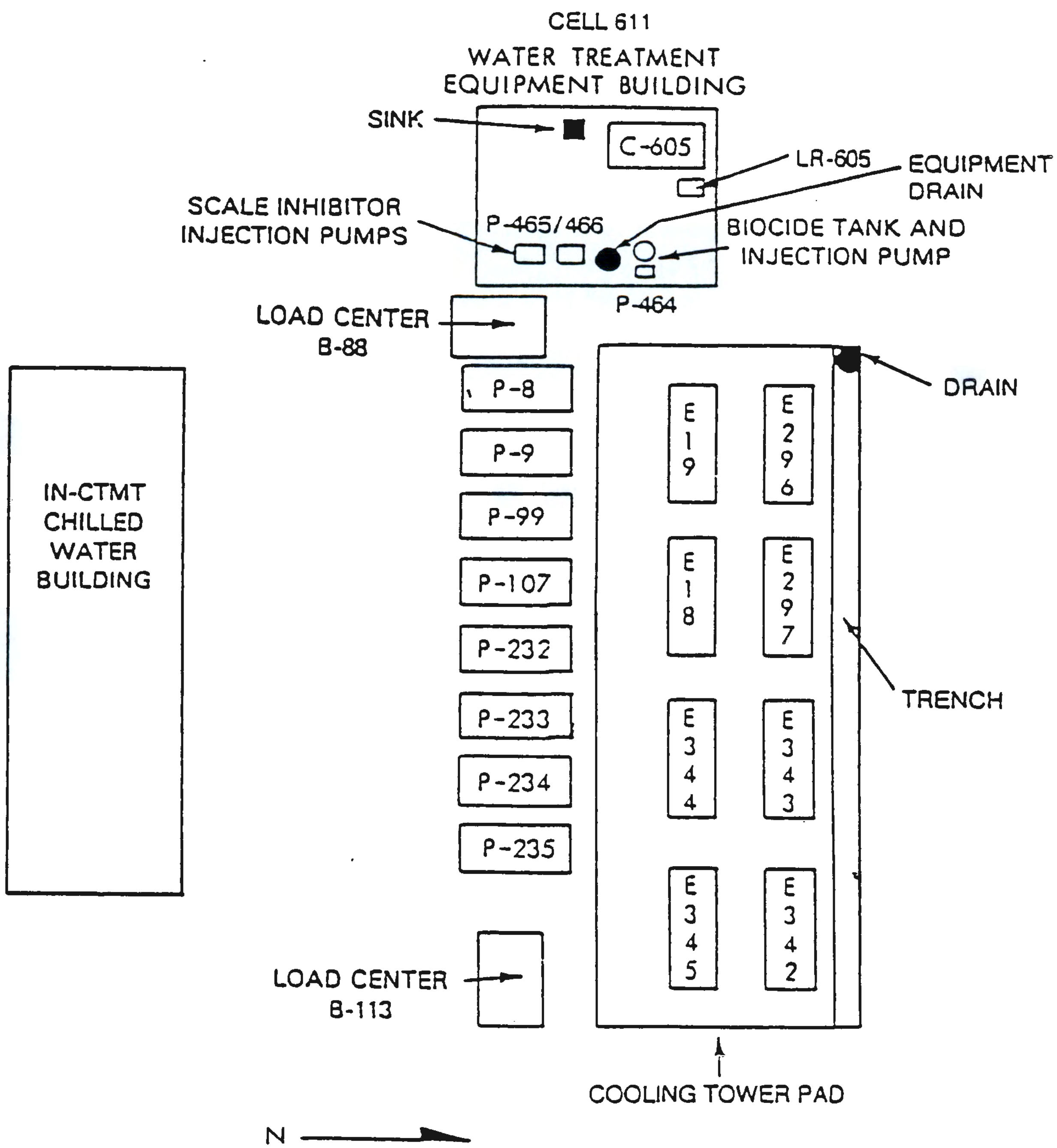

Figure 2. Location of the FFTF cooling tower contributors to the 400 Area Secondary Cooling Water (WHC, 1990).

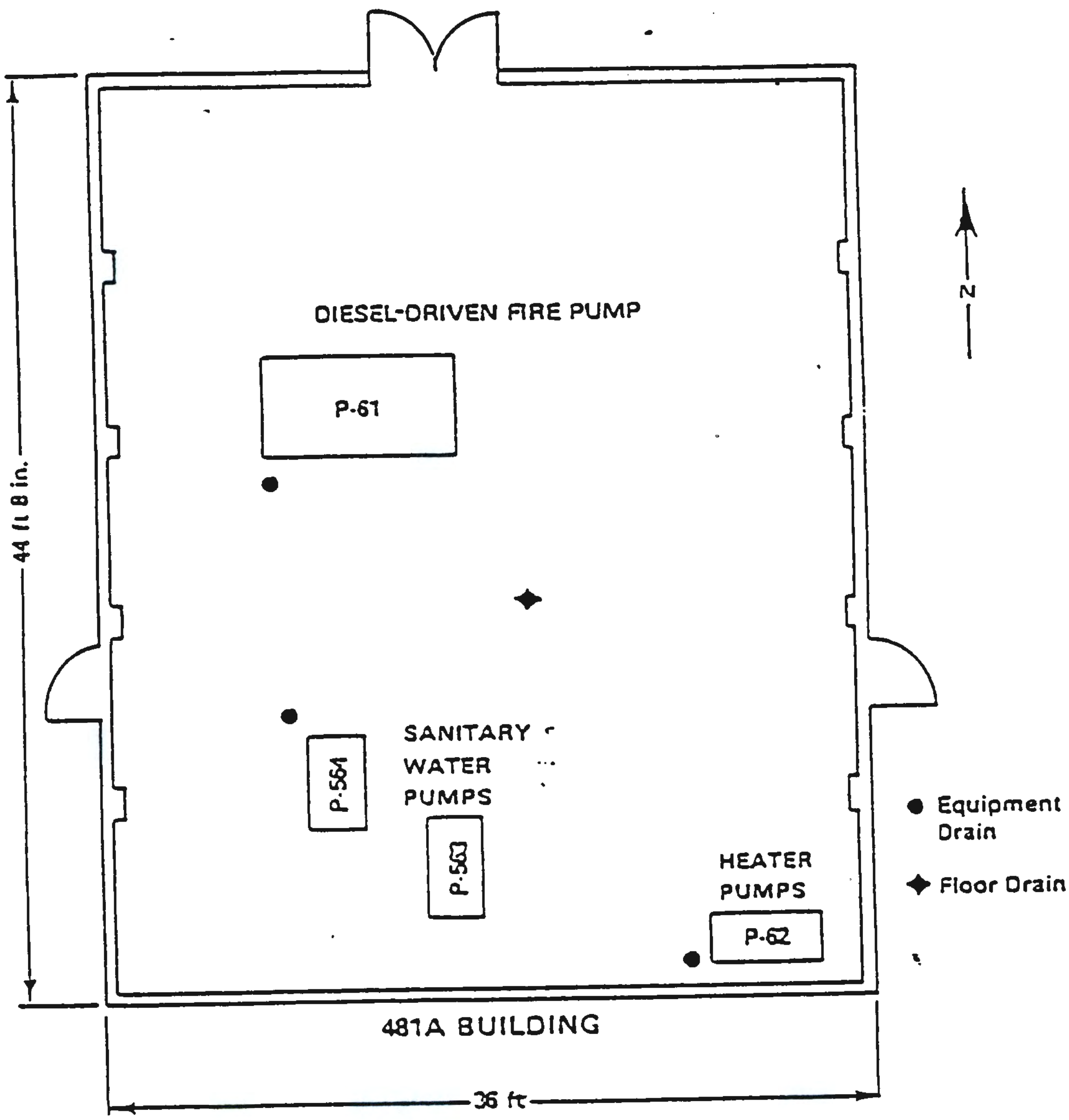

Figure 5. Location of the 481-A Pumphouse contributors to the 400 Area Secondary Cooling Water (WHC, 1990)

ATTACHMENT D

Materials Stored On Site
Section C - Item 7

ATTACHMENT D

MATERIALS STORED ON SITE

MATERIAL	QUANTITY*
Mineral Oil	28963 G
Nitrogen	20372 C
Polychlorinated Biphenyls	100259 L
Ammonium Hydroxide	21 L
Dearborn 727	15 L
Dearborn 878	108 G
Dearborn 702	703 G
Diesel Fuel	5509 G
Ethylene Glycol	13329 G
Firemate 8808[1]	0
Hydraulic Oil	15 G
Lubricating Oil	1705 G
Silica Gel	1356 L
Zeolite	0
Acetylene	3640 C
Stargon	1560 C
Trichlorofluoromethane	450 G
Acetone	6 G
Air	1398 C
Argon	11712 C
Carbon Dioxide	6 C
Chevron Thinner 325	520 G
Helium	21682 C
Isopropyl Alcohol	2 G

MATERIALS STORED ON SITE (CONT.)

Kerosene	900 G
Machine Oil	644 G
Methane	0
Motor Oil	0
Oxygen	4263 C
Propane	50 L
Lead	7623 L
1,1,1-Trichloroethane	6 G
Unleaded Gasoline	60 G
Phenoline 305 Finish	798 G
Chlorodifluoromethane	16000 C
Gas Mix, Hear 75/25	1520 C
Hydrogen	1164 C
Ammonia	55 G
Diethylene Glycol Mono ethyl ether	18 G
Silicon	110 L
Sodium	150 L
Freon 12	10 L
Freon 22	100 L
Ammonium Nitrate	5210 L
Sodium Hypochlorite	28 G
Grease	210 G
Sulfuric Acid, 100%	384 G

* G = gallons
L = liters
C = cubic feet

1. Firemate is a Trademark of W. R. Grace & CO., Lake Zurich, IL.

ATTACHMENT E

400 Area Secondary Cooling Water Flow Charts
Section D - Item 3

400 AREA WATER BALANCE

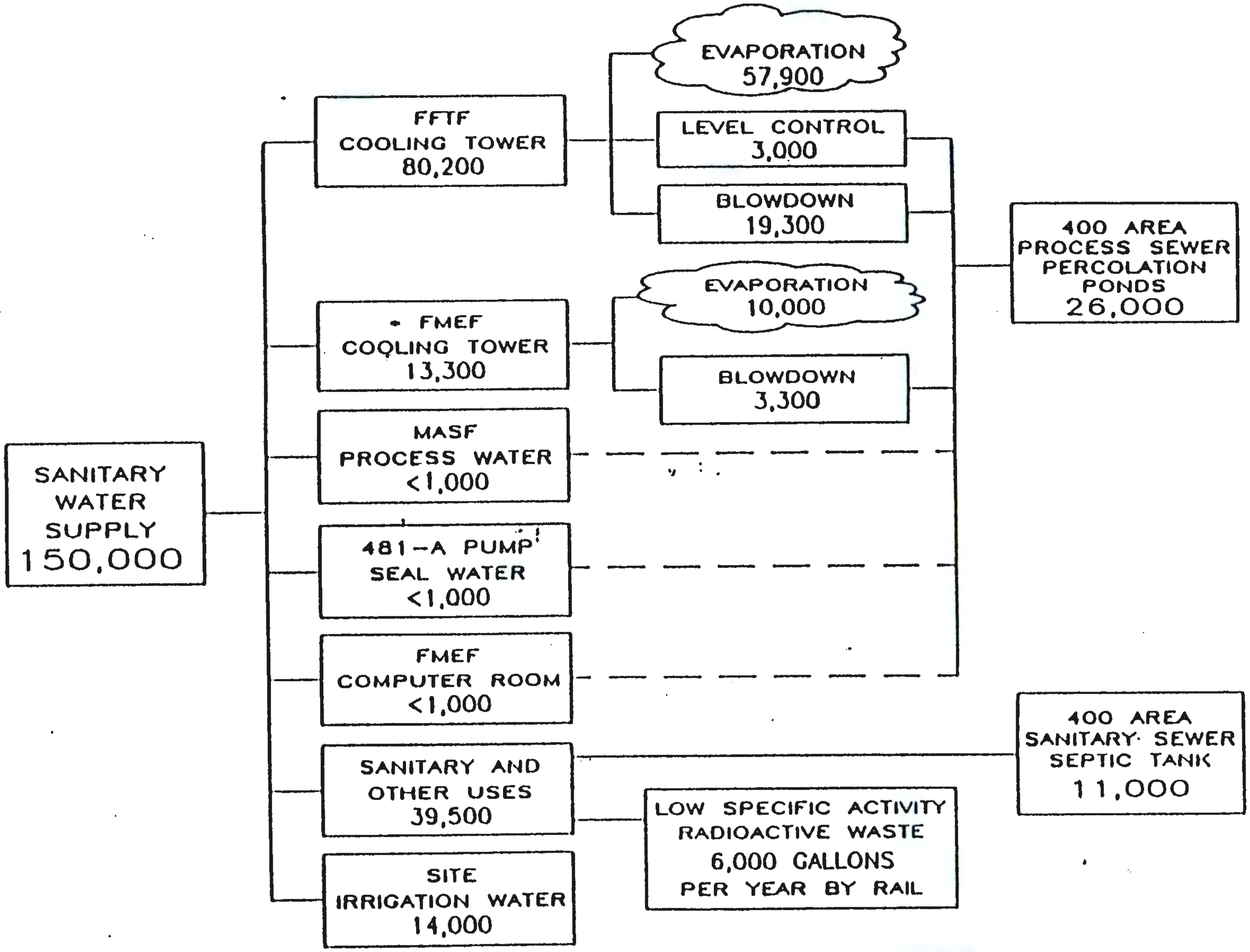

FIGURE 1: AVERAGE ANNUAL DAILY FLOW RATES (GPD)

* FMEF COOLING TOWERS OPERATED MAY THROUGH SEPTEMBER.

Dashed lines indicate no intermediate activity prior to going to the Process Sewer.

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400 AREA WATER BALANCE

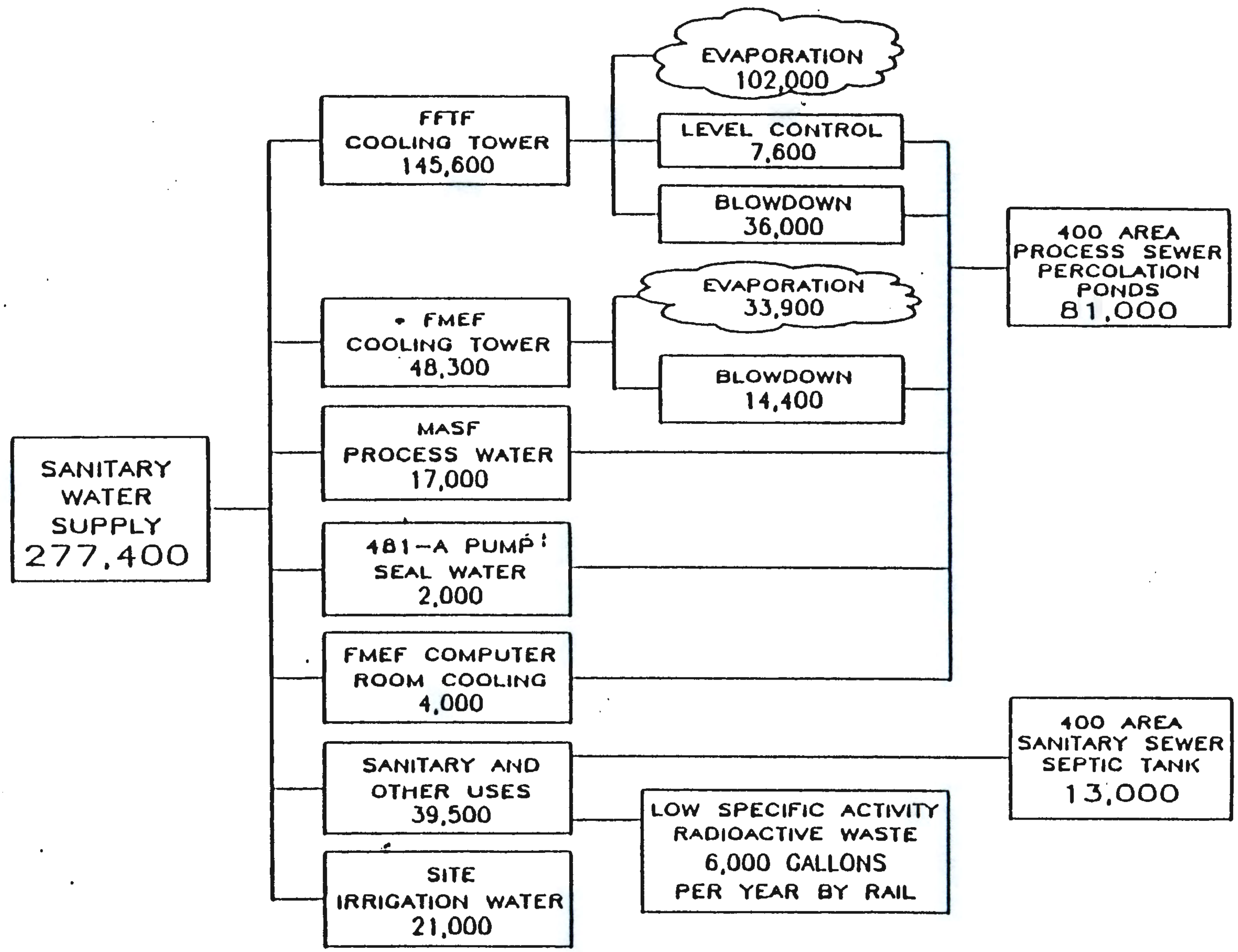

FIGURE 2: PEAK DAILY FLOW RATES (GPD)

• FMEF COOLING TOWERS OPERATED MAY THROUGH SEPTEMBER.

ATTACHMENT F

Stormwater Disposal Map
Section F - Item 6

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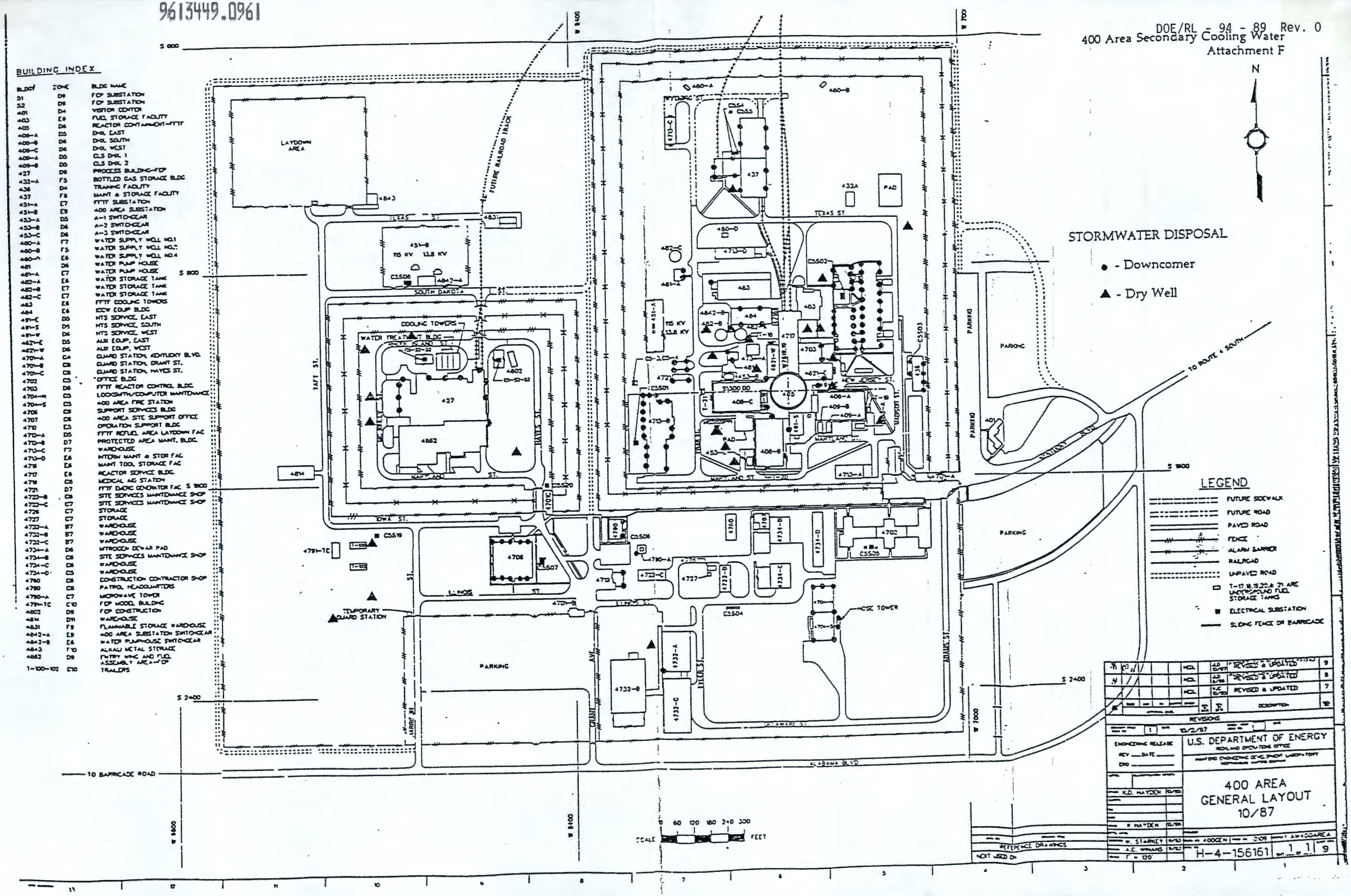
400 Area Secondary Cooling Water
Attachment F



ATTACHMENT G

400 Area Topographic Maps
Section H - Item 3

ATTACHMENT G

There are two sets of maps in this attachment. The first set of maps, numbered H-13-000401 and H-13-000402, is a topographic map of the 400 Area. The features shown on this map are the street names, water supply locations, drywells and the stormwater discharge downcomers. The second map is the Wooded Island, WA 7.5 minute quadrangle map. This map shows the locations of the 400 Area percolation ponds and the monitoring well associated with the ponds.

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

WOODED ISLAND QUADRANGLE
WASHINGTON
7.5 MINUTE SERIES (TOPOGRAPHIC)

400 Area Secondary Cooling Water
Attachment G

Mapped, edited, and published by the Geological Survey

Control by USGS and NOS/NOAA

Topography by photogrammetric methods from aerial photographs taken 1973. Field checked 1974

Lambert conformal conic projection. 1927 North American Datum 10,000-foot grid based on Washington coordinate system, south zone

1000-meter Universal Transverse Mercator grid ticks, zone 11, shown in blue

The difference between 1927 North American Datum and North American Datum of 1983 (NAD 83) for 7.5 minute intersections is given in USGS Bulletin 1875. The NAD 83 is shown by dashed corner ticks

Fine red dashed lines indicate selected fence lines

Where omitted, land lines have not been established

UTM GRID AND 1978 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

SCALE 1:24 000

CONTOUR INTERVAL 10 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

THIS MAP COMPLIES WITH NATIONAL MAP ACCURACY STANDARDS
FOR SALE BY U. S. GEOLOGICAL SURVEY, DENVER, COLORADO 80225, OR RESTON, VIRGINIA 22092
A FOLDER DESCRIBING TOPOGRAPHIC MAPS AND SYMBOLS IS AVAILABLE ON REQUEST

ROAD CLASSIFICATION

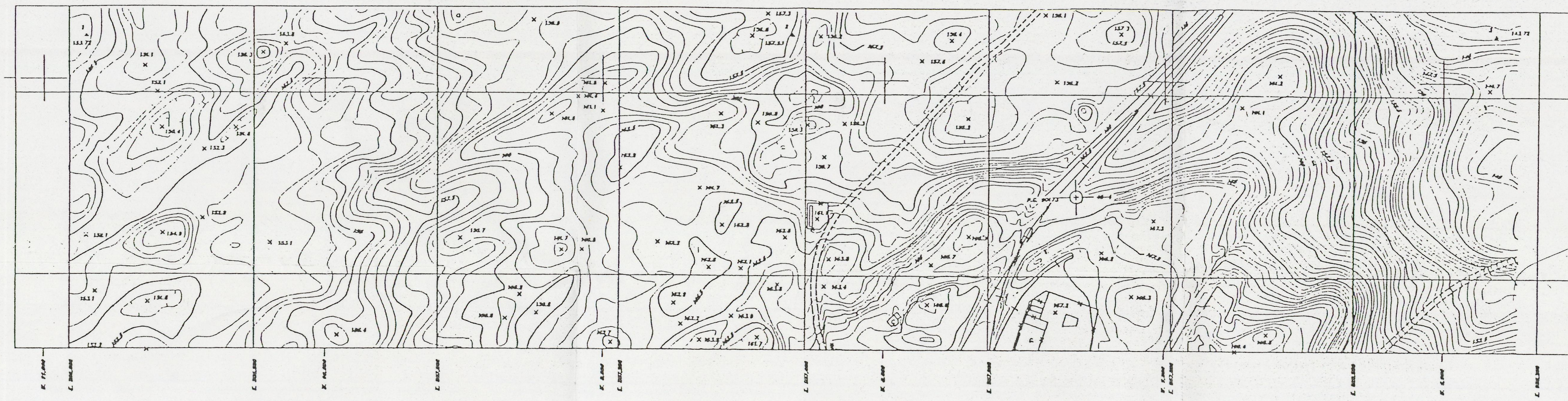
Primary highway, hard surface — Light-duty road, hard or improved surface
Secondary highway, hard surface — Unimproved road
Interstate Route — U. S. Route — State Route

WASHINGTON
QUADRANGLE LOCATION

WOODED ISLAND, WASH.
46119-D3-TF-024
1978

DMA 2176 IV NE-SERIES V891

see Wooded Island, WA
7.5 minute quadrangle,
Section 18 for disposal
site and monitoring well location



MATCH LINE SEE DRAWING H-13-000401

LEGEND

INTERMEDIATE CONTOUR		BUILDING NUMBER	405
INDEX CONTOUR (METERS)		SECURITY FENCE	
SPOT ELEVATION (METERS)		PERIMETER FENCE	
IMPROVED/PAVED ROAD		HIGH VOLTAGE POWER	
UNIMPROVED\PAVED ROAD		POWER/ UTILITY POLE	
DIRT ROAD		TREES	
BUILDINGS		LIGHT POLE	
TANKS		TOWER\ WEATHER STATION	
CONCRETE LINE/ SIDEWALK	4" FW	BENCH MARK (METERS)	
RAILROAD		CONCRETE PAD	
PIPELINE		PHOTO CONTROL	
FIRE WATER LINE	4" FW	DRYWELL	
HANFORD PLANT COORDINATES (FEET)	S. 1,000 W. 10,000	WATER SUPPLY WELL	
WASHINGTON STATE COORDINATES (METERS)	N. 123,500 E. 586,500	DOWNCOMER (Stormwater Disposal)	

SITE PLAN

SCALE: 1:2000

0 20 40 80 120 160 METERS

0 100 200 300 400 500 750 1000 FEET

GENERAL NOTES

1. THIS MAP IS BASED ON AERIAL PHOTOGRAPHY FLOWN 8/20/88. THE TOPOGRAPHIC MAP WAS PREPARED BY GEONEX,INC. AND CERTIFIED TO MEET NATIONAL MAP ACCURACY STANDARDS. OFFICIAL COPIES OF THE GEONEX MAPS THAT SHOW THE CERTIFICATE ARE LOCATED IN THE WESTINGHOUSE ENGINEERING FILES AS DRAWING NUMBERS H-4-72044 SHEETS 1 AND 2. THE NAMES OF PHYSICAL FEATURES AND THE TITLE BLOCK OF THE H-13-0000401 AND H-13-000402 MAPS WERE ADDED BY WESTINGHOUSE HANFORD COMPANY.

2. WASHINGTON COORDINATE SYSTEM: THE OFFICIAL STATE PLANE COORDINATE SYSTEM AS DEFINED BY THE REVISED CODE OF WASHINGTON (RCW). THE HANFORD SITE LIES WITHIN THE WASHINGTON COORDINATE SYSTEM, SOUTH ZONE. THIS GRID COVERS THE ENTIRE SITE AND USES X (EASTINGS) AND Y (NORTHINGS) COORDINATES.

   HORIZONTAL DATUM: NAD-83 LAMBERT PROJECTION

   VERTICAL DATUM: NATIONAL GEODETIC SURVEY DATUM AS PROVIDED BY KAISER ENGINEERS - HANFORD.

   COORDINATES ARE SHOWN AS METERS.
   CONTOURS ARE SHOWN AS 1/2 METERS.

3. HANFORD PLANT GRID: A LOCAL GRID SYSTEM WITH ITS INITIAL POINT NORTHEAST OF THE 400 AREA. IT COVERS 200-E AND 200-W AS WELL AS GENERAL SITE WORK SUCH AS WELLS AND BURIAL GROUNDS. COORDINATES ARE SHOWN AS FEET. IT IS ROTATED FROM NORTH AND IS ON A SLIGHTLY DIFFERENT SCALE THAN LAMBERT.

SUPERSEDES DRAWING H-4-72048
REV 1 PER ECN 145785

OFFICIAL RELEASE
DATE NOV 07 1991

REF NUMBER	TITLE
H-4-72046 SHEET 1	400 AREA TOPOGRAPHIC MAP
H-4-72046 SHEET 2	400 AREA TOPOGRAPHIC MAP

REFERENCES

NEXT USED ON H-13-000401

CADFILE N000402A

REVISIONS

CADCODE 1E:10M:AC02:10 0-H

DRAWN J.R. KAPPI

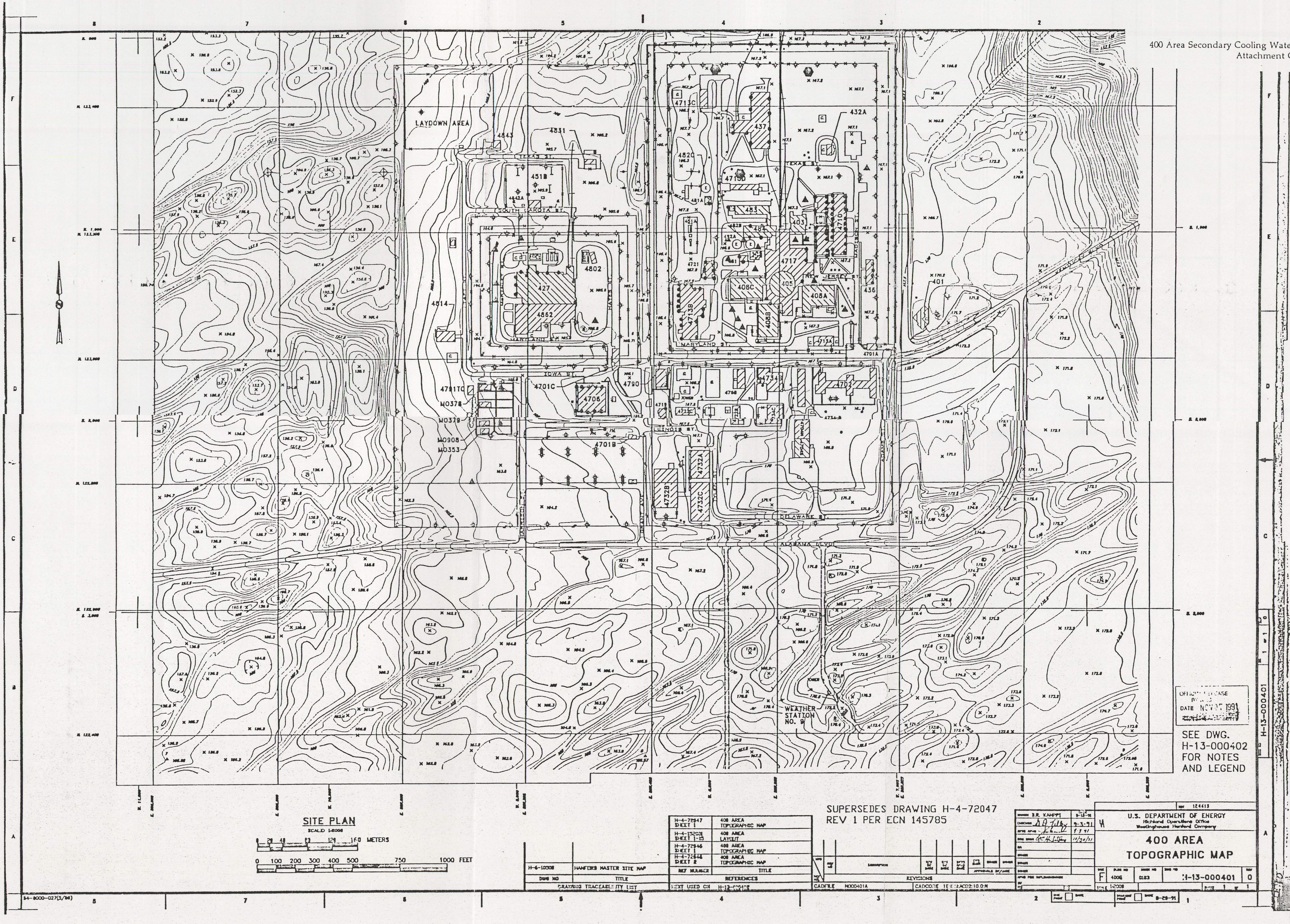
U.S. DEPARTMENT OF ENERGY
Richland Operations Office
Westinghouse Hanford Company

400 AREA TOPOGRAPHIC MAP

SIZE			DWG NO	REV
F	406G	0103	H-13-000402	0

SCALE 1:2000 SHEET 1 OF 1

400 Area Secondary Cooling Water
Attachment G



ATTACHMENT H

Well Logs
Section H - Item 4

ATTACHMENT H

Well logs for the following well are attached:

499-S1-8J

WELL LOG	BY: [illegible] DATE: 12/13/84	RIG [illegible]	WELL NO. #4 DEPTH: TO	SUBMITTAL NO.	PROJECT: CONTRACT: DAJ 1710

TOTAL CASING LENGTH	DEPTH	DRILL METHOD	WET/DRY SAMPLE	LITHOLOGIC DESCRIPTION % Each Grain Size, Color, Roundness, Caliche, etc.	TIME	DRILLING COMMENTS
				moved & set up Rig		
					Sub time	

WELL LOG	BY: Greg B[illegible] DATE: 12/20/84		RIG Drewego	WELL NO. #4 DEPTH: – TO 19'	SUBMITTAL NO.	PROJECT: CONTRACT: J1J 1710
TOTAL CASING LENGTH	DEPTH	DRILL METHOD	WET/DRY SAMPLE	LITHOLOGIC DESCRIPTION % Each Grain Size, Color, Roundness, Caliche, etc.	TIME	DRILLING COMMENTS
5'	5'	H	W	Fine to Course tan sand + silt		
10'	10'	"	"	same as 5' sample		
15'	15'	"	"	Med to Course sand + some silts		
					Shks time	

WELL LOG	BY [illegible] DATE 12/21/94	RIG [illegible]	WELL NO. 4 DEPTH: 19' TO 35'	SUBMITTAL NO.	PROJECT: CONTRACT: SAS 1712

TOTAL CASING LENGTH	DEPTH	DRILL METHOD	WET/DRY SAMPLE	LITHOLOGIC DESCRIPTION % Each Grain Size, Color, Roundness, Caliche, etc.	TIME	DRILLING COMMENTS
20'	20	H	W	F to M tan sand		
25'	25'	"	"	same		
30	30'	"	"	F to C tan + gray sand		
35'	35'	"	"	same as 30' sample		
					Shr: time	

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V-0749-0000

WELL LOG		BY: [illegible] DATE: 12/24/154		RIG [illegible]	WELL NO. #4 DEPTH: 39' TO 60'	SUBMITTAL NO.		PROJECT: CONTRACT: JAJ 1710
TOTAL CASING LENGTH	DEPTH	DRILL METHOD	WET/DRY SAMPLE	LITHOLOGIC DESCRIPTION % Each Grain Size, Color, Roundness, Caliche, etc.		TIME	DRILLING COMMENTS	
40	40'	D	Dry	(F to C) tan-gray sand	changed	to drive barrel		
45'	45'	"	"	Same				
50'	50'	"	"	Same				
55'	55'	"	"	Same				
60'	60'	"	"	Same				
						Shes		

WELL LOG	BY: [illegible]	RIG:	WELL NO. 2-1	SUBMITTAL NO.	PROJECT:
	DATE: 12/27/81	Omega	DEPTH: 60' TO 81'		CONTRACT: SAJ 171

TOTAL CASING LENGTH	DEPTH	DRILL METHOD	WET/DRY SAMPLE	LITHOLOGIC DESCRIPTION % Each Grain Size, Color, Roundness, Caliche, etc.	TIME	DRILLING COMMENTS
60'	60'	d	Dry	Same F to M+C Tan sand		
65'	65'	"	"	Same		
70'	70'	"	"	Sam		
75'	75	"	"	m to C Black + tan sand		
80'	80'	"	"	Same as 75' sample		
					[illegible]	time

WELL LOG	BY: [illegible] DATE: 11/15/94	RIG: Omega	WELL NO. #4 DEPTH: 51' TO 105'	SUBMITTAL NO.	PROJECT: CONTRACT: SAJ1710

TOTAL CASING LENGTH	DEPTH	DRILL METHOD	WET/DRY SAMPLE	LITHOLOGIC DESCRIPTION % Each Grain Size, Color, Roundness, Caliche, etc.	TIME	DRILLING COMMENTS
85'	85'	D	Dry	m to C Black + tan sands		
90'	90'	"	"	Same		
95'	95'	"	"	Same		
100'	100'	"	"	Same		
105'	105'	"	"	Same		
					Shp tank	

WELL LOG

BY: [illegible]
DATE: 12/21/[illegible]

RIG: Cmwago

WELL NO. [illegible]
DEPTH: 105' TO 116'

SUBMITTAL NO.

PROJECT:
CONTRACT: SA51210

TOTAL CASING LENGTH	DEPTH	DRILL METHOD	WET/DRY SAMPLE	LITHOLOGIC DESCRIPTION % Each Grain Size, Color, Roundness, Caliche, etc.	TIME	DRILLING COMMENTS
[illegible]'	110'	[illegible]	Dry	m to C tan + black sand		
[illegible]'	115'	"		Same		
				picked up 17'3" of 14" casing + Repaired [illegible]		
					[illegible] time	

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DOE/RL - 94 - 89 Rev. 0

400 Area Secondary Cooling Water
Attachment H

WELL LOG

BY: [illegible] | DATE: 1/2/55 | RIG: Omega | WELL NO. #4 | DEPTH: 116' TO 126' | SUBMITTAL NO. | PROJECT: | CONTRACT: JAJ17[illegible]

TOTAL CASING LENGTH	DEPTH	DRILL METHOD	WET/DRY SAMPLE	LITHOLOGIC DESCRIPTION % Each Grain Size, Color, Roundness, Caliche, etc.	TIME	DRILLING COMMENTS
120'	120'	D	Dry	F to C tan + Black sand + [illegible] silt		
125'	125'	"	•	Same		
					Stri[illegible] time	

EXHIBIT "A"

WELL LOG

BY: [illegible signature]
DATE: 1/3/85

RIG: [illegible]

WELL NO. ~4
DEPTH: 126' TO 135'

SUBMITTAL NO.

PROJECT:
CONTRACT: [illegible]

TOTAL CASING LENGTH	DEPTH	DRILL METHOD	WET/DRY SAMPLE	LITHOLOGIC DESCRIPTION % Each Grain Size, Color, Roundness, Caliche, etc.	TIME	DRILLING COMMENTS
130'	130'	D	Dry	F to C Black + tan sand + some silt		
135'	135'	"	"	Same as 130' sample.		
					[illegible signature]	

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400 Area Secondary Cooling Water
Attachment H

DOE/RL - 94 - 89 Rev. 0

WELL LOG		BY: [illegible]		RIG	WELL NO. 1	SUBMITTAL NO.	PROJECT:
		DATE: 1/4/85		[illegible]	DEPTH: 135' TO 145'		CONTRACT:

TOTAL CASING LENGTH	DEPTH	DRILL METHOD	WET/DRY SAMPLE	LITHOLOGIC DESCRIPTION % Each Grain Size, Color, Roundness, Caliche, etc.	TIME	DRILLING COMMENTS
135'	135'	D C	(Dry) to F	sand tan + Black sand to 136'		
140'	140'	Hard tools	(Wet)	wide F to C Black sand + silt + some small gravels		
145'	145'	"	"	same as 140' sample		
				drilled 10' + picked up 11' of 14" at 10:8		
					This time	

WELL LOG		BY Gary Collins DATES 1/7/85		RIG Chevega	WELL NO. 84 DEPTH: 145' TO 155'	SUBMITTAL NO.	PROJECT: CONTRACT: DAJ 17AD
...L. ...NG ...TH	DEPTH	DRILL. METHOD	WET/DRY SAMPLE	LITHOLOGIC DESCRIPTION % Each Grain Size, Color, Roundness, Caliche, etc.		TIME	DRILLING COMMENTS
5'	145'	H	Wet	F to C tan + Black sand + silt			
'	150	"	"	SAME			
5'	155'	"	"	SAME			
				Item # 1 10'			
				Item # 3 10'		8hr.	time

9613449.0974

WELL LOG		BY: [illegible] DATE: 7/3/85		RIG Ciemego	WELL NO. #4 DEPTH: 155' TO 165'	SUBMITTAL NO.	PROJECT: CONTRACT: SAJ 1710

TOTAL CASING LENGTH	DEPTH	DRILL METHOD	WET/DRY SAMPLE	LITHOLOGIC DESCRIPTION % Each Grain Size, Color, Roundness, Caliche, etc.	TIME	DRILLING COMMENTS
157'	160'	H	Wet	F to C tan + Black sand + silt		
165'	165'	"	"	same		
				Item #1 10'		
				Item #3 2'		
					3hrs time	

WELL LOG		BY [illegible signature] DATE: 1/10/85		RIG Drewego	WELL NO. #4 DEPTH: 165' TO 165'	SUBMITTAL NO.	PROJECT: CONTRACT: JAJ171D

TOTAL CASING LENGTH	DEPTH	DRILL METHOD	WET/DRY SAMPLE	LITHOLOGIC DESCRIPTION % Each Grain Size, Color, Roundness, Caliche, etc.	TIME	DRILLING COMMENTS
				set 60' of 10" casing, liner set to 160'		
				Item # 4 60' 10" casing		

WELL LOG	BY: Jerry Rullins DATE: 4/3/95	RIG Durango	WELL NO. #4 DEPTH: 165' TO 165'	SUBMITTAL NO.	PROJECT: CONTRACT: SAJ1710

TOTAL CASING LENGTH	DEPTH	DRILL METHOD	WET/DRY SAMPLE	LITHOLOGIC DESCRIPTION % Each Grain Size, Color, Roundness, Caliche, etc.	TIME	DRILLING COMMENTS
				set 100' of 10" casing		
				Item #4 100' 10" casing		
					This time	

V-0749-0000

WELL LOG	BY: [illegible] DATE: 1/11/85	RIG	WELL NO. #4 DEPTH: 165' TO 175'	SUBMITTAL NO.	PROJECT: CONTRACT: SAS 17[illegible]

[..]AL. [..]ING [..]GTH	DEPTH	DRILL METHOD	WET/DRY SAMPLE	LITHOLOGIC DESCRIPTION % Each Grain Size, Color, Roundness, Caliche, etc.	TIME	DRILLING COMMENTS
[..]0'	170'	H	W	sand silt & small gravel		
[..]5'	175'	"	"	same		
				Rm #4 10'		
					Shr time	

9613449.0976

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400 Area Secondary Cooling Water
Attachment H

WELL LOG		BY: [illegible]		RIG	WELL NO. #4	SUBMITTAL NO.	PROJECT:
		DATE: [illegible]		[illegible]	DEPTH: 175' TO 183'		CONTRACT: [illegible]

TOTAL CASING LENGTH	DEPTH	DRILL METHOD	WET/DRY SAMPLE	LITHOLOGIC DESCRIPTION % Each Grain Size, Color, Roundness, Caliche, etc.	TIME	DRILLING COMMENTS
[illegible]	[illegible]	H	wet	black sand + gravels		
183'				some water in + standing at 179'		
				Item #4 5'		
					Skis time	

WELL LOG		BY: [illegible] DATE: 1/15/95		RIG [illegible]	WELL NO. #4 DEPTH: 133' TO 195'	SUBMITTAL NO.	PROJECT: CONTRACT: [illegible]
TOTAL CASING LENGTH	DEPTH	DRILL METHOD	WET/DRY SAMPLE	LITHOLOGIC DESCRIPTION % Each Grain Size, Color, Roundness, Caliche, etc.	TIME	DRILLING COMMENTS
185'	185'	H	Wet	black sand + gravels		
190'	190'	"	"	Same		
195'	195'	"	"	Same		
				Item #4 10'		
					Break time	
				not able to drill open hole from 133' to 195'		

100 Area Secondary Cooling Water Attachment H

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9613449.0977

WELL LOG		BY: [illegible]	RIG	WELL NO. #4	SUBMITTAL NO.	PROJECT:
		DATE: [illegible] 95	[illegible]	DEPTH: 195' TO 202'		CONTRACT: JAJ176

TOTAL CASING LENGTH	DEPTH	DRILL METHOD	WET/DRY SAMPLE	LITHOLOGIC DESCRIPTION % Each Grain Size, Color, Roundness, Caliche, etc.	TIME	DRILLING COMMENTS
[illegible]'	[illegible]'	H	wet	sand silt & gravels approx. [illegible] (tan)		
				making good water.		
				Open hole 4' to 6' ahead of casing		
				Item # 4 7'		
						Skis time

WELL LOG		BY: [illegible] DATE: 11/7/85		RIG [illegible]	WELL NO. 4 DEPTH: 202' TO 211'	SUBMITTAL NO.	PROJECT: CONTRACT: SAJ170
TOTAL CASING LENGTH	DEPTH	DRILL METHOD	WET/DRY SAMPLE	LITHOLOGIC DESCRIPTION % Each Grain Size, Color, Roundness, Caliche, etc.		TIME	DRILLING COMMENTS
205'	205'	H	Wet	Ringold sand silt + gravels			
210'	210'	"	"	Same			
				drill 10' Ahead of casing water still comes in			
				Item #4 9'			
						Shr	

100 Area Secondary Cooling Water
Attachment H

9613449.0978

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WELL LOG		BY [illegible signature] DATE: 1/13/84		RIG Durango	WELL NO. #4 DEPTH: 211' TO 216'	NO.	CONTRACT: JAS 1711
TOTAL CASING LENGTH	DEPTH	DRILL METHOD	WET/DRY SAMPLE	LITHOLOGIC DESCRIPTION % Each Grain Size, Color, Roundness, Caliche, etc.		TIME	DRILLING COMMENTS
215'	215'	H	wet	(Ringold) sand silt + gravels			
				hole open from 210' to 216'			
				Rig broke down (main Clutch)			
				Item #4 ~~[illegible]~~ 5'		7 hrs time	

EXHIBIT "A"

WELL LOG	BY: [signature] DATE: 1/21/89	RIG: Omegas	WELL NO. #4 DEPTH: 216' TO 216'	SUBMITTAL NO.	PROJECT: CONTRACT: JAJ171C

TOTAL CASING LENGTH	DEPTH	DRILL METHOD	WET/DRY SAMPLE	LITHOLOGIC DESCRIPTION % Each Grain Size, Color, Roundness, Caliche, etc.	TIME	DRILLING COMMENTS
				Rig Broke Down had to pull Jack shaft out & get Repairs		
					6hrs	time

9613449.0979

400 Area Secondary Cooling Water
Attachment H

WELL LOG	BY: [illegible signature] DATE: 1/24/55	RIG	WELL NO. #4 DEPTH: 216' TO 220'	SUBMITTAL NO.	PROJECT: CONTRACT: JAJ1712

TOTAL CASING LENGTH	DEPTH	DRILL METHOD	WET/DRY SAMPLE	LITHOLOGIC DESCRIPTION % Each Grain Size, Color, Roundness, Caliche, etc.	TIME	DRILLING COMMENTS
				installed new Jack shaft +	Back	to drilling all 1:00 P.M.
210'	220'	H	W	hard Ringold (dark gray)		
				drilled 10' Ahead of Casing		
				Item #4 1'	Other time.	
				Item # 5 3'		

WELL LOG	BY: [signature] DATE: 1/29/85	RIG: [illegible]	WELL NO. #4 DEPTH: 220' TO 231'	SUBMITTAL NO.	PROJECT: CONTRACT: JAJ1710

TOTAL CASING LENGTH	DEPTH	DRILL METHOD	WET/DRY SAMPLE	LITHOLOGIC DESCRIPTION % Each Grain Size, Color, Roundness, Caliche, etc.	TIME	DRILLING COMMENTS
210'	225'	H	wet	hard Ringold (dark gray)		
220'	230'	"	"	Same		
				(hole is making extra mud from 210' to 231')		
				Item #5		
						[signature] time

EXHIBIT "A"

9613449.0980

DOE/RL - 94 - 89 Rev. 0

400 Area Secondary Cooling Water
Attachment 4

V-0749-0008

WELL LOG		BY [illegible] DATE: 4/28/85		RIG Drivage	WELL NO. #4 DEPTH: 231' TO 239'	SUBMITTAL NO.	PROJECT: CONTRACT: JA51742
TOTAL CASING LENGTH	DEPTH	DRILL METHOD	WET/DRY SAMPLE	LITHOLOGIC DESCRIPTION % Each Grain Size, Color, Roundness, Caliche, etc.		TIME	DRILLING COMMENTS
230'	235'	H	W	Hard Ringold (dark gray)			
						6½ hrs	drilling
				Item #5 7'		1½ hrs	bail test
				bail test		8 hrs	time
				casing set at 230'			
				hole open to 237'			
				15 to 20 gal per min with 10' drop in water			
				Item #9 1½ hrs time bail test + back to Drilling			

EXHIBIT "C"

V-0749-0000

WELL LOG

BY: [illegible] DATE: 1/29/94

RIG: Chargo

WELL NO. #4

DEPTH: 233' TO 243'

SUBMITTAL NO.

PROJECT:

CONTRACT: JA J171

TOTAL CASING LENGTH	DEPTH	DRILL METHOD	WET/DRY SAMPLE	LITHOLOGIC DESCRIPTION % Each Grain Size, Color, Roundness, Caliche, etc.	TIME	DRILLING COMMENTS
				after bail test heaving sand + mud problems		
				cased hole off to 238' + back to Drilling		
40'	240'	H	W	Ringold sand silt + extra mud.		
				lost time for bail test 5 hrs time		
				Item #9 5 hrs time		
				Item #5 5'		
					5 hrs time	

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400 Area Secondary Cooling Water
Attachment 14

V-0749-0000

WELL LOG	BY: [illegible signature] DATE: 1/30/95	RIG Owacga	WELL NO. #4 DEPTH: 243' TO 250'	SUBMITTAL NO.	PROJECT: CONTRACT: TA51710

TOTAL CASING LENGTH	DEPTH	DRILL METHOD	WET/DRY SAMPLE	LITHOLOGIC DESCRIPTION % Each Grain Size, Color, Roundness, Caliche, etc.	TIME	DRILLING COMMENTS
240'	245'	H	W	Hard Ringold sand silt + gravels		
250'	250'	"	"	same		
				drilled 11' ahead of casing		
				extra mud comming in hole all day		
				Item #5 7'		
						Shift time

WELL LOG	BY: Jim Butler DATE: 2/1/85	RIG: Omaego	WELL NO. #4 DEPTH: 261' TO 269'	SUBMITTAL NO.	PROJECT: CONTRACT: JAJ1710

TOTAL CASING LENGTH	DEPTH	DRILL METHOD	WET/DRY SAMPLE	LITHOLOGIC DESCRIPTION % Each Grain Size, Color, Roundness, Caliche, etc.	TIME	DRILLING COMMENTS
260'	265'	H	W	sand silt & gravels Ringold		
				extra mud in hole not (normal)		
				Item # 5 7'		
					6hr time	

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400 Area Secondary Cooling Water
Attachment 14

WELL LOG		BY: [signature] DATE: 7/4/55		RIG [illegible]	WELL NO. #4 DEPTH: 268' TO 275'	SUBMITTAL NO.	PROJECT: CONTRACT: JAJ 1710
TOTAL CASING LENGTH	DEPTH	DRILL METHOD	WET/DRY SAMPLE	LITHOLOGIC DESCRIPTION % Each Grain Size, Color, Roundness, Caliche, etc.		TIME	DRILLING COMMENTS
270'	270'	H	W	sand silt + gravels			
270'	275'	"	"	same			
				extra mud comming in bad at 272'			
				bail test 4hrs time at 271' (made good water)			
				Item # 5 7'			
				Item # 9 4hrs time (to test)			8hrs time
				(+ clean hole back out)			

EXHIBIT "A"

WELL LOG		BY: [illegible] DATE: 7/7/55		RIG Omega	WELL NO. #4 DEPTH: 293' TO 195'	SUBMITTAL NO.	PROJECT: CONTRACT: JAJ1710
TOTAL CASING LENGTH	DEPTH	DRILL METHOD	WET/DRY SAMPLE	LITHOLOGIC DESCRIPTION % Each Grain Size, Color, Roundness, Caliche, etc.		TIME	DRILLING COMMENTS
230'	295'	H	W	sand silt + good gravels Ringold			
				(welder broke down)			pipe driving very hard 275' to 290'
							6 hrs' time

WELL LOG	BY ... DATE: 5/11/54		RIG Cimarron	WELL NO. #4 DEPTH: 295' TO 302'	SUBMITTAL NO.	PROJECT: CONTRACT: SA5170
TOTAL CASING LENGTH	DEPTH	DRILL METHOD	WET/DRY SAMPLE	LITHOLOGIC DESCRIPTION % Each Grain Size, Color, Roundness, Caliche, etc.	TIME	DRILLING COMMENTS
280'	300'	H	Wet	sand silt + gravels Rigold		
				casing driving hard from 280' to 290'		
				open hole 15' ahead of casing		
						8hrs time

EXHIBIT "A"

WELL LOG		BY: [illegible]		RIG	WELL NO. #4	SUBMITTAL NO.	PROJECT:
		DATE: 7/15/93		Cravgo	DEPTH: 302' TO 309'		CONTRACT: DAS12[illegible]

TOTAL CASING LENGTH	DEPTH	DRILL METHOD	WET/DRY SAMPLE	LITHOLOGIC DESCRIPTION % Each Grain Size, Color, Roundness, Caliche, etc.	TIME	DRILLING COMMENTS
290'	305'	H	Wet	sand silt + gravels Ringold		
				casing driving hard from 290' to 300'		
					Shis time	

EXHIBIT "A"

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400 Area Secondary Cooling Water
Attachment 14

V-0749-0000

WELL LOG	BY: [illegible] DATE: 2/18/85	RIG Omega	WELL NO. #4 DEPTH: 309 TO 315'	SUBMITTAL NO.	PROJECT: CONTRACT: 5AJ1710

TOTAL CASING LENGTH	DEPTH	DRILL METHOD	WET/DRY SAMPLE	LITHOLOGIC DESCRIPTION % Each Grain Size, Color, Roundness, Caliche, etc.	TIME	DRILLING COMMENTS
300'	310'	H	W	sand silt + gravels Ringold		
310'	315'	"	"	same		
				casing driving hard from	300' to	310'
				hard Ringold to 315'		
					See time	

EXHIBIT "A"

WELL LOG		BY: Jerry Bultena DATE: 2/15/85		RIG Onwega	WELL NO. #4 DEPTH: 315' TO 323'	SUBMITTAL NO.	PROJECT: CONTRACT: SWJ 17D
TOTAL CASING LENGTH	DEPTH	DRILL METHOD	WET/DRY SAMPLE	LITHOLOGIC DESCRIPTION % Each Grain Size, Color, Roundness, Caliche, etc.		TIME	DRILLING COMMENTS
310'	320'	H	Wet	sand silt + gravels hard Ringold			
						Ehr's time	

DRILL LOG	BY Jim Bulleur / DATE 2/19/85	RIG Orwego	WELL NUMBER #4 / DEPTH 323' "329'		SUBCONTRACT NO. SAJ1710

TOTAL CASING	DEPTH	DRILL METHOD	WET/DRY SAMPLE	LITHOLOGIC DESCRIPTION % EACH GRAIN SIZE, COLOR, ROUNDNESS, CALICHE, ETC.	TIME	DRILLING COMMENTS
~~325~~'						
310'	325'	H	wet	sand silt + gravels Hard Ringold		
				cased hole from 310' to 320' (casing driving hard)		
						Blue lime

REMARKS:

WELL LOG		BY: [signature]	RIG: Omega	WELL NO. #4	SUBMITTAL NO.	PROJECT:
		DATE: 2/20/53		DEPTH: 329' TO 349'		CONTRACT: JAJ1710

TOTAL CASING LENGTH	DEPTH	DRILL METHOD	WET/DRY SAMPLE	LITHOLOGIC DESCRIPTION % Each Grain Size, Color, Roundness, Caliche, etc.	TIME	DRILLING COMMENTS
320'	330'	H	Wet	sand silt + gravels Riverall		
	335'	"	"	334 to 335' starting into dark gray clay + gravils		
	340'	"	"	dark gray clay + some gravils		
	345'	"	"	same as 340'		
					Shris tima	

400 Area Secondary Cooling Water
Attachment 14

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WELL LOG		BY: [signature] DATE: 2/21		RIG: Chicago	WELL NO. #4 DEPTH: 349 TO 357	SUBMITTAL NO.	PROJECT: CONTRACT: SA51710
TOTAL CASING LENGTH	DEPTH	DRILL METHOD	WET/DRY SAMPLE	LITHOLOGIC DESCRIPTION % Each Grain Size, Color, Roundness, Caliche, etc.		TIME	DRILLING COMMENTS
320'	350'	H	wet	dark gray clay some sand + gravels			
320'	355'	"	"	same			
320'	357'	"	"	hole falling in above stop to install casing			
				cased hole from 320' to 340'			
						Shi's time	

WELL LOG		BY: [signature] DATE: 7/23/95		RIG Omega	WELL NO. #4 DEPTH: 357' TO 365'	SUBMITTAL NO.	PROJECT: CONTRACT: JAT 120
TOTAL CASING LENGTH	DEPTH	DRILL METHOD	WET/DRY SAMPLE	LITHOLOGIC DESCRIPTION % Each Grain Size, Color, Roundness, Caliche, etc.		TIME	DRILLING COMMENTS
				Cleaned hole back to 357', (caving)(problems & mud)			
				Cased hole from 340' to 350'			
350'	360'	H	Wet	back into cemented gravels, clay, & sand from 357' to 360'			
350'	365'	H	Wet	cemented gravels & silt & some sand			
						8 hrs time	

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400 Area Secondary Cooling Water
Attachment H

EXHIBIT "A"

WELL LOG		BY: [illegible signature] DATE: 12/5/85		RIG Omega	WELL NO. #4 DEPTH: 365' TO 375'	SUBMITTAL NO.	PROJECT: CONTRACT: JAJ170
TOTAL CASING LENGTH	DEPTH	DRILL METHOD	WET/DRY SAMPLE	LITHOLOGIC DESCRIPTION % Each Grain Size, Color, Roundness, Caliche, etc.		TIME	DRILLING COMMENTS
				cased hole from 350' to 360'			
360'	370'	H	Wet	sand silt & gravels (Cemented)			
370'	375'	"	"	same			
				took water sample At 365'			
							8 hrs time

EXHIBIT "A"

WELL LOG		BY [illegible signature] DATE: 2/28/[illegible]	RIG Omega	WELL NO. 4 DEPTH: 375' TO 385'	SUBMITTAL NO.	PROJECT: CONTRACT: JAJ 1710
TOTAL CASING LENGTH	DEPTH	DRILL METHOD	WET/DRY SAMPLE	LITHOLOGIC DESCRIPTION % Each Grain Size, Color, Roundness, Caliche, etc.	TIME	DRILLING COMMENTS
				casing at 360'		
360'	380'	H	Wet	sand silt + gravels		
360'	385'	H	Wet	cobbles gravels + dark gray clay		(Hard to drill)
						Blair Lenie

EXHIBIT "A"

9613449.0988

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400 Area Secondary Cooling Water
Attachment H

WELL LOG		BY: Jim Butler		RIG: Chavez	WELL NO. #4	SUBMITTAL NO.	PROJECT:
		DATE: 6/17/55			DEPTH: 385' TO 400'		CONTRACT: JAT 1710

TOTAL CASING LENGTH	DEPTH	DRILL METHOD	WET/DRY SAMPLE	LITHOLOGIC DESCRIPTION % Each Grain Size, Color, Roundness, Caliche, etc.	TIME	DRILLING COMMENTS
360'	390'	H	Wet	gravels + dark gray clay (cemented)		
"	395'	"	"	SAME AS 390'		
"	400'	"	"	SAME AS 390'		
						Shks time

ATTACHMENT I

Geology and Hydrogeology of the 400 Area
Section H - Items 5 & 6

ATTACHMENT I

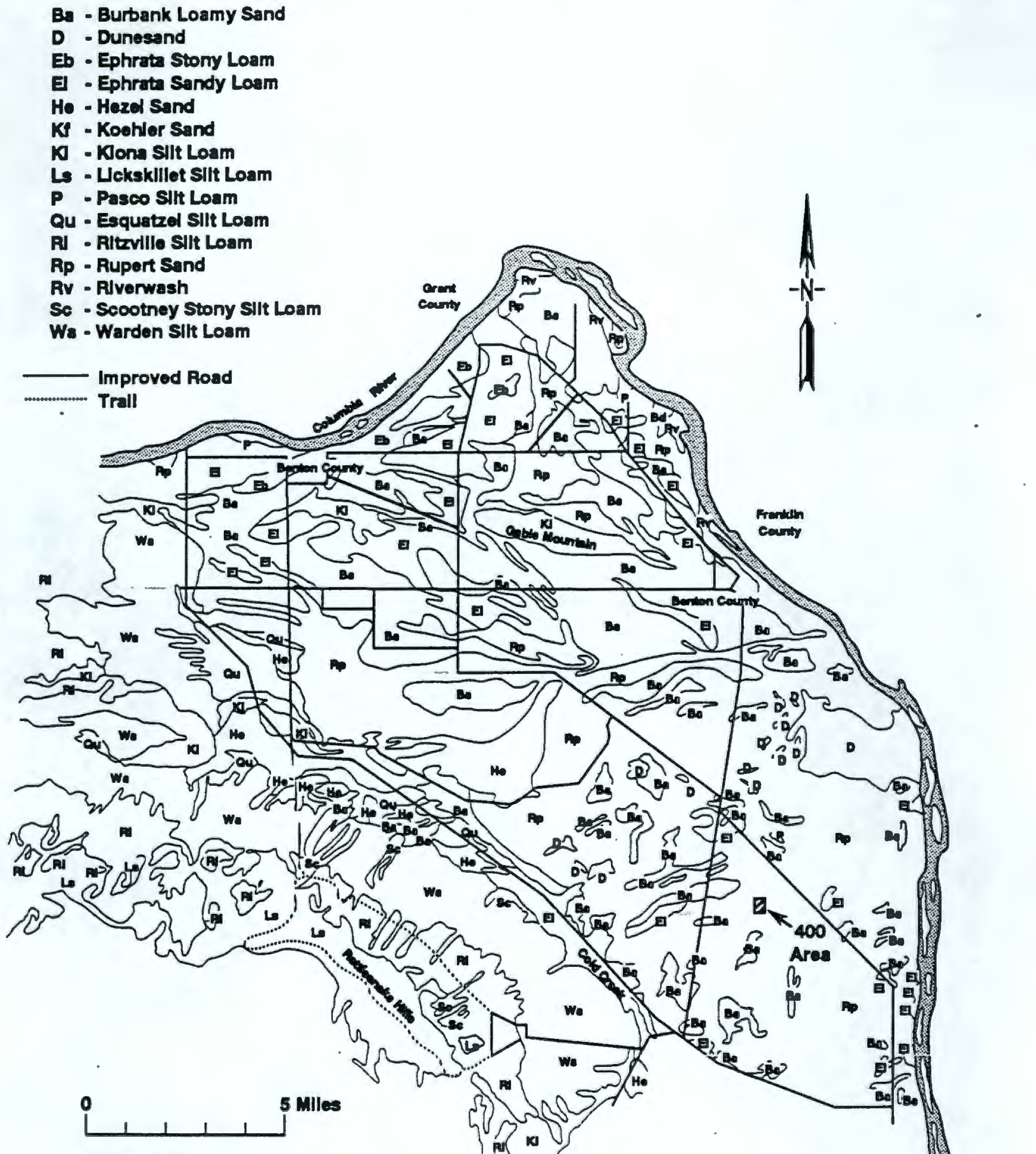
Hydrogeology of the 400 Area is summarized in Groundwater Impact Assessment Report for the 400 Area Ponds: WHC-EP-0587. The geologic strata consist of approximately 600 feet of fluvial, lacustrine and glaciofluvial sediments which overlie the Columbia River Basalt Group. These sediments are divided into the Miocene-Pliocene Ringold Formation and the Pleistocene Hanford Formation. A thin veneer of eolian silt and sand covers the area.

The Columbia River Basalt Group is approximately 600 feet below the ground surface. The uppermost basalt flow consists of an upper flow breccia and a lower hard, dense basalt. The Ringold Formation is approximately 450 feet thick. The Ringold Formation consists of interstratified clay, silt, sand, and gravel and is described in more detail in Geology and Hydrology of the Hanford Site: A Standard Text for Use in Westinghouse Hanford Company Documents and Reports, WHC-SD-ER-TI-003 and Revised Stratigraphy for the Ringold Formation, Hanford Site, South Central Washington, WHC-SD-EN-EE-004. The Hanford formation is up to 150 feet thick in the area, and consists of a sand-dominated facies, which is primarily a dense, laminated, fine to coarse sand with little silt. The near surface soils at the 400 Area are composed of very dense, laminated fine to medium sand with little silt.

The unconfined aquifer in the 400 Area is at approximately 390 feet above mean sea level. Groundwater flows generally to the east-southeast.

Included in this attachment are a soil map and description of soil types, from the report Soil Survey Hanford Project in Benton County Washington: BNWL 243, April, 1966.

"modified from BNWL-243"



Earth Sciences Section
Environmental and Radiological Sciences
March, 1966

Correlation Table

Current Classification		1919 Soil Survey	
Symbol	Soil Type	Symbol	Soil Type
Ri	Ritzville silt loam	Rs, R, Rl	Ritzville sand, very fine sand and loam
Rp	Rupert sand	Ws, Wf	Winchester sand, fine sand
Kf	Koehler sand	Kf	Koehler fine sand
Ba	Burbank loamy sand	Es, Bs, Bf, Ef	Ephrata sand, Beverly fine sand, very fine sand
He	Hezel sand	Qf, Qs, Qt	Quincy sand
El	Ephrata sandy loam	Ef	Ephrata sandy loam, fine sandy loam
Ls	Lickskillet silt loam	S	Scabland; elevation 2,000 ft.
Eb	Ephrata stony loam	S	Scabland glacial deposits near Columbia River
Ki	Kiona silt loam	S	Scabland; elevation 2,000 ft.
Wa	Warden silt loam	So, Sl, Ss	Sagemoor fine sand very fine sand, silt loam
Sc	Scootney stony silt loam	Sf	Stacy stony silt loam
P	Pasco silt loam	P, Pc	Pasco fine sandy loam, clay
Qu	Esquatzel silt loam	Ey, Eo	Esquatzel fine sandy loam, silt loam
Rv	Riverwash	Rv	Riverwash
D	Dune sand	D	Dune sand

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Approximate Classification of Hanford Soils Engineering and Higher Categories

Soil Type	Classification: Soils and Men 1938	7th Approximation	Unified	A.A.S.H.O.
Ritzville silt loam	Brown intergrade to Regosol	Andic Aridic Haplustoll	ML	A-4
Rupert sand	Regosol	Typic Torripsamment	Surface SM Subsoil SP to SM	A-4
Hezel sand	Regosol	Typic Torrifluvent	Surface SM Subsoil ML	A-2 A-4
Koehler sand	Regosol	Mollic Durorthid	SM	A-2
Burbank loamy sand	Regosol	Typic Torripsamment	Surface SM Subsoil GM to GP	A-2
Ephrata sandy loam	Sierozem integrade to Regosol	Andic Mollic Camborthid	Surface SM to ML Subsoil ML	A-2 to A-4 A-4 to A-1
Lickskillet silt loam	Lithosol	Lithic Haplustoll	ML to GM	A-4 to A-1
Kiona silt loam	Sierozem integrade to Regosol	Andic Mollic Camborthid	GM	A-1
Warden silt loam	Sierozem integrade to Regosol	Andic Mollic Camborthid	SM to ML	A-2 to A-4
Scootney stony silt	Sierozen integrade to Regosol	Andic Mollic Camborthid	SM to ML	A-2 to A-4
ata sandy loam	Sierozem integrade to Regosol	Mollandeptic Camborthid	Surface SM-ML Subsoil ML	A-2 to A-4 A-4 to A-1
Pasco silt loam	Alluvial	Andic Cumulic Haplaquoll	SM to ML	A-4
Esquatzel silt loam	Alluvial	Andic Cumulic Haplaquoll	SM to ML	A-4
Riverwash	Miscellaneous	Not soil	GP	A-1
Dune sand	Miscellaneous	Not soil	SP to SW	A-3

Capability Classification

Soil Type	Dryland	Irrigated
Ritzville silt loam	III-VII	I-IV
Rupert sand	VII	IV
Koehler sand	VII	IV
Burbank loamy sand	VII	IV
Hezel sand	VII	IV
Ephrata sandy loam	VI	II-IV
Lickskillet silt loam	VI & VII	---
Ephrata stony loam	VI	---
Kiona silt loam	VI	---
Warden silt loam	IV	I-IV
Scootney stony silty loam	VI	---
Pasco silt loam	IV	III
Esquatzel silt loam	III	I
Riverwash	VIII	---
Dune sand	VIII	---

ATTACHMENT J

Wastewater Information
Section E

ATTACHMENT J
SECTION E : WASTEWATER INFORMATION

Ortho Phosphate : Result was determined by Phosphate (PO4), EPA method 300.0.

Total Phosphate : Result was determined by Phosphate as Phosphorous, EPA method 365.2.

Nitrate-N : This result is actually Nitrate-Nitrite-N (NO3-NO2-N). This determination is the total inorganic nitrogen present in the sample. Nitrate-N result is actually expected to be lower than the NO3-NO2-N result provided.

TKN-N : This result was estimated by adding Ammonia as N with NO3-NO2-N. Since TKN is a measure of all nitrogen present in the sample, this estimate is a close approximation to the actual result. This estimate was used because current labs on contract do not perform TKN-N.

Ammonia-N : This result is truly Ammonia-N EPA method 350.1.

Please note the following units:
mg/l is ppm
ug/l is ppb

ATTACHMENT K

REFERENCES
Section H - Item 7

ATTACHMENT K

REFERENCES

Bechtel, 1971a, Final Geology Report for the Fast Flux Test Facility: BR-5853-C-005, Bechtel Power Corporation, San Francisco, CA.

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Delaney, C.D., K. A. Lindsey, and S. P. Reidel, 1991, Geology and Hydrology of the Hanford Site: A Standard Text for Use in Westinghouse Hanford Company Documents and Reports, WHC-SD-ER-TI-003, Westinghouse Hanford Company, Richland, WA.

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Lindsey, K. A., 1991, Revised Stratigraphy for the Ringold Formation, Hanford Site, South Central Washington, WHC-SD-EN-EE-004, Westinghouse Hanford Company, Richland, WA.

WHC, 1990, 400 Area Secondary Cooling Water Stream-Specific Report: WHC-EP-0342, Addendum 28, Westinghouse Hanford Company, Richland, WA.

WHC, 1991, Groundwater Maps of the Hanford Site, June 1991: WHC-EP-0394-3, Westinghouse Hanford Company, Richland, WA.

WHC, 1992a, 400 Area Secondary Cooling Water Sampling and Analysis Plan: WHC-SD-FF-PLN-002, Westinghouse Hanford Company, Richland, WA.

WHC, 1992b, Project W-252, Phase II Liquid Effluent Engineering Report: WHC-SD-W252-ER-001, Rev. 0, Westinghouse Hanford Company, Richland, WA.

WHC, 1992, Groundwater Impact Assessment Report for the 400 Area Ponds: WHC-EP-0587, Westinghouse Hanford Company, Richland, WA.