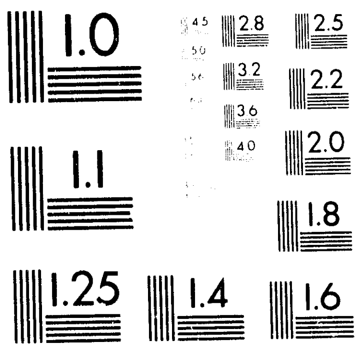
1.0
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1.4
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1 of 2

STATE WASTE DISCHARGE PERMIT APPLICATION
FOR THE 200 AREA EFFLUENT TREATMENT FACILITY
AND THE STATE-APPROVED LAND DISPOSAL SITE

Prepared for:

U.S. Department of Energy
P.O. Box 550
Richland, Washington 99352

Prepared by:

Westinghouse Hanford Company
P.O. Box 1970
Richland, Washington 99352

and

Science Applications International Corporation
1845 Terminal Drive
Richland, Washington 99352

WHC Contract No. MLW-SVV-073750, Task Order S-93-26
SAIC Project No. 01-1011-03-4546

August 1993

WASHINGTON STATE DEPARTMENT OF ECOLOGY

STATE WASTE DISCHARGE PERMIT APPLICATION FOR INDUSTRIAL DISCHARGES TO LAND

For Office Use Only

Date Application Received	Date Fee Paid	Application/ Permit No.	
Date Application Accepted		Facility No.	
Temporary Permit Effective Date		Temporary Permit Expiration Date	

This application is for a waste discharge permit as required in accordance with provisions of Chapter 90.48 RCW and Chapter 173-216 WAC. Additional information may be required. Information previously submitted and applicable to this application should be referenced in the appropriate section.

SECTION A. GENERAL INFORMATION

1. Company Name: U.S. Department of Energy
2. Mailing Address: Richland Operations Office
   P.O. Box 1970
   Street
   Richland, Washington 99352
   City/State Zip
3. Facility Address: 200 East Area and 200 West Area
   Street
   Richland, Washington 99352
   City/State Zip
4. Person to contact who is familiar with the information contained in this application:
   James E. Rasmussen — U.S. DOE, Staff Chief, Regulatory Permits — (509) 376-2247
   Name — Title — Telephone
5. Check One:
   ☐ Existing Discharge
   ☒ Proposed Discharge
   Anticipated, date of October, 1994

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of a fine and/or imprisonment for knowing violations.

[signature] 8/25/93 Manager, Richland Operations Office

Signature* Date Title

John D. Wagoner

Seal if applicable Printed Name

*Applications must be signed by either the owner, the principal executive officer or a duly authorized representative.

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): 9999

   Description: See Attachment A. No existing manufacturing processes produce waste. The production of nuclear materials at the Hanford Site generated wastes over the past 50 years during the site's defense mission. The 200 Area Effluent Treatment Facility will initially provide treatment of the 242-A Evaporator Process Condensate which is key to the current Hanford Site mission of waste management and environmental restoration and remediation. Attachment A describes the pretreatment of the wastes in the 242-A Evaporator and contains a description of the waste water.

   Attachment B provides a description of ETF treatment processes.

2. Include a production schematic flow diagram of the process and service activities described above on a separate sheet.
   See Attachment A, Figure A-2 and Figure A-3.

3. List raw materials and products: The 242-Evaporator Process Condensate and the waste water stored in the Liquid Effluent Retention Facility will be the initial sources of the waste water treated at the ETF. Raw materials used at the ETF are listed in the table below. Quantities reflect the nominal storage capacity of the storage tanks.

RAW MATERIALS	
Type	Quantity
92% H_2SO_4	7,500 gallons
50% NaOH	5,000 gallons
Hydrogen Peroxide	2,500 gallons
Cleaning Solution in Distillate Flush Tank Flush	To Be Determined
PRODUCTS	
The 200 Area ETF initially will receive process condensate from the 242-A Evaporator and the Liquid Effluent Retention Facility (LERF). The only raw materials used in the ETF process are hydrogen peroxide and concentrated and dilute solutions of sodium hydroxide and sulfuric acid. The finished "products" of the treatment plant are treated waste water and cooling tower blowdown to be disposed of at the State-Approved Land Disposal Site (SALDS), and a concentrated dry powder consisting primarily of ammonium sulfate and sodium sulfate.	

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 #
Effluent Treatment Facility (ETF)	Process condensate stored in the Liquid Effluent Retention Facility (LERF)	Continuous	1
	Process condensate from the 242-A Evaporator	Continuous	2
	ETF cooling tower blowdown (combined with ETF treated waste water downstream of verification tanks and disposed at the SALDS)	Continuous	3
Other Hanford Areas	Other aqueous wastes to be treated if effluent meets discharge limits	Batch or Continuous	4

2. On a separate sheet, describe in detail the treatment and disposal of all waste waters as described above. Include a schematic flow diagram for all waste water treatment and disposal systems. See Attachment B, Section 2.0 for a description of the waste water treatment at ETF and Section 2.12 for a description of the ETF cooling tower unit and blowdown. Figure B-2 provides a schematic of the ETF processes. See Attachment C for a description of the SALDS.
3. Indicate treatment provided to each waste stream identified above.

Waste Stream(s) ID #	Treatment	Waste Stream(s) ID #[a]	Treatment
	Air flotation	1,2,4	pH correction
	Centrifuge		Ozonation
	Chemical precipitation	1,2,4	Reverse osmosis[b]
	Chlorination		Screen
	Cyclone		Sedimentation
1,2,4	Filtration		Septic tank
1,2,4	Flow equalization		Solvent separation
	Grease or oil separation		Bio. treatment, type:
	Grease trap		Rainwater diversion or storage
	Grit removal		Other phys. treatment type:
1,2,4	Ion exchange	1,2,4	Other chem. treatment type: UV oxidation

[a] Secondary waste stream is discussed in Attachment B, Section 3.0.
[b] Includes synthetic semipermeable membranes.

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

The ETF is planned to start operations in October 1994. A load-in station will be added to the ETF. The load-in station will provide a waste acceptance area for wastes that may be transported from other locations on the Hanford Site in the future.

5. If production processes are subject to seasonal variations, provide the following information. Write "Yes" for each month waste stream is produced.
Note that waste stream #1 will be processed initially, and eventually this waste stream will be replaced by waste stream #2.

Waste Stream ID #	MONTHS											
	J	F	M	A	M	J	J	A	S	O	N	D
1,2	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
3	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
4	On an as-needed basis											

6. Shift information: The ETF will be operated on a schedule of 42 days of operation and 5-25 days of maintenance (16 days average of non-operation for maintenance). *As experience is gained in operation of the facility, the number of employees may increase or decrease as needed.

a. Number of shifts per work day: 3
b. Number of work days per week: 7
c. Average number of work days per year: 265
d. Maximum number of work days per year: 365
e. Number of employees per shift:

	Employees		Shift
1st	~10 (4-15)*	1st	7:30
2nd	~10 (4-15)*	2nd	15:30
3rd	~10 (4-15)*	3rd	23:30

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: Small quantities of materials such as lubricating oils, solvents, and cleaners for maintaining the ETF equipment may be stored onsite. Quantities are unknown at this time. This information will be available at the ETF on completion of construction and purchasing of chemicals for operation startup.

8. Describe any water recycling or material reclaiming processes:

None.

9. Does this facility have:

-Spill Control and Containment Plan (per 40 CFR 112)? [X] Yes [ ] No
-Emergency Response Plan (per WAC 173-303-350)? [X] Yes [ ] No

-Runoff, spillage, or leak control plan (per WAC 173-216-110(f))? ☒ Yes ☐ No
This information will be supplied in the RCRA Part B permit application.

SECTION D. WATER CONSUMPTION AND WATER LOSS

1. Water source(s) include the following: 1) Waste water received from LERF and 242-A Evaporator, 2) Raw water from the Columbia River transferred through the 200 East Area water supply system for the cooling tower, and 3) Demineralized water trucked to ETF or produced onsite for laboratory use.

   ☐ Public System (Specify) ______

   ☐ Private Well ☐ Surface Water

   a. Water Right Permit Number: N/A. The U.S. Government has a reserved water right to utilize water for purposes of Hanford Site activities

   b. Legal Description: S01 withdrawal point
   B 1/4S, B Section, 13 TWN, 24 RE

2. a. Indicate total water use: Gallons per day (average) 156,000 gpd waste water; 46,300 gpd raw water; 2,085 gpd demineralized water

   Gallons per day (maximum) 216,000 gpd waste water; 64,000 gpd raw water; 2,880 gpd demineralized water

   b. Is water metered? ☐ Yes ☒ No, not at the ETF

3. Attach a line drawing showing the water flow through the facility. Indicate source of intake water, operations contributing waste water 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 B, Figure B-1 for layout of ETF and Figure B-2 for waste water flows in ETF.

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.

See Table B-1 for ETF anticipated effluent concentrations that are based on best engineering judgement. Because the values provided are estimated and no analyses have been performed, the analytical methods and detection limits are not applicable. See Table B-2 for anticipated cooling tower blowdown constituent concentrations.

Parameter/CAS No.	Concentrations Measured	Analytical Method	Detection Limit
pH			
Conductivity			
Total Dissolved Solid			
Total Suspended Solid			
BOD (5 day)			
COD			
Ammonia-N			
TKN-N			
Nitrate-N			
Ortho-phosphate-P			
Total-phosphate-P			
Total Oil & Grease			
Calcium/7740-70-2			
Magnesium/7439-95-4			
Sodium/7440-23-5			
Potassium/7440-09-7			
Chloride			
Sulfate			
Fluoride			
Cadmium/7440-43-9			
Chromium/7440-49-3			
Lead/7439-92-1			
Mercury/7439-97-6			
Selenium/7782-49-2			
Silver/7440-22-4			
Copper/7440-50-8			
Iron/7439-89-6			
Manganese			
Zinc/7440-66-6			
Barium/7440-39-3			
Total Coliform			

2. Waste water characteristics for toxic pollutants.

The intent of this question is to determine which chemicals are or might be present in the process water or waste water. 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
Waste Water Characterization for Toxic Pollutants

(The information in this table is based on ETF design criteria, see also Table B-1 for ETF anticipated effluent concentrations and Table B-2 for cooling tower blowdown constituent concentrations.)
Source: WHC (1992c)

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
	P	Arsenic/7440-38-2	A		3,3 Dimethylbenzidine/119-93-7
A		Azobenzene/103-33-3	A		1,2 Dimethylhydrazine/540-73-8
	P	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

ABST/PRST	CONSTITUENT/CAS No.	ABST / PRST	CONSTITUENT/CAS No.
A	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
*P	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
*P	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	**P	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	*P	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
*P	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
A	PCBs/1336-36-3		

* These compounds are not process chemicals, but are predicted constituents of ETF influent.
** Hydrazine used historically at PUREX, but is not anticipated in 242-A Evaporator PC.

SECTION F. STORMWATER

1. Do you have a stormwater NPDES permit? ☐ Yes ☒ No
   The ETF Building does not have a specific storm water permit.
2. Have you applied for a stormwater NPDES permit? ☐ Yes ☒ No
   The ETF Building has not applied for a storm water permit.
3. Are you covered or have you applied for coverage under a general or group stormwater permit? ☒ Yes ☐ No
   A General NPDES permit for stormwater has been applied for by the Department of Energy for the Hanford Site.

4. Describe the size of the stormwater collection area. ETF (This does not apply to SALDS which is not paved.)

a.	Unpaved Area	634,000* sq. ft.
b.	Paved Area	60,000 sq. ft.
c.	Other Collection Areas (Roofs, Diked Areas, etc.) *inside security fence	78,000 sq. ft.

5. Describe the stormwater management systems.

   Stormwater from the ETF building will be managed by a series of gutters and down spouts, which are shown on drawings H-2-89049 and H-2-89050 (Attachment D). Water will be collected from the roof by rain gutters and transferred to down spouts. The down spouts will drain to graveled areas which are shown on the maps near the ETF building. Water will either evaporate or soak into the soil at this point.

   Paved areas will be sloped to direct stormwater away from the facility as shown on drawing H-2-89039 (Attachment D). The stormwater will be transferred to graveled ditches where the water will either evaporate or soak into the soil.

6. Attach a map showing stormwater drainage/collection areas, disposal areas and discharge points.
   See maps in Attachment D.

SECTION G. OTHER INFORMATION

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

   No liquid wastes or sludges are generated that are not disposed of in the waste stream. See Attachment B, Section 3.0 for description of the processes that generate the powdered waste produced at the ETF. The powdered waste is regulated under RCRA and will be stored in the Hanford Facility Central Waste Complex until a disposal facility is identified.

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

   Raw materials such as sulfuric acid, sodium hydroxide, and hydrogen peroxide will be stored in tanks in the ETF building. Drummed powdered waste will be stored in the filled-drum storage area in the ETF building. Other wastes such as spent UV lamps, spent RO membranes, spent filters, spent HEPA filters, spent ion exchange resins, and peroxide decomposer cartridges will be drummed and temporarily stored in the filled drum storage area.

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: ☐ Waste hauler; ☐ Self; ☐ Other (identify) ________

   Drummed wastes from the ETF are not hauled off the Hanford Site. The waste will be stored at the Central Waste Complex.

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

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

   After the ETF is in operation, SARA Title 313 information will be submitted as part of the Hanford Site annual report.

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.
   See Attachment C, Section 1.0

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

   Air Permitting
   - Approval to Construct, National Emission Standards for Hazardous Air Pollutants
   - Approval to Construct, Radiological Airborne Emission
   - Approval to Construct, Controls for New Sources of Toxic Air Pollutants
   - Notification of Startup, National Emissions Standards for Hazardous Air Pollutants

   Waste Water Permitting
   - Septic System Permit
   - State Waste Discharge Permit

   Hazardous Waste Permitting
   - Dangerous Waste Permit
   - Delisting Petition

3. Attach a topographic map with contour intervals used by USGS. Show the following on this map:
   See Attachment C, Section 2.0 and Figures C-1 and C-2.

   a. Location and name of internal and adjacent streets
   b. Surface water drainage systems N/A
   c. Water supply and other wells within 500 feet of the site
      No water supply wells within 500 feet.
   d. Surface water diversions within 500 feet of the site N/A
   e. Chemical and product handling and storage facilities
      None within 500 feet of SALDS
   f. Infiltration sources, such as drainfields, lagoons, dry wells, and abandoned wells within 500 feet of the site N/A
   g. Waste water and cooling water discharge points with ID numbers
      (See Section C.1)
   h. Other activities and land uses within 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.

   Monitoring well 699-48-77A is the only well located within 500 feet of the site. Figure C-2 (Attachment C) depicts the well location. Figure C-3 (Attachment C) provides summarized well log information. Copies of the borehole log are provided in the appendix to Attachment C.

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

   See Attachment C, Section 3.0 and Figure C-5.

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

   See Attachment C, Section 3.0

7. Information for this permit was obtained from the references listed in Attachment E, and from interviews with the cognizant Westinghouse Hanford Company personnel for the Hanford 200 Area ETF/SALDS. The permit application was compiled by:

   Science Applications International Corporation
   1845 Terminal Drive
   Richland, WA 99352

   See Attachment E for additional reference materials.

END - END - END

ATTACHMENT A

WASTE SOURCES TO THE 200 AREA EFFLUENT TREATMENT FACILITY AND TREATMENT PROCESS OVERVIEW

ATTACHMENT A

200 AREA EFFLUENT TREATMENT FACILITY WASTE SOURCES AND TREATMENT PROCESS OVERVIEW

1.0 INTRODUCTION

Application is being made for a permit pursuant to Chapter 173-216 of the Washington Administrative Code (WAC), to discharge treated waste water and cooling tower blowdown from the 200 Area Effluent Treatment Facility (ETF) to land at the State-Approved Land Disposal Site (SALDS). The ETF is located in the 200 East Area and the SALDS is located north of the 200 West Area. These locations are depicted in Figure A-1.

The production of nuclear materials at the Hanford Site generated wastes over the past 50 years. The Standard Industrial Classification (SIC) code for the production of nuclear fuels is 2819. The production wastes included the following: (1) fuel fabrication wastes, (2) laboratory wastes, (3) decontamination wastes, and (4) research and development wastes. Some of these wastes were discharged to cribs, ponds, and ditches. Other wastes were stored in underground double-shell and single-shell tanks.

The ETF is an industrial waste water treatment plant that will initially receive waste water from the following two sources, both located in the 200 Area on the Hanford Site: (1) the Liquid Effluent Retention Facility (LERF) and (2) the 242-A Evaporator. The waste water discharged from these two facilities is process condensate (PC), a by-product of the concentration of waste from DSTs that is performed in the 242-A Evaporator. Because the ETF is designed as a flexible treatment system, other aqueous waste streams generated at the Hanford Site may be considered for treatment at the ETF. The origin of the waste currently contained in the DSTs is explained in Section 2.0. An overview of the concentration of these waste in the 242-A Evaporator is provided in Section 3.0. Section 4.0 describes the LERF, a storage facility for process condensate.

Attachment A responds to Section B of the permit application and provides an overview of the processes that generated the wastes, storage of the wastes in double-shell tanks (DST), preliminary treatment in the 242-A Evaporator, and storage at the LERF. For purposes of the application, the 242-A Evaporator is considered similar to a manufacturing process because it generates the waste water that is proposed for treatment in the ETF and disposal at the SALDS.

Attachment B addresses waste water treatment at the ETF (under construction) and the addition of cooling tower blowdown to the treated waste water prior to disposal at SALDS. Attachment C describes treated waste water disposal at the proposed SALDS. A general schematic of the treatment processes is presented in Figure A-2.

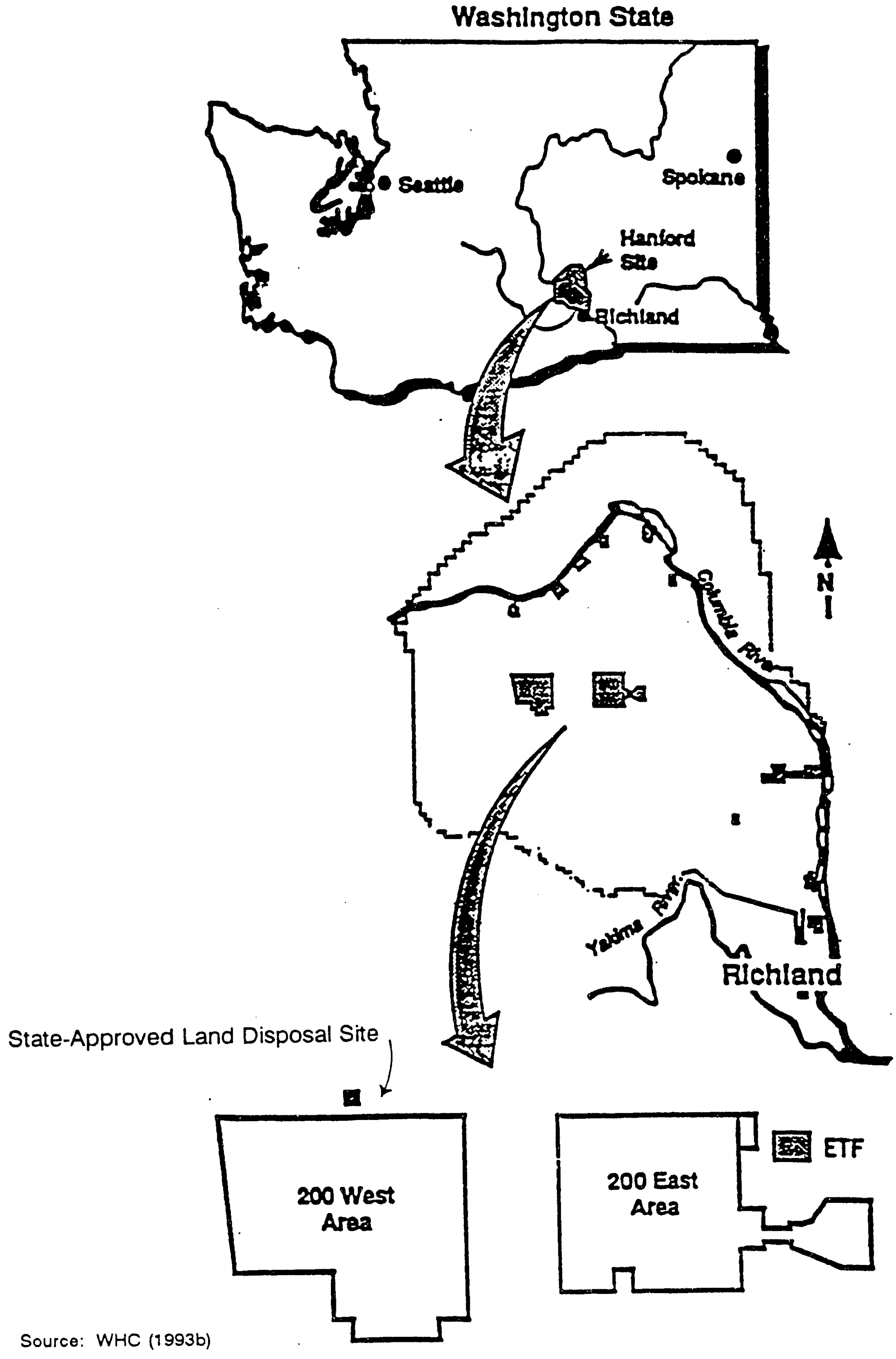
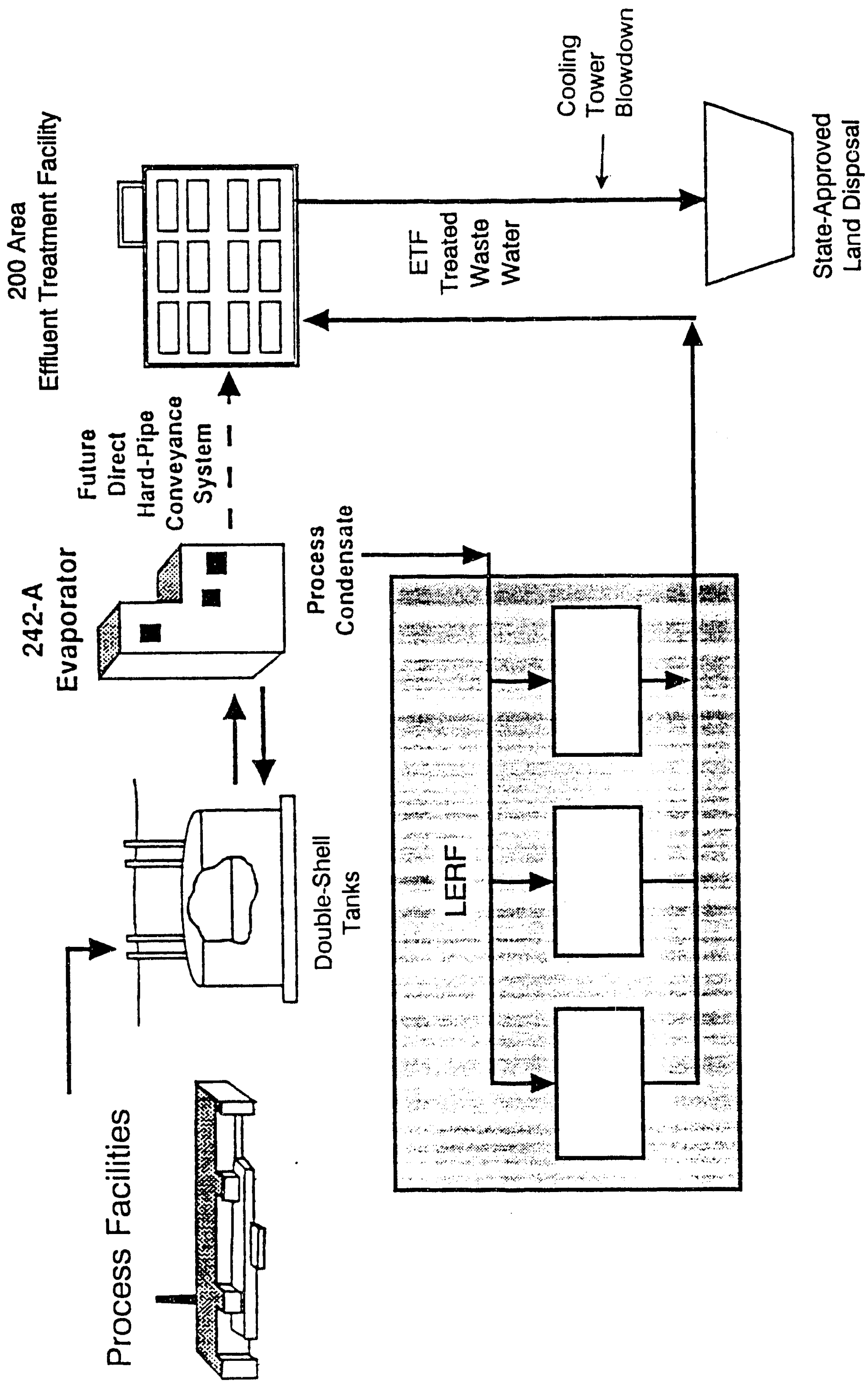


Figure A-1. Location of the State-Approved Land Disposal Site and the Effluent Treatment Facility.



LERF = Liquid Effluent Retention Facility

Source: DOE (1992a)

Figure A-2. Overview of Waste Water Source and Treatment Program.

920407.1027

2.0 SOURCES OF THE WASTE STREAMS TO THE 242-EVAPORATOR

The 242-A Evaporator will process wastes generated by past and present operations of numerous Hanford Site waste generators and processors. The wastes will be withdrawn from storage in the underground DSTs and processed in the 242-A Evaporator in different campaigns according to their classification by total organic carbon, transuranic content, and potential effects on the evaporation process (DOE 1992b). Some waste now stored in DSTs was generated before the DSTs were in service. This waste was originally stored in single-shell tanks but has been transferred to DSTs (DOE 1991). Other wastes currently stored in the DSTs were generated from, but not limited to, the following processing operations (DOE 1992b):

- S Plant laboratory and decontamination wastes
- T Plant spent decontamination solutions
- 300 Area laboratory wastes
- 300 Area fuels fabrication
- 400 Area laboratory waste
- 100-N dilute phosphate decontamination waste, and 100 Area spent fuel storage basin sulfate waste from ion exchange regeneration and sand filter backwashing
- Single-shell tank salt well pumping waste
- Plant process and miscellaneous waste, including cell drainage and vessel cleanout waste
- PUREX Plant.

The DSTs are located in the 200 East and 200 West Areas. Each tank has a nominal capacity of 1 million gallons (3.8 million liters). The liquid wastes in the tank contain low concentrations of fission products that generate low quantities of heat (less than 0.1 BTU per hour per gallon). The wastes are considered mixed waste, because the waste contains both radioactive components regulated under the Atomic Energy Act, and listed hazardous wastes regulated pursuant to the Resource Conservation and Recovery Act and Washington Dangerous Waste Regulations, WAC 173-303. Additional information on the contents of the DST waste can be found in the *Double-Shell Tank System Dangerous Waste Permit Application* (DOE 1991).

3.0 WASTE PROCESSING AT THE 242-A EVAPORATOR

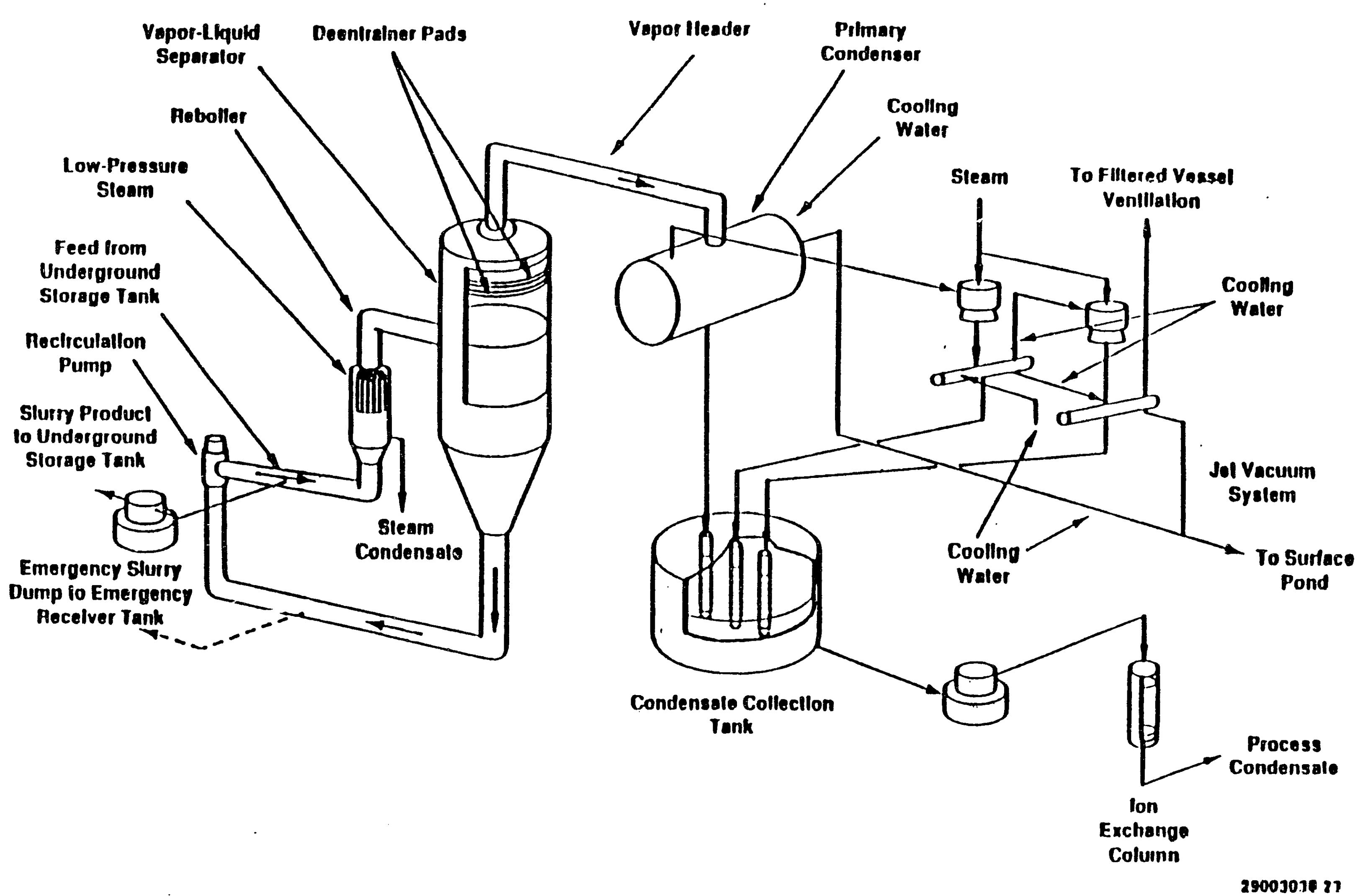
The 242-A Evaporator is used as a waste concentrator for the wastes that are stored in the DSTs. The purpose of the 242-A Evaporator is to concentrate liquid wastes into a slurry of reduced volume to allow for greater storage capacity in the existing DSTs. The 242-A Evaporator uses a conventional forced recirculation, vacuum evaporation system to concentrate the waste solutions. In this treatment process, water and volatile substances are evaporated from the waste feed, and the vapor is subsequently recondensed as process condensate (PC) and stored at the LERF. The residual concentrated slurry contains the majority of the radionuclides and inorganic constituents. The slurry is designated as an extremely hazardous mixed waste and is returned to the DSTs for storage pending further treatment.

The 242-A Evaporator process is depicted schematically in Figure A-3. In general terms, the 242-A Evaporator receives waste feed in the recirculation line, where the waste feed blends with the main process slurry stream. The waste feed and the recirculated slurry flow together into the reboiler where the waste stream is heated and the pressure is reduced to cause the liquid to flash to steam. The slurry remaining in the separator continues to be concentrated by removal of the boiled-off liquid. The slurry is removed; when it has reached a target-specific gravity (an indicator of increasing solute concentration), some of the slurry stream is transferred to a DST. The remaining slurry is recirculated and blends with the waste feed.

The vapor from the separator chamber is transported to a condenser where it is cooled and condensed forming the PC. The PC is contained in the condensate collection tank (C-100) which has a nominal capacity of 17,800 gallons (67,400 L). An agitator operates intermittently to keep the tank contents mixed and to prevent settling of solids, as the liquid is pumped through a filter to remove particulates greater than 5 microns.

The PC then passes through an ion exchange column to remove radionuclides (primarily cesium-137 and strontium-90) (DOE 1992b). Following filtration, the PC is pumped to the LERF where it awaits further treatment. The PC will be stored at the LERF while the ETF is under construction. After completion of the ETF, the PC will be pumped directly to the ETF treatment system, bypassing the LERF. Because the ETF design incorporates an ion exchange unit, the 242-A Evaporator ion exchange column will be bypassed when PC is pumped directly to the ETF. This will allow for a greater rate of processing of the DST feed streams.

The PC contains a variety of constituents including organic and inorganic constituents and radionuclides. Thirty-four samples of PC were analyzed prior to shutdown of the 242-A Evaporator. Additionally, process control samples were collected during the operation of the 242-A Evaporator. The analytical data from both sets of samples are summarized in Table A-1, which represents an initial estimate of PC composition. These data were presented in the *200 Area Effluent Treatment Facility Delisting Petition* (DOE 1992). The exact composition of the PC, however, will vary depending on the source of the DST waste that is treated in the 242-A Evaporator. Table A-2 presents the analytical methods used.



Source: WHC (1991)

Figure A-3. 242-A Evaporator Process Schematic.

4.0 LIQUID EFFLUENT RETENTION FACILITY

The LERF consists of three covered surface impoundments with a capacity of 6.5 million gallons each. These basins will be used to store PC until the ETF can process it. Only two basins will be used at any one time; the third basin will be held in reserve. A RCRA Part B permit application for this storage facility was submitted to The Washington State Department of Ecology (Ecology) in June 1991 and is currently being reviewed by Ecology.

Table A-1. 242-A Evaporator Effluent Characterization Data.[a]

Parameter	Units[b]	Average	90% Confidence Interval[c]	Maximum
Conductivity	μS	304	--	590
pH		10.0	--	11.3
Inorganic Constituents				
Total Dissolved Solids	ppb	NA	NA	2,700
Aluminum	ppb	1,295	1,330	4,992
Ammonium	ppb	482,511	511,344	9,350,000
Barium	ppb	6.8	7.2	8
Boron	ppb	65	97	151
Cadmium	ppb	5	SD	SD
Calcium	ppb	2,600	2,800	8,300
Carbonate	ppb	98,000	104,347	750,00
Chloride	ppb	1,000	1,200	2,300
Chromium	ppb	52	66	156
Copper	ppb	60	67	127
Fluoride	ppb	874	971	12,273
Iron	ppb	112	131	503
Magnesium	ppb	122	153	3,670
Manganese	ppb	5	SD	SD
Mercury	ppb	0.3	0.31	0.69
Phosphorus	ppb	1,177	1,336	6,195
Nickel	ppb	14	15	17
Nitrate	ppb	2,800	2,292	5,000
Potassium	ppb	5,944	6,495	19,238
Silicon	ppb	15,616	24,252	985,819
Sodium	ppb	3,586	4,469	51,497
Sulfate	ppb	2,600	2,800	13,000
Sulfide	ppb	36,000	66,000	66,000
Vanadium	ppb	6.3	6.7	7

Table A-1. 242-A Evaporator Effluent Characterization Data.[a] (cont.)

Parameter	Units[b]	Average	90% Confidence Interval[c]	Maximum
Organic Constituents				
Total organic carbon	ppb	42,024	218,415	4,920,000
Acetone	ppb	980	1,000	5,100
Benzyl alcohol	ppb	13	14	18
Benzaldehyde	ppb	23	SD	SD
2-Butoxyethanol	ppb	380	400	920
1-Butanol	ppb	9,800	11,000	88,000
2-Butanone	ppb	51	53	120
Butoxyglycol	ppb	280	290	810
Butoxydiglycol	ppb	19	44	27
Butoxytriethyleneglycol	ppb	35	SD	SD
Butraldehyde	ppb	56	62	230
Caproic acid	ppb	70	SD	SD
Chloroform	ppb	14	14	27
3,5-Dimethylpyridine	ppb	21	23	24
Dimethylnitrosamine	ppb	57	SD	SD
Dodecane	ppb	43	52	46
Ethoxytriethyleneglycol	ppb	99	120	150
Ethyl alcohol	ppb	2	SD	SD
Hexadecane	ppb	17	SD	SD
Heptadecane	ppb	18	SD	SD
Methoxydiglycol	ppb	40	52	52
Methoxytriglycol	ppb	220	370	370
Methylene chloride	ppb	120	140	180
Methyl n-propyl ketone	ppb	9.3	9.7	12
Methyl n-butyl ketone	ppb	13	14	79
MIBK (Hexone)	ppb	11	14	68
2-Methylnonane	ppb	16	17	17
Pentadecane	ppb	20	SD	SD
Phenol	ppb	33	SD	SD

Table A-1. 242-A Evaporator Effluent Characterization Data.[a] (cont.)

Parameter	Units[b]	Average	90% Confidence Interval[c]	Maximum
2-Propanol	ppb	22	SD	SD
Pyridine	ppb	550	SD	SD
Tetradecane	ppb	76	83	440
Tetrahydrofuran	ppb	37	39	170
Tributyl phosphate	ppb	3,900	4,100	21,000
1,1,1-Trichloroethane	ppb	5	SD	SD
Tridecane	ppb	70	77	350
Triglyme	ppb	90	SD	SD
Radionuclides				
Alpha	pCi/L	160	350	750
Beta	pCi/L	4,600	6,000	74,000
137 Cesium[d]	pCi/L	4,400	5,400	26,000
^{155} Europium	pCi/L	1,400	SD	SD
^{239} Plutonium	pCi/L	0.00037	0.00068	0.0024
^{147} Promethium	pCi/L	1,300	1,600	4,100
^{106} Ruthenium	pCi/L	10,500	11,080	17,800
^{90} Strontium[d]	pCi/L	5,200	7,600	81,000
^{113} Tin	pCi/L	540	770	2,500
Tritium	pCi/L	5,600,000	6,300,000	24,000,000
Uranium (gross)	pCi/L	20	33	140

a Source: DOE (1992b)

b μS = microsiemen; ppb = parts per billion; SD = single detection; pCi/L = picocuries per liter; NA = not available.

c 90% Confidence Interval based on 34 samples of 242-A Evaporator Process Condensate (DOE 1992b)

d ^{137} Cesium and ^{90} strontium values have been multiplied by 10 to account for the removal of the existing ion exchange system in the 242-A Evaporator

Table A-2. 242-A Evaporator Process Condensate Analytical Methods.[a]

Parameter	Test Method	Source[b]
Organics		
Volatile organics	EPA 8240	SW-846
Semivolatile organics	EPA 8270	SW-846
Total organic carbon	EPA 9060	SW-846
Inorganic Anions		
Chloride	EPA 9250	SW-846
Fluoride	EPA 340.2	EPA-600
Nitrate/nitrite	EPA 9200	SW-846
Phosphate	EPA 365.2	EPA-600
Sulfate	EPA 300.0	EPA-600
Sulfide	EPA 9030	SW-846
Inorganic Cations		
Ammonium	ASTM D 1426-89	ASTM
Aluminum	EPA 6010	SW-846
Arsenic	EPA 6010	SW-846
Barium	EPA 6010	SW-846
Cadmium	EPA 6010	SW-846
Calcium	EPA 6010	SW-846
Chromium	EPA 6010	SW-846
Lead	EPA 6010	SW-846
Magnesium	EPA 6010	SW-846
Manganese	EPA 6010	SW-846
Mercury	EPA 6010	SW-846
Selenium	EPA 6010	SW-846
Silver	EPA 6010	SW-846
Sodium	EPA 6010	SW-846

Table A-2. 242-A Evaporator Process Condensate Analytical Methods.[a] (cont.)

Parameter	Test Method	Source[b]
Zinc	EPA 6010	SW-846
Miscellaneous		
Alpha activity	EPA 9310	SW-846
Beta Activity	EPA 9310	SW-846
Biochemical oxygen demand (BOD)	EPA 405.1	EPA-600
pH	EPA 9040	SW-846
Specific gravity	SM-2710.F	SM
Temperature	SM-2550 (field)	SM
Total dissolved solids	EPA 160.1	EPA-600

[a] Source: DOE 1992b
[b] SW-846 (EPA 1990); SM (APHA 1989); EPA-600 (EPA 1983); ASTM (ASTM 1990)

ATTACHMENT B

200 AREA EFFLUENT TREATMENT FACILITY

ATTACHMENT B

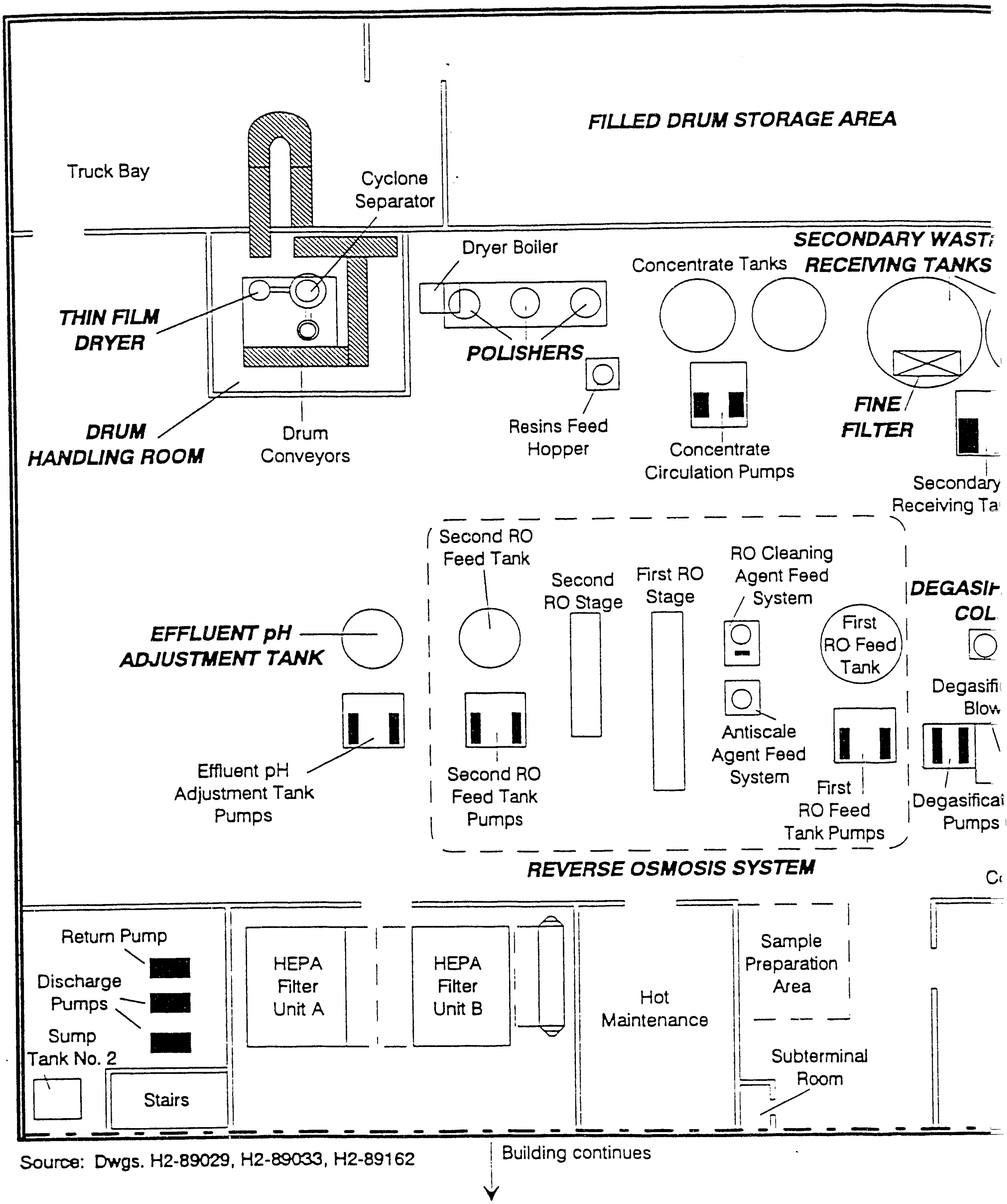
200 AREA EFFLUENT TREATMENT FACILITY

1.0 INTRODUCTION

The 200 Area Effluent Treatment Facility (ETF) receives waste water from the 242-A Evaporator and the LERF. In the future, it is intended to route other waste streams from the Hanford Site to the ETF for treatment. Other waste streams that can be treated to meet the established effluent discharge limits will be treated at the ETF. The waste waters are treated in a series of process units or systems, applying best available technology to reduce radioactive constituents, except tritium, and to reduce the concentrations of the organic and inorganic constituents. Before discharge, the quality of the treated waste water is analyzed to verify that the discharge limits have been met. The treated waste water is piped to the State-Approved Land Disposal Site (SALDS) north of the 200 West Area, where the treated waste water is discharged to the ground under the authority of a Washington State Waste Discharge Permit and an approved Hazardous Waste Delisting Petition.

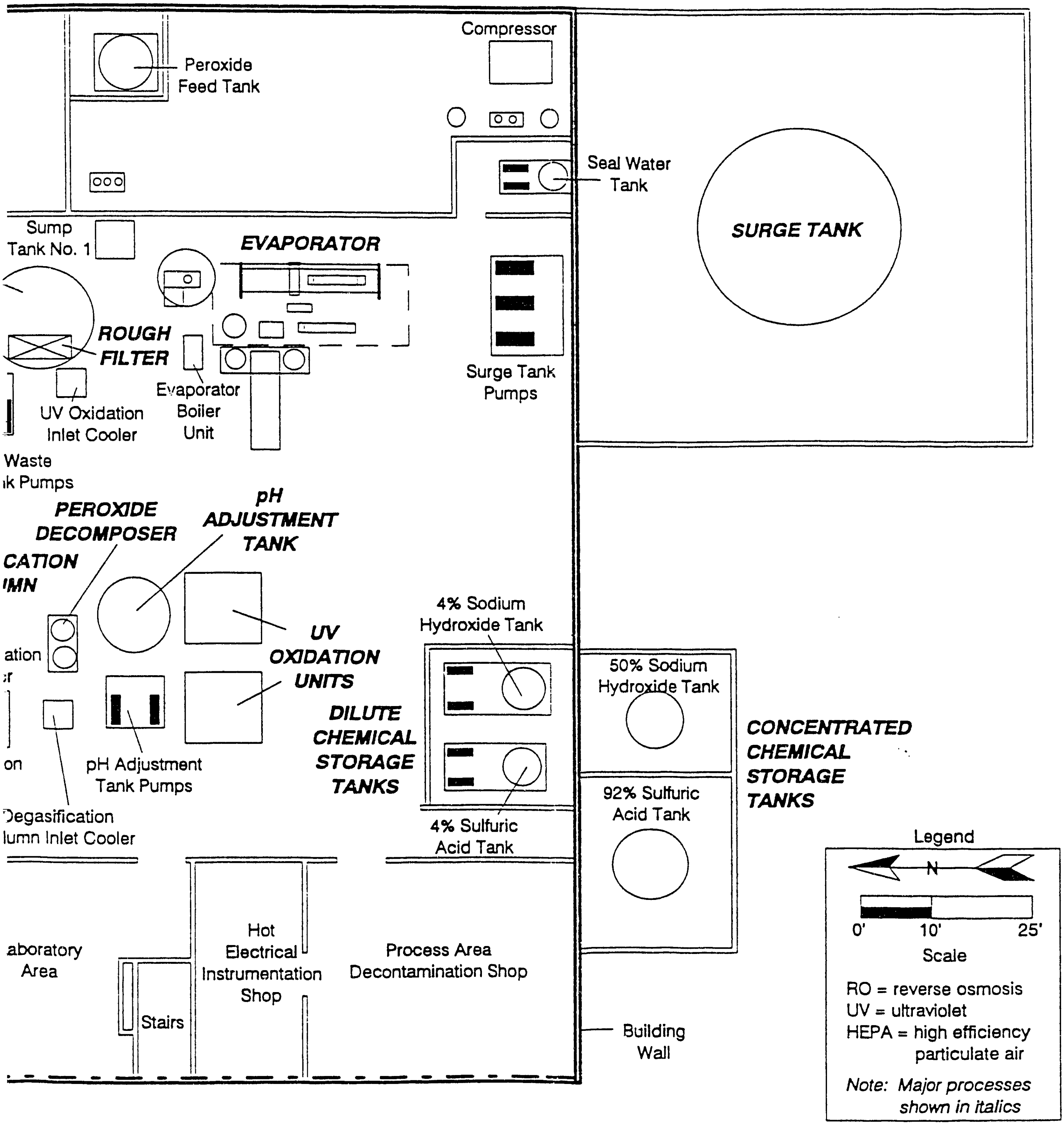
The ETF contains several tanks and process unit systems for the treatment of dilute waste waters generated on the Hanford Facility. Figure B-1 provides an overview of the ETF Building layout and Figure B-2 is the flow diagram of the treatment process. The ETF effluent concentrations to be disposed at the SALDS are provided in Table B-1. Information about the ETF effluent concentrations in Table B-1 was derived from health-based limits, ground water protection limits, and best engineering judgement of treatment capability. Information about the concentrations anticipated in the cooling tower blowdown is provided in Table B-2 and was derived from the *Columbia River Characterization Data Report in Support of Project L-045* (WHC 1992d). The concentrations in both tables are estimates and will be revised based on the results of the pilot plant testing and any additions or deletions of influent streams. The pilot plant results will be submitted to Ecology as part of the Delisting Petition (DOE 1992b).

Waste water is piped to the ETF through two lines. One pipeline extends directly from the LERF to the surge tank at the ETF. The second pipeline extends to the ETF from the major elbow in the transfer piping between the 242-A Evaporator and the LERF. The ETF receives waste water for treatment in the surge tank. The waste water passes from the surge tank into the primary treatment train where the organic, inorganic, and radioactive constituents are removed from the waste water. Waste generated during the primary process passes into the secondary treatment train where the waste is processed and prepared for final transfer to an onsite TSD unit. The primary and secondary treatment trains are described in the following sections.



Source: Dwgs. H2-89029, H2-89033, H2-89162

Figure B-1. Location of Treatment Units



n 200 Area Effluent Treatment Facility Process Area.

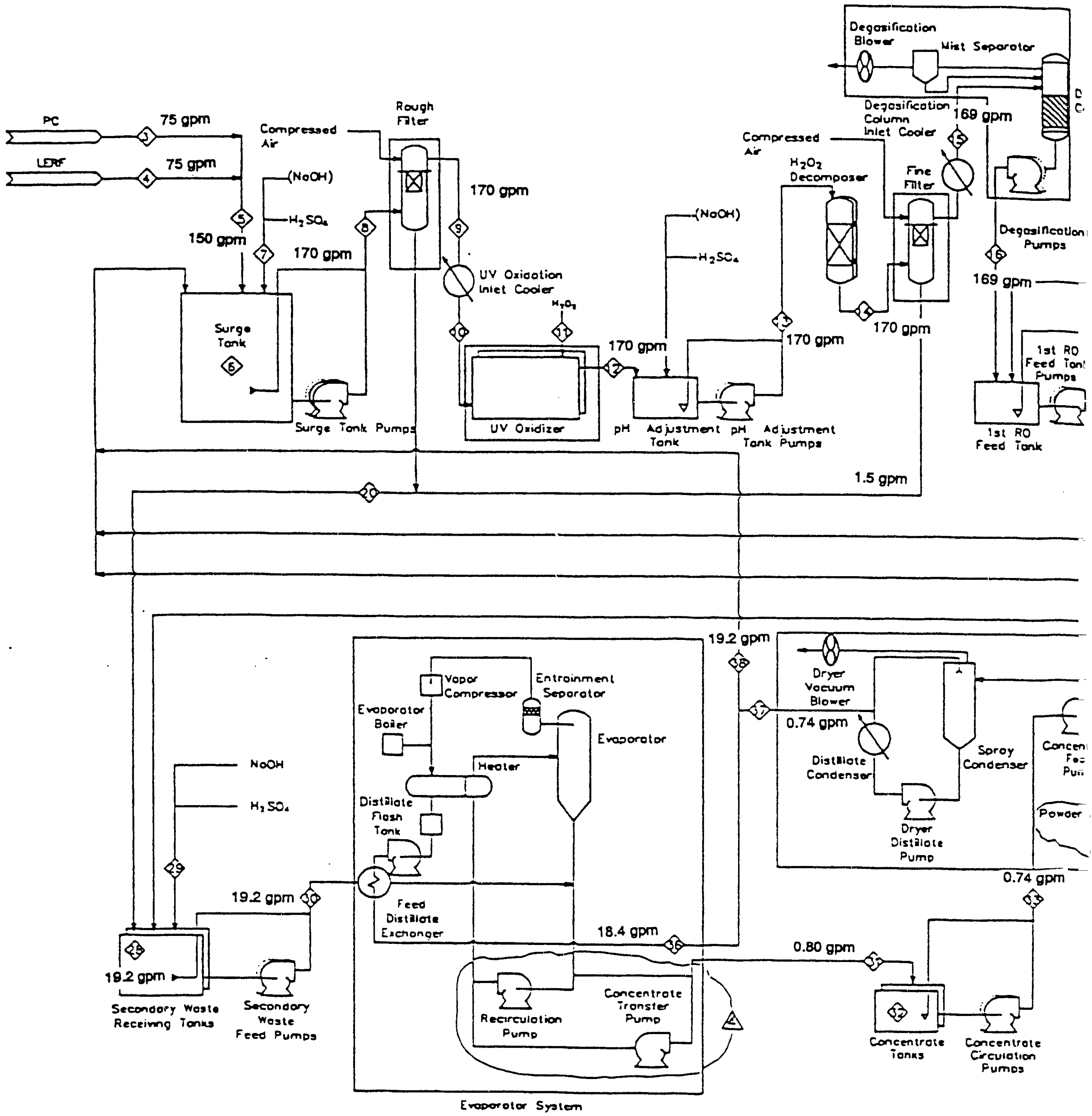
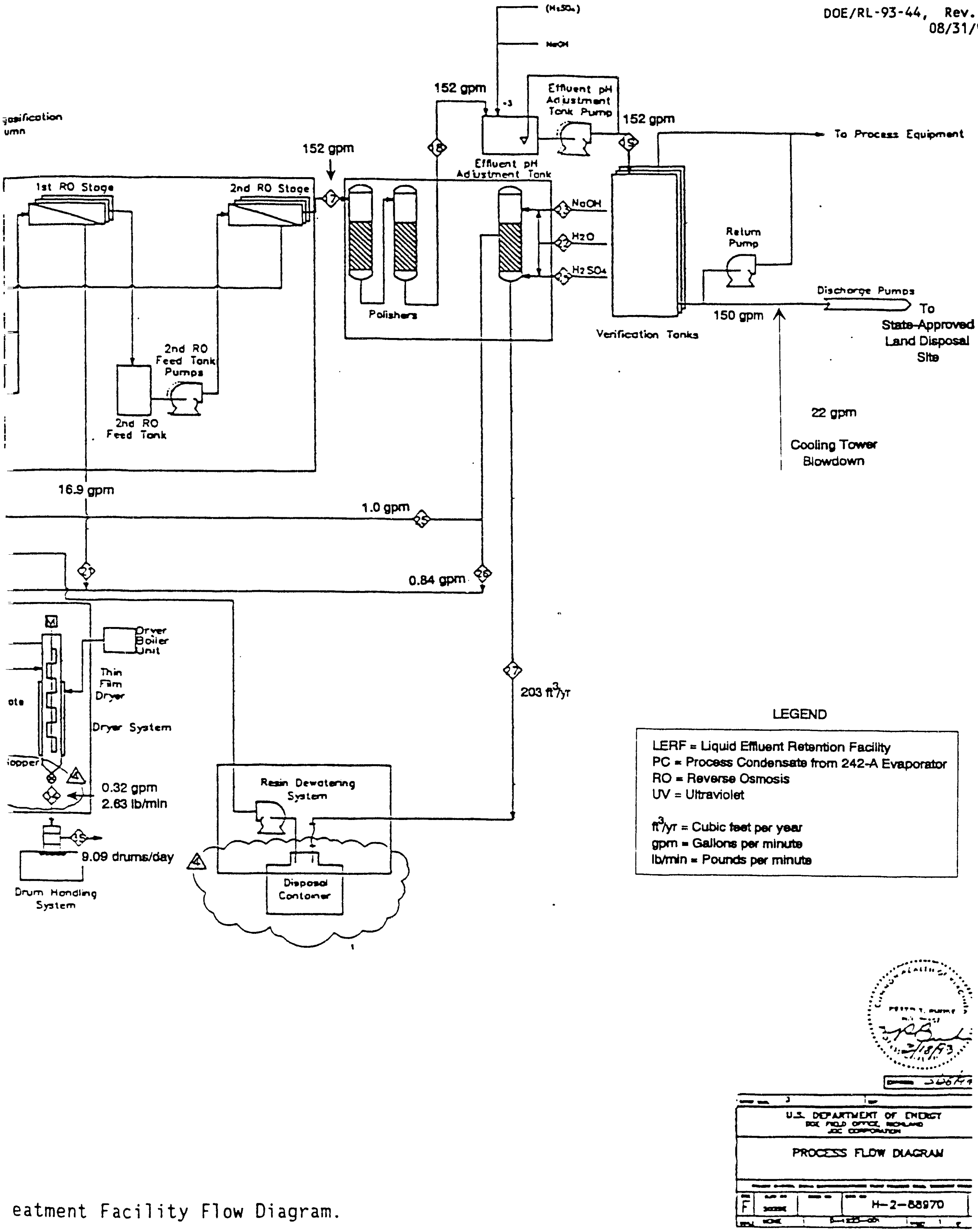


Figure B-2. 200 Area Effluent T



LEGEND

LERF = Liquid Effluent Retention Facility
PC = Process Condensate from 242-A Evaporator
RO = Reverse Osmosis
UV = Ultraviolet

ft³/yr = Cubic feet per year
gpm = Gallons per minute
lb/min = Pounds per minute

eatment Facility Flow Diagram.

Table B-1. ETF Effluent Concentrations.

Parameter	ETF Effluent
pH	6.5-8.5
Inorganic Constituents (ppb)[a]	
Aluminum	7,000
Antimony	6
Arsenic	50
Barium	1,000
Beryllium	4
Cadmium	10
Chloride	200
Chromium	50
Copper	1,000
Cyanide	200
Fluoride	4,000
Iron	300
Lead	50
Manganese	50
Mercury	2
Nickel	100
Nitrate	44,268
Selenium	50
Silver	200
Sulfate	250,000
Vanadium	200
Zinc	5,000
Radionuclides (pCi/L)[b]	
Gross Alpha Radiation	2,500
Gross Beta Radiation	5,000
^{90} Strontium	8
Tritium	24,000,000[c]

Table B-1. ETF Effluent Concentrations. (cont.)

Parameter	ETF Effluent
Organic Constituents (ppb)[a]	
Acetone	4,000
Benzene	5
Benzyl alcohol	10,000
Carbon tetrachloride	150
Chloroform	70
Cresylic acid (cresols)	2,000
Di-n-octyl phthalate	700
Ethyl ether	7,000
Ethylbenzene	700
Isophorone	9
Methanol	20,000
Methylene chloride	50
Methyl ethyl ketone	2,000
Methyl isobutyl ketone (MIBK)	2,000
Naphthalene	1,000
2-Naphthylamine	10
N-Nitrosodimethylamine	10
Phenol	20,000
Pyridine	40
Styrene	100
Toluene	1,000
1,1,1-Trichloroethane	200
1,1,2-Trichloroethane	50
Xylenes (total)	10,000

a ppb = parts per billion
b pCi/L = picocuries per liter
c Source: WHC 1989. Based on 83 samples with detectable levels of tritium. Expected tritium values from 242-A Evaporator: Average = 5.6E+06 pCi/L; 90% Confidence Interval = 6.3E+06 pCi/L; Maximum = 2.4E+07 pCi/L.

Table B-2. Anticipated Cooling Tower Blowdown Concentrations.[a]

Parameter	Blowdown Concentration[b]	Analytical Method	Detection Limit[b]
pH	6 - 9	---	---
Conductivity	900 μS	NV	NV
Total Dissolved Solids	1.07×10^6	EPA 160.1	3,000
Total Suspended Solids	42,000	EPA 160.2	3,000
BOD (5 day)	BDL	EPA 405.1	2,000
COD	400,000	EPA 410.4	7,000
Ammonia-N	420	EPA 350.2	10
TKN-N	NA	---	---
Nitrate-N	BDL	EPA 353.3/354.1	30
Ortho-Phosphate-P	BDL	EPA 365.2/365.3	10
Total Phosphate-P	300	EPA 365.2/365.4	10
Total oil and grease	NA	---	---
Calcium	108,000	EPA 200.7/SW6010,-TR	NV
Magnesium	BDL	EPA 200.7/SW6010,-TR	25
Sodium	500	EPA 200.7/SW6010,-TR	0.1
Potassium	BDL	EPA 200.7/SW6010,-TR	300
Chloride	16,000	EPA 325.3	1,800
Sulfate	124,000	EPA 375.4	1,000
Fluoride	600	EPA 340.2	100
Cadmium	BDL	EPA 213.2/SW7131,-TR	0.1
Chromium	BDL	EPA 200.7/SW6010,-TR	7
Lead	BDL	EPA 239.2/SW7421,-TR	0.8
Mercury	BDL	EPA 245.1/SW7470	0.2
Selenium	BDL	EPA 270.2/SW7740,-TR	0.8
Silver	BDL	EPA 270.2-TRM/272.2-T	0.2
Copper	BDL	EPA 200.7/SW6010,-TR	2

Table B-2. Anticipated Cooling Tower Blowdown Concentrations.[a] (cont.)

Parameter	Blowdown Concentration[b]	Analytical Method	Detection Limit[b]
Iron	250	EPA 200.7/SW6010,-TR	10
Manganese	BDL	EPA 200.7/SW6010,-TR	25
Zinc	BDL	EPA 200.7/SW6010,-TR	2
Barium	160	EPA 200.7/SW6010,-TR	1.0
Total Coliform	3,000	SM 908A	2 MPN/dL

[a] Source: maximum numbers were abstracted from WHC 1991b using the following assumptions:
1) Blowdown flow rate is 22 gal/min (83.8 L/min)
2) Blowdown concentration is six times the concentration of raw water constituents
3) Addition of the following chemicals to control corrosion, scaling, and biological growth: Na^+ = 5.0 E+02 ppb; ClO^- = 5.0 E+02 ppb; SO_4^{-2} = 5.8 E+04 ppb; and TRC[223] = 1.2 E+04 ppb (Calgon proprietary chemical made of organophosphate polymer. TRC[223] is a Calgon, Inc. trademark.)

[b] Concentrations are in μg/L unless otherwise noted.

NV	=	Data not available
NA	=	Not analyzed
BDL	=	Below detection limit
ppb	=	parts per billion

2.0 PRIMARY TREATMENT TRAIN

The primary treatment train in the ETF receives waste water in the surge tank, processes the waste water, and discharges the treated waste water to the soil column. The primary treatment train consists of the following systems:

- Surge tank (pH adjustment)
- Coarse filtration
- Ultraviolet/Oxidation (UV/OX) system
- pH adjustment
- Hydrogen peroxide decomposer
- Fine filter
- Degasification
- Reverse Osmosis (RO) system
- Polisher Ion Exchange columns
- pH adjustment
- Verification tanks
- Cooling tower unit and blowdown.

2.1 SURGE TANK

The waste water enters the ETF at the surge tank, located outside the ETF Building on the south side. The surge tank also receives waste extracted by various systems within the primary treatment train, such as sumps, regeneration rinsing water from the polisher, and the distillate from the ETF evaporator and the thin film dryer.

The surge tank is insulated and the contents heated to prevent freezing. The pH of the contents is adjusted to about 6.0 by the metered addition of 92-weight percent sulfuric acid (H_2SO_4) or 50-weight percent sodium hydroxide (NaOH). The main purpose of pH control in the surge tank is to change free ammonia into ammonium ion to prevent ammonia from being discharged into the vessel ventilation system. This pH range also corresponds to the operation range for the UV/OX system. A titration analyzer is used to adjust and maintain the pH.

One of the three surge tank pumps circulates the contents, mixing the sulfuric acid or the sodium hydroxide and the waste water to a uniform pH. A second pump forces the pH adjusted waste water through the rough filter. The remaining pump serves as a spare.

2.2 COARSE FILTRATION

The 2-micron rough filter removes the larger particulates from the waste water. The solids accumulating on the filter element are backwashed to the secondary waste receiving tanks with pulses of compressed air, forcing water back through the filter. The backwash operation is started automatically by a rise in differential pressure across the filter. The backwash operation is accomplished in 5 minutes, at an expected frequency of less than once a week.

The filter medium is expected to operate for at least 1 year between replacements. The filtered waste water then passes through a plate cooler, to reduce the temperature to less than 100 °F (38 °C), before entering the UV/OX chambers.

2.3 ULTRAVIOLET OXIDATION SYSTEM

The purpose of the UV/OX system is to break down the organic compounds in the waste water, producing carbon dioxide, water, and inorganic ions. The UV/OX system uses the photochemical reaction of UV light on hydrogen peroxide to decompose the organic constituents.

Hydrogen peroxide is mixed with the waste water, and then exposed to UV light. The photochemical reaction of UV light and hydrogen peroxide causes the formation of hydroxyl radicals and other reactive species that cause the decomposition of organics.

Organic destruction is accomplished in two UV/OX units. During the UV/OX process, the waste water passes through mixing and dosing chambers in turn within the reaction chamber where the hydrogen peroxide is added.

In each reaction chamber, a high-intensity UV lamp is covered by a quartz tube with a tube-cleaning device. Cleaning of the quartz tube exteriors and reaction chamber interiors is performed automatically by rubber rings that slide across the surface of the quartz tubes. This cleaning process occurs in a stand-by mode as necessary without process shutdown.

The UV/OX system is equipped with automatic shutdown should the following circumstances occur: overpressurization, moisture in lamp end enclosure, high temperature, low water, failure of the hydrogen peroxide storage/feed module, high lamp drive enclosure temperature, and open access door. Also provided is a level sensor to protect the UV lamps against the risk of exposure to air. Should the liquid levels fall low enough to expose the lamps to air, the UV lamps are shut down automatically. After shutdown, the UV lamps cannot be restarted until the lamp temperature decreases to a specified level. After UV/OX, the waste water is received in the pH adjustment tank.

2.4 pH ADJUSTMENT

The pH adjustment chemically alters the ammonia and carbonate ions in the waste water. The waste water pH is adjusted with a solution of 4 weight percent sulfuric acid or 4-weight percent sodium hydroxide to a pH of approximately 4.0. In this acidic solution, ammonia is converted to an ammonium ion specie that is removed downstream by the RO system. Acidification also changes the chemistry of the carbonate ion, causing it to form carbon dioxide, a gas with low solubility that can be removed from the waste water.

The pH adjustment tank has two pumps, one of which operates as a spare. A constant liquid level is maintained in the tank to facilitate an even and constant pH of the waste water. The waste water is pumped next through the hydrogen peroxide decomposer.

2.5 HYDROGEN PEROXIDE DECOMPOSER

The purpose of the hydrogen peroxide decomposer is to reduce the amount of hydrogen peroxide left in the waste water from the UV/OX system. The hydrogen peroxide injected for the UV/OX system is not completely consumed in the process of organic destruction, leaving approximately 100 to 200 parts per million in the waste water. A strong oxidant, hydrogen peroxide could harm the membranes in the RO system. Therefore, the waste water is sent through a simple packed column that decomposes the hydrogen peroxide into water and oxygen.

The residual hydrogen peroxide is decomposed by flowing through one of two vessels containing packed beds of catalyst. A safety relief valve on each vessel opens to relieve excessive system pressure to sump tank No. 2. The break down of hydrogen peroxide forms water and oxygen as the waste water flows through the catalyst bed. The gas generated by the decomposition of the hydrogen peroxide accumulates at the top of the hydrogen peroxide decomposer column and is discharged to the sump tank, which is vented to the vessel offgas system. The waste water discharge flows from the decomposer to the fine filter.

2.6 FINE FILTRATION

The purpose of the fine filter is to remove suspended solids larger than approximately 0.5 micron. The filter is designed to operate at up to 150 pounds per square inch gauge.

Differential pressure between the inlet and outlet of the fine filter is monitored. When the differential pressure reaches a predetermined value, the filter goes into the backwash operation automatically. Solids accumulating on the filter element are backwashed to the secondary waste receiving tank with pulses of compressed air that force water back through the filter. The backwashing operation is expected to last 5 minutes and occur less than once a week. The filter is expected to operate for at least 1 year before replacement. The waste water discharged through the filter then undergoes degasification.

2.7 DEGASIFICATION

The function of the degasification column is to remove the carbon dioxide formed when the waste water was acidified in the pH adjustment tank. Carbonate ions are removed to prevent increasing the contaminant loading to the RO system and other downstream ETF processes (i.e., IX, evaporation, and drying).

A plate-type heat exchanger is provided for cooling the waste water fed to the degasification column. The carbon dioxide-laden waste water passes down through a packed bed at a slight vacuum [approximately 2 inches of water (0.051 kilograms per square centimeter)] with air blowing up through the packed bed. Because of the low solubility of the carbon dioxide, contact with the countercurrent air purges the waste water of the carbon dioxide molecules. Offgas from the degasification column is discharged by the degasification blower to the vessel offgas system.

Extremely low pressure developed by the column blower that could compromise column integrity is relieved by a pressure relief safety valve. The column liquid level is controlled automatically. The degasified waste water is fed to the first stage RO feed tank by the degasification pump.

2.8 REVERSE OSMOSIS SYSTEM

The function of the RO system is to reduce the concentration of dissolved solids, radionuclides, and any remaining large molecular weight organic materials in the waste water.

Reverse osmosis is a process that uses pressure to force clean water molecules through special membranes while keeping the larger-molecule contaminants within the membranes. The waste water passes through two or more of the pressure vessels containing the RO membranes before going to the next system.

The membranes are of a composite polyamide type that are nearly impermeable to ammonium ions. Contaminants, including the ammonium, are removed from the waste water as the fluid moves through the membranes. The cleaned waste water discharged from the system is referred to as the permeate, while the contaminated waste is called the reject stream, concentrate, retentate, or brine.

The RO system used at the ETF enhances contaminant removal by using two stages (instead of one) and by a crossflow pattern through the membrane modules. The solute concentrate from the first stage RO membranes are collected in the secondary waste receiving tanks, and the permeate (the waste water that has passed through the membranes) is routed to the second stage RO for additional treatment before being discharged to the polisher. Concentrate from the second stage RO is routed back to the first stage RO feed tank. Note that the complete RO system is designed with 50 percent excess capacity (i.e., one third of the system is always in a cleaning or standby mode, while the other two thirds are in operation).

2.9 POLISHER

The purpose of the polisher is for final removal of residual dissolved solids from the waste water.

The discharge permeate from the second RO stage is pumped to the polisher, which consists of three IX columns, each with mixed beds of cation and anion resin. Two of the columns operate while the third is regenerated, or cleaned. The IX columns operate in series, meaning waste water flows down through one IX column and then down through the second column.

When the capacity of the resin in the first of the two online columns is exceeded, as detected by an increase in the conductivity of the IX column effluent, the column is removed from service for regeneration. The third unit, which was offline, is placed in service (to become the second of two on-line columns).

The column removed from service is prepared for regeneration by separating the resins into a layer of anion resin and a layer of cation resin. The resins are separated by an upflow of clean water from the verification tank, which floats the lighter anion resin to the top of the resin bed. The contaminants in the cation resin is eluted with dilute (4 weight percent) sulfuric acid and the anion resin with dilute (4 weight percent) sodium hydroxide. The resulting concentrated (salt-loaded) regeneration waste streams are collected in the secondary waste receiving tanks. Thereafter, a dilute rinsing of both the anion and cation resins occurs, producing a solution (rinse waste) that is collected in the surge tank. Compressed air is used to remix the cation and anion bed after regeneration is complete.

Eventually, the IX resins become exhausted so that further regeneration is useless. When that happens, the spent resins are slurried, or washed, with water from the IX vessels into a disposal container. The container is sealed with a special lid that allows the following: spent resin to go in the containers, resin dewatering and water removal, and television monitoring of the resin and water levels within the container. Slurried resin enters the container through the lid to displace air that is removed by a blower. The air flows through an entrainment separator to remove water drops and then flows through a high-efficiency particulate air (HEPA) filter into the vessel ventilation system. Liquid is removed from the container by a pump, and sent to the surge tank as required to remove water from the resin.

The IX vessels are equipped with visual inspection ports that allow observation during resin separation, bed expansion, and operation. Each vessel outlet is monitored for conductivity and pH to prevent overloading of the resin beds between regeneration cycles. Automatically operated valves recycle poor quality effluent back to the surge tank, if needed, to prevent contamination of the verification tanks. Resin traps and a resin strainer prevent resin loss into the verification tanks. The waste water discharged from the polisher system is piped to the effluent pH adjustment tank.

2.10 pH ADJUSTMENT

This final pH adjustment tank neutralizes the waste water for discharge. A small flow of dilute sulfuric acid or dilute sodium hydroxide is used to adjust the pH to between 6.5 and 8.5. An eductor in the tank ensures adequate mixing of the added chemicals. The pH of the waste water is monitored and controlled continuously.

The liquid level in the effluent pH adjustment tank is kept at a constant level to facilitate the pH adjustment process. A signal from the tank liquid level sensor transmitted to the flow control valve on the tank outlet adjusts the level in the tank by causing a corresponding increase or decrease in the flow to the verification tanks. Should an overflow occur, the waste water is collected in sump tank No. 2.

2.11 VERIFICATION TANKS

Three verification tanks hold the treated waste water while a laboratory analysis is performed to determine if treatment is complete. The verification sample is taken by a flow proportional sampler as the treated waste water is pumped from the effluent pH adjustment tank to the verification tanks. The treated waste water can be pumped back into the treatment train, if the waste water does not meet the Washington State waste discharge limits.

The three verification tanks alternate between three operating modes: receiving treated waste water, holding treated waste water during laboratory analysis and verification, or discharging verified waste water.

All of the verification tanks have a liquid level sensor, a liquid level indicator, and a high level alarm. The verification tank system includes three pumps: one delivers treated waste water to the SALDS, one pump circulates the treated waste water through tank eductors and serves as a water supply to various processes within the ETF, and one pump is a spare on standby.

2.12 COOLING TOWER UNIT AND BLOWDOWN

Two ETF processes (UV/OX and RO) have upper temperature limitations. Consequently, the ETF design incorporates heat exchangers and a cooling tower unit to control waste water temperatures.

Blowdown from the cooling tower is discharged to the SALDS through the same pipeline that carries the ETF treated waste water. The blowdown is combined with the waste water flow downstream of the verification tanks. Either one or both of the waste streams can flow down the pipeline to the SALDS at any one time. The blowdown results from an average of six cycles of concentration and averages up to 22 gal/min (5.8 L/min). Raw water is used in the cooling systems. Corrosion and scale inhibitors are added during routine operations.

3.0 SECONDARY TREATMENT TRAIN

The following waste, generated by the primary treatment train systems, is processed in the secondary treatment train:

- Concentrate from the first RO stage
- Backwash from the rough and fine filters
- Regeneration waste from the polisher.

The secondary treatment train collects, concentrates, dries, and packages the waste in 55-gallon (208-liter) steel containers. The secondary treatment train consists of the following systems:

- Secondary waste receiving tanks
- ETF evaporator
- Concentrate receiving tanks
- Thin film dryer
- Container handling system.

3.1 SECONDARY WASTE RECEIVING TANKS

Secondary waste is collected in two secondary waste receiving tanks. The tanks alternate between receiving the secondary waste generated, and serving as a feed tank for the ETF evaporator feed tank. The rising liquid in the tank activates a high-level switch that diverts the flow to the other tank. Each secondary waste receiving tank has a pump on the tank outlet that can be used to circulate the tank contents or to supply feed to the ETF evaporator. A high-level alarm indicates an abnormal situation.

Chemical pH adjustment of the tank contents is accomplished by the controlled addition of dilute sulfuric acid or dilute sodium hydroxide. The pH is adjusted to approximately 6.0 for corrosion control of the ETF evaporator and thin film dryer equipment and to minimize any ammonia generation.

3.2 200 AREA EFFLUENT TREATMENT FACILITY EVAPORATOR

The purpose of the ETF evaporator is to reduce the volume of waste before drying. Feed from the secondary waste receiving tank is pumped through a preheater (feed/distillate exchanger) to a forced circulation evaporator loop. In the evaporator loop, concentrate is produced as water is driven off overhead.

Water vapor in the overheads from the ETF evaporator passes through an entrainment separator, which removes entrained water droplets and solid particulates, returning them to the evaporator loop. The cleaned vapor is condensed and fed to the distillate flush tank. Some condensate from this tank is sprayed into the entrainment separator to scrub out particulates. Finally, the condensate is cycled back to the surge tank for further processing.

3.3 CONCENTRATE RECEIVING TANKS

The ETF evaporator concentrate is pumped to the two concentrate tanks. These concentrate tanks function alternately between concentrate receiver and feed tank for the thin film dryer. The rising liquid level in the tank receiving concentrate actuates a high-level switch that diverts the flow to the other concentrate tank. Should the tank fail to divert the flow to the alternate tank, the resulting overflow would go to sump tank No. 1.

Both concentrate tanks have a circulation pump on the tank outlet that can be used to circulate the tank contents or to supply feed to the thin film dryer via the concentrate feed pump. Dilute sulfuric acid and dilute sodium hydroxide can be added to the tanks for pH adjustment. Homogenization by an eductor and pH adjustment (if necessary) is completed before the tank is filled and enters the feed mode. The concentrate tank circulation pump feeds the concentrate feed pump, which in turn supplies the thin film dryer.

A sample from the recirculation line is taken to characterize the tank contents, which is used for container content characterization. This provides complete characterization of the container contents and minimizes exposure to workers.

The temperature of the concentrate is increased by a steam preheater to enhance the operation of the thin film dryer.

3.4 THIN FILM DRYER

The purpose of the thin film dryer is to dry the concentrated secondary waste into a powder. Concentrate is distributed on the inner cylinder of the thin film dryer by wiper blades that rotate on a shaft centered in the cylinder. The shaft is driven by an electric motor. The concentrate is dried by steam heat introduced into a annular space (steam jacket) between the outer shell and the inner cylinder. Steam heat transferred across the inner cylinder wall heats the concentrate as it flows down the inside surface. Heating is controlled by regulating the steam pressure to the steam jacket. Condensate from the steam is returned to a steam boiler dedicated to the dryer. A safety valve on the thin film dryer steam and vapor lines vent independently to sump tank No. 1.

Overhead vapor released by the drying of the concentrate is condensed in a spray condenser. The condensed vapor forms a distillate by direct contact within a spray condenser. The distillate flow is circulated by a dryer distillate pump. Excess heat is removed from the distillate by a water-cooled heat exchanger. Part of the distillate is circulated back to the condenser spray nozzles. The remaining distillate is pumped to the surge tank. Any noncondensible vapors and particulates from the spray condenser are exhausted by a vacuum blower to the vessel ventilation system.

The concentrate dries into a film as it flows down the length of the dryer. The dried film, or powder, is scraped off the dryer cylinder by blades attached to the rotating shaft. The powder is funnelled through a cone-shaped powder hopper at the bottom of the dryer and into a rotary valve that feeds the powder into a container. An air-driven vibrator mounted on the cone section assists powder movement out of the thin film dryer into a 55-gallon (208-liter) container.

3.5 CONTAINER HANDLING SYSTEM

Empty containers with liners and lids are removed from the empty-container storage and placed on a conveyor. The containers are moved into the container filling area after passing through an air lock. An empty container located under the powder port of the thin film dryer is raised into position by an elevator. The container is sealed to the thin film dryer and the rotary valve begins the transfer of powder out of the thin film dryer into the empty container. Air displaced from the container is vented to the extrainment separator attached to the ETF evaporator that exhausts to the vessel ventilation system.

The container is filled to a predetermined weight, then moved along the conveyor to the smear station airlock. At the smear station airlock, the container is moved onto the discharge conveyor by remote control. The airlock is opened and the smear sample (surface wipe) is taken and the radionuclide contamination level is counted. If the container has contaminated material on the outside, the container is moved to the washdown station where the container is washed with treated water from the verification tanks. The container wash water drains to sump tank No. 1. The washed container is air-dried and retested. Filled containers that pass the smear test are labeled, placed on pallets, and moved by forklift to the filled storage area at the ETF pending transfer to the Central Waste Complex.

ATTACHMENT C

STATE-APPROVED LAND DISPOSAL SITE

ATTACHMENT C

STATE-APPROVED LAND DISPOSAL SITE

1.0 INTRODUCTION AND LEGAL DESCRIPTION

The treated waste water from the 200 Area Effluent Treatment Facility (ETF) will be disposed to the soil column at the State-Approved Land Disposal Site (SALDS). An average flow of 150 gal/min (568 L/min) of ETF treated waste water and 22 gal/min (83 L/min) of ETF cooling tower blowdown will be piped to the SALDS, which is located north of 200 West Area. The combined flow of the two streams will be discharged to a crib (i.e., a covered structure with a bottom open to the ground) and infiltrate into the soil (WHC 1993b).

Disposal of the treated waste water from the ETF at the SALDS was selected from an evaluation of the following five candidate disposal alternatives:

Soil column disposal, including crib and pond disposal options

Discharge to the Columbia River

Evaporation, both solar and mechanical

Beneficial use options, including recycling and irrigation

No action.

The ranking process incorporated weighting factors to demonstrate the relative importance of the following criteria: (1) minimizing radiation exposure as low as reasonably achievable (ALARA), (2) environmental impacts, (3) permitting requirements, (3) capital and operating costs, and (4) implementation (WHC 1993b).

The highest total scores (most desirable option) were assigned to the soil column alternative. The crib and pond disposal scores for ALARA were higher (less risk) than for any of the other alternatives because the potential for radiation exposure is significantly lower for the soil column disposal system. Crib disposal ranked higher than pond disposal because the pond would provide a surface area with a potential for radiation exposure to animals (environmental impact criterion), and more effluent would evaporate from a pond (ALARA criterion). Because of extensive characterization requirements and the complexities associated with permitting, crib disposal was ranked lower (less desirable) than some other alternatives for permitting and implementation criteria.

The third highest ranked alternative was mechanical evaporation. This disposal alternative would cost considerably more than other disposal alternatives and would result in comparatively higher offsite exposure levels. Nonetheless, it was given comparatively high scores for environmental impact, permitting, and ease/feasibility of implementation criteria (WHC 1993b).

The selected disposal alternative was the crib. The disposal area will be designated as the SALDS when the State Waste Discharge Permit is issued (WHC 1993b).

The SALDS is located approximately 5.9 miles (3.7 kilometers) west of the ETF, north of the 200 West Area. The SALDS is located outside of the 200 West fenced boundary, approximately 1,200 feet (366 meters) north of 27th Street, and approximately 900 feet (274 meters) east of Dayton Avenue. The SALDS operations area is bounded by the following Hanford coordinates: N47900, W77000; and N48075, W76880 (Section 36 of T13N, R27E) (Figure C-1). The area of waste water infiltration is approximately 110 feet (34 meters) by 200 feet (61 meters). This property is currently owned by the U.S. Government, and the Department of Energy has tenancy. Thus, no contractual agreements are needed with other land owners.

This location was selected from a list of seven potential sites. Each site was evaluated on a set of determining (go/no go) criteria and a set of engineering criteria. The determining criteria included the following:

Sufficient land area and infiltration capacity to allow infiltration at the anticipated average flow rate

No unacceptable impacts on any identified RCRA or CERCLA site

No unacceptable impact on cultural, historical, or archeological resources

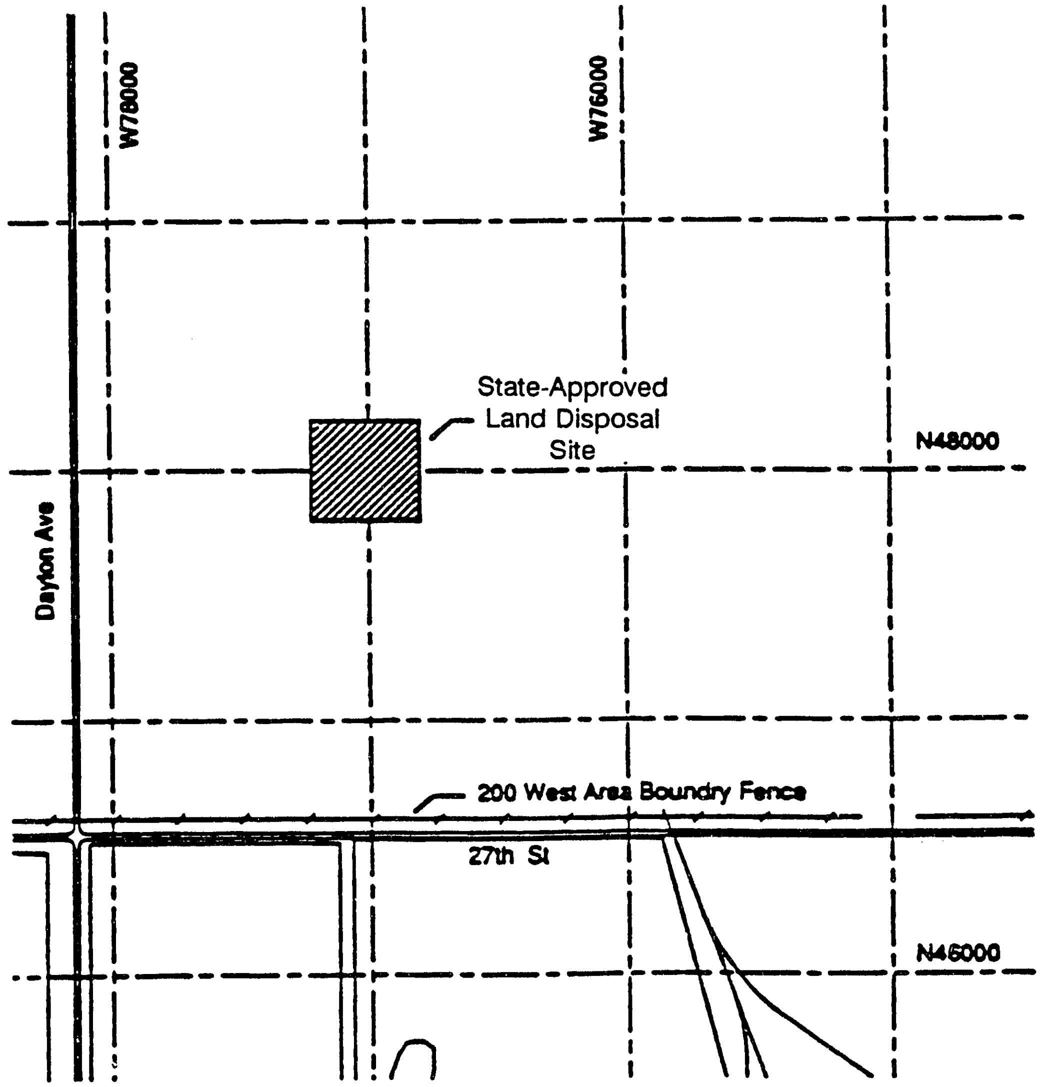
No unacceptable impact on endemic threatened or endangered plant or animal species

No land use conflicts (WHC 1993b).

The engineering criteria included the following: (1) health and safety, (2) environmental impact, (3) operational impact, and (4) land use. Each of these criteria was assigned a numerical weighting factor (WHC 1993b).

2.0 LOCATIONAL INFORMATION

Figure C-2 provides the locational information requested in Section H.3 of the permit application. No streets or roads are located within 500 feet of the site. No water supply wells, surface water drainage systems, or surface



Source: WHC (1993b)

Figure C-1. Location of State-Approved Land Disposal Site on Hanford Grid.

water diversions are located within 500 feet of the site. No drainfields, dry wells, or abandoned wells are located within 500 feet of the site. One monitoring well has been installed and an additional borehole drilled at the site; these are discussed in Section 3.0. Land uses within 1,500 feet (0.457 km) include the northernmost processing areas within the 200 West Area. A railroad line is located within 1,000 feet (305 m) of the site. A number of monitoring wells have been installed in the 200 West Area as depicted in Figure C-2.

3.0 HYDROGEOLOGY AND SOILS

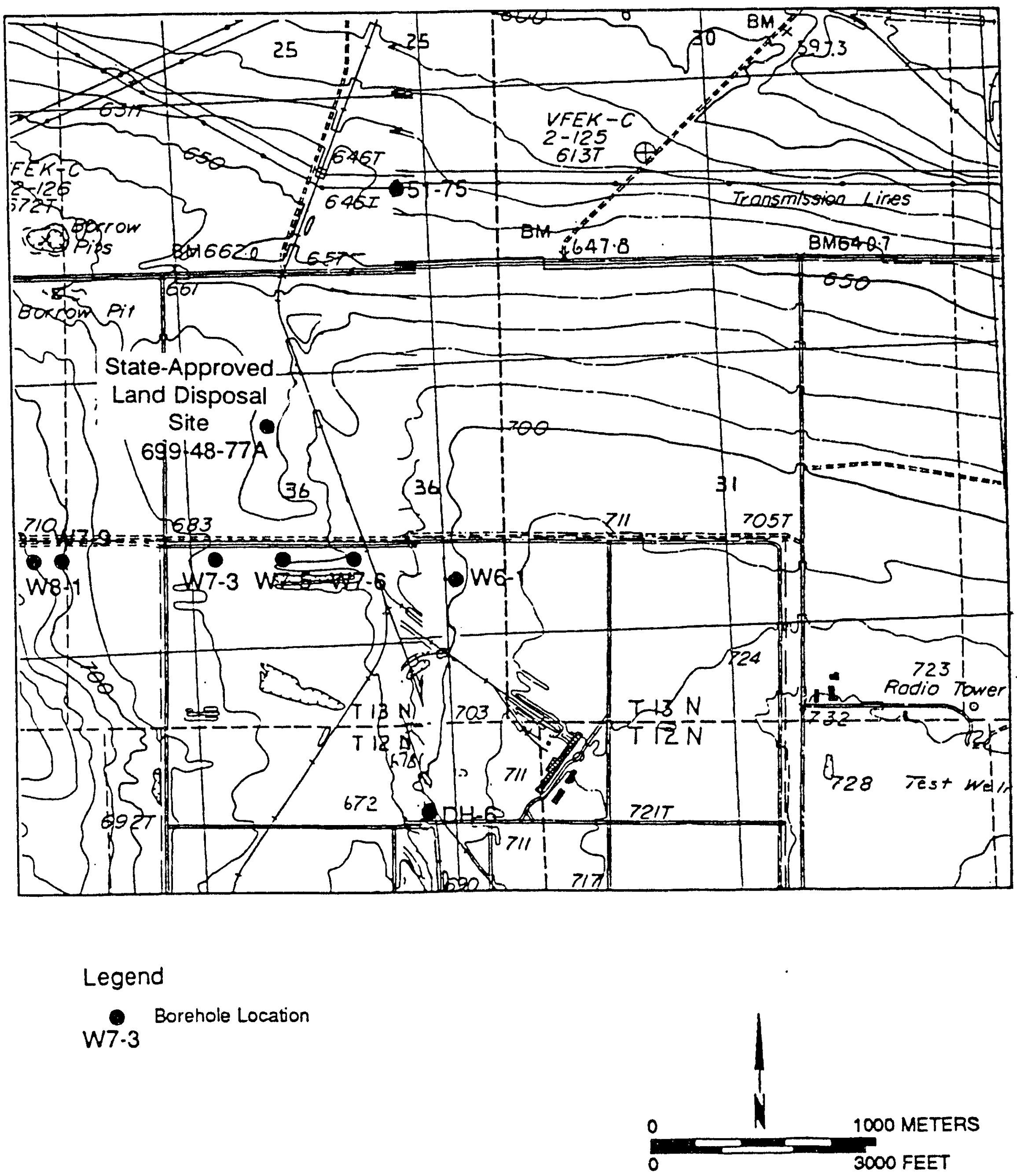
3.1 STRATIGRAPHY

Two boreholes were drilled and a well was installed in the second borehole at the SALDS location and reported in the *Characterization Report, C-018H Soil Column Disposal Siting Evaluation* (WHC 1993a). The first, borehole 699-48-77B, was drilled to a depth of 60 feet below ground surface (bgs), but was abandoned because it was drilled off-center. The second, well 699-48-77A, is located a few feet east of the first borehole. This borehole was drilled to a depth of 455 feet bgs using the cable-tool drilling method and core barrel sample recovery, where the Elephant Mountain Member of the Columbia River Basalt Group was penetrated. The well log information for well 699-48-77A and borehole 699-48-77B (0 to 60 feet bgs) are summarized in Figure C-3. A copy of the borehole log is provided at the end of Attachment C. Well 699-48-77A was completed as a RCRA groundwater monitoring well with a 10-slot, 20-foot (6.1-meter) long stainless steel screen installed between 212.4 and 232.4 feet bgs. Soil samples were collected during drilling for analyses to determine chemical and physical properties.

The stratigraphy between the ground surface and the water table is summarized as follows (WHC 1993a):

Hanford Formation. The Hanford formation is approximately 23 feet thick at the borehole site and consists predominantly of open-framework gravels with a sandy matrix typical of deposits of the gravel dominated facies. The formation shows little lithologic variation in the area of the proposed site. A thin silt lens occurs at the base of the gravel sequence above the Plio-Pleistocene and early Palouse interval. The Hanford formation thickens to the north and south of the site.

Plio-Pleistocene Unit and Early Palouse Soil. The combined thickness of the Plio-Pleistocene unit and early Palouse soil is approximately 42 feet, with the depth interval ranging from 23 feet to 65 feet bgs. The upper portion probably correlates to the early Palouse soil, but because of the method of drilling, no



Source: WHC (1993a)

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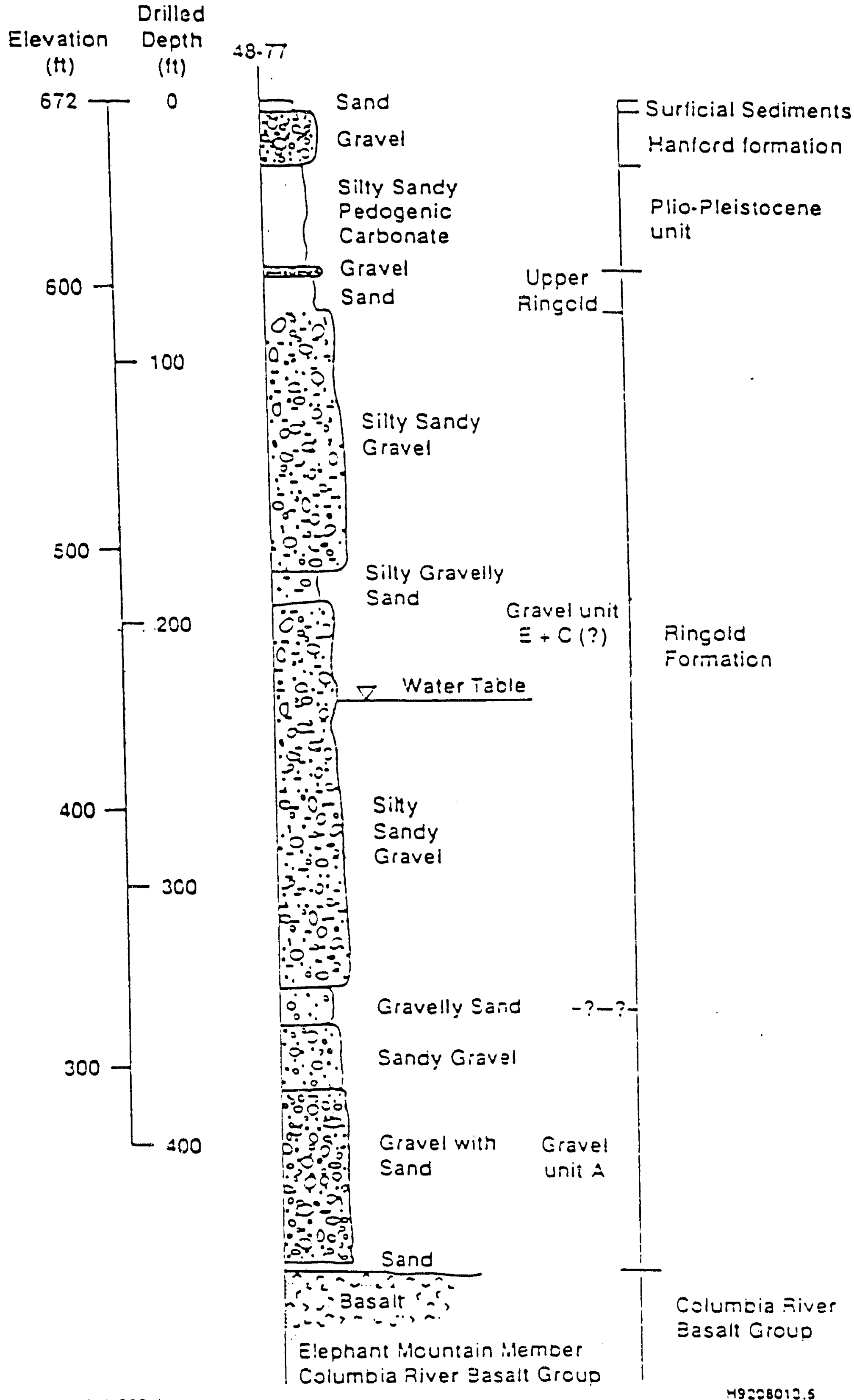
Figure C-2. Topographic Map Showing Well Locations and Other Features in the Vicinity of the State-Approved Land Disposal Site.



Source: WHC (1993a)

Figure C-3. Stratigraphic Units at Well 699-77A.

attempt was made to separate the early Palouse from the Plio-Pleistocene unit. The combined Plio-Pleistocene and early Palouse interval consists of the following: (1) interfingering carbonate-cemented silt, (2) sand, (3) gravel, and (4) carbonate-poor silt and sand. Thin pedogenic calcium lenses occur throughout the unit. Some cemented sands occur in the unit as well.

Ringold Formation. The Ringold Formation is approximately 390 feet thick in the borehole. The formation is dominated by gravel sequences which begin at 65 feet bgs and extend to the top of the Columbia River Basalt Group at 455 feet bgs. A major cataclysmic flood channelway is incised into the Ringold Formation which occurs approximately one-half mile north of the disposal site. The channelway, a result of erosion during a cataclysmic flood event, penetrates the Plio-Pleistocene and early Palouse interval, the upper Ringold, and a large portion of the Ringold E unit (Figure C-3). The channelway is filled with approximately 150 feet of Hanford formation gravel-dominated deposits. The exact position of the erosional channelway edge is not known because no boreholes penetrate deep enough to encounter the edge.

The sandy sequence that occurs between the base of the Plio-Pleistocene and early Palouse interval (65 feet bgs) and the top of the uppermost Ringold gravels (unit E) (83 feet bgs) at the site is interpreted to be erosional remnants of the upper Ringold unit. The Plio-Pleistocene and the early Palouse strata pinch out to the north, west, and east of the site. The upper unit extends to the south into the northern part of the 200 West Area.

The upper unit quickly grades downward into the gravels of unit E between 83 and 87 feet bgs. These gravels extend to a depth of 305 feet bgs with silt content increasing below 170 feet bgs. The next 40 feet (315 to 355 feet bgs) consists largely of sand with a significant gravel and silt component. These deposits are underlain by 40 feet (355 to 395 feet bgs) of sandy gravels that in turn overlie 57 feet (395 to 452 feet bgs) of gravels containing only minor amounts of sand. The base of the Ringold Formation is marked by a thin sandy unit (3 feet) overlying the basalt.

The lower mud sequence found south of the borehole is not present at the site and is interpreted to pinch out to the south. With the lower mud sequence absent, gravel unit E directly overlies gravel unit A, making differentiation between the two units impossible. However, if the top of unit A is projected towards the site from borehole 299-W6-1 (see geologic cross-section, Figure C-4), it would occur near the top of the sand-poor gravels at 395 feet bgs. Consequently much of the lower 60 feet of the Ringold section at the site may be part of gravel unit A.

Surface soils in the area of the SALDS are predominantly loamy sand and sandy loam (Figure C-5). The soils map indicates that Burbank Loamy Sand predominates in the immediate vicinity of the site. Under the Unified Classification System, this soil is classified as a medium sand. The soils to the southwest, north and northeast of the site are described as Ephrata Sandy Loam which is classified as medium sand to medium loam.

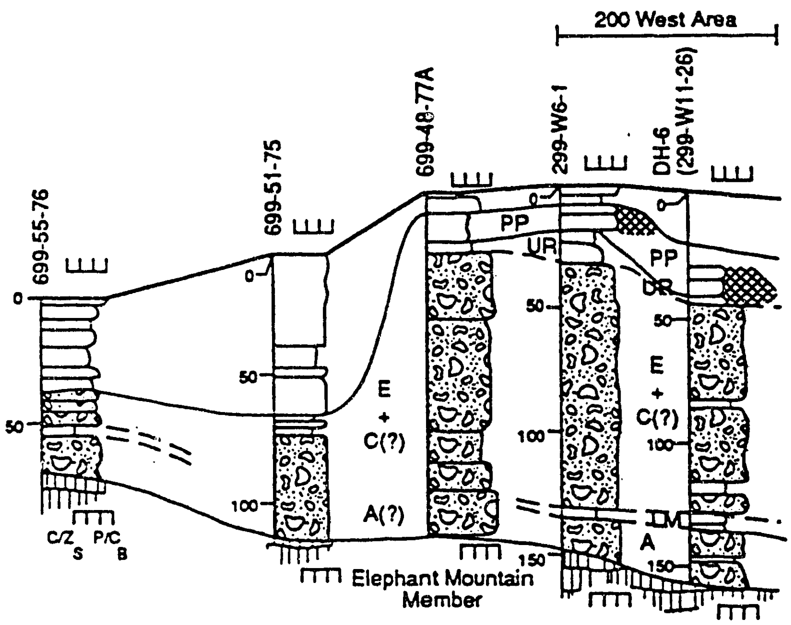
3.2 SOIL CHEMISTRY

Soil samples were taken at depth ranges and analyzed for the following: (1) metals, (2) anions and cations, (3) radionuclides, (4) volatile organics, (5) semivolatile organics, (6) pesticides, and (7) poly chlorinated biphenyls (PCBs). The inorganic and radionuclide data are presented in Table C-1.

The concentrations of organic constituents were notably low. At a depth between 68.5 and 70 feet bgs, two volatile organic constituents were identified. These were 2-butanone (methyl ethyl ketone) and 4-methyl-2 pentanone (methyl isobutyl ketone) at concentrations of 27 and 130 micrograms/kilogram (μg/kg), respectively. These concentrations are well below Model Toxics Control Act Cleanup Regulation Method B cleanup standards (Washington Administrative Code [WAC] 173-340-720(3)). All pesticides and PCBs were below the limits of detection. The concentrations of semivolatile compounds were at or near the detection limits, except for trace concentrations of benzoic acid and phthalates that were reported for several samples. The compound 4-hydroxy-4-methyl-2-pentanone was reported as a tentatively identified compound, but was also identified in the field blank. Carboxylic acids were also tentatively identified compounds and are potential natural constituents of the soils (WHC 1993a).

3.3 HYDROGEOLOGY

The multiaquifer system within the Pasco Basin has been conceptualized as consisting of the following four primary units: (1) suprabasalt sediment of the Hanford and Ringold formations, (2) Saddle Mountain Basalt, (3) Wanapum Basalt, and (4) Grande Ronde Basalt. Groundwater reportedly flows both within a suprabasalt aquifer system, consisting of fluvial and lacustrine sediments, and within a system of deeper confined to semiconfined aquifers in the following strata: (1) basalt flow tops, (2) flow bottom zones, and (3) sedimentary interbeds (WHC 1993a). These deeper aquifers are inter-calated with aquitards consisting of basalt flow interiors. Vertical flow and leakage between the aquitards are inferred from water level or potentiometric surface data, but the flow and leakage are not quantified and direct measurements are not available (DOE 1988). A discussion of the groundwater flow in the suprabasalt aquifer and the basalt confined aquifer systems is provided in the *Characterization Work Plan, C-018H Soil Column Disposal Site Evaluation* (WHC 1992c).



Explanation for Cross-Section

Grain Size Scale - Horizontal Relief of Section Indicates Grain Size of Dominant Particles in Bed

SP
C/Z C/B

- C/Z - Clay and Silt
- S - Sands (fine-grained to granular)
- P - Pebble Gravel
- C/B - Cobble to Boulder Gravel

Vertical scale in feet

Abbreviations

- PP - Plio-Pleistocene Unit
- UR - Upper Unit, Ringold Formation
- E - Uppermost Gravel-Dominated Sequence, Ringold Formation
- A - Lowermost Gravel-Dominated Sequence, Ringold Formation
- C - Discontinuous Gravel-Dominated Sequence Below Unit E and Above Unit A, Ringold Formation
- LM - Lower Mud (Fine-Grained) Sequence, Ringold Formation

Source: WHC (1993a)

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Figure C-4. North-South Cross Section Through the Sedimentary Units Above the Columbia River Basalt Group at the State-Approved Land Disposal Site.

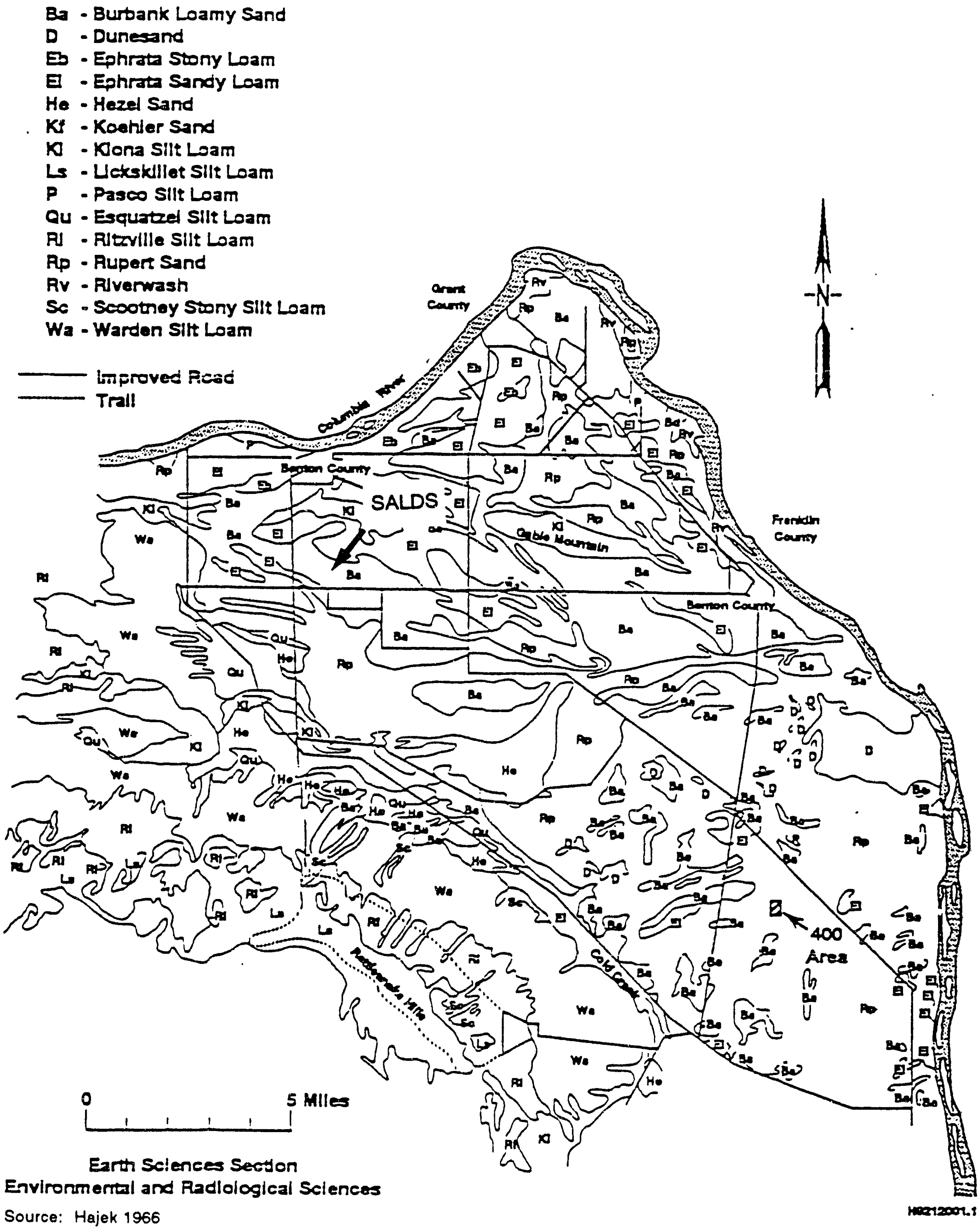


Figure C-5. Soil Survey Map of the State-Approved Land Disposal Site.

Table C-1. Concentrations of Inorganic Constituents and Radionuclides in Soil Borings 699-48-77-A and B.[a]

Analyte	Depth in Feet Below Ground Surface						
	1.5-2.5	26.5-27.5	29.7-30.7	68.5-70.0	Replicate 68.5-70.0	84.5-86.2	229.5-231.5
Metals ($\mu g/g$ = mg/kg)[b]							
Aluminum	6,000	6,300	5,200	2,400	3,200	4,100	3,600
Antimony	6.4	5.6	4.7	<48	<45	6.6	<46
Arsenic	<4.6	<4.3	<4.5	<48	<45	<4.6	<46
Barium	70	56	42	40	36	60	30
Beryllium	0.29	0.32	0.24	<0.29	<0.27	0.20	<0.28
Cadmium	<0.28	<0.26	<0.27	<2.9	<2.7	0.55	<2.8
Chromium	7.2	7.8	10	<9.7	<9.0	6.4	<9.3
Chromium-hexavalent	<0.04	<0.04	<0.04	<0.49	<0.49	<0.49	<0.49
Cobalt	8.2	7.0	7.0	<4.8	<4.5	6.4	<4.6
Copper	12	12	15	7.4	11	11	6.8
Iron	17,000	14,000	14,000	7,900	9,800	12,000	8,400
Lead	5.1	4.7	4.8.	<48	<45	4.9	<46
Magnesium	3,300	2,800	3,600	1,900	2,500	2,900	2,500
Manganese	250	210	210	120	150	180	140
Mercury	<0.1	<0.0	<0.1	<0.1	<0.1	<0.1	<0.1
Molybdenum	<0.92	0.92	<0.91	<9.7	<9.0	<0.91	<9.3
Nickel	7.9	7.9	11	<9.7	11	10	<9.3
Selenium	<4.6	<4.3	<4.5	<48	<45	<4.6	<46
Silver	<0.55	<0.52	<0.54	<5.8	<5.4	<0.55	<5.6
Strontium	22	24	49	18	15	21	10
Uranium	6.5	<2.6	<2.7	<29	<27	6.6	<28
Vanadium	40	38	31	13	18	31	15

Table C-1. Concentrations of Inorganic Constituents and Radionuclides in Soil Borings 699-48-77-A and B.[a] (cont.)

Analyte	Depth in Feet Below Ground Surface						
	1.5-2.5	26.5-27.5	29.7-30.7	68.5-70.0	Replicate 68.5-70.0	84.5-86.2	229.5-231.5
Zinc	31	26	28	20	21	24	26
pH, Anions, and Cations (μg/g = mg/kg)[b]							
pH (dimensionless)	9.0	9.1	9.4	9.2	9.1	9.3	9.1
Bromide	<20	<20	<20	<20	<20	<20	<20
Calcium	5,700	5,200	20,000	3,800	4,200	4,500	2,300
Chloride	<20	<20	<20	<20	<20	<20	<20
Cyanide	<1.0	<10.	<1.0	<1.0	<1.0	<1.0	<1.0
Fluoride	<2	<2	<2	<2	<2	<2	5
Lithium	6.3	5.3	6.6	<3.9	<3.6	4.5	4.3
Nitrate	<20	<20	<20	<20	<0.2	<0.2	<20
Sodium	220	240	200	<19	38	220	170
Sulfate	<20	<20	37	<20	<20	<20	<20
Radionuclides (pCi/g)[c]							
Alpha	10.4	27.4	24.2	12.6	8.3	5.2	3.5
Beta	12.5	19.1	21.3	<10	<10	<10	<10
^{137}Cesium	<2	<0.00001	<0.01	<2	<2	<2	<2

a Source: WHC (1993a)

b μg/g = micrograms per gram; mg/kg = milligrams per kilogram, unless otherwise noted

c pCi/g = picocuries per gram

The groundwater flow at the proposed disposal site is to the northeast between Gable Mountain and Gable Butte towards the Columbia River (WHC 1992c) (Figure C-6). The gravels of unit E dominant in the Ringold Formation are the principal water table aquifer in the area. Groundwater was encountered at 218.72 feet bgs (approximately 465 feet above mean sea level) during the borehole drilling. A mini-pump test was performed on May 18, 1992. The test involved pumping for five hours at a rate of 1.65 gal/min (6.25 L/min), for a total discharge of 495 gallons (1,875 liters). The drawdown at the end of the test was 14.0 feet (4.3 meters). Water level recovery was relatively rapid (less than 100 minutes), although the water level recovered only to within 2 feet (0.6 meter) of the pretest static water level before it stabilized. An instantaneous slug test was performed for one hour on May 19, 1992. Test results are provided in the *Characterization Report, C-018H Disposal Siting Evaluation* (WHC 1993a).

The influence of the anticipated hydraulic loading of the treated waste water from the ETF on groundwater flow was modeled (WHC 1993c), and the resulting contour lines are provided in Figure C-7. The direction of groundwater flow results from the combined influences of the following: (1) recharge, (2) discharge at the SALDS location, and (3) aquifer transmissivity. The close spacing of the water table contours in the vicinity of the site indicates a groundwater mound and slow movement of the groundwater in the direction of the Columbia River.

3.4 GROUNDWATER QUALITY

The groundwater quality in the monitoring well that was installed in well 699-48-77A was initially monitored June 19, 1992, and will continue to be monitored on a quarterly basis. The groundwater temperature was approximately 65 degrees Fahrenheit, and the field pH and conductivity were 7.71 and 316 microMhos, respectively in June 1992. Table C-2 provides the available analytical data for the inorganic constituents that were above the laboratory quantitation limits (WHC 1993a). All constituents monitored were below detection limits except the following: (1) coliform, (2) nitrate, (3) carbon tetrachloride, (4) unfiltered iron, and (5) unfiltered manganese. Both of the filtered metals were below the detection limits, suggesting that the unfiltered values are an artifact of well construction or development. Nitrate concentrations were below the WAC 173-200 criterion. Coliform was detected at 65 counts/deciliter which is above the groundwater quality standard criterion of 1 count/deciliter. Carbon tetrachloride was detected at an estimated concentration of 1.3 ppb which is above the groundwater quality criterion of 0.3 ppb. The value for carbon tetrachloride is estimated because it is below the quantitation level contractually required (5 ppb). During the next sampling period, the contractual quantitation level will be lowered, providing more accurate data.

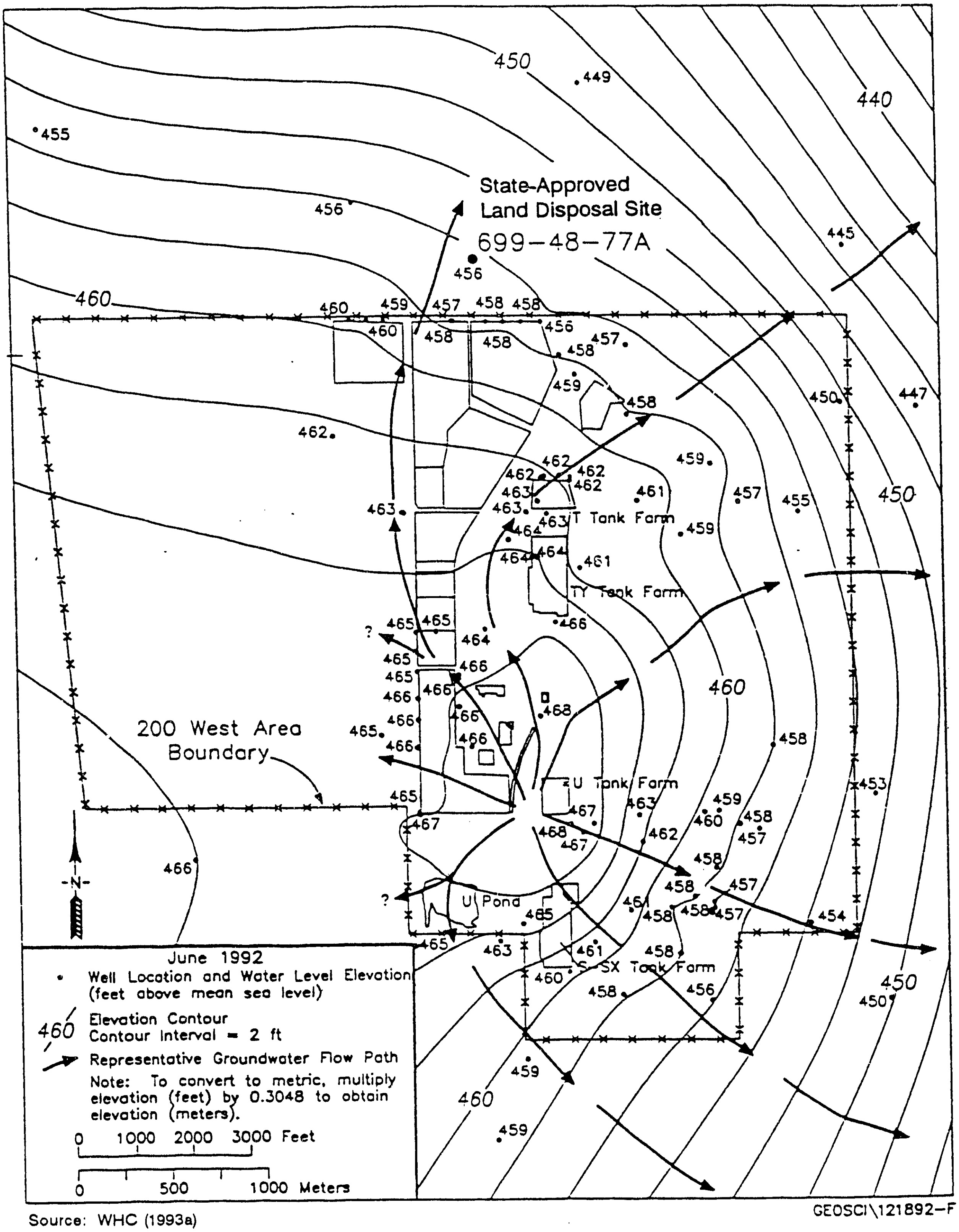
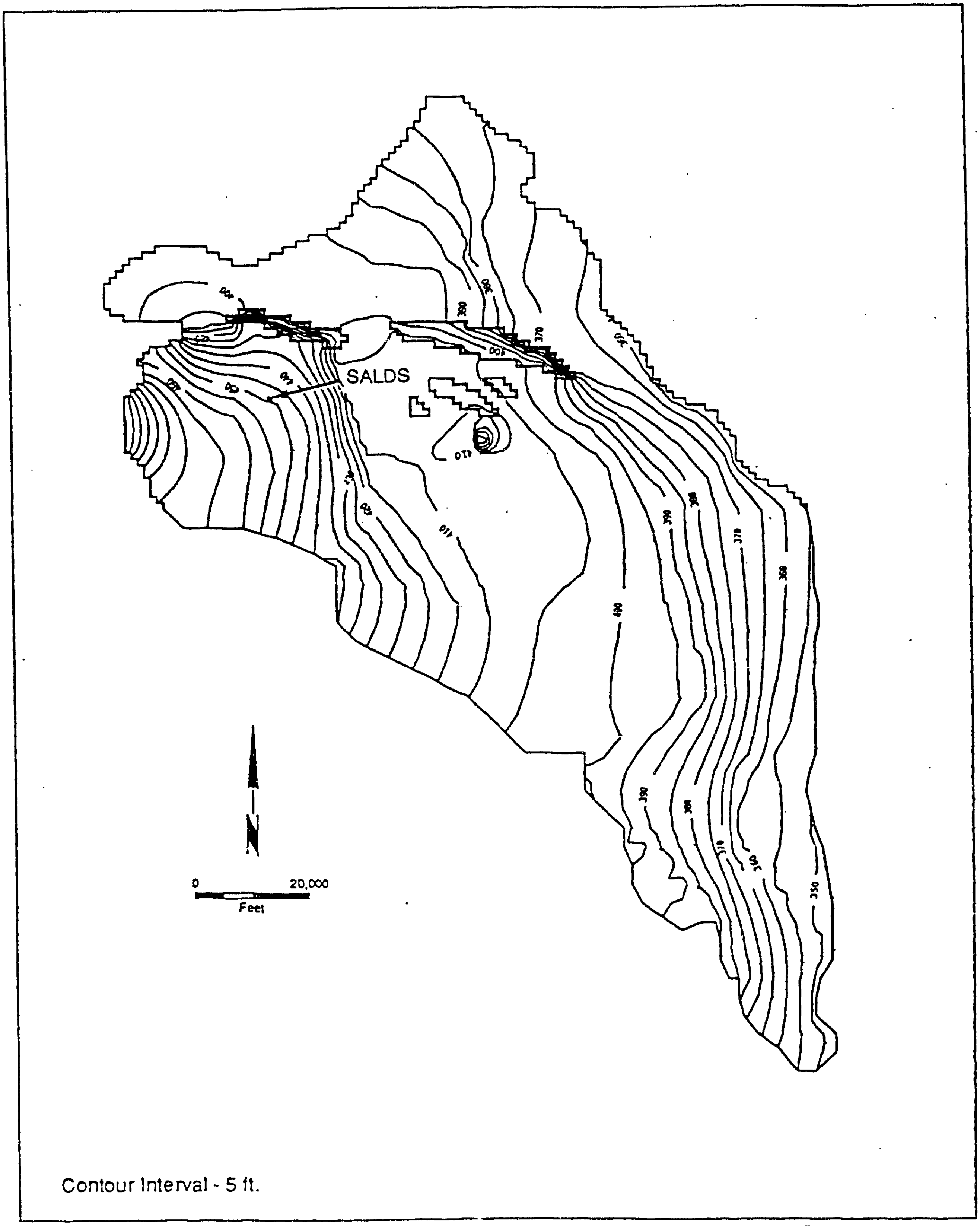


Figure C-6. Water Table Map for the State-Approved Land Disposal Site and Vicinity.



Source: WHC (1993b)

923 E026.020/45314/4-1-93

Figure C-7. Simulated Equipotentials with Disposal at the State-Approved Land Disposal Site.

Table C-2. Groundwater Quality Data From Well 699-48-77A With At Least One Detected Value[a]

Analyte	Concentration
	June, 1992
Metals (ppb)[b]	
Barium, total	74.0
Barium, dissolved	67
Iron, total	560
Iron, dissolved	20 U
Magnesium, total	12,000
Magnesium, dissolved	12,000
Manganese, total	27
Manganese, dissolved	10 U
Zinc, total	87.0
Zinc, dissolved	10.0 U
Cations and Anions (ppb)[b]	
Calcium, total	33,000
Calcium, dissolved	31,000
Chloride	6,600
Fluoride	400
Nitrate	28,000
Potassium, total	3,700
Potassium, dissolved	3,300
Sodium, total	17,000
Sodium, dissolved	15,000
Sulfate	25,000
Other Parameters (units as indicated)	
Coliform bacteria (counts/100 ml)	65 (2)[c]
Alpha particle activity (pCi/L)	1.73 U (1.76)[c]
Beta particle activity (pCi/L)	5.05 U (2.70)[c]

a Source: WHC (1993a)
b ppb = parts per billion; pCi/L = picocuries per liter; ml = mililiter; U = constituent present as concentrations below quantitation level
c September, 1992 data

Borehole Log: Well No. 699-48-77A

VALIDATED [signature] 6/5/9[illegible] SIGNATURE/DATE

p 1 of 6

WELL CONSTRUCTION REPORT

Page 1 of 2

Specification No. WHC-S-014 150143, 119402 Rev No. 6 166752

ECNs 127439, 164223 150132, 150130, 150138, 150137 166757, 17229

Project RCRA / W017 C018H

Location N of ZOO W

Drilling Company Jensen Drilling

Driller Darrell Perkins

Other (Companies) MCE Hart Crowser, Ebasco, NACES

Geologist(s) DENNIS ANDERSON - MCE; TCS Edrington/HC; C. Wright - Hart Crowser - Ken Lane; R.A. Weingarten - Ebasco; Nancy Ballantyne - Ebasco; Paul Anderson - Ebasco; Keith J. Swett - NACES

Well No. 699-48-77A Temp. Well No. 1A

Coordinates N137,969.02; E566,413.57

Casing Elev. 674.72' Ground Elev. 672.25'

Drilling Method

Verification Method VISUAL observation

Criteria WHC-S-014: 5.2 5.3 7.5, EII 6.7 Sec 6.2

	Air	Mud	Initials	Date
Rotary / Backhoe	N/A 0-20'	N/A 100'-103' 136-457.7	N/A	N/A
Cable Tool	① 20'-100' 103-136	-	DJA	4/9/92
Drilling Fluid	raw H2O	1407.5 gals	DJA	4/9/92
Other	② Wellguard	see back	DJA	4/9/92

Geophysical Logging

Sondes	Interval	Date
Spectral Gamma	0' - 56'	2/7/92 CSW
Spectral Gamma	57' - 115'	2/14/92
Spectra Gamma	113' - 162'	2-21-92
Gross Gamma	162' - 30'	2-21-92
Gross Gamma	334.5' - 130'	3-12-92
Spectra Gamma	334.5' - 130'	3-13-92
Spectra Gamma	384.5' - 327.'	3/27/92
Gross Gamma	457' - 300'	4/9/92

Completion Data

Drilled Depth 457.7' 232.7' (SUMP)

Completed Depth 237.1 (SAND PACK)

Date Started 1/21/92

Date Completed 5/19/92

Static Water Level/Date 215.4' bls 5-4-92

Aquifer Testing

Type INSTANTANEOUS SLUG

Flow Meter I.D. No. N/A

Cal. Due Date N/A

Length of Test 1hr

Volume Pumped N/A

Drawdown N/A

Date of Test 5/19/92

Completion Results

Cleaning

Verification Method VISUAL INSPECTION

Criteria WHC-S-014 4.2.2, 7.6, 7.7 WHC-CM 7-7: 5.1

	Initials	Date
Drilling Tools/Rig	DJA / CSW	4/4/92 1/21/92 ④ ②
Temporary Materials	DJA	4/9/92
Permanent Materials	K.L.	5-4-92

Screen

Type	Length	Slot Size
T-304 STAINLESS continuous wire	(2) 10' sections	10 SLOT

Depth(s) 232.4' - 212.4' bls 232.7' w/ END CAP

Verification Method verify w/ STEEL TAPE

Criteria WHC-S-014: 4.2.3, 4.2.5, 4.2.1, 12.2.1

Initials K.L. Date 5-4-92

Material Storage/Packing

Verification Method VISUAL observation

Criteria WHC-S-014: 4.2.2, 7.3

	Initials	Date
Mtl. Handling/Storage	K.L.	5-4-92
Material Packing	K.L.	5-4-92

Lubricants/Additives

Verification Method VISUAL observation

Criteria WHC-S-014: 7.2

	Identify	Initials	Date
Additives	① raw H2O	DJA	4/9/92
Lubricants	② Wellguard	DJA	4/9/92

Straightness Test

Verification Method VISUAL observation

Criteria WHC-S-014: 8.2

Initials DJA Date 4/9/92

A-6000-436 (09/90)

VALIDATED

p. 2 of 6

WELL CONSTRUCTION REPORT
(continuation sheet)

639-48-77A

Page 2 of 2

Casing (permanent)

Type	Size	Placement
T-304 SS 10SLOT SCREEN	4"	232.7 - 212.4'
T-304(L) SS BLANK	4"	212.4' - 25' AGL
		-
		-

Verification Method: VERIFICATION W/steel tape

Criteria: WHC-S-014 : 4.2.1, 4.2.4, 4.2.5, 12.2.1

Initials: K. L Date: 5-4-92

Well Protection

Verification Method: VISUAL observation

Criteria: WHC-S-014 4.2.10

	Initials	Date
Protective Posts	E.C.L	07/13/92
Protective Casing	E.C.L	07/13/92
Site Restored	E.C.L	07/13/92
Cap, Hasp and Lock	E.C.L	07/13/92
Surface Pad	E.C.L.	07/13/92

Annular Seal/Filter Pack

Verification Method: Verification W/steel tape Criteria: WHC-S-014: 4.2.6, 4.2.7, 4.2.8, 4.2.9

Type	Interval	Volume	Initials	Date
Bentonite chips	237.1 - 457.1	103.5 ft³ 150 sacks	K.L	5-4-92
Silica sand 20-40	206.7' - 237.1	43 ft³ 39 sacks	K.L.	5-4-92
Bentonite pellets 3/8"	199.1 - 206.7'	27 ft³ 6 buckets	K.L	5-4-92
Bentonite crumbles	8.0' - 199.1	222.9 ft³ 314 sacks	K.L.	
Cement Grout	25' - 8.0'	15.4 ft³ 12 sacks	K.L	5-4-92

Well Survey/Labeling

Verification Method: Review of Survey Report

Criteria: WHC-S-014 : 3.4

	Initials	Date
Measurement Point Surveyed	NB	7/28/92
Protective Casing/Brass Cap Surveyed	NB	7/28/92
Well Number Stenciled	NB	7/28/92
Brass Cap Labeled	NB	7/28/92

Pump Installation

Verification Method: VISUAL observation

Criteria: WHC-S-014: 4.2.2, 4.2.11

	Initials	Date
Pump Decon/Prep	[illegible]	5/19/92
Installed	[illegible]	5/15/92
Pump Tested	[illegible]	5/15/92

Other (initial if performed)

_____ Well Abandonment _____ Downhole TV Inspection 16 Complete As-Built Diagram, Driller's/Geologist's Logs

[illegible] 5/14/92 Well Development

Comments/Remarks ① RAW H_2O added. - 2/3/92 : 25 gal. 2/6/92 : 50 gal. + 25 gal ; 2/10/92 = 450 gals ; 2/11/92 = 15 gals ; 2/12/92 = 35 gals ; 2/13/92 = 25 gals 2/17/92 = 75 Gal. 2/19/92 : 25 Gallons 2/18/92 75 Gal 2/19/92 100 Gal. 2/20/92 75 Gal 2/25/92 185 Gal. 2/26/92 = 175 Gallons ; 2/27/92 : 125 gals ;

② Well guard added 1/23/92 1/30/92 2/4/92 2/5/92 2/6/92 2/24/92 3/24/92 3/31/92

③ Rcd temp materials - casing 1/30/92 casing 1/22/92 casing 2/12/92 ; 2/14/92, casing - boiler 3/13/92, 3/16/92 [illegible]

④ Rcd tools = 1/7/92, 3/31/92, 3/23/92, 3/24/92, ~~3/25/92~~ 3/26/92 3/31/92

Reviewed By (Sign/Print Name) [signature] / BRUCE A WILLIAMS Date 8-5-92

WELL SUMMARY SHEET

Boring or Well No. 699-48-77A

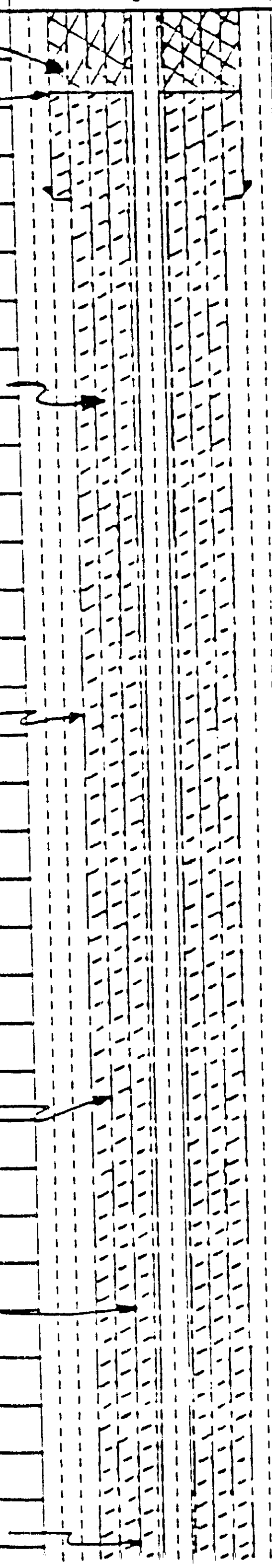
Sheet 1 of 3

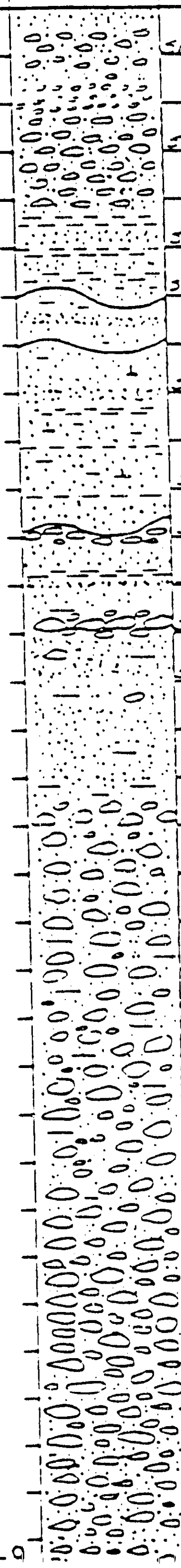
Location: N- 200 WEST
Project: RCRA / W017 / C018 H

Elevation: 672.25' (ground surface)
Drilling Contractor: Jensen Drilling

Driller: Darrell Perkins
Drilling Method and Equipment: CABLETOOL - Sod Str

Prepared By: Dennis Anderson (Sign/Print Name) Date: 1/7/92
Reviewed By: Edward S. Lafuse (Sign/Print Name) Date: 2/15/96





CONSTRUCTION DATA Description	Diagram	Depth in Feet	Graphic Log	GEOLOGIC/HYDROLOGIC DATA Lithologic Description
CEMENT GROUT 3.5'-20'		5		slightly silty sandy GRAVEL
16" temporary carbon steel		10		" " " "
casing to 19.71' bls		15		silty sandy GRAVEL
		20		" " "
—		25		silty gravelly SAND
		30		slightly gravelly slightly silty SAND w/ "caliche"
		35		" " " " " "
BENTONITE CRUMBLES 9.0' - 100'		40		slightly gravelly slightly silty SAND
		45		" " " " "
		50		slightly silty SAND
		55		slightly silty, slightly gravelly SAND
		60		sandy SILT
		65		slightly silty sandy GRAVEL
		70		slightly silty slightly gravelly SAND
12" temporary carbon steel		75		" ~~Sand~~ silty DTA " " ~~SILT~~ DTA
casing to 166.14' bls		80		" ~~Sand~~ DTA " " ~~SILT~~ DTA
		85		slightly silty sandy GRAVEL
		90		sandy GRAVEL
		95		" "
		100		slightly silty sandy GRAVEL
		105		" " " "
10" temporary CARBON		110		" " " "
steel CASING to 334.83'		115		" " " "
bls		120		" " " "
		125		silty sandy GRAVEL
		130		sandy GRAVEL
8" temporary casing		135		" "
to 396.2' bls		140		slightly sandy GRAVEL
		145		sandy GRAVEL
		150		" "
6" temporary carbon		155		" "
steel casing to 447.65'		160		" "
				" "

WELL SUMMARY SHEET

Boring or Well No. 699-48-77A

Sheet 2 of 3

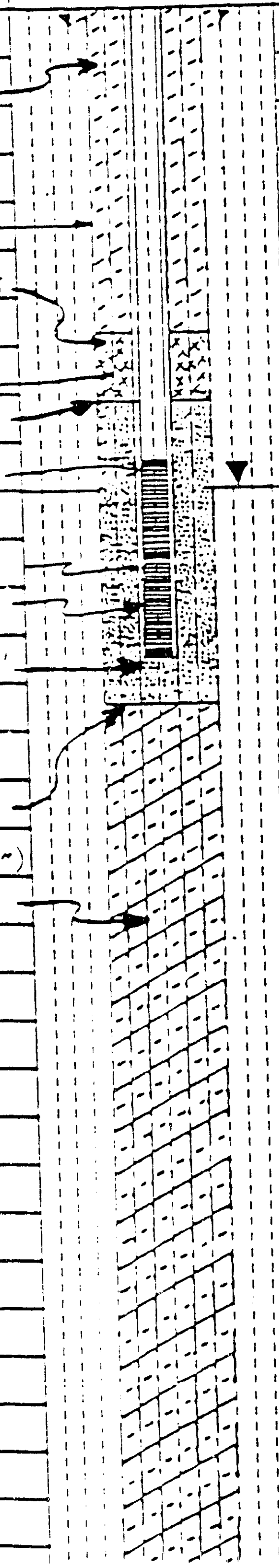
Location	200 West Area - C018H	Project	RCRA / W017 / C018H
Elevation	672.25'	Drilling Contractor	Jensen Drilling
Driller	Darrell Perkins	Drilling Method and Equipment	Cabletool - Std Str
Prepared By (Sign/Print Name)	Dennis Anderson	Date 2/20/92	Reviewed By (Sign/Print Name) Edward C. LaFuir — Date 5/15/92

CONSTRUCTION DATA

Description

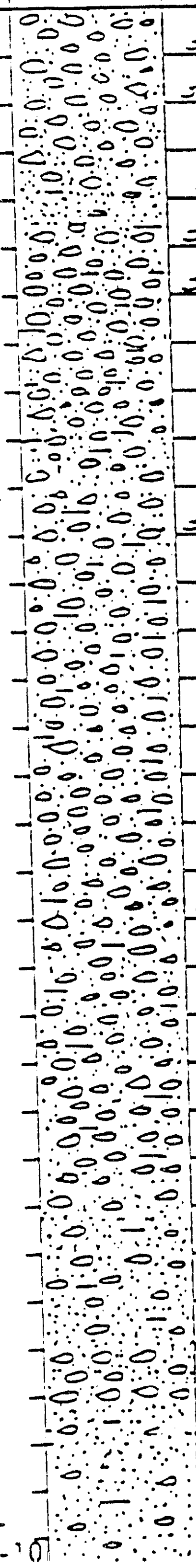
- Bentonite Crumbles 50' - 100.1' bls
- 10" temporary carbon steel casing set to 334.83' bls
- Bentonite Pellets (1/4") 100.1' - 206.3' bls
- 8" temporary carbon steel casing to 396.2' bls
- Top of Sand Filter (20-40) 206.3' bls
- Top of Screen 212.4' bls
- 6" temporary carbon steel casing to 447.65' bls
- 212.4 - 232.4 304 Stainless Steel 10 slot Screen
- Bottom of Well (Sump) 232.7'
- Static water level - 215.4'
- Bottom of Sand Filter (20-40) 233.1'
- Bentonite Chips (coarse - 3/8") 233.1' - 453.1' bls

Diagram



GEOLOGIC/HYDROLOGIC DATA

Graphic Log



Depth in Feet	Lithologic Description
170	sandy GRAVEL
175	silty sandy GRAVEL
180	" " "
185	Slightly silty slightly gravelly SAND
190	slightly silty slightly gravelly SAND
195	silty sandy GRAVEL
200	" " "
205	" " "
210	" " "
215 (215.4 SWL)	" " "
220	silty sandy GRAVEL
225	" " "
230	" " "
235	" " "
240	" " "
245	" " "
250	" " "
255	" " "
260	silty sandy GRAVEL
265	" " "
270	" " "
275	" " "
280	" " "
285	" " "
290	" " "
295	slightly silty slightly gravelly SAND
300	silty sandy GRAVEL
305	slightly silty gravelly SAND
310	silty sandy GRAVEL
315	slightly silty gravelly SAND
320	" " " "
325	" " " "
	" " " "

WELL SUMMARY SHEET

Boring or Well No. 699-48-77A

Sheet 3 of 3

Location 200 West Area - C018H

Elevation 672.25'

Driller Darrell Perkins

Prepared By [signature] (Sign/Print Name) Date 3/17/92

Project RCRA / W017 / C018H

Drilling Contractor Jensen Drilling

Drilling Method and Equipment Cable tool - Spd Str

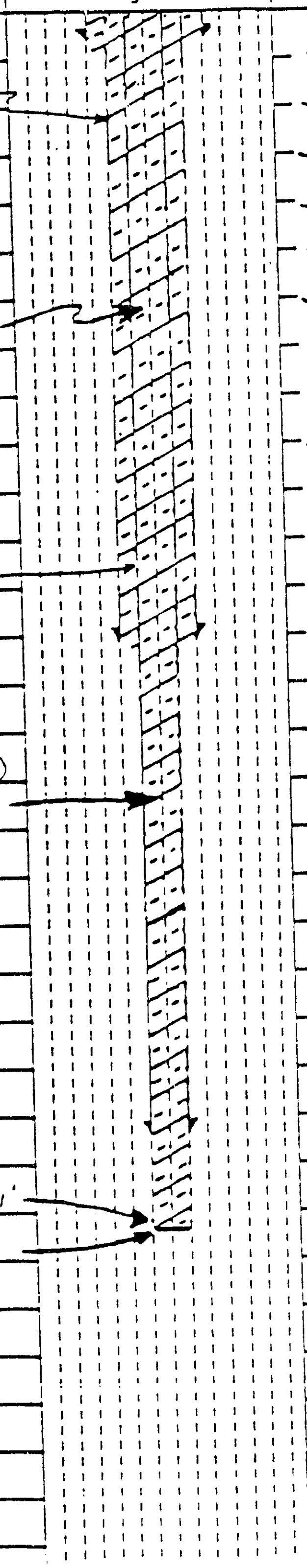
Reviewed By Edward C. Rafuse [signature] (Sign/Print Name) Date 05/5/92

CONSTRUCTION DATA

Description

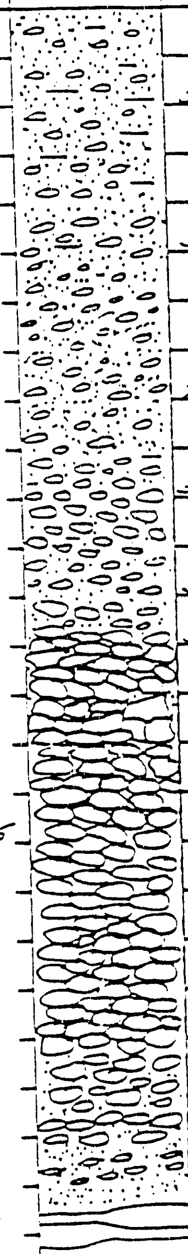
- 8" temporary carbon steel casing to 396.2' bls
- Bentonite Chips (coarse ~3/4") 237.1' - 457.1' bls
- 6" temporary carbon steel casing to 447.65' bls
- Bentonite Chips (coarse ~3/4") 237.1' - 457.1' bls
- Bottom of Bentonite Chips 457.1'
- (T.D.) Bottom of Hole 457.7' bls

Diagram



GEOLOGIC/HYDROLOGIC DATA

Graphic Log



Depth in Feet	Lithologic Description
335	slightly silty gravelly SAND
340	silty gravelly SAND
	" " "
345	" " "
350	
355	slightly silty slightly sandy GRAVEL
	" " " " "
360	" " " " "
365	
370	sandy GRAVEL
	" "
375	
380	slightly silty sandy GRAVEL
	" " " "
385	
390	slightly sandy GRAVEL
395	slightly sandy GRAVEL
400	GRAVEL
405	GRAVEL
	" w/ trace sand
410	"
415 (over 420)	"
420	"
425	"
430	"
435	"
440	"
445	
450	slightly gravelly SAND
455	slightly sandy Basalt @ 453.5 (BASALT @ 453.5)
460	

p. 6-66

KAISER ENGINEERS HANFORD

SURVEY DATA REPORT

Request No. 9 2 3 - 2 1 9

File No. 6 9 9 - N 4 W 7

Project/W.C. No.	Title
	600 AREA WELL SURVEY

KEH Job No.	Prepared By	Date	Reviewer
ER2411-32-77-26	M.F. Harrington	6/22/92	V. Coyne 1 1

DESCRIPTION OF WORK

Horizontal and vertical location of well 699-48-77A and vadose borehole.

ACCEPTABILITY (Within Plan Tolerance)

- Yes [ ]
- No [ ]
- NA [X]
- TBD by Requestor [ ]

DISTRIBUTION

Survey File	OR
Field Project File	-
P. Collier	1
D. Weekes	1
J. Rieger	1

SURVEY RESULTS AND COMMENTS

WELL NO.	COORDINATES 200W (feet)	LAMBERT NAD'83 (meters)		ELEVATIONS (NGVD'29 FEET) TOP OF BRASS CAP	HYDROSTAR PLATE N. SIDE	TOP OF OUTER CASING N. SIDE	TOP OF INNER CASING N SIDE
699-48-77A	N:47602.7 W:77020.0	N:137,969.02 E:566,413.57	NGVD'29	672.25	674.74	674.72	N/A
699-48-77B	N:47590.0 W:77013.3	N:137,965.15 E:566,415.60	NGVD'29	671.73	N/A	N/A	N/A

BOREHOLE LOG

Boring or Well No. 699-48-77A

Sheet *3 of 27

Location 200 W C018H — Project RCRA / W017 C018H

672' ground surface

Elevation N 137,969 E 566,414 — Drilling Contractor Jensen

Driller Darrell Perkins — Drilling Method and Equipment Cable tool - Spd Str 60

Prepared By Dennis Anderson [signature] (Sign/Print Name) — Date 1/16/92

Reviewed By Edward C. Rafuse [signature] (Sign/Print Name) — Date 2/4/92

Depth (feet)	Sample: Type and No.	Sample: Blows or Recovery	Graphic Log	Sample Description: Soil Classification, Particle Size Distribution, Color, Moisture Content, Sorting, Angularity, Mineralogy, Reaction to HCl.	Comments: Depth of Casing, Drilling Rate, Casing Size & Type, Bit Size, Water Level
60*				slightly silty sandy GRAVEL (5% silt 25% sand 70% GRAVEL) 10% vcs 10% vcp	Caliche @ 60.3-60.5' bls
				5% sc 15% cs 10% cp	
61.3	NO RECOVERY	6"-6 blows 6"-6 blows 6"-9 blows 6"-24 blows ST		15% ms 20% mp 30% fs 25% fp 30% vfs 25% vfp	minor CaCO3 cementation @ 63.0-63.9' bls
63.3				3.75Y 4/3.5 olbrn-olwet, 2.5Y 6/3 ltyel brn dry, mod sorting, rnd-wellrnd / spherical-subdisc mod Rxn to 10% HCl on carbonate coated clasts 60% basalt 30% Qtz 5% volporph 5% Qtze	carbonate coated clasts @ 65' bls weak in sands
65'	1rad 1moist 2 lith	DB			65' sample 1/16/92 @ 1100
				slightly silty slightly gravelly SAND (5% silt 10% gravel, 85% SAND)	
67.5'	A/P #17 col lected chem sample " "	6"-10 blows 6"-29 blows 6"-46 blows 6"-42 blows 6"-15 blows		10% mp 10% vcs 25% fs 20% fp 10% cs 35% vfs 60% vfp 20% ms 3.75Y 3/2 vydkgrbrn-dkolgry wet 3.75Y 6/2 ltbrngry-ltolgry dry; sample dry, well-mod sorting, No Rxn, 45% basalt 40% Qtz, 5% Qtze, 5% volporph 5% felsic grnstone, musc. subrnd-rnd / subprismoidal-subdisc	split tube samples taken from 67.5' - 70' bls, 1/30/92 @ 1405 fair amt of magnetite to .25 mm
70'	1rad 1moist 2 lith (DB)	ST/DB			70' sample 1/30/92 @ 1656
				slightly silty slightly gravelly SAND (5% silt 10% gravel 85% SAND) 10% vcs 10% cp 20% vcs 10% mp 30% ms 35% fp 20% fs 45% vfp 20% vfs 3.75Y 6/2 ltbrngry-ltolgry Dry, 3.75 vydkgrbrn-dkolgry wet; mod-well sorting, No Rxn.	
75	1rad 1moist 2 lith	DB			75' sample 2/3/92 @ 0845
				slightly silty, slightly gravelly SAND -5% silt -10% gravelly 85% SAND dist and color sample same as 75' well sorted, subrnd-rnd / sphercal-subdiscoidal, No Rxn	1 gallon DI H2O added @ 79' bls for recovery
				*-Note: See BOREHOLE LOG FOR WELL 699-48-77B for a description of the 0'-60' interval. (Report #1)	No moist sample
80	1rad 1CaCO3 2 lith	DB		Nancy Ballantyne [signature] / Nancy Ballantyne	80' sample 2/3/92 @ 1545

BOREHOLE LOG

Boring or Well No. 699-48-77A

Sheet 4 of 22

Location: 200 West Area
Project: RCRA / W017 C018H
Elevation: 672' (ground surface) N 137,969 E 566,414
Drilling Contractor: Jenson
Driller: Darrell Perkins
Drilling Method and Equipment: cable tool - Spd Str
Prepared By: [signature] (Sign/Print Name) Date 2/4/92
Reviewed By: Edward C. Rafuse [signature] (Sign/Print Name) Date 2/11/92

Depth (feet)	Sample Type and No.	Sample Blows or Recovery	Graphic Log	Sample Description: Soil Classification, Particle Size Distribution, Color, Moisture Content, Sorting, Angularity, Mineralogy, Reaction to HCl.	Comments: Depth of Casing, Drilling Rate, Casing Size & Type, Bit Size, Water Level
80				Slightly silty sandy GRAVEL (5% silt, 25%	upper Ringold?
				sand 70% GRAVEL) 5% sc 10% vcp	loose - non compacted sands
	—			10% vcs 10% cp	
				10% cs 20% mp	
				20% ms 3% fp	upper/middle Ringold cnt
				30% fs 25% vfp	@ 82.5' bls
				30% vfs 3.7 5y dk olgry - vydk grnbrn wet,	
				3.75y 3/2 Holbrn-olgry dry, dry sample very poor sorting	
	1 rdd / 1 moist	6" - 15 blows		subrnd - wellrnd / sph - subdisc, No Rxn, 70% basalt	
85	2 lith	ST / DB-85'		20% Qtz 5% volporph 5% Qtze	85' sample 2/4/92 @ 0815
	chem ? samples ?	6" - 33 blows / 6" - 51 blows / 6" - 75 blows ST		Sandy GRAVEL w/ less than 5% silt	split spoon samples taken
				5% sc 5% vcs 5% vcp	from 84.2'-86.2', 2/4/92 @ 1430
				10% cs 15% cp	open framework
				25% ms 20% mp	non-consolidated
				25% fs 25% fp	
				20% vfs 30% vfp	
				3.75y 3/0 vydkgry - vy dkgry wet, 3.75y 5/2	split tube sample taken from
				grnbrn - olgry dry, vy poor sorting, 80%	90.0'-92.0', 2/5/92 @ 1050
	1 rdd / 1 moist			basalt, 15% Qtz, 5% Qtze volporph, No	
90	2 lith	DB		Rxn, subrnd - rnd / spherical - subdisc.	90' sample 2/5/92 @ 0710
		6" - 28 blows		Sandy GRAVEL	
	A/P # 13 / col wash # 13	6" - 77 blows / 6" - 83 blows / 6" - 80 blows ST		SIZE DIST, COLOR, SORTING, ang. min. and	
				Rxn same as 90' sample	
					open framework
	1 rdd / 1 moist				
95	2 lith	DB			95' sample 2/5/92 @ 1615
				Slightly silty sandy GRAVEL (5% silt 15%	
				sand 80% GRAVEL) 5% sc 5% vcp	
				5% vcs 15% cp	
				10% cs 20% mp	
				25% ms 25% fp	open framework
				25% fs 30% vfp	
				30% vfs	
	1 rad / 1 moist			3.75y 3/2 vydkgr brn - dk olgry wet, 2.5y 4/2	
				dkgrbrn wet (sands); 2.5y 5/2.5 grnbrn - ltolbrn dry	
100	2 lith	DB		10% basalt 30% Qtz 5% Qtze 5% volporph	100' sample 2/6/92 @ 1335

BOREHOLE LOG

Boring or Well No. 699-48-77A

Sheet 5 of 22

Location: 200 W C018H

Elevation: 672' g.s. N 137,969 E 566,414

Driller: Darrell Perkins

Prepared By: Dennis Anderson (Sign/Print Name) Date 2/11/92

Project: RCRA 1W017

Drilling Contractor: Jensen

Drilling Method and Equipment: CABLETOOL - Spd Str

Reviewed By: Edward C. Rafuse (Sign/Print Name) Date 2/14/92

Depth (feet) 100'	Sample Type and No.	Sample Blows or Recovery	Graphic Log	Sample Description: Soil Classification, Particle Size Distribution, Color, Moisture Content, Sorting, Angularity, Mineralogy, Reaction to HCl.	Comments: Depth of Casing, Drilling Rate, Casing Size & Type, Bit Size, Water Level
				Slightly silty sandy GRAVEL (5% silt 10% sand 85% GRAVEL) 10% sc 10% vcs 20% cp 30% cs 25% mp 40% ms 25% fp 20% fs 20% vfp	sample taken by C. Wright recopied on 2/12/92. H2O added to drilling
105'	Irad / CaCO3 / 2 lith	DB		3.75y 3/2 vydkgrbrn - dkolgry WET, 2.5y 4/2 dkgrybrn, sample damp, poor sorting, subrnd - subang / subdiscoidal No Rxn 70% basalt 20% Qtz. 5% Qtze 5% vol porph	105' @ 2/11/92 11:20
110'	Irad / CaCO3 / 2 lith	DB		slightly silty sandy GRAVEL (5% silt 10% sand, 85% GRAVEL) sample similar to 105'	110 sample recopied from C. Wright. 2/11/92
115	Irad / CaCO3 / 2 lith	DB		slightly silty sandy GRAVEL (5% silt, 15% sand, 80% GRAVEL) 10% vcs 15% vcp 5% sc 25% cs 15% cp 30% ms 20% mp 25% fs 25% fp 10% vfs 20% vfp 3.75y 3/2 vydkgrybrn - dkolgry WET, 3.75y 5/2 grybrn - olgry dry, damp, poor sorting subrnd - rnd / subpris - subdisc. No Rxn 50% basalt 30% Qtz 10% Qtze, 5% gran 5% vol porph	open framework > sands @ 112' bls. H2O added for recovery. 115' sample 2/12/92 @ 0815
120'	Irad / CaCO3 / 2 lith	DB		slightly silty sandy GRAVEL (5% silt, 15% sand 80% GRAVEL) sample similar to 115'	Note: sand lense @ 115.5 - 115.7' bls. 120' sample 2/12/92 @ 1100

BOREHOLE LOG

Boring or Well No. 699-98-77A

Sheet 6 of 22

Location 200 W C018H

Elevation 672' g.s. N137,969 E566,414

Driller Darrell Perkins

Prepared By Dennis Anderson (Sign/Print Name) Date 2/12/92

Project RCRA / W017 C018H

Drilling Contractor Jensen

Drilling Method and Equipment CABLE TOOL - Spd Ste

Reviewed By EDWARD C. RAFUSE / Edward C. Rafuse (Sign/Print Name) Date 2/28/92

Depth (feet)	Sample Type and No.	Sample Blows or Recovery	Graphic Log	Sample Description: Soil Classification, Particle Size Distribution, Color, Moisture Content, Sorting, Angularity, Mineralogy, Reaction to HCl.	Comments: Depth of Casing, Drilling Rate, Casing Size & Type, Bit Size, Water Level
120	–			silty sandy GRAVEL (5% silt, 15% sand 80% GRAVEL 25% vcp 10% vcs 10% sc 20% cp 20% cs 20% mp 25% ms 15% fp 20% fs 10% vfp ~10% vfs	raw H_2O added for recovery; poor drilling rate
				3.75y 3/2 vydkgrybrn - dkolgry WET 3.75y 5/2 grybrn - olgry damp very poor sorting subrnd - rnd - spher. - subdisc. No Rxn 60% basalt 25% Qtz 5% QtzE 10% gran volpor.	35 gals H_2O added for recovery 2/12/92
125	1rad / 1CaCO3 / 2 1ith	DB			125' 2/12/92 @ 1550
				sandy GRAVEL (10% sand 90% GRAVEL) 15% sc 15% vcp 10% vcs 15% cp 15% cs 20% mp 25% ms 20% fp 30% fs 5% vfp 20% vfs	
				all desc same as 125' sample	
130	1rad / 1CaCO3 / 2 1ith	DB			130' 2/13/92 @ 1000
				sample @ 135 similar to 125 + 130' samples	poor drilling rate; open framework
					25 gals H_2O added - 2/13/92
135	1rad / 1CaCO3 / 2 1ith	DB			135' sample 2/13/92 @ 1420
				slightly sandy GRAVEL (<10% sand 90% GRAVEL) gravels undet due to HT sands: ms 35% fs - 35% vfs 30%	Begin hard tooling @ 136.5' bls
				slurry = 5y 5/1 gray, sands / GRAVELS 3.75 3/0 - 6/4 vydkgry - ltyelbrn - varied ang due to HT 25% vol porph 10% QtzE 20% basalt 25% Qtz 20% greenstone 10% granites No Rxn	added 75 gals H_2O 2/18/92
140	1rad / 1CaCO3 / 2 1ith	HT			140' sample 2/18/92 @ 1440

BOREHOLE LOG

Boring or Well No. 699-48-77A

Sheet 7 of 22

Location 200 W C018H
Elevation 672' 9.3. N 137,969 E 566,414
Driller Darrell Perkins
Prepared By Dennis Anderson (Sign/Print Name) Date 2/19/92
Project RCRA / W017 C018H
Drilling Contractor Jensen
Drilling Method and Equipment CABLETOOL - Speed Star
Reviewed By Edward G. Ryan (Sign/Print Name) Date 2/21/92

Depth (feet) 140	Sample Type and No.	Sample Blows or Recovery	Graphic Log	Sample Description: Soil Classification, Particle Size Distribution, Color, Moisture Content, Sorting, Angularity, Mineralogy, Reaction to HCl.	Comments: Depth of Casing, Drilling Rate, Casing Size & Type, Bit Size, Water Level
				sandy GRAVEL (< 10% sand 90% GRAVEL)	
				sands. 15% ms	
				25% fs	poor recovery,
				60% vfs w/ drilling silt	very slow drilling
	–			slurry - 5y 5/1 gray, sands - GRAVELS:	due to cementation of
				3.75 3/6 - 6/4 vydkary - Hyel brn,	gravels
				var in color, wet & dry, ang to subang	
	1 rad			due to HT, 25% volporph, 25% basalt,	100 gals H2O used 2/19/92
	1 CaCO3			10% Qtze 20% grnstne, gran. 20% Qtz	
145	2 lith	HT		No Rxn.	145' sample 2/19/92 @ 0910
				sample similar to 145' desc.	
					cont cementation and
					slow drill rate
	1 rad				
	1 CaCO3				
150	2 lith	HT			150' sample 2/19/92 @ 1200
				sample similar to 145-150'	
				< in sands	
	1 rad				
	1 CaCO3				
155	2 lith	HT			155 sample 2/20/91 @ 1010
				sample consistent with 140-155	
				lack of sands in previous samples	
				due in part to amt of H2O added	
				to bore hole	
	1 rad				
	1 CaCO3				
	2 lith	HT			160 sample 2/20/92 @ 1320

BOREHOLE LOG

Boring or Well No. 699-48-77A

Sheet 8 of 22

Location 2000' N of 200W Fence
Project C018H / RCRA
Elevation 672' 9.3, N 137,969 E 566,414
Drilling Contractor Jensen
Driller D. Perkins.
Drilling Method and Equipment Cable Tool Speed Star
Prepared By C Wright (Sign/Print Name) Date 2/25/92
Reviewed By Edward C. Kaput (Sign/Print Name) Date 2/29/92

Depth (Feet)	Sample Type and No.	Sample Blows or Recovery	Graphic Log	Sample Description: Soil Classification, Particle Size Distribution, Color, Moisture Content, Sorting, Angularity, Mineralogy, Reaction to HCl.	Comments: Depth of Casing, Drilling Rate, Casing Size & Type, Bit Size, Water Level
160'	2 LITL 1 Red 1 Clear	HT		Sandy Gravel (<10% Sand, 90% Gravel)	
				Sand 15% MS	2/20/92 1320
				25% FS	
				60% VFS	
				Slurry 5Y 5/1 Grey Sands: Gravel	
				3.75 3/0 - 6/4 v.d. Grey - Lt Yel. Brown	
				V. in Color Angular to SubAngular	
				due to HT 25% Vol. purple	
				25% Basalt 10% QTZ, 20% Granitoid	
				20% QTZ No Rxn to HCL	
165'	2 LITL 1 Red 1 Clear	HT		165' Similar to 160'	2/20/92 1720
					N.D. 160'-165' copied from
					D. Anderson Log, CW
170'	2 LITL 1 Clear 1 Red	HT		Silty SANDY Gravel 15% Silt	Sample at 1420
				30% Sand 65% Gravel	2/25/92
				Sand ~~15% MS~~ 15% CS	
				40% MS	
				20% FS	
				25% VFS	
				Slurry 5Y 5/1 Grey Pebbles 3.75 6/4	
				V. D. Grey wet 30% Basalt 30% QTZ	
				10% metamorphics 30% Volcanics	
				No Rxn Angular Fragments of Rounded	
175'	2 LITL 1 Red 1 Clear	HT		Sub Spherical Pebbles	
				175' Silty Sandy Gravel	1635 2/25/92
				Similar to 170' - More Silt.	

BOREHOLE LOG

Boring or Well No. 699-48-77A

Sheet 9 of 22

Location 200 N. of 200 W Fence.
Project W017 / C018H
Elevation 672'9.3" N 137,969 E 576,414
Drilling Contractor Jensen
Driller D. Perkins
Drilling Method and Equipment Cable Tool 72 speed SF
Prepared By C. Wright (Sign/Print Name) Date 2/26/92
Reviewed By Edward C. Ra... / Edward a. L... (Sign/Print Name) Date 2/29/92

Depth (Feet)	Sample Type and No.	Sample Blows or Recovery	Graphic Log	Sample Description: Soil Classification, Particle Size Distribution, Color, Moisture Content, Sorting, Angularity, Mineralogy, Reaction to HCl.	Comments: Depth of Casing, Drilling Rate, Casing Size & Type, Bit Size, Water Level
180'	2 liter 1 road 1 Moist	HT		~~Slightly Silty Gravelly~~ Silty Sandy Gravel ~~Sand~~ (50% Gravel, 35% Sand, 15% Silt. Sand 10% CS 70% MS 20% FS. Slightly 5Y5/1 Grey Gravel 3.75 3/6-6/4 V.D. Grey. Angular Fragment. 20% Basalt, 50% QTZ + QTZite 30% Volcanics No Rxn to HCl	Good Drilling 0825 2/26/92. 184' Casing Drops 3'
185'	2 liter 1 road 1 Moist	HT		185' Slightly Silty Slightly Gravelly Sand. (15% Gravel 10% Silt 75% Sand.) 100% FS - Basalt 80% MS 20% FS. Color Similar to 180. Sand 60% Felsic 40% Mafic. Gravel Mineralogy Similar to 180'. No Rxn to 10% HCl. plastic	1035 2/26/92. Sand Ends 187'. Sand Heaves 5' into Casing.
190'	2 liter 1 road 1 Moist	HT		190' Slightly Silty Slightly Gravelly Sand (20-25% Gravel 10% Silt 65% Sand.) Similar to 185' Except For Slightly Higher Gravel Content	~~1145~~ 2/26/92 1120
195'	2 liter 1 road 1 Moist	HT		195' Silty Sandy Gravel (~~8~~ 50% Gravel 40% Sand 10% Silt) 10% LP 80% MS 30% MP 20% FS 60% FP 5Y5/1 Grey Wet. Angular Fragments Hard Rock 60% QTZ QTZite, 30% Basalt 10% Granitic Pebbles (Fragments) Rounded, Spherical to Discoidal Sand 50% Mafic No Rxn to HCl	2/26/92 1400

BOREHOLE LOG

Boring or Well No. 699-48-77A

Sheet 10 of 22

Location 2000 Ft N of 200w Fence

Elevation 672'9.5' N 137,969 E 566,414

Driller P. Perkins.

Prepared By C. Wright (Sign/Print Name) Date 2/27/92

Project C018H /RCRA Unit

Drilling Contractor Jensen

Drilling Method and Equipment Cable Tool 72 Spudder

Reviewed By Edward C. Rogers (Sign/Print Name) Date 3/20/92

Depth (Feet)	Sample Type and No.	Sample Blows or Recovery	Graphic Log	Sample Description: Soil Classification, Particle Size Distribution, Color, Moisture Content, Sorting, Angularity, Mineralogy, Reaction to HCl.	Comments: Depth of Casing, Drilling Rate, Casing Size & Type, Bit Size, Water Level
200'	2 Liter, 1 Rad, 1 CaCO3	HT		200' Silty Sandy Gravel (50% Grav. 40% Sand 10% Silt) 10% CP 80% MS; 30% MP 20% FS; 60% FP; 5Y 6/1 Grey Wet (From Added H2O); Angular From Hard Tool; 60% Qtz+Qtzite. 30% Basalt. 10% Granite; Rounded, Spherical To Discoidal. No Rxn To HCl.	1550 2/26/92
205'	2 Liter, 1 Rad, 1 CaCO3	HT		205' Silty Sandy Gravel Similar To 200'	0835 2/27/92
210	2 Liter, 1 Rad, 1 CaCO3	HT		210' Silty Sandy Gravel - Similar To 200' - Possibly more Felsic Gravels (ie more Quartz)	1035 2/27/92
215'	2 Liter, 1 Rad, 1 CaCO3	HT		215' Silty Sandy Gravel (40% Sand 40% Gravel 20% Silt) 100% FG Due To HT. 30% CS 50% MS; 5Y 6/1 Grey Wet 20% FS; 50% Qtz+Qtzite 30% Basalt; 15% Volcanics/Unknown 5% Greenstone; Sand 50% Angular To Sub Angular due to Hard Tool. No Rxn To HCl	1445 2/27/92 Good mud!

Boring or Well No. 699-48-77A

BOREHOLE LOG

Sheet 11 of 22

Location 200 N of 200W Fence
Elevation 672' g.s. N 137,969 E 566,414
Driller D. Perkins
Prepared By C. Walker (Sign/Print Name) Date 03/03/92
Project C018H / RCRA W027
Drilling Contractor Jansen
Drilling Method and Equipment 22 SpeedStar
Reviewed By Edward C. Lotfus (Sign/Print Name) Date 03/11/92

Depth (Feet)	Sample Type and No.	Sample Blows or Recovery	Graphic Log	Sample Description: Soil Classification, Particle Size Distribution, Color, Moisture Content, Sorting, Angularity, Mineralogy, Reaction to HCl.	Comments: Depth of Casing, Drilling Rate, Casing Size & Type, Bit Size, Water Level
220'	2 ltr 1 Rad 1 Cs can	HT		220' Silty Sandy Gravel 40% Sand 40% Gravel 20% Silt	1600 2/27/92
					Hard Drilling 224 onward.
225'	2 ltr 1 Rad 1 Cs can	HT		225' Silty Sandy Gravel (40% Gravel 40% Sand 20% Silt.) 10% MG 60% MS 90% FG 40% VFS 5Y 6/1 Grey Wet (Slurry) 50% QTZ + QTZITE 30% Basalt 15% Igneous, 5% Metamorphics Sand ± 50% Mafic. Angular To Sub Angular Gravel due To Hard Tool. Subdiscoidal. No Rxn To 10% HCl.	1055 3/2/92
230'	2 ltr 1 Rad 1 Cs can A/P19 A/P20 A/P21 1 Rad 3 ltr	ST ST 18/5/43/35 #1 6/6/45/180 #2		226 Silty Sand Gravel (40% Gravel 40% Sand 20% Silt) Similar To 225' Splitspoon 229.5-231.5 + 230.5-233 Matrix Supported Course pebble Conglomerate. *Water Hit Fine Sand/Silt Matrix pebbles ± 50% Total Volume	1335 3/2/92 Water Hit With Casing ST 229.24 TO 230 BGS Swl Shot up To 216' BGS
235'	2 ltr 1 Rad 1 Cs can	HT		235' Silty Sandy Gravel (70% Gravel 20% Sand 10% Silt/Clay 100% FG 50% MS 50% FS Fractured by HT. ~~5Y 4/4~~ 5Y 6/1 Gray Wet (As Slurry) Angular From HT. 50% QTZ, 30% Basalt 20% Igneous No Rxn To HCl. Probably Similar To Above	3/3/92 1500 Fine Sand Clumps in Slurry

BOREHOLE LOG

Boring or Well No. 699-48-77A

Sheet 12 of 22

Location 200W C018H Site

Project W017/C018H

Elevation 672' g.s. N137,969 E566,413

Drilling Contractor Jensen

Driller D. Perkins

Drilling Method and Equipment Cable Tool 72 Speedstar

Prepared By C. Wright / C. Wright (Sign/Print Name) Date 3/4/92

Reviewed By Edward C. Rafuse / Edward C. Rafuse (Sign/Print Name) Date 03/10/92

Depth (Feet)	Sample: Type and No.	Sample: Blows or Recovery	Graphic Log	Sample Description (Soil Classification, Particle Size Distribution, Color, Moisture Content, Sorting, Angularity, Mineralogy, Reaction to HCl)	Comments (Depth of Casing, Drilling Rate, Casing Size & Type, Bit Size, Water Level)
240'	2lith 1sand 1carb	HT		240' Silty Sandy Gravel - Similar To 235'	1630 3/3/92
245'	2lith 1sand 1carb	HT		245' Silty Sandy Gravel (40% Gravel 40% Sand 20% Silt) 10% MG 60% MS 90% FG 40% FS 5Y6/1 Grey Slurry 50% Qtz + Qtzite, 30% Basalt 20% Igneous. No Rxn To HCl Angular Fragments of Rounded pebbles	0940 3/4/92 V. Fine Sand. Thin Slurry
250'	2lith 1sand 1carb	HT		250' Silty Sand Gravel (40% Gravel 40% Sand 20% Silt) Similar To 245'	1105 3/4/92
255'	2lith 1sand 1carb	HT		255' Silty Sand Gravel (60% Gravel, 25% Sand 15% Silt) Otherwise Similar To 245' Sand Slightly Coarser Than Above	3/4/92 1235

BOREHOLE LOG

Boring or Well No. 699-48-77A

Sheet 13 of 22

Location 200W C018H
Elevation 672' g.s. N 137,969 E 566,414
Driller D. Perkins
Prepared By C. Wright (Sign/Print Name) Date 03/05/92
Project W017/C018H
Drilling Contractor Jensen
Drilling Method and Equipment 22 Speedstar/Cable Tool
Reviewed By Edward C. Rafferty (Sign/Print Name) Date 03/10/92

Depth (Feet)	Sample: Type and No.	Sample: Blows or Recovery	Graphic Log	Sample Description: Soil Classification, Particle Size Distribution, Color, Moisture Content, Sorting, Angularity, Mineralogy, Reaction to HCl.	Comments: Depth of Casing, Drilling Rate, Casing Size & Type, Bit Size, Water Level
260'	2Lith 1 Rad 1 CaCO3	HT		260' Silty Sandy Gravel (30% Gravel 50% Sand 20% Silt (Clay)) 20% MG 30% CS 80% FG 50% MS 20% FS 5Y6/1 Grey Slurry. Angular Fragments of Rounded Subdiscoidal pebbles 50% Qtzarzite, 30% Basalt 20% Volcanic + Igneous No Rxn to 10% HCL	1330 3/4/92 Thick Mud
265'	2Lith 1 Rad 1 CaCO3	HT.		265' Silty Sandy Gravel (40% Gravel 40% Sand 20% Silt (Clay)) Similar to 260'.	1050 3/5/92
270'	2Lith 1 Rad 1 CaCO3	HT		270' Silty Sandy Gravel 40% Gravel 40% Sand 20% Silt Similar to 260'	510 3/5/92
275'	2Lith 1 Rad 1 CaCO3	HT.		275' Silty Sandy Gravel 50% Gravel 25% Sand 15% Silt Similar to Above.	620 3/5/92

BOREHOLE LOG

Boring or Well No. 699-48-77A
Sheet 14 of 22

Location 200W
Elevation 672' g.s. N 137,969 E 566,414
Driller D. Perkins
Prepared By C. Wright (Sign/Print Name) Date 03/09/92
Project W017/C018H
Drilling Contractor Jensen
Drilling Method and Equipment 72 Speed Star/Cable Tool
Reviewed By Edward C. Rafuse (Sign/Print Name) Date 03/14/92

Depth (Feet)	Sample Type and No.	Sample Blows or Recovery	Graphic Log	Sample Description: Soil Classification, Particle Size Distribution, Color, Moisture Content, Sorting, Angularity, Mineralogy, Reaction to HCl.	Comments: Depth of Casing, Drilling Rate, Casing Size & Type, Bit Size, Water Level
280	2 1/4" 1 Red 1 Cal	HT		280' Silty Sandy Gravel Similar to 275'	1620 3/5/92
285'	2 1/4" 1 Red 1 Cal	HT		285' Silty Sandy Gravel (40% Gravel 40% Sand 20% Silt/Clay) 30% MG 20% CS 70% FG 50% MS 30% FS 5Y 6/2 Lt Olive Grey. Sub-ang. Angular Fragments of Rounded Sub-standard pebbles No Rxn to HCl, 50% QTZ, 30% Basalt 20% Igneous	3/6/92 0840
290'	2 1/4" 1 Red 1 Cal	HT		290' Silty Sandy Gravel (50% Sand 30% Gravel 20% Silt) Similar to 285, Slightly more Sand	3/6/92 1000
295'	2 1/4" 1 Red 1 Cal	HT		295' Slightly Silty Slightly Gravelly Sand. (70% Sand 15% Gravel 15% Silt/Clay) 100% FG 30 20% CS 20% MS 5Y 6/2 Lt Olive Grey 60% FS Sand 50% Mafic ± No Rxn to HCl	1500 3/6/92

BOREHOLE LOG

Boring or Well No. 699-48-77A

Sheet 15 of 22

Location 699 2000' N of 200 W Fence 672'9.3'
Project W017/C018H
Elevation N 137,969 E 566,414
Drilling Contractor Jensen
Driller D. Perkins.
Drilling Method and Equipment Cable Tool 22 Speedstar
Prepared By [signature] (Sign/Print Name) Date 3/6/92
Reviewed By Edward C. Rafuse [signature] (Sign/Print Name) Date 03/14/92

Depth (Feet)	Sample: Type and No.	Sample: Blows or Recovery	Graphic Log	Sample Description: Soil Classification, Particle Size Distribution, Color, Moisture Content, Sorting, Angularity, Mineralogy, Reaction to HCl	Comments: Depth of Casing, Drilling Rate, Casing Size & Type, Bit Size, Water Level
300	2 lith 1 rad 1 chlog	HT		300' Silty Sandy Gravel (50% Gravel 30% Sand 20% Silt) 100% FG (Hard Tool) 40% CS 30% MS 30% FS 5Y6/1 Grey - Silvery 50% Qtz + Qtzite 30% Basalt 20% Granite + metamorphic Angular fragments of Rounded pebbles Sand 50% mafic. No Rxn to 10% HCl	1630 3/6/92 300'-305 - Heaving material in casing.
305'	2 lith 1 rad 1 chlog	HT		Slightly Silty Gravelly Sand (25% Gravel 65% Sand 10% Silt) 20% MG 20% CS 80% FG 30% MS 50% FS 5Y6/1 - 5Y6/2 Lt Olive Grey Silvery Pebbles - Angular Fragment of Rounded & Ecoidal pebbles. 40% Basalt 30% Qtz + Qtzite 30% Granitic No Rxn. Sand 50% mafic.	0950 3/10/92 Heaving into Casing
310'	2 lith 1 rad 1 chlog	HT		310' Silty Sandy Gravel (50% Gravel 30% Sand 20% Silt) Similar to 300'	1145 3/10/92 No longer Heaving 312
315'	2 lith 1 rad 1 chlog	HT		Slightly Silty Gravelly Sand (25% Gravel 65% Sand 10% Silt) Similar to 305'	1455 3/10/92

A-6000-397 (04/90)

BOREHOLE LOG

Boring or Well No. 699-48-77A

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Location 200W C018H

Elevation 672' s.s. N 137,969 E 566,414

Driller D. Perkins

Prepared By C. Wright (Sign/Print Name) Date 03/11/92

Project C018H

Drilling Contractor Jensen

Drilling Method and Equipment Cable Tool 72 Speed Star

Reviewed By Edward C. Lefthrow / Edward C. Lefthrow (Sign/Print Name) Date 03/11/92

Depth (feet)	Sample Type and No.	Sample Blows or Recovery	Graphic Log	Sample Description (Soil Classification, Particle Size Distribution, Color, Moisture Content, Sorting, Angularity, Mineralogy, Reaction to HCl.)	Comments (Depth of Casing, Drilling Rate, Casing Size & Type, Bit Size, Water Level)
320'	24 HR 1 Red 1 Gallon	HT		Slightly Silty Gravelly Sand (25% Gravel 65% Sand 10% Silt) Similar to 315	1640 3/10/92
325	24 HR 1 Red 1 Gallon	HT		325' Slightly Silty Gravelly Sand 25% Gravel, 65% Sand 10% Silt. 20% MG 20% CS; 80% FG 30% MS; 50% FS. 5Y6/1 - 5Y6/2 Lt Olive Gray Silver Angular Fragment of Rounded pebbles 40% Basalt 30% Qtz + Qtzite Sand 50% mafic, No Rxn To HCl	0935 3/11/92
330	24 HR 1 Red 1 Gallon	HT		330 Slightly Silty Gravelly Sand (25% Gravel, 65% Sand 10% Silt) Similar To Above	3/11/92 1030
335	24 HR 1 Red 1 Gallon	HT		335' Slightly Silty Gravelly Sand (25% Gravel, 65% Sand 10% Silt) Similar To Above	3/11/92 1325 10" Set at 334.83

BOREHOLE LOG

Boring or Well No. 699-48-77A

Sheet 17 of 22

Location 200W AREA / C018H
Elevation 672' g.s. N137,969 E566,414
Driller Darrell Perkins
Prepared By [signature] (Sign/Print Name) Date 3/17/92

Project C018H
Drilling Contractor Jensen Drilling
Drilling Method and Equipment CABLE TOOL / Spd Str
Reviewed By EDWARD C. RAFUSE [signature] (Sign/Print Name) Date 03/19/92

Depth (feet)	Sample Type and No.	Sample Blows or Recovery	Graphic Log	Sample Description: Soil Classification, Particle Size Distribution, Color, Moisture Content, Sorting, Angularity, Mineralogy, Reaction to HCl.	Comments: Depth of Casing, Drilling Rate, Casing Size & Type, Bit Size, Water Level
340				silty gravelly SAND (15% silt 30% gravel 55% SAND) gravels predomit. m-fp-ang; 20% cs, 25% fs, 55% vfs	Begin hardtooling w/ 8" casing 3/17/92 @ 1430
				3.75y 5/3 ltolbrn-olive wet 3.75y 6/3 ltyelbrn-plol dry, sorting undet. sands are subang-subrnd, 40% basalt 30% Qtz, 20% Qtzs, 10% volporph, grnstne. No Rxn w/ 10% HCl.	No H2O added.
	1 rad, 1 CaCO3, 2 lith				340' sample 3/17/92 @ 1615
345		HT		sample similar to 340'	
	1 rad, 1 CaCO3, 2 lith				345' sample 3/18/92 @ 0815
350		HT		silty gravelly SAND (10% silt, 35% gravel 55% SAND) gravels undet for part size; 25% cs, 25% fs, 50% vfs	
				3.75y 5/3 ltolbrn-olive wet 3.75y 6/3 ltyelbrn-plol dry, sorting undet gravels ang, sands subang-subrnd 45% basalt, 35% Qtz 15% Qtzs, 5% volporph, musc, grnstne, No Rxn to 10% HCl.	
	1 rad, 1 CaCO3, 2 lith				350' sample 3/18/92 @ 0935
355		HT		slightly silty slightly sandy GRAVEL (5% silt, 10% sand, 85% GRAVEL) gravels undet; 25% cs, 25% fs, 50% vfs	
				3.75y 5/3 ltolbrn-olive wet, 3.75y 6/3 ltyelbrn-plol dry, sorting undet. gravels ang - sands subrnd 50% basalt 35% Qtz 10% Qtzs 5% gran, musc, misc	
	1 rad, 1 CaCO3, 2 lith			No Rxn	355' sample 3/18/92 @ 1300
360		HT			

Boring or Well No. 699-48-77A

Sheet 18 of 22

BOREHOLE LOG

Location 200 W / C018H
Project W017 / C018H
Elevation 672' s.s. N137,969 E566,414
Drilling Contractor Jensen Drilling
Driller Darrell Perkins
Drilling Method and Equipment CABLE TOOL / Spd Str
Prepared By [signature] (Sign/Print Name) Date 3/18/92
Reviewed By Edward C. Kafuse [signature] (Sign/Print Name) Date 03/20/92

Depth (feet)	Sample Type and No.	Sample Blows or Recovery	Graphic Log	Sample Description: Soil Classification, Particle Size Distribution, Color, Moisture Content, Sorting, Angularity, Mineralogy, Reaction to HCl.	Comments: Depth of Casing, Drilling Rate, Casing Size & Type, Bit Size, Water Level
360				slightly silty slightly sandy GRAVEL (<5% silt <10% sand 85+% GRAVEL) gravels undet 20% cs 25% fs 55% vfs. 3.75 4 5/3 Hol brn - olive wet. 3.75 4 6/3 Hyel brn - pale ol dry; sorting undet gravels ang, sands subang - subrnd / subdiscoidal: 45% basalt, 40% Qtz, 10% Qtze, 5% volporph, gran grnstne No Rxn	No H2O added, good drill rate. 360' sample @ 1905 3/18/92
365	1rad 1CaCO3 2lith	HT		sample similar to 360'	No H2O added, good drill rate, poss. loose uncons. gravels. 365' sample 3/18/92 @ 1550
370	1rad 1CaCO3 2lith	HT		sandy GRAVEL (20% sand 80% GRAVEL) 20% cs 30% fs 50% vfs. gravels undet. 3.75 4 5/3 Hol brn - ol wet, 3.75 4 6/3 Hyel brn - pale ol. dry, sorting undet. gravels ang, sands subang - subrnd 40% basalt, 40% Qtz, 10% Qtze, 10% volporph. gran. No Rxn to 10% HCl	370 sample 3/18/92 @ 1650
375	1rad 1CaCO3 2lith	HT		same same as above.	375' sample 3/19/92 @ 0915
380	1rad 1CaCO3 2lith	HT			

BOREHOLE LOG

Boring or Well No. 699-48-77A

Sheet 19 of 22

Location: 200W AREA - C018H
Project: W017 / C018H
Elevation: 672' g.s. N 137,969 E 566,414
Drilling Contractor: Jensen Drilling
Driller: Darrell Perkins
Drilling Method and Equipment: CABLE TOOL / Spd Str
Prepared By: [signature] (Sign/Print Name) Date 3/19/92
Reviewed By: Edward C. Rafferty [signature] (Sign/Print Name) Date 04/06/92

Depth (feet)	Sample Type and No.	Sample Blows or Recovery	Graphic Log	Sample Description: Soil Classification, Particle Size Distribution, Color, Moisture Content, Sorting, Angularity, Mineralogy, Reaction to HCl.	Comments: Depth of Casing, Drilling Rate, Casing Size & Type, Bit Size, Water Level
380				Slightly silty sandy GRAVEL (5% silt 15% sand 80% GRAVEL 15% cs 25% fs 60% vfs 3.75y 5/3 lt olbrn - ol - wet; 3.75y 6/3 lt yel brn - plol dry; sorting undet. gravels undet. sands sub-rnd; 40% basalt 45% Qtz 10% QtzE 5% ml porph gran, No Rtn to HCl	No H_2O added; Slower drill rate than 375-380
385'	1rad / $CaCO_3$ / 2 lith	HT			380' sample 3/19/92 @ 1100
				Sample similar to 380'	No H_2O used
390	1rad / $CaCO_3$ / 2 lith	HT			385' Sample 3/19/92 @ 1400
				Slightly sandy GRAVEL (10% sand - 90% GRAVE) desc same as ABOVE	
395	1rad / $CaCO_3$ / 2 lith	HT			390' sample 3/19/92 @ 1510
				GRAVEL w/ possible small amt of sand. Consolidated sands are fine - vfs gravels undet. slurry: 5y 4/1 dk gry, 6/1 lt gry dry rock: 3.75y 3/0 v dk gry - 3/1 v dk gry 3.75y 5/0 gry - 5/1 gray ang, No Rtn to 10% HCl, 80% basalt 5% Qtz 15% grnstone, QtzE, No cont. magnetics to 1mm ~1% -	NOTED Color change @ 393' > dk; drill advised slow drill rate due to cementation/cons.
400	1rad / $CaCO_3$ / 2 lith	HT			395' sample 3/23/92 @ 0800

A-6000-382 (04/90)

BOREHOLE LOG

Boring or Well No. 699-48-77A

Sheet 20 of 22

Location 200 W Area - C018H
Project W017 - C018H
Elevation 672' g.s. N 137,969 E 566,414
Drilling Contractor Jensen Drilling
Driller Darrell Perkins
Drilling Method and Equipment Cable tool - Spd Str
Prepared By Dennis Anderson (Sign/Print Name) Date 3/23/92
Reviewed By Edward C. LaFarge (Sign/Print Name) Date 04/07/92

Depth (feet) 400	Sample Type and No.	Blows or Recovery	Graphic Log	Sample Description: Soil Classification, Particle Size Distribution, Color, Moisture Content, Sorting, Angularity, Mineralogy, Reaction to HCl.	Comments: Depth of Casing, Drilling Rate, Casing Size & Type, Bit Size, Water Level
				GRAVEL w/ trace sand	
				Consolidated gravels, sands are fine-vfs	tight drilling
				slurry: 5y 4/1 dkgry 6/1 ltgry dry	slow drill rate
				rock: 3.75y 3/0 vydkgry - 3/1 vydkgry	
				3.75y 5/0 gry - 5/1 gray	very consolidated
				gravels ang No Rxn to 10% HCl, 80%	
				basalt, 5% Qtz, 15% grnstone, gran Qtz	
				magnetite to 1mm, noticeable amt of	
	1rad / 1CaCO3			metallic material in sample due to	400' sample 3/23/92 @ 0940
405	2 lith	HT		hardtool	
				GRAVEL w/ trace sand	
				slurry: 5y 4/1 dkgry - 6/1 ltgry dry	very consolidated
				rock: 3.75y 3/0-3/2 vydkgy - vydkolgrbrnwet	
				3.75y 4/0-4/2 vydkgry - vydkolgry dry	shoe has become elongated
				70% basalt, 20% grnstne, 10% Qtz, magnetite	will down size to 6"
				to .5mm. est. snc mp — lc, vfs-ms, No	
				Rxn to 10% HCl, sample ang, rndness undet.	8" casing set @ 396.2' bls
					metallic material in sample.
	1rad / 1CaCO3				
410	2 lith	HT			405 sample 3/24/92 @ 1510
				GRAVEL w/ trace sand sand vfs-fs	Begin 6" hardtool
				slurry - 5y 4/1 dkgry 6/1 ltgry dry	4/1/92
				rock - 3.75y 3/0-3/2 vydkgry - olgry - vydk	slow drill rate
				gry brn wet: 3.75y 4/0-4/2 vydkgry	No H2O added
				vydkolgry dry. 30% basalt, 35%	
				Qtz, 35% grnstone, ang No Rxn to HCl	PID detected 3ppm @
				desc same as above	brehole AM 4/1/92
	1rad / 1CaCO3				poss middle Ringold.
415	2 lith	HT			410' sample 4/1/92 @ 0830
				GRAVEL w/ trace sand (<10%) vfs-fs	
				slurry - 5y 2.5 olgry - ol wet	
				5.5y 1/1 gray - dry	
				rock - 5y 4/2 - 6/6 olgry → olyellow - wet	
				5y 5/2 - 7/6 olgry → yellow - dry	slow drill rate
				poor sorting, ang due to HT, No Rxn to	
				10% HCl, 40% basalt, 40% Qtz, 20%	poss middle Ringold
	1rad / 1CaCO3			grnstne,	
420	2 lith	HT			415 sample 4/1/92 @ 1515

BOREHOLE LOG

Boring or Well No. 699-48-77A
Sheet 21 of 22

Location: 200 W Area - C018H
Project: W017 - C018H
Elevation: 672'S.S. N 137,969 E 566,414
Drilling Contractor: Jensen Drilling
Driller: Darrell Perkins
Drilling Method and Equipment: CABLETOOL - Spd Str
Prepared By: Dennis Anderson (Sign/Print Name) Date 4/1/92
Reviewed By: Edward C. Rafuse (Sign/Print Name) Date 04/07/92

Depth (feet)	Sample Type and No.	Sample Blows or Recovery	Graphic Log	Sample Description (Soil Classification, Particle Size Distribution, Color, Moisture Content, Sorting, Angularity, Mineralogy, Reaction to HCl)	Comments (Depth of Casing, Drilling Rate, Casing Size & Type, Bit Size, Water Level)
420–425	- ; 1rad/1CaCO3/2lith	HT	(gravel pattern)	GRAVEL w/ trace sand (<10%) vfs-fs slurry - 5y 4/1 dk gry - wet; 5y 5/2 olgry - dry; rock. 5y 3/2-4/3 dkolgry - pl - wet; 5y 4/1-5/3 dkgry - pl - dry; sample wet, poor sorting, sample w/ fp-mp rnd/subdiscoidal, No Rxn to 10% HCl; 40% basalt, 10% Qtz 50% gmone.	< consolidation; 420' sample 4/1/92 @ 1515
425–430	1rad/1CaCO3/2lith	HT	(gravel pattern)	sample same as above	> consolidation; 425' sample 4/1/92 @ 1645
430–435	1rad/1CaCO3/2lith	HT	(gravel pattern)	sample same as above: except as noted; rock: 5y 3/1.5 vvdkgray - dkolgry - wet; 5y 4/1 dkgry - dry; 50% basalt 40% gmone 10% Qtz-QtzE	driller stated @ looser material; poss basaltic colluvium.; 430' sample 4/2/92 @ 1120
435–440	1rad/1CaCO3/2lith	HT	(gravel pattern)	GRAVEL color same as 430' sample. remaining desc. same as 425-430' sample; 60% basalt 35% gmstone 5% Qtz	poss. basaltic colluvium; 435' sample 4/2/92 @ 1315

A-6000-382 (04/90)

BOREHOLE LOG

Boring or Well No. 699-48-77A

Sheet 22 of 22

Location: 200 W AREA - C018H

Project: W017 - C018H

Elevation: 672' g.s. N 137,969 E 566,414

Drilling Contractor: Jensen Drilling

Driller: Darrell Reekuns

Drilling Method and Equipment: Cabletool - Spd Str

Prepared By: [signature] (Sign/Print Name) Date: 4/2/92

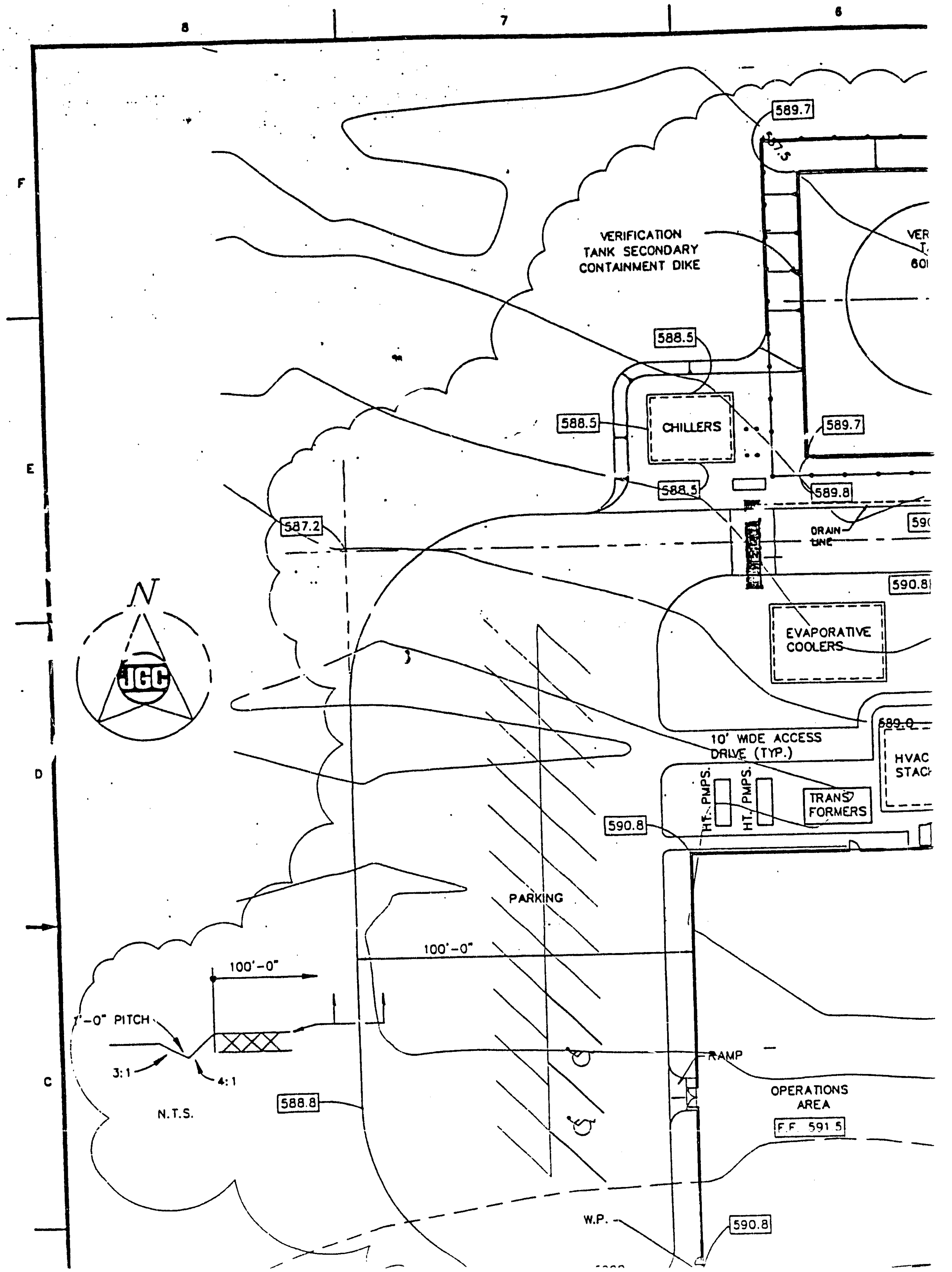
Reviewed By: Edward C. Kafusf [signature] (Sign/Print Name) Date: 07/20/92

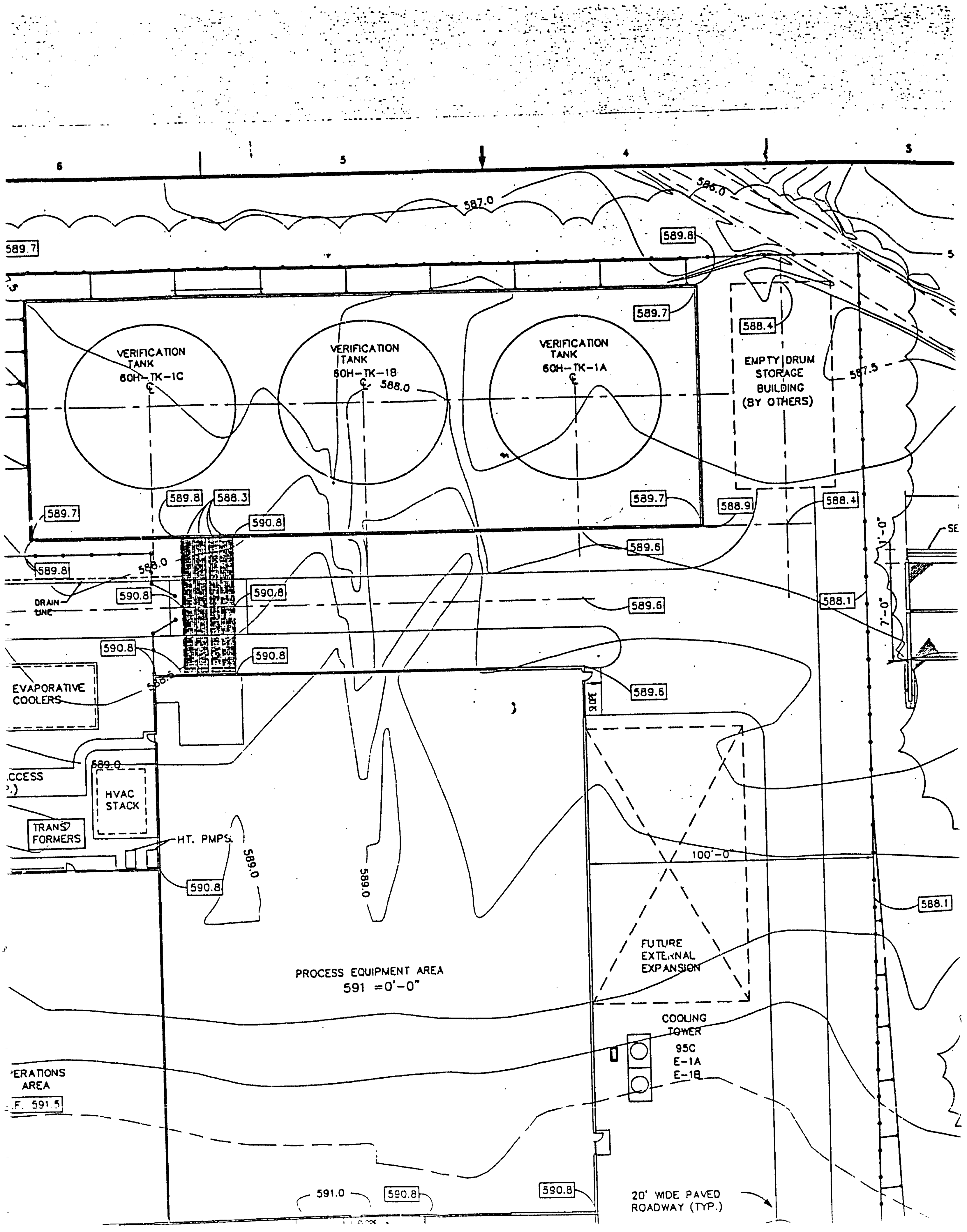
Depth (feet)	Sample Type and No.	Sample Blows or Recovery	Graphic Log	Sample Description: Soil Classification, Particle Size Distribution, Color, Moisture Content, Sorting, Angularity, Mineralogy, Reaction to HCl.	Comments: Depth of Casing, Drilling Rate, Casing Size & Type, Bit Size, Water Level
440				GRAVEL w/trace sand (95+% gravel 5-%	
				sand) GRAVELS undet. sands vfs-fs	slow drill rate
				slurry 5y 3.5/1 dk grey; vydk grey wet	Consolidated - Closed framework
				rock 5y 2.75/1.5 black dk ol grey wet	No H2O added
	—			5y 4/1.5 dk grey - ol grey dry	
				sample saturated, sorting undet., rndness undet	
				sands subrnd - subdiscoidal. No Rxn to 10% HCl	
				85% basalt, - chloritic basalt, 10% Qtz w/	
	1rad			Fe stain 5% Qtze	
445	1CaCO3 2 lith	HT			440' sample 4/2/92 @ 1525
				445' sample same as above	
					very slow drill rate
					consolidated material
	1rad 1CaCO3				
450	2 lith	HT			445' sample 4/6/92 @ 1310
				450' sample same as above	
					possible flow area due to
					fineness of material
					sands encountered @ 452'
					w/ minor gravels
	1rad 1CaCO3				
455	2 lith	HT			450' sample 4/6/92 @ 1500
				basalt (100%)	
				desc undet.	< gravels
				Color: 2.75/1/0 black	very slow drill rate
				No Rxn to 10% HCl	basalt @ 454.5'
	1rad 1CaCO3 2 lith				
460'	1 x-ray				455' sample 4/8/92 @ 1150

A-6000-382 (04/90)

ATTACHMENT D

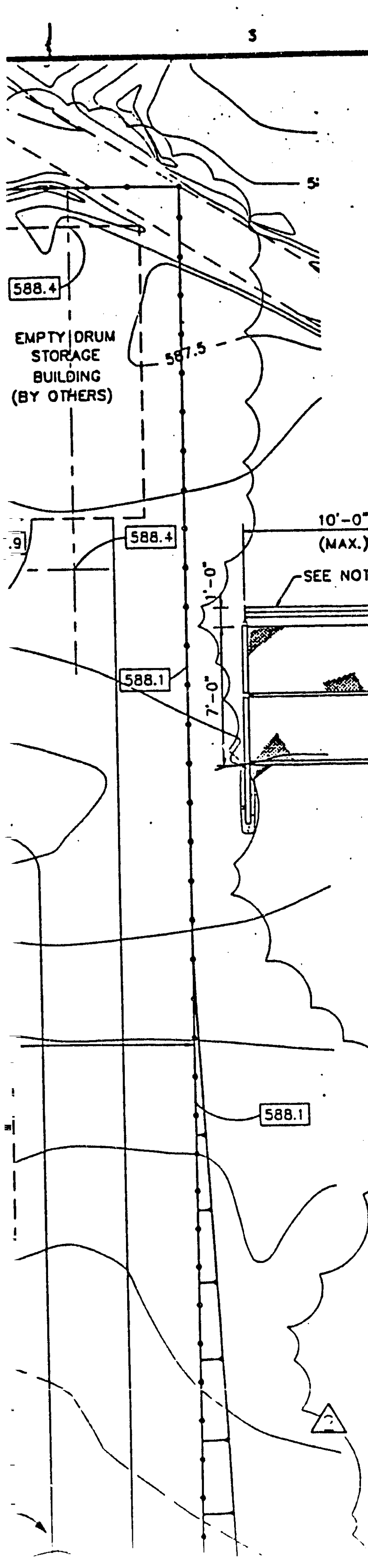
MAPS SHOWING STORMWATER DRAINAGE AREAS

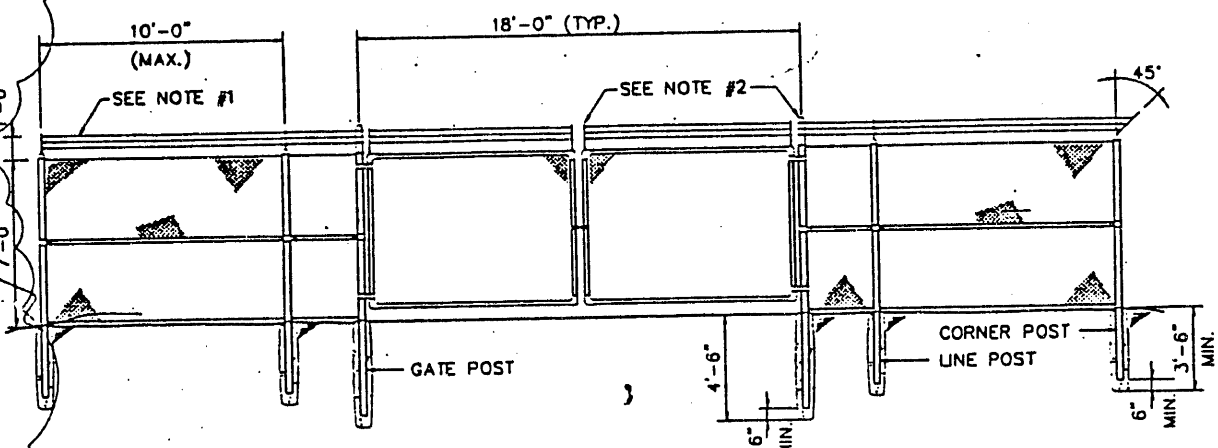

8
7
6
F
E
D
C
VERIFICATION
TANK SECONDARY
CONTAINMENT DIKE
589.7
588.5
588.5
CHILLERS
589.7
588.5
589.8
587.2
DRAIN LINE
590.8
EVAPORATIVE
COOLERS
10' WIDE ACCESS
DRIVE (TYP.)
HT. PMPS.
HT. PMPS.
TRANSFORMERS
590.8
PARKING
100'-0"
100'-0"
PITCH
3:1
4:1
N.T.S.
588.8
RAMP
OPERATIONS
AREA
F.F. 591.5
W.P.
590.8



6
5
4
3
587.0
586.0
589.7
589.8
589.7
588.4
VERIFICATION TANK 60H-TK-1C
VERIFICATION TANK 60H-TK-1B
VERIFICATION TANK 60H-TK-1A
588.0
EMPTY DRUM STORAGE BUILDING (BY OTHERS)
587.5
589.8
588.3
589.7
588.9
588.4
589.7
590.8
589.6
589.8
588.0
DRAIN LINE
590.8
590.8
589.6
588.1
1'-0"
7'-0"
590.8
590.8
EVAPORATIVE COOLERS
589.6
SLOPE
589.0
ACCESS
HVAC STACK
TRANSFORMERS
HT. PMPS.
589.0
589.0
590.8
100'-0"
588.1
FUTURE EXTERNAL EXPANSION
PROCESS EQUIPMENT AREA
591 =0'-0"
COOLING TOWER
95C
E-1A
E-1B
OPERATIONS AREA
F.F. 591.5
591.0
590.8
590.8
20' WIDE PAVED ROADWAY (TYP.)

ATTACHMENT D



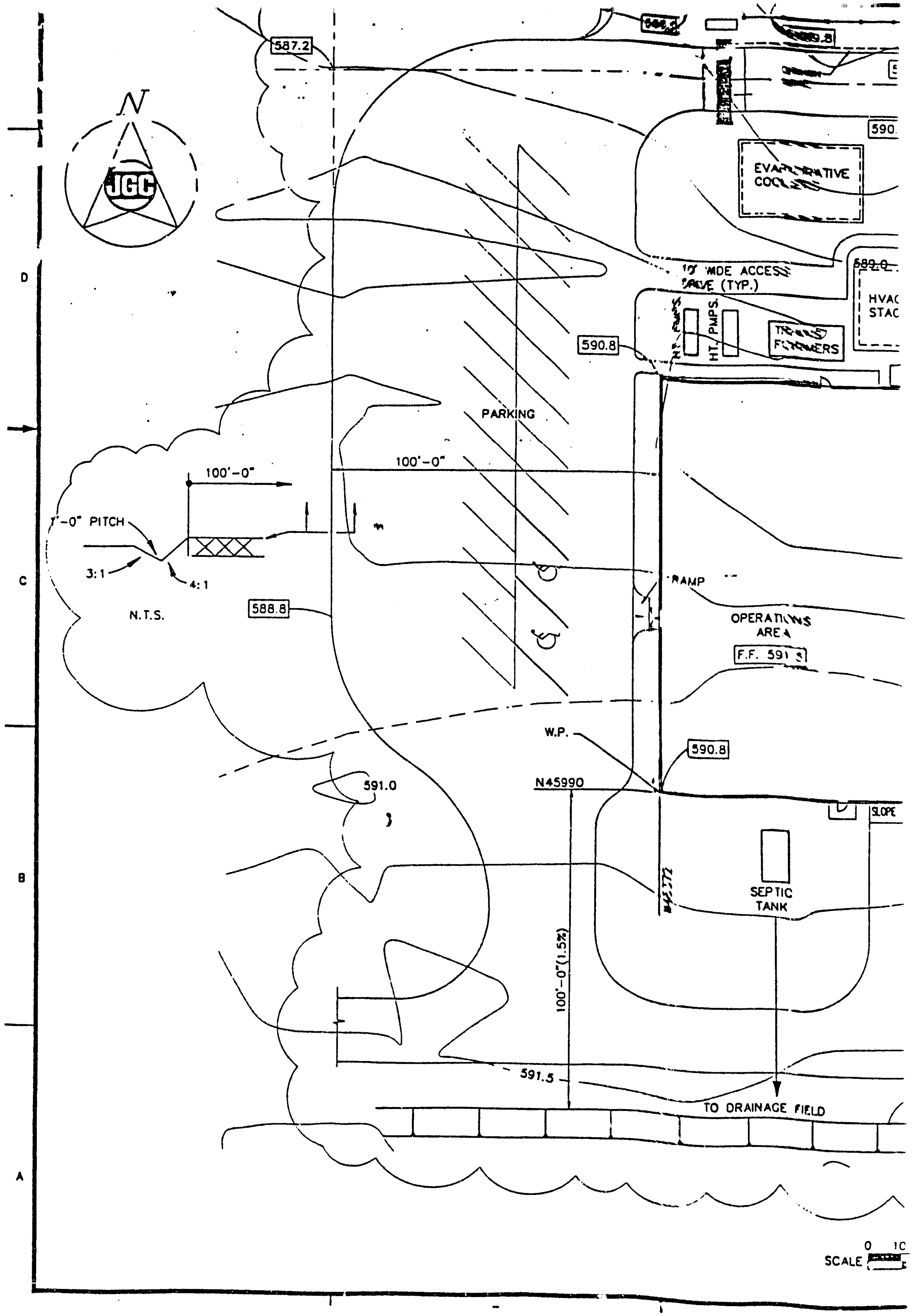


TYPICAL FENCE DETAIL

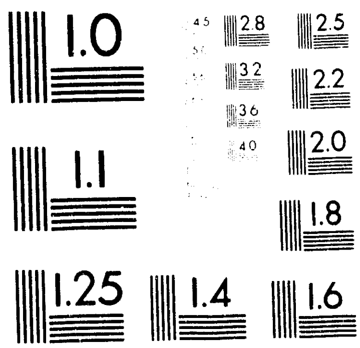
SCALE 0 1' 2' 4' 8'

NOTES:

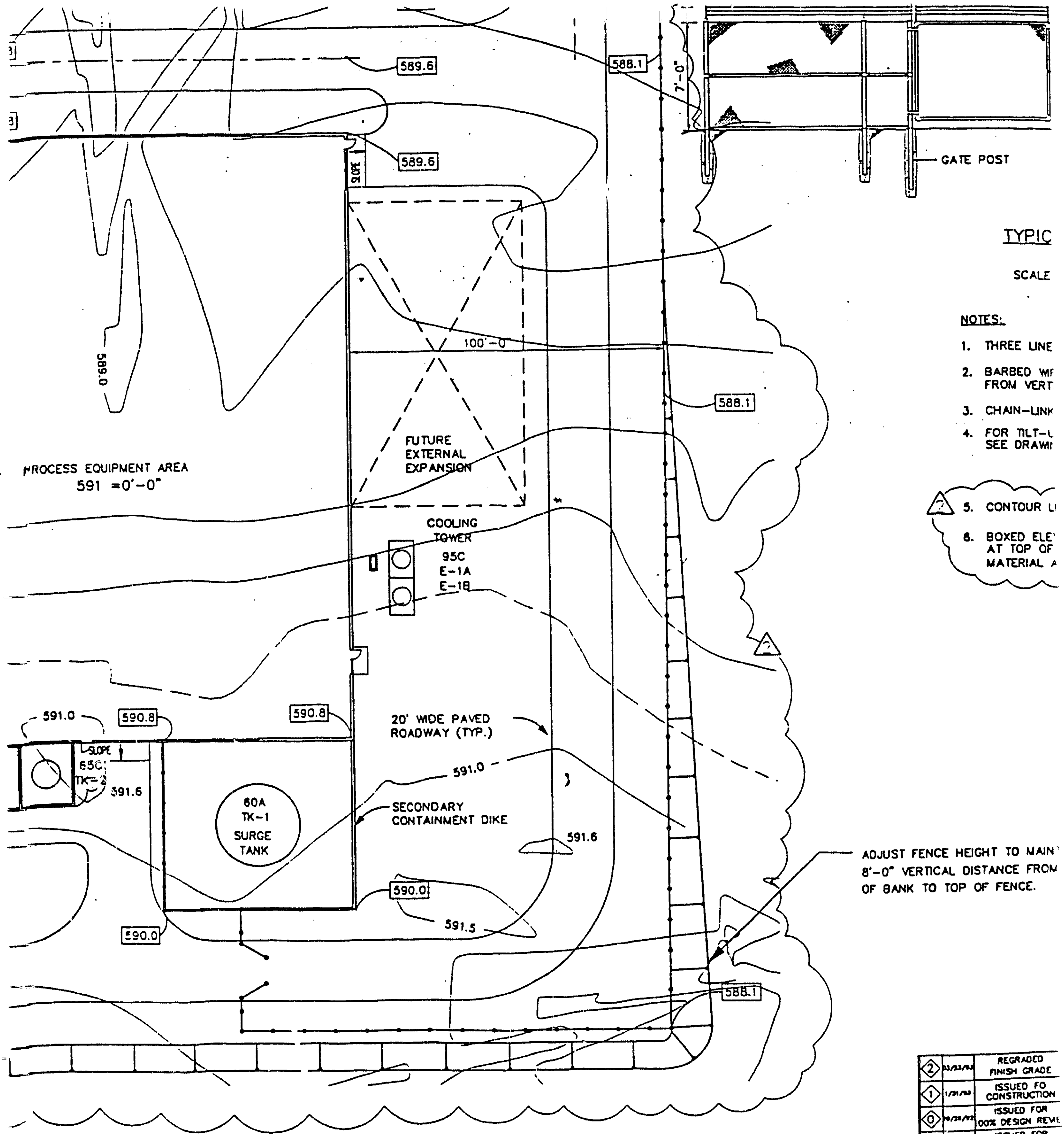
1. THREE LINES OF FOUR-POINT BARBED WIRE SHALL BE INSTALLED.
2. BARBED WIRE EXTENSION ARMS SHALL BE SLANTED OUTWARD 45° FROM VERTICAL.
3. CHAIN-LINK FENCE SPECIFICATION 02831.
4. FOR TILT-UP PANEL INFORMATION AT VERIFICATION TANKS, SEE DRAWINGS H-2-89070, SECTION 1/89070
5. CONTOUR LINES REPRESENT APPROXIMATE EXISTING GRADE.
6. BOXED ELEVATIONS REFESENT FINISHED ELEVATION AT TOP OF CONCRETE, ASPHALT, OR STABILIZATION MATERIAL AS APPROPRIATE.



N
JGC
587.2
EVAPORATIVE COOLERS
10' WIDE ACCESS DRIVE (TYP.)
HT. PMPS.
TRANSFORMERS
HVAC
590.8
PARKING
100'-0"
1'-0" PITCH
3:1
4:1
N.T.S.
588.8
RAMP
OPERATIONS AREA
F.F. 591.5
W.P.
590.8
N45990
591.0
SLOPE
SEPTIC TANK
100'-0"(1.5%)
591.5
TO DRAINAGE FIELD
D
C
B
A
SCALE
0


1.0
2.8
2.5
3.2
2.2
3.6
4.0
2.0
1.1
1.8
1.25
1.4
1.6

2 of 2



REV	DATE	DESCRIPTION
2	3/23/93	REGRADED FINISH GRADE
1	1/31/93	ISSUED FO CONSTRUCTION
0	10/20/92	ISSUED FOR 100% DESIGN REVIE
A	9/30/92	ISSUED FOR INTERNAL REVIEW

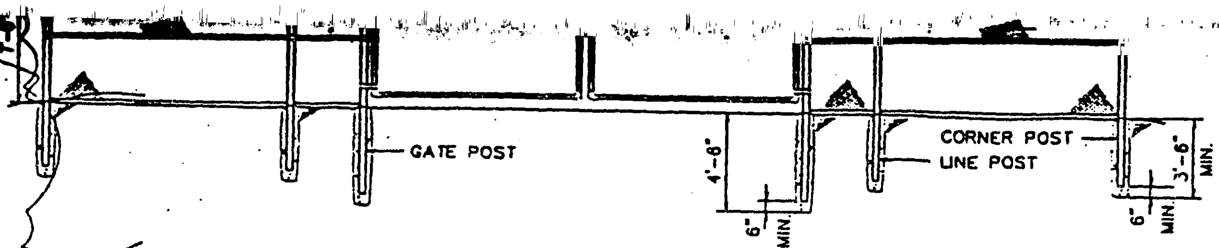
REVISION

NUMBER	TITLE	NUMBER	TITLE

DRAWING TRACEABILITY LIST — REFERENCES — NEXT USED ON

CADFILE 8E89039A CA

5 4 3 2

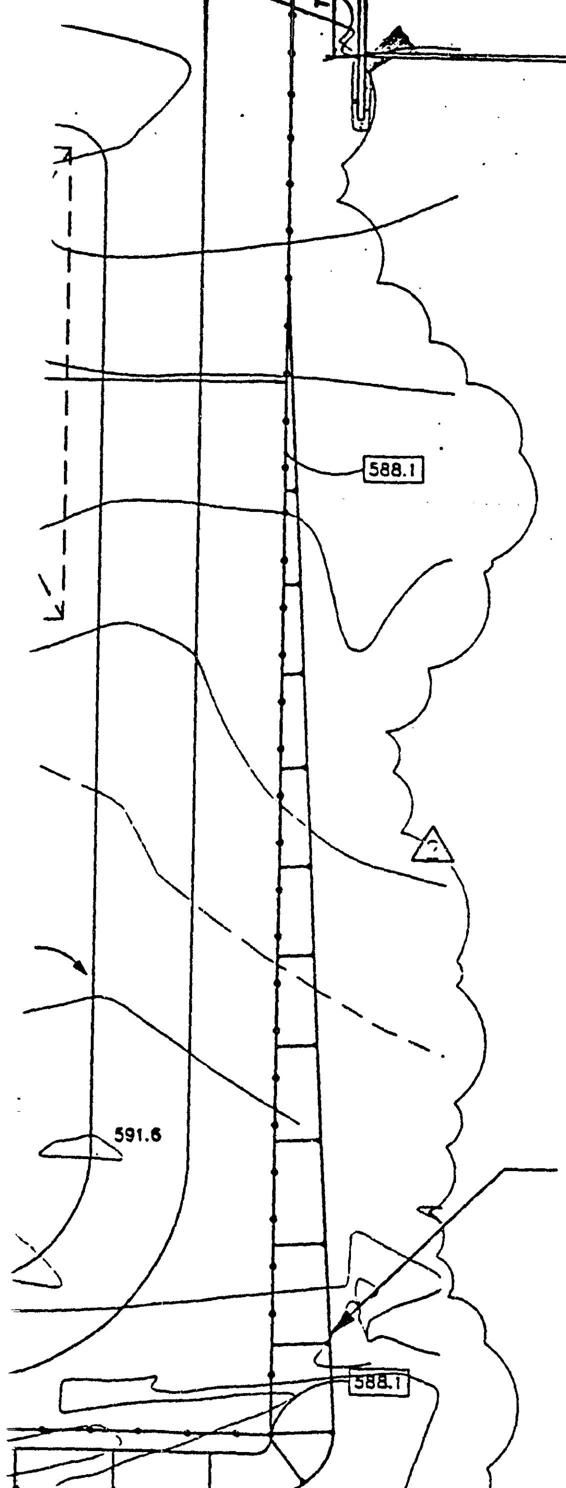


TYPICAL FENCE DETAIL

SCALE 0 1' 2' 4' 8'

NOTES:

1. THREE LINES OF FOUR-POINT BARBED WIRE SHALL BE INSTALLED.
2. BARBED WIRE EXTENSION ARMS SHALL BE SLANTED OUTWARD 45° FROM VERTICAL.
3. CHAIN-LINK FENCE SPECIFICATION 02831.
4. FOR TILT-UP PANEL INFORMATION AT VERIFICATION TANKS, SEE DRAWINGS H-2-89070, SECTION 1/89070
5. CONTOUR LINES REPRESENT APPROXIMATE EXISTING GRADE.
6. BOXED ELEVATIONS REPESENT FINISHED ELEVATION AT TOP OF CONCRETE, ASPHALT, OR STABILIZATION MATERIAL AS APPROPRIATE.



EXPIRES: 4/10/93

REV	DATE	DESCRIPTION	DRAWN	CHK'D	APP'D
2	03/23/93	REGRADED FINISH GRADE	CHR	ECH	
1	1/21/93	ISSUED FO CONSTRUCTION	MHM	ECH	EFH
0	10/20/92	ISSUED FOR 100% DESIGN REVIEW	MHM	ECH	EFH
A	9/30/92	ISSUED FOR INTERNAL REVIEW	MHM	IWO	ECH

REVISIONS

CADFILE 8E89039A | CADCODE 28:18V:ACDX:11:55

NUMBER	TITLE
REFERENCES	

TITLE | TRACEABILITY LIST | NEXT USED ON

IMPACT LEVEL 3

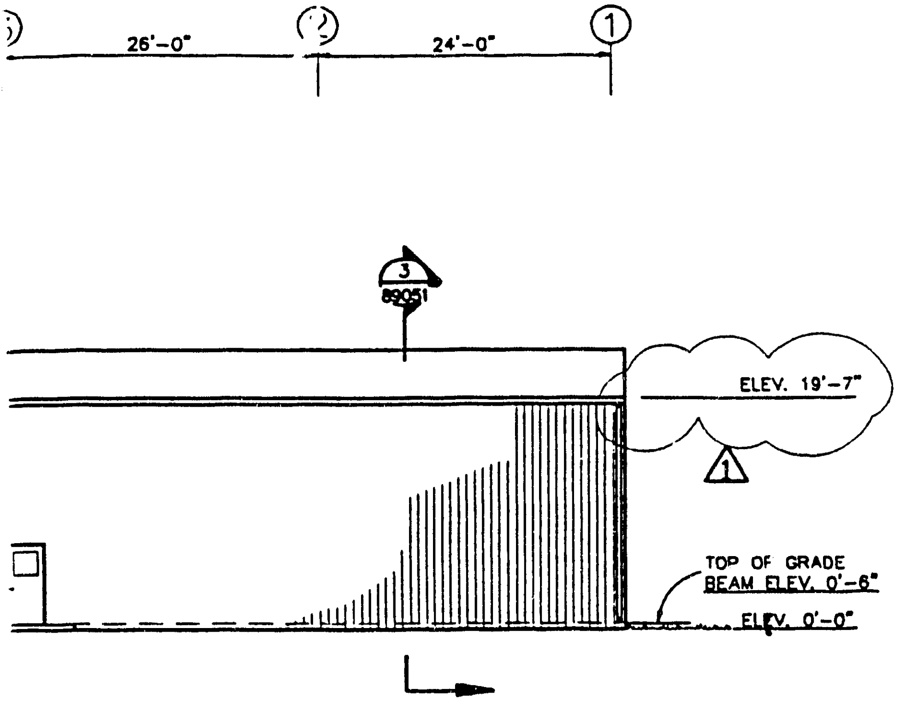
U.S. DEPARTMENT OF ENERGY
DOE FIELD OFFICE, RICHLAND
JGC CORPORATION

SITE PLAN FINISH GRADE

PROJECT C-018H, 242-A EVAPORATOR/PUREX PLANT PROCESS COND. TREATMENT FACILITY

SIZE	BLDG NO	INDEX NO	DWG NO	REV
F	2025E		H-2-89039	2

SCALE AS NOTED | 0-1312-004 | SHEET 1 OF 1



NOTE:

1. SEE ARCHITECTURAL DRAWINGS H-2-89047 AND 89048

REV	DATE	DESCRIPTION	ORIGIN	CHECKED	APP'D
1		ISSUED FOR CONSTRUCTION	MHM	ECH	
0		ISSUED FOR 100% DESIGN REVIEW	MHM	ECH	EFH
A		ISSUED FOR INTERNAL REVIEW	MAC	RIO	ECH

REVISIONS

NUMBER	TITLE

REFERENCES

NEXT USED ON

CADFILE

CADCODE

EXPIRES 4/10/97

3

U.S. DEPARTMENT OF ENERGY
DOE FIELD OFFICE, RICHLAND
JGC CORPORATION

ARCHITECTURAL NORTH AND SOUTH ELEVATIONS

SIZE	BLDG NO	INDEX NO	DWG NO	REV
F	2025E		H-2-89049	1

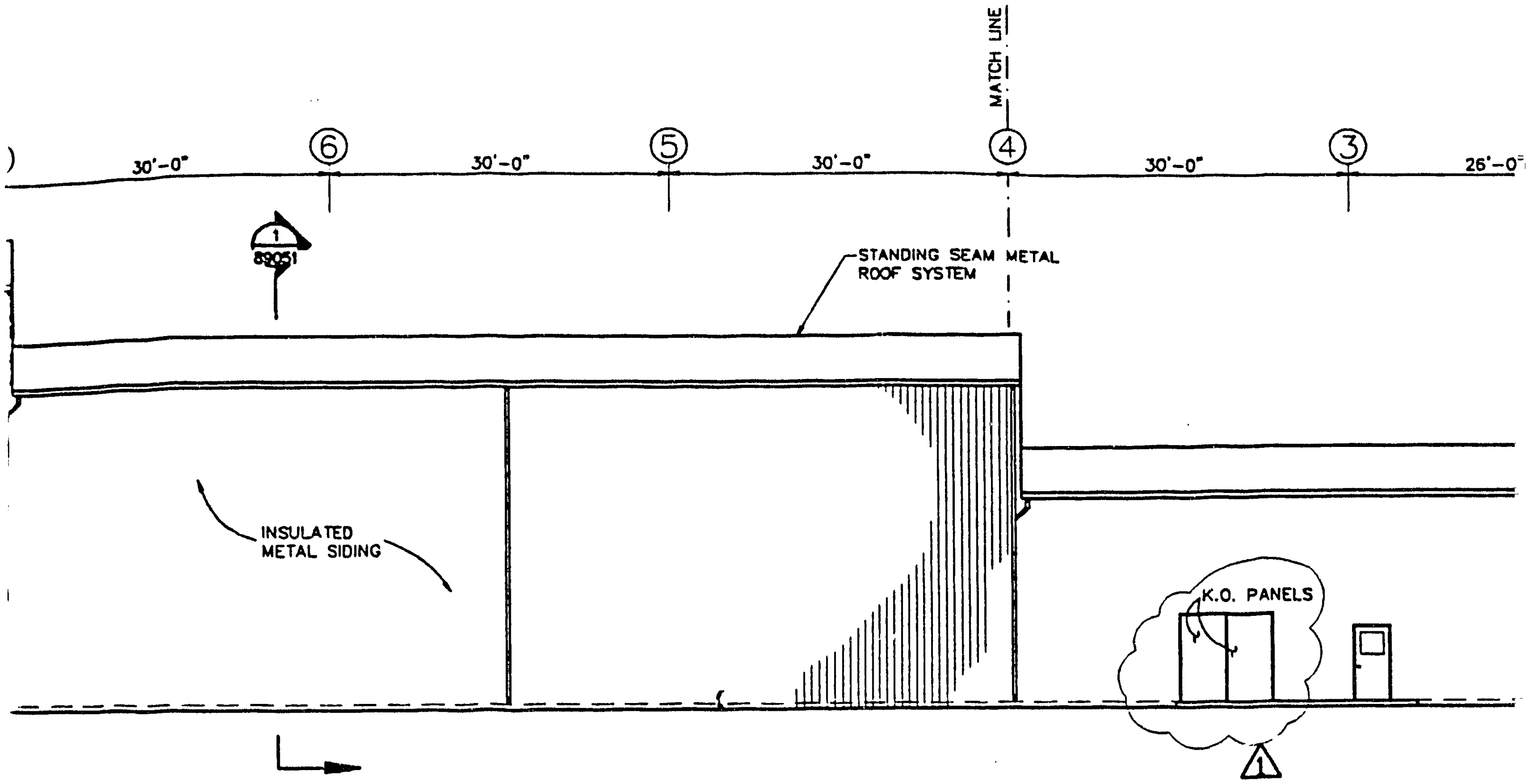
SCALE 1/8"=1'-0" D-1302-003 SHEET 1 OF 1

3 2 1

D C A

19930221 • CHUCK R. • 89049

SOUTH ELEVATION
LOOKING NORTH

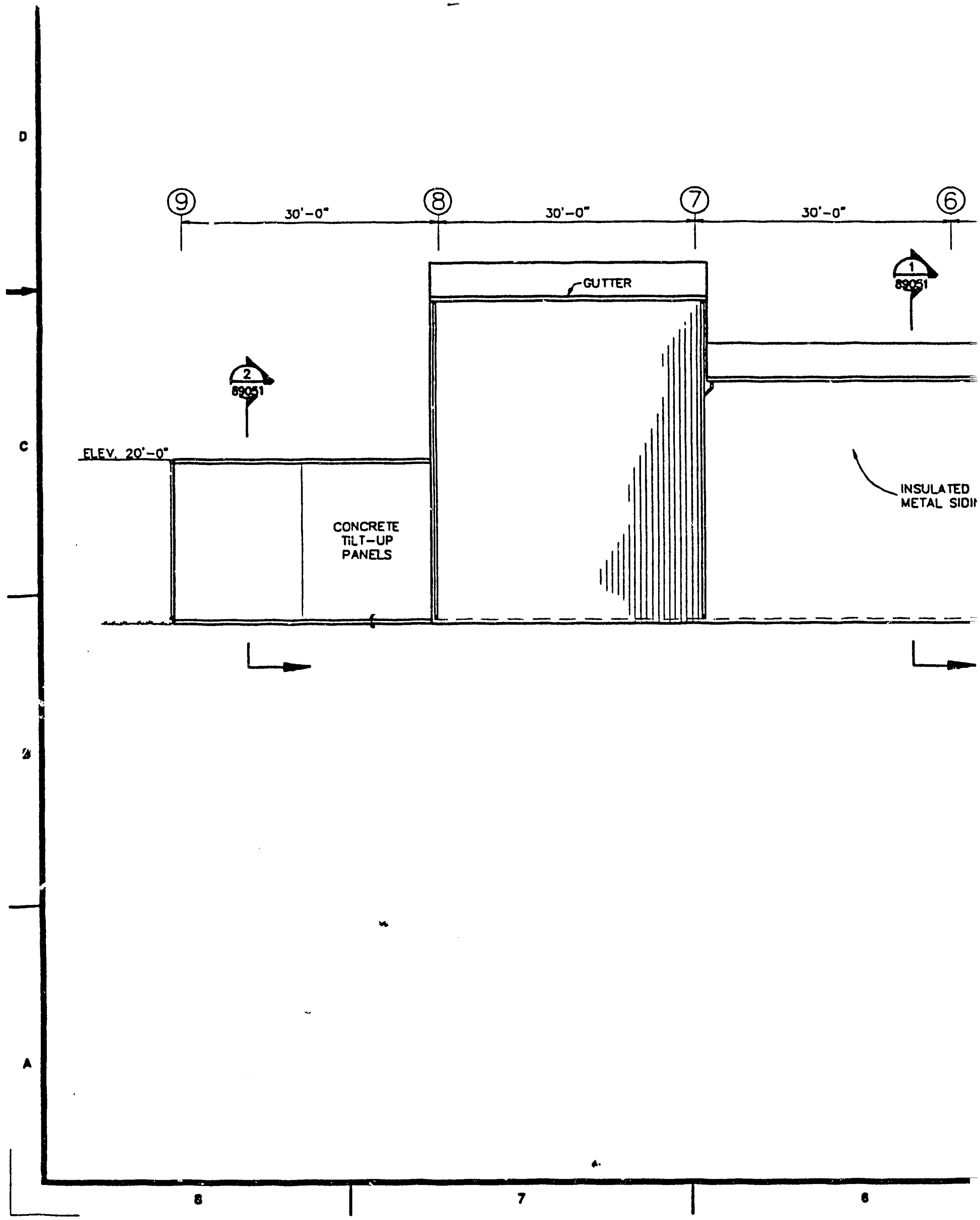


NORTH ELEVATION
LOOKING SOUTH

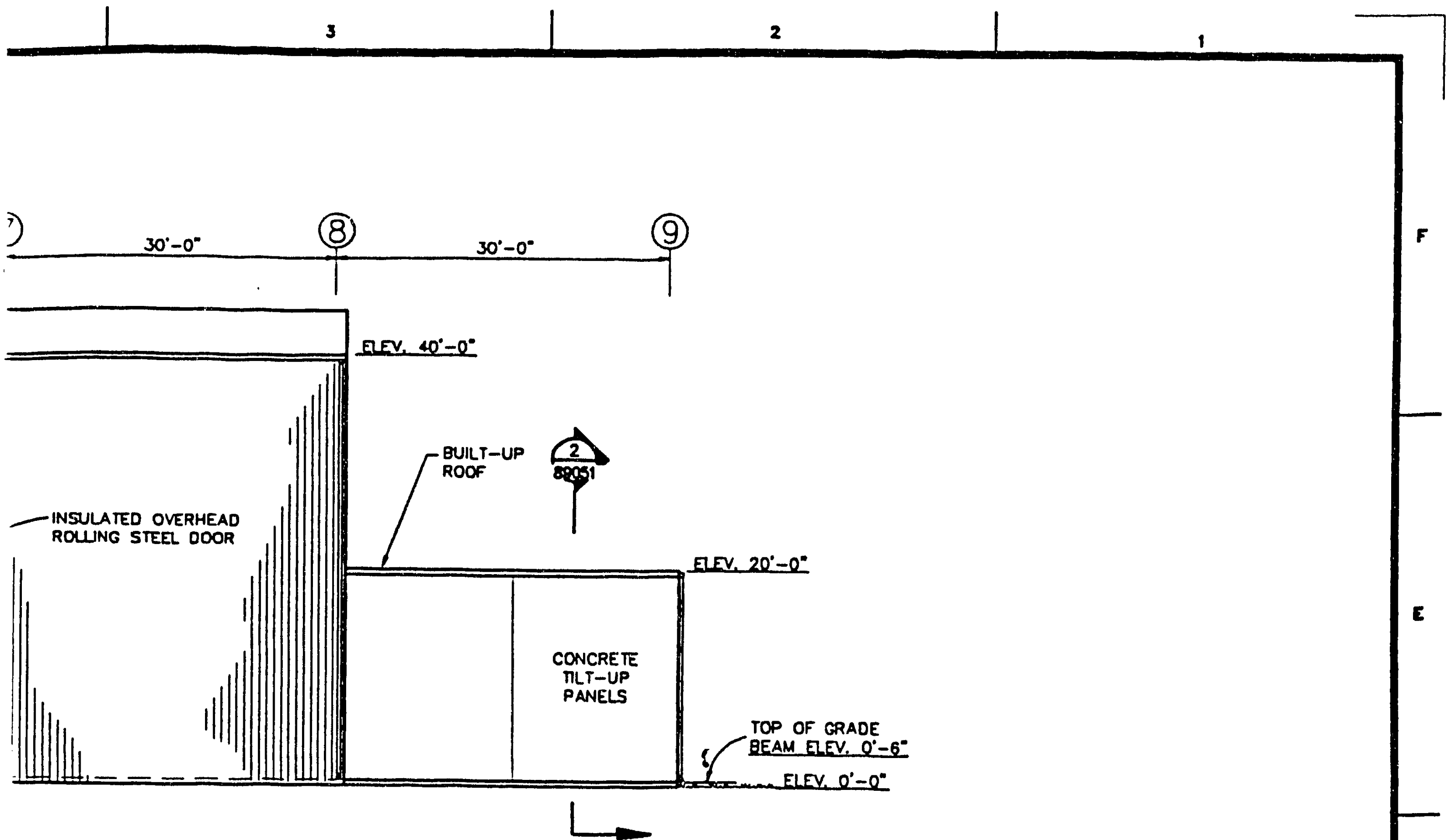
SCALE 0 4' 8' 16' 24'

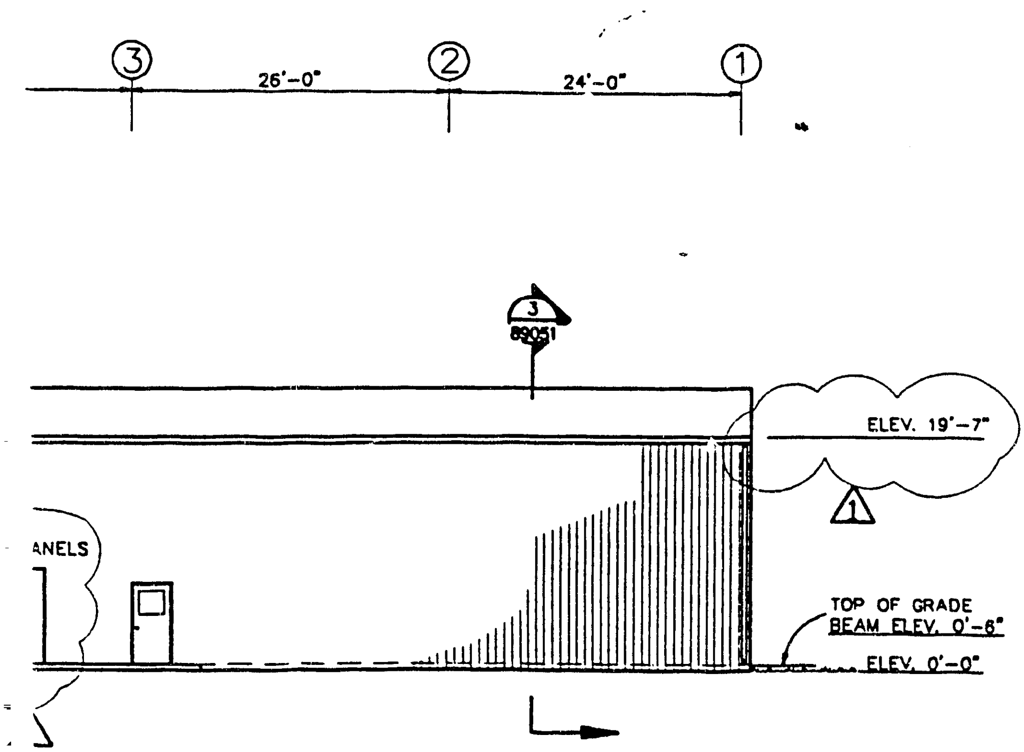
		NUM
NUMBER	TITLE	
DRAWING TRACEABILITY LIST		NEXT U

6 5 4



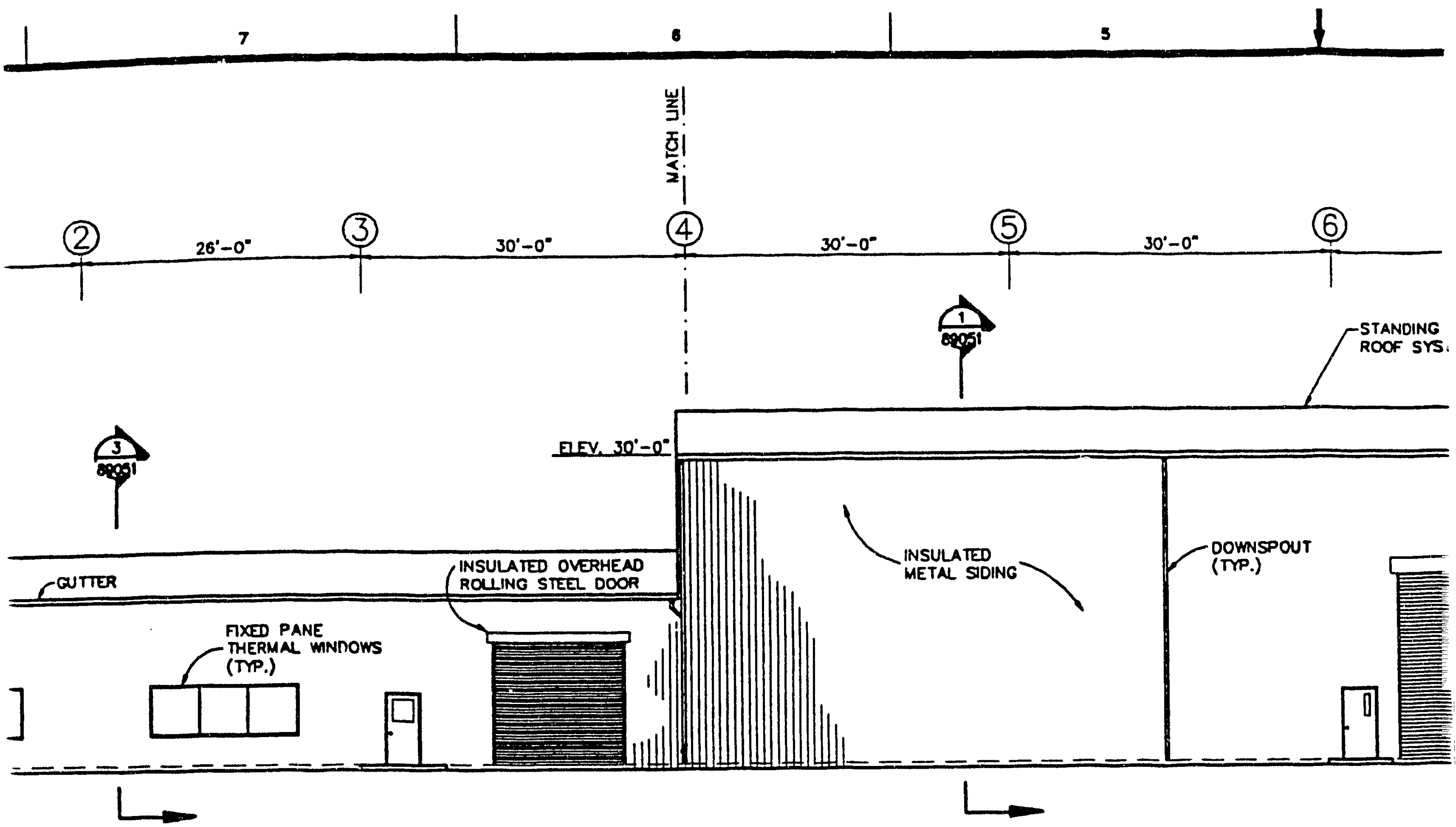
D
C
A
9
8
7
6
30'-0"
30'-0"
30'-0"
GUTTER
1
89051
2
89051
ELEV. 20'-0"
CONCRETE TILT-UP PANELS
INSULATED METAL SIDI
8
7
6



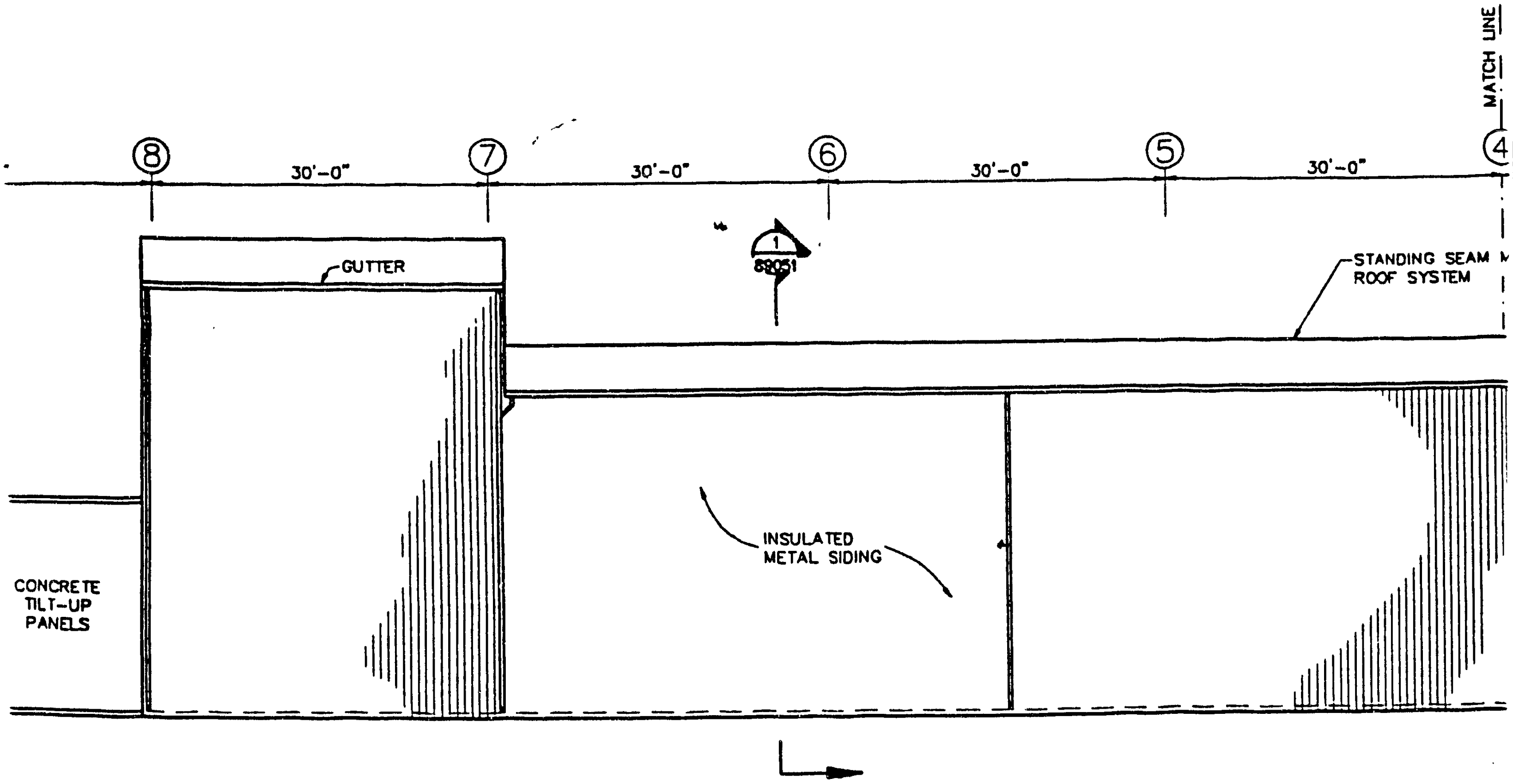


NOTE:

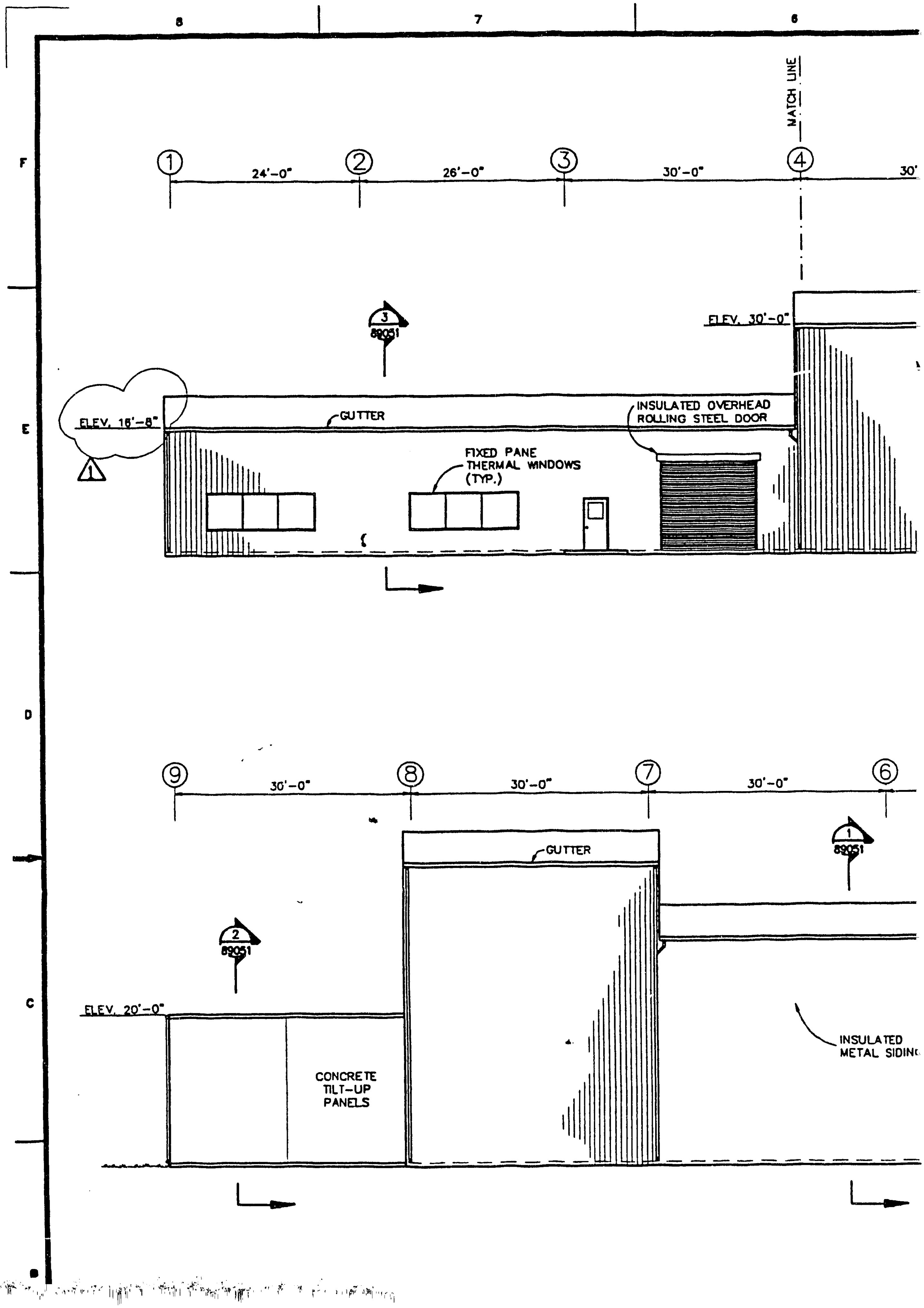
1. SEE ARCHITECTURAL DRAWINGS H-2-89047 AND 89048



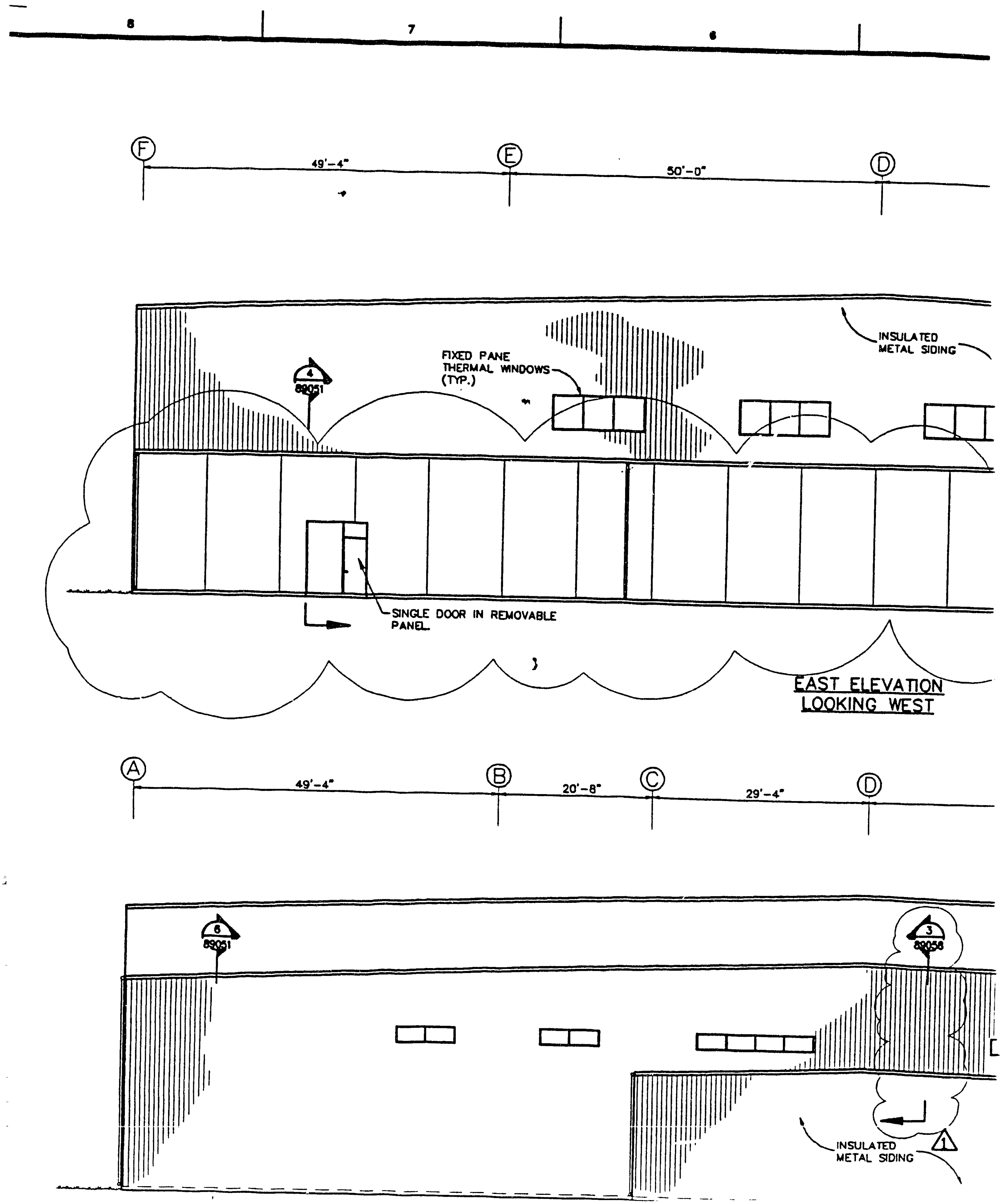
SOUTH ELEVATION
LOOKING NORTH



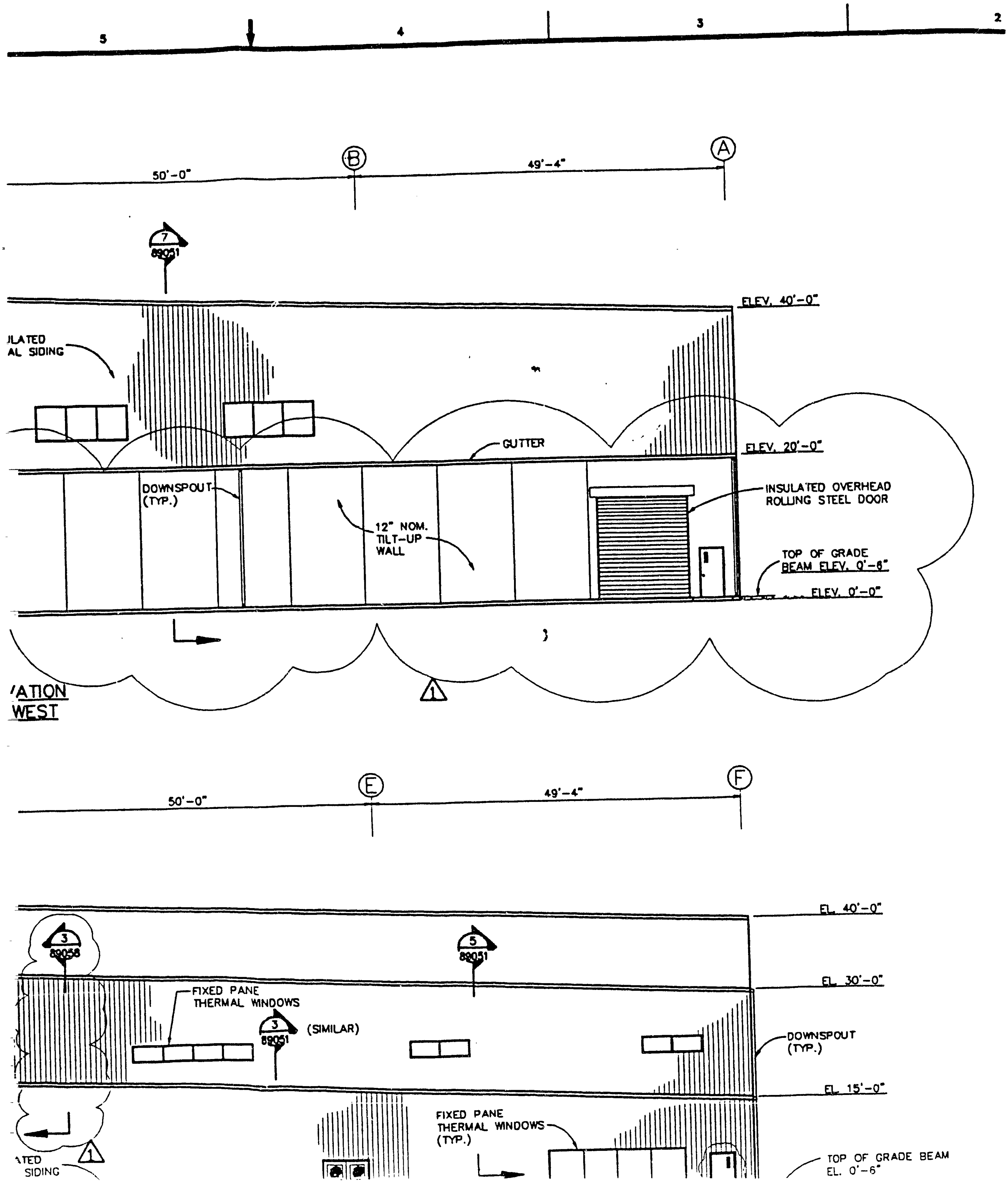
NORTH ELEVATION
LOOKING SOUTH



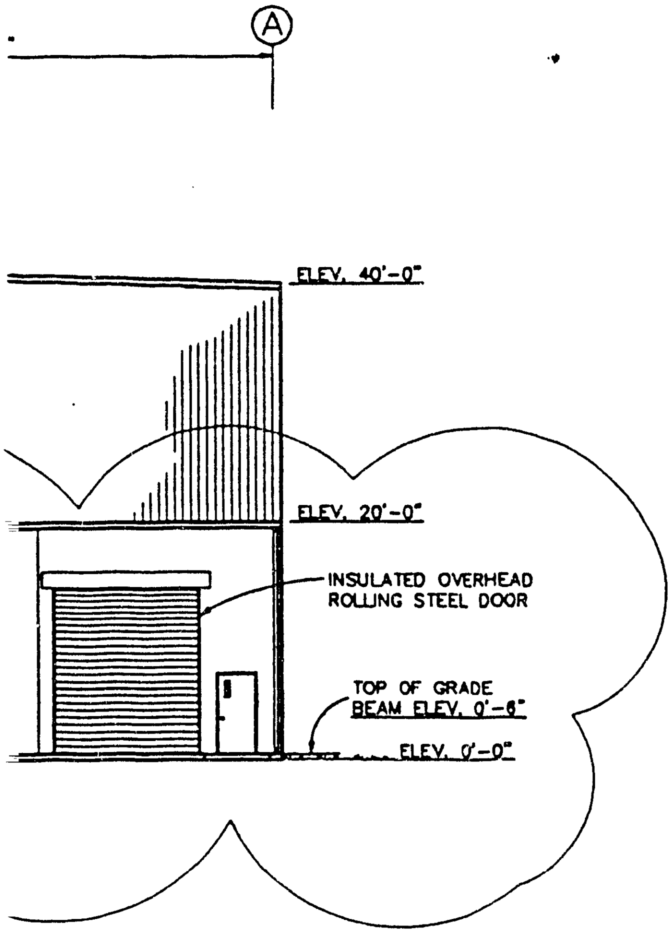
8
7
6
F
E
D
C
MATCH LINE
1
24'-0"
2
26'-0"
3
30'-0"
4
30'
3
89051
ELEV. 30'-0"
ELEV. 16'-8"
GUTTER
INSULATED OVERHEAD ROLLING STEEL DOOR
FIXED PANE THERMAL WINDOWS (TYP.)
1
9
30'-0"
8
30'-0"
7
30'-0"
6
1
89051
GUTTER
2
89051
ELEV. 20'-0"
CONCRETE TILT-UP PANELS
INSULATED METAL SIDIN

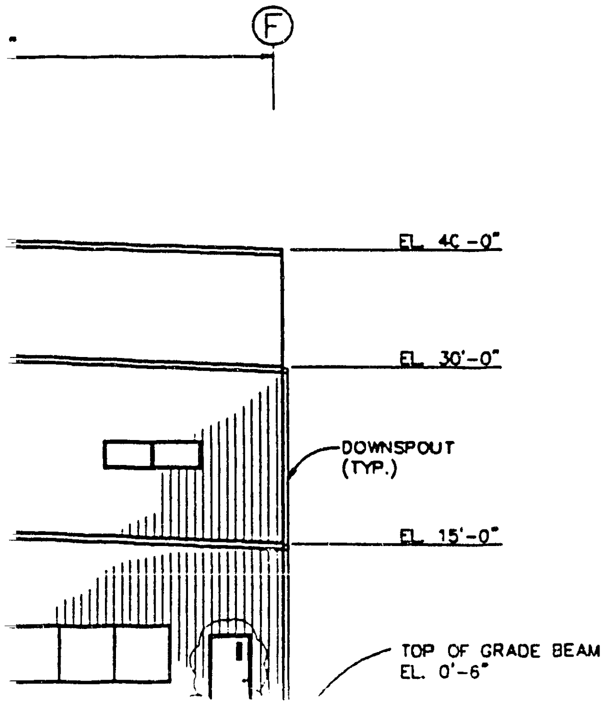


8
7
6
F
49'-4"
E
50'-0"
D
4
89051
FIXED PANE
THERMAL WINDOWS
(TYP.)
INSULATED
METAL SIDING
SINGLE DOOR IN REMOVABLE
PANEL.
EAST ELEVATION
LOOKING WEST
A
49'-4"
B
20'-8"
C
29'-4"
D
6
89051
3
89058
INSULATED
METAL SIDING
1



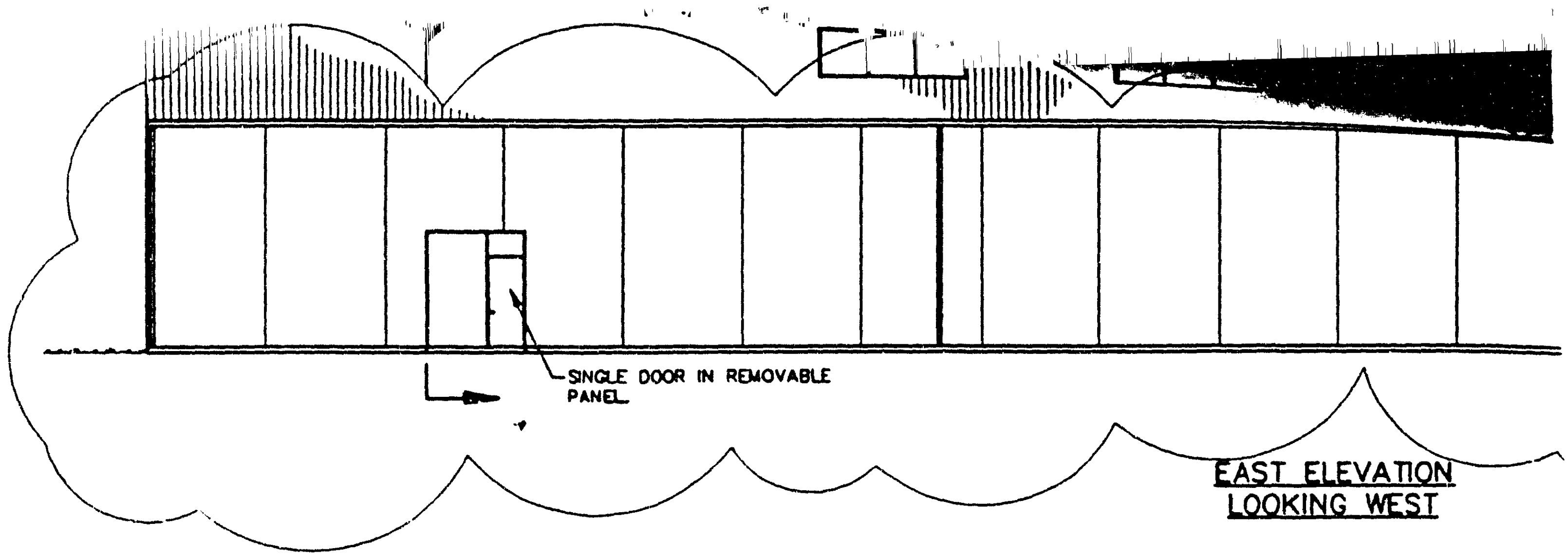
5
4
3
2
B
A
50'-0"
49'-4"
7
89051
ELEV. 40'-0"
ULATED
AL SIDING
GUTTER
ELEV. 20'-0"
DOWNSPOUT
(TYP.)
INSULATED OVERHEAD
ROLLING STEEL DOOR
12" NOM.
TILT-UP
WALL
TOP OF GRADE
BEAM ELEV. 0'-6"
ELEV. 0'-0"
1
'ATION
WEST
E
F
50'-0"
49'-4"
EL. 40'-0"
3
89058
5
89051
EL. 30'-0"
FIXED PANE
THERMAL WINDOWS
3
89051
(SIMILAR)
DOWNSPOUT
(TYP.)
EL. 15'-0"
FIXED PANE
THERMAL WINDOWS
(TYP.)
1
ATED
SIDING
TOP OF GRADE BEAM
EL. 0'-6"



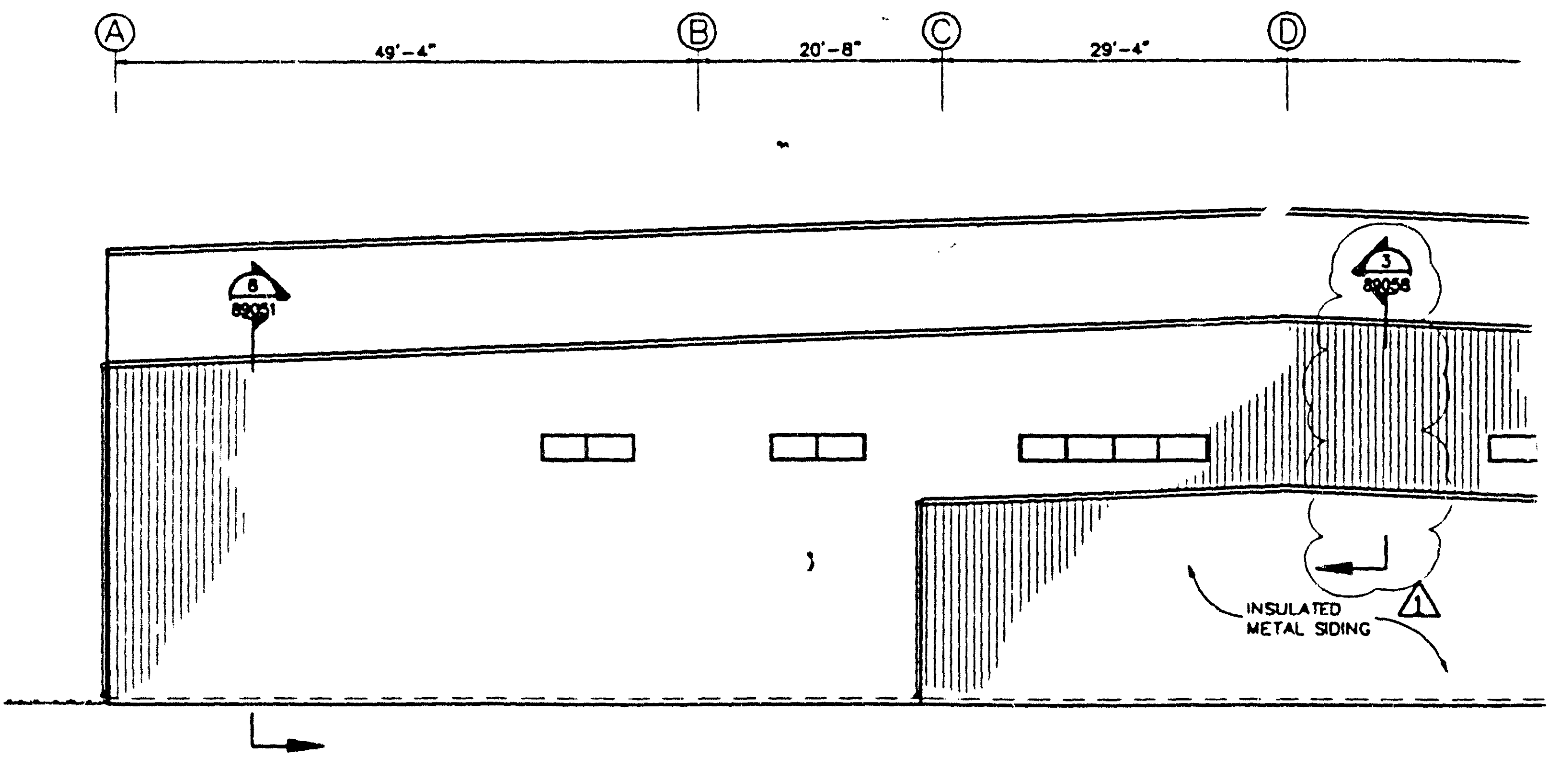


NOTES:

1. SEE DRAWINGS H-2-89047 AND H-2-89048
2. GENERAL ARRANGEMENT DRAWINGS. SEE H-2-89029 AND H-2-89030.

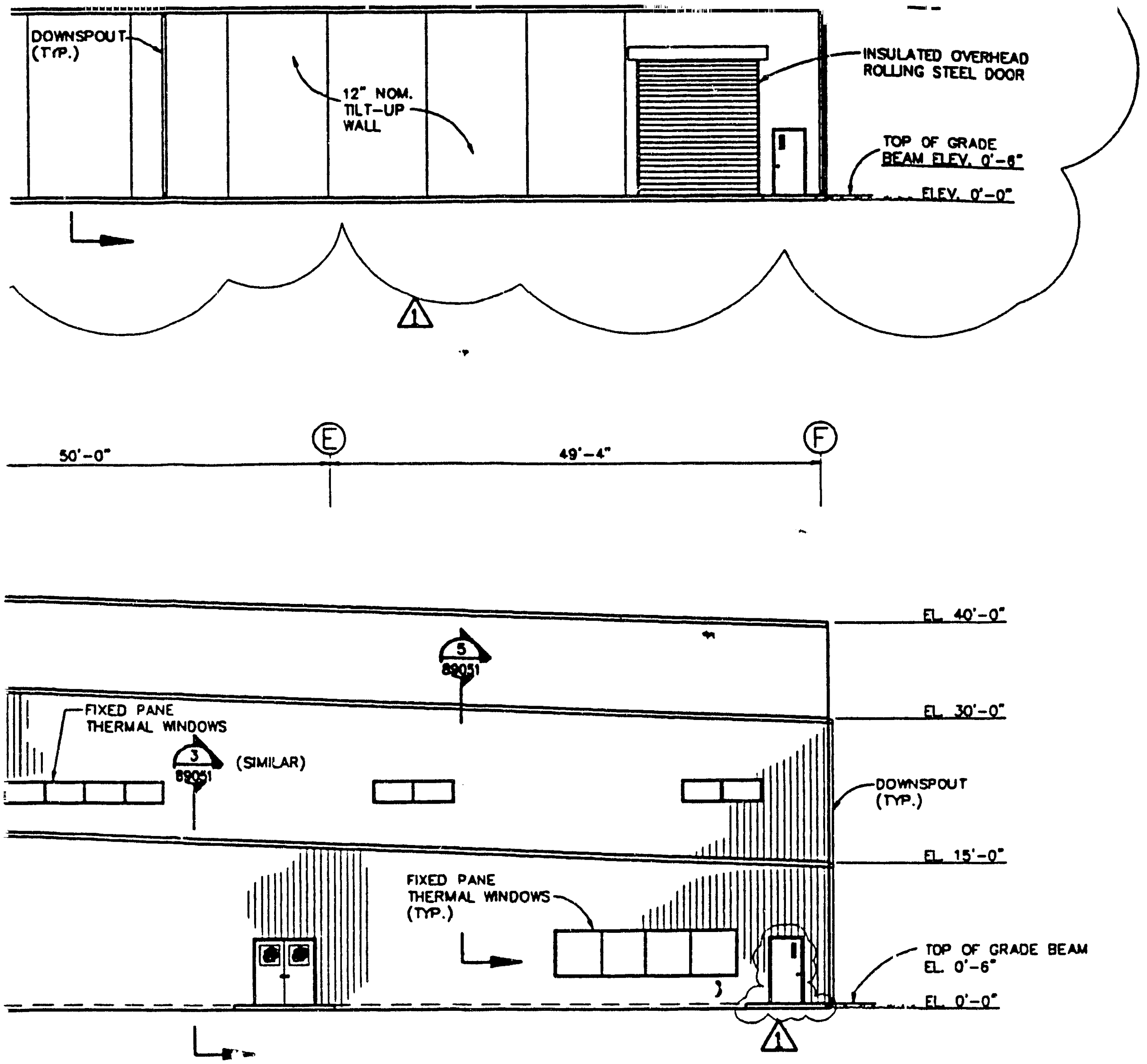


EAST ELEVATION
LOOKING WEST



WEST ELEVATION
LOOKING EAST

8 7 6 5



		NUMBER	TITLE
NUMBER	TITLE	REFERENCES	
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REV	DATE	DESCRIPTION			
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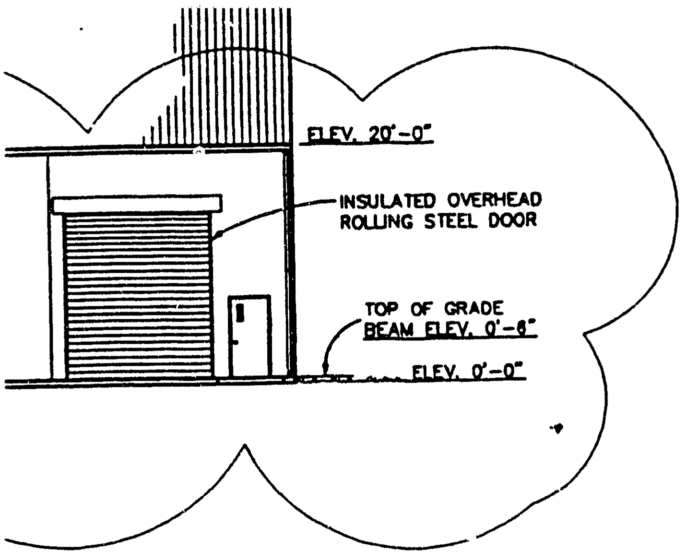
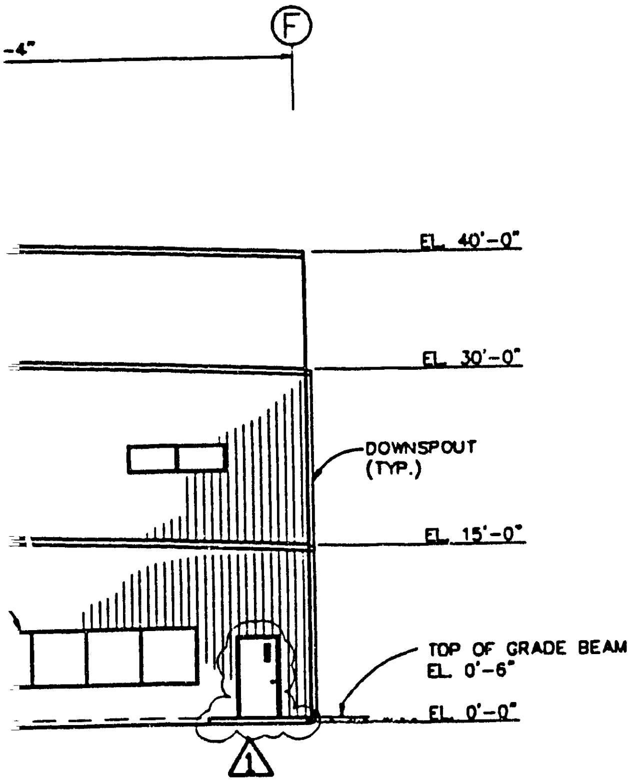
0	[illegible]	ISSUED FOR [illegible]00% DESIGN REVIEW	MHM	ECH	EFH
B	[illegible]	ISSUED FOR INTERNAL REVIEW	MHM	RIO	ECH
A	[illegible]	ISSUED FOR INTERNAL REVIEW	MAC	RIO	ECH
REVISIONS					
CADFILE [illegible]		CADCODE [illegible]			

4 3 2





NOTES:

1. SEE DRAWINGS H-2-89047 AND H-2-89048
2. GENERAL ARRANGEMENT DRAWINGS. SEE H-2-89029 AND H-2-89030.

1		ISSUED FOR CONSTRUCTION	MHM	ECH	
0		ISSUED FOR 60% DESIGN REVIEW	MHM	ECH	EFH
B		ISSUED FOR INTERNAL REVIEW	MHM	RWO	ECH
A		ISSUED FOR INTERNAL REVIEW	MAC	RWO	ECH

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U.S. DEPARTMENT OF ENERGY
DOE FIELD OFFICE, RICHLAND
JGC CORPORATION

ARCHITECTURAL
EAST AND WEST ELEVATIONS

F | 2025E | H-2-89050 | 1

SCALE 1/8"=1'-0" | D-13G2-004 | SHEET 1 OF 1

EXPIRES 4/6/93

3/18/93

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ATTACHMENT E

REFERENCES

ATTACHMENT E

REFERENCES

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