GEOLOGY OF THE 241-SX TANK FARM

by

W. H. Price
K. R. Fecht

Environmental Engineering Section
Research Department
Research and Engineering Division

April 1976

ATLANTIC RICHFIELD HANFORD COMPANY
RICHLAND, WASHINGTON 99352

—NOTICE—
This report was prepared as an account of work sponsored by the United States Government. Neither the United States nor the United States Department of Energy, nor any of their employees, nor any of their contractors, subcontractors, or their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness or usefulness of any information, apparatus, product or process disclosed, or represents that its use would not infringe privately owned rights.

DISCLAIMER

This report was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor any agency Thereof, nor any of their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof.

DISCLAIMER

Portions of this document may be illegible in electronic image products. Images are produced from the best available original document.

TABLE OF CONTENTS

	<u>Page</u>
INTRODUCTION.	1
PROCEDURES	3
GENERALIZED GEOLOGY	3
COLUMBIA RIVER BASALT GROUP	6
RINGOLD FORMATION	6
Middle Ringold.	7
Upper Ringold	8
EOLIAN SILT DEPOSIT.	8
GLACIOFLUVIAL DEPOSITS.	9
CLASTIC DIKES.	10
BACKFILL MATERIAL	10
WATER TABLE	10
GLOSSARY	11
SELECTED REFERENCES	13

LIST OF TABLES

<u>Table</u>		<u>Page</u>
I	TANK FARM GEOLOGY DOCUMENTS AVAILABLE AS OF APRIL, 1976	1
II	241-SX TANK FARM GEOLOGY MAPS.	2
III	TYPICAL GRAIN SIZE AND CALCIUM CARBONATE VALUES FOR MAJOR MIDDLE RINGOLD LITHOLOGIES BENEATH 241-SX TANK FARM	7
IV	TYPICAL GRAIN SIZE AND CALCIUM CARBONATE VALUES FOR UPPER RINGOLD LITHOLOGY BENEATH 241-SX TANK FARM	8
V	TYPICAL GRAIN SIZE AND CALCIUM CARBONATE VALUES FOR 241-SX TANK FARM EOLIAN SILT	8
VI	TYPICAL GRAIN SIZE AND CALCIUM CARBONATE VALUES FOR MAJOR GLACIOFLUVIAL LITHOLOGIES BENEATH 241-SX TANK FARM.	9
VII	TYPICAL GRAIN SIZE AND CALCIUM CARBONATE VALUES FOR THE 241-SX TANK FARM BACKFILL.	10

LIST OF FIGURES

<u>Figure</u>		<u>Page</u>
1	STEPS OUTLINING THE PREPARATION OF TANK FARM GEOLOGY MAPS.	4
2	GENERALIZED STRATIGRAPHIC COLUMN FOR THE 200 AREA TANK FARMS	5

GEOLOGY OF THE 241-SX TANK FARM

INTRODUCTION

A series of maps have been compiled to document the structure and stratigraphy of the sediments underlying the high-level radioactive waste storage tank farms located within the Energy Research and Development Administration Hanford Reservation. The primary purpose of these maps is to provide basic geologic information to be utilized to evaluate the impact of suspected and confirmed tank leaks. For convenience of usage map sets for each tank farm have been published in separate document packets (see Table I). The contents of this packet (see Table II) contain maps compiled only for the 241-SX Tank Farm.

TABLE I

TANK FARM GEOLOGY DOCUMENTS AVAILABLE
AS OF APRIL, 1976*

<u>Title</u>	<u>Document Number</u>
Geology of the 241-A Tank Farm	ARH-LD-127
Geology of the 241-AX Tank Farm	ARH-LD-128
Geology of the 241-B Tank Farm	ARH-LD-129
Geology of the 241-BX Tank Farm	ARH-LD-130
Geology of the 241-BY Tank Farm	ARH-LD-131
Geology of the 241-C Tank Farm	ARH-LD-132
Geology of the 241-S Tank Farm	ARH-LD-133
Geology of the 241-SX Tank Farm	ARH-LD-134
Geology of the 241-T Tank Farm	ARH-LD-135
Geology of the 241-TX Tank Farm	ARH-LD-136
Geology of the 241-TY Tank Farm	ARH-LD-137
Geology of the 241-U Tank Farm	ARH-LD-138
Generalized Geology of the 241-SY Tank Farm	ARH-LD-139

*Additional documents will be completed as new tank farms are built and well monitoring networks installed.

TABLE II

241-SX TANK FARM GEOLOGY MAPS

<u>Title</u>	<u>Drawing Number</u>
241-SX Tank Farm Geologic Map Legend and Plot Plan	H-2-38985
241-SX Tank Farm Geologic Characterization Cross Section A-A'	H-2-38923
241-SX Tank Farm Geologic Characterization Cross Section B-B'	H-2-38924
241-SX Tank Farm Geologic Characterization Cross Section C-C'	H-2-38925
241-SX Tank Farm Geologic Characterization Cross Section D-D'	H-2-38926
241-SX Tank Farm Geologic Characterization Cross Section E-E'	H-2-38927
241-SX Tank Farm Geologic Characterization Cross Section F-F'	H-2-38928
241-SX Tank Farm Geologic Characterization Cross Section G-G'	H-2-38929
241-SX Tank Farm Geologic Characterization Cross Section H-H'	H-2-38930
241-SX Tank Farm Geologic Characterization Cross Section I-I'	H-2-38931
241-SX Tank Farm Geologic Characterization Cross Section J-J'	H-2-38932
241-SX Tank Farm Geologic Characterization Base of Backfill	H-2-38920
241-SX Tank Farm Geologic Characterization Paleotopography of Silt Horizon	H-2-38921
241-SX Tank Farm Geologic Characterization Paleotopography of Silty Medium to Very Fine Sand Horizon	H-2-38922

PROCEDURES

During the drilling of 47 dry wells and 6 water wells in and around the 241-SX Tank Farm, sediment samples were collected from one to 5-foot depth intervals. Information utilized to prepare this series of maps was obtained by the analysis of these samples, numbering approximately 1200.

Each sediment sample was quantitatively analyzed according to grain size and CaCO_3 content. Size analysis was carried out utilizing a nest of 9 sieves selected for coincidence with the Wentworth (1922) grain size nomenclature (see H-2-38985). The CaCO_3 content of each sample was determined utilizing a semiquantitative CO_2 displacement method (Horwitz, 1970). Size and CaCO_3 data was input into the Rocksran Computer Program (Parr, 1974) which categorized each sediment sample into 1 of 19 classes (classification scheme modified after Folk, 1968; see H-2-38985). After analysis, each sample was visually examined to aid in further characterization. Each sample was subsequently stored in the Hanford Well Library for future reference.

For convenience of usage, the geologic maps were prepared at the same scale (1" = 16') as drawing H-2-36944 (Wells in 241-SX Tank Farm As-built). Steps outlining the preparation of the maps are listed in Figure 1.

GENERALIZED GEOLOGY

Included within this section is a brief discussion of the geology underlying the 241-SX Tank Farm. The stratigraphic descriptions included, along with the Glossary (see page 11), are designed only to provide sufficient information to permit a general understanding of the Tank Farm maps presented. For a more detailed discussion of the regional geologic setting of the 241-SX Tank Farm, the reader is referred to articles listed in the Selected References (see page 13).

The 241-SX Tank Farm is underlain by four major stratigraphic units (see Figure 2); (1) basalt of the Columbia River Group which forms the bedrock beneath the area; (2) semiconsolidated sediments of the Ringold Formation

FIGURE 1

STEPS OUTLINING THE PREPARATION
OF TANK FARM GEOLOGY MAPS

ERA	PERIOD	EPOCH	YEARS B. P.	STRATIGRAPHIC NAME AND/OR UNIT		LITHOLOGY DESCRIPTION	
CENOZOIC	QUATERNARY	MODERN	30	BACKFILL		VERY POORLY SORTED GRAVEL, SAND & SILT	
		PLEISTOCENE		GLACIOFLUVIAL SEDIMENTS		FAIRLY WELL SORTED FLUVIAL SAND & SILT WITH SOME GRAVEL	
				EOLIAN SILT		FINE SAND & SILT DERIVED FROM THE UPPER RINGOLD	
	TERTIARY	PLIOCENE	1,000,000	RINGOLD FORMATION	UPPER RINGOLD	WELL SORTED FLUVIAL OR LACUSTRINE SILT & SAND WITH SOME CALCAREOUS LAYERS	
					MIDDLE RINGOLD	FLUVIAL GRAVEL & SAND VARIABLY CEMENTED WITH CALCIUM CARBONATE & SILICA	
		MIOCENE		11,000,000	COLUMBIA RIVER BASALT GROUP	ELEPHANT MOUNTAIN MEMBER	DENSE BLACK EXTRUSIVE IGNEOUS ROCK, MICRO VESICULAR, BRICK BAT ENTABLATURE & NO COLUMNADE
						RATTLESNAKE RIDGE MEMBER	TUFFACEOUS SANDSTONE
						POMONA MEMBER	DENSE BLACK EXTRUSIVE IGNEOUS ROCK. SCATTERED OLIVINE PHENOCRYSTS, UPPER & SOMETIMES BASAL ENTABLATURE WELL DEVELOPED, FAN JOINTING IN COLUMNADE

WHP/KRF 1976

FIGURE 2

GENERALIZED STRATIGRAPHIC COLUMN
THE 200 AREA TANK FARMS

which directly overlie the bedrock; (3) unconsolidated eolian silt; and (4) unconsolidated sand, silt, and gravel, collectively termed glacio-fluvial sediments, which directly overlie the eolian silt. A more detailed description of the character of these units underlying the Tank Farm follows.

COLUMBIA RIVER BASALT GROUP

About 20 million years ago a series of fissures opened around the periphery of the subsiding Pasco Basin and large volumes of basaltic lava poured out over the land surface. The highly fluid lava was extruded intermittently from these fissures until approximately 8 million years ago. At the cessation of Columbia River Basalt volcanism, the basin had been filled with more than 12,000 feet of basalt.

The surface of the Columbia River Basalt lies beneath 241-SX Tank Farm at an elevation of 85 feet (all elevations based on feet above mean sea level measured at approximate center of Tank Farm). On the 241-SX Tank Farm maps, this surface occurs approximately 275 feet below the bottom border of the prepared cross sections.

RINGOLD FORMATION

Following the cessation of Columbia River Basalt volcanism the ancestral Columbia River transported sediments from the surrounding highlands into the Pasco Basin where they accumulated to form the Ringold Formation. Beneath the Hanford Reservation, this formation is up to 1200 feet thick and can generally be divided into three units on the basis of lithology; the clays and silts of the lower Ringold unit; the pebbles and cobbles of the middle Ringold unit; and the silts and fine sands of the upper Ringold unit.

Within the region beneath 241-SX Tank Farm, the lower Ringold unit is missing. The combined thickness of the middle and upper Ringold units present is approximately 428 feet.

Middle Ringold

Beneath the 241-SX Tank Farm, the 418-foot thick middle Ringold unit lies unconformably on the Columbia River Basalt and dips to the southeast about 50 feet per mile. The unit consists predominantly of well-rounded pebbles and cobbles with the interstitial spaces filled with medium to fine sand and silt cemented in places with SiO_2 or CaCO_3 . Table III summarizes the grain size and CaCO_3 values of the middle Ringold sediments.

TABLE III

TYPICAL GRAIN SIZE AND CALCIUM CARBONATE VALUES
FOR MAJOR MIDDLE RINGOLD LITHOLOGIES
BENEATH 241-SX TANK FARM

Lithology	%Pebbles & Cobbles	% Sand					%Silt & Clay	%CaCO ₃
		Very Coarse	Coarse	Medium	Fine	Very Fine		
Sandy Gravel	77	2	3	4	9	5	1	.3
Cemented Calcareous to Siliceous Slightly Silty Sandy Gravel	70	4	6	6	8	5	1	0-12.0
Coarse to Medium Sand	2	11	25	29	15	11	7	1.0
Slightly Cemented Calcareous to Siliceous Slightly Silty Sand Gravel	72	4	5	6	7	5	1	0-12.0
Coarse to Medium Sand	1	9	26	36	15	10	4	1.0
Cemented Calcareous to Siliceous Slightly Silty Sandy Gravel	67	8	7	6	6	5	1	0-12.0

The lower portion of the middle Ringold unit (elevation 85-223 feet) is blue-gray in color suggesting that the sediments have not undergone oxidation and have continuously been below the water table since their deposition. In contrast, sediments of the middle Ringold unit above the 223-foot elevation level have undergone oxidation as evidenced by their gray-brown color and their well developed weathering rinds.

Although the middle Ringold unit consists predominantly of pebbles and cobbles, a few sand units up to 17 feet in thickness occur beneath 200 West Area. Such units represent either lacustrine or fluvial deposits layed down during periods of decreased velocity of the ancestral Columbia River. Two such units are found beneath the 241-SX Tank Farm at elevations of 378 feet and 398 feet.

Upper Ringold

The upper Ringold unit, which overlies the middle Ringold unit, occurs between elevations 503 and 513 feet. The unit consists predominately of coarse to medium sand and silt. These sediments, like the sand units of the middle Ringold, are representative of a period of decreased velocity of the ancestral Columbia River or temporary ponding. Table IV summarizes the grain size and CaCO_3 values of the upper Ringold unit.

TABLE IV

TYPICAL GRAIN SIZE AND CALCIUM CARBONATE VALUES FOR
UPPER RINGOLD LITHOLOGY BENEATH 241-SX TANK FARM

Lithology	%Pebbles & Cobbles	% Sand					%Silt & Clay	%CaCO ₃
		Very Coarse	Coarse	Medium	Fine	Very Fine		
Slightly Silty Coarse to Medium Sand	1	10	21	22	15	11	20	1.2

EOLIAN SILT DEPOSIT

After deposition of the upper Ringold, the top of the unit was subjected to subaerial erosion. The surface of the unit was altered by wind which winnowed, reworked, and redeposited the sands and silts. These winddeposited sediments, termed Early Palouse soil or eolian silt, occur beneath the 241-SX Tank Farm between elevations 513 and 534 feet. Table V summarizes the grain size and CaCO_3 content of the eolian silt.

TABLE V

TYPICAL GRAIN SIZE AND CALCIUM CARBONATE VALUES
FOR 241-SX TANK FARM EOLIAN SILT

Lithology	%Pebbles & Cobbles	% Sand					%Silt & Clay	%CaCO ₃
		Very Coarse	Coarse	Medium	Fine	Very Fine		
Silty Very Fine Sand to Sandy Silt	0	0	1	9	20	34	36	2.0

GLACIOFLUVIAL DEPOSITS

During the close of the Ice Age, approximately 20,000 years ago, a continental ice sheet covered much of northern Washington. As the ice sheet retreated northward, the breakup of ice dams resulted in catastrophic floods in which large volumes of glacial meltwater were released. During one of these floods, over 500 cubic miles of water is estimated to have poured into the Pasco Basin at a rate of more than 9 cubic miles of water per hour. Sediments deposited within the basin by such flooding now comprise the glaciofluvial unit. The characteristic variability of sediment size and degree of sorting within this unit can be attributed to changes in water velocity and water level which occurred during the flooding process.

Glaciofluvial deposits are found beneath the 241-SX Tank Farm between elevations 534 and 609 feet. The 75-foot thick section of these deposits consists predominantly of coarse to medium sand with some pebbles and medium to very fine sand with some silt. Table VI summarizes the grain size and CaCO_3 values of the glaciofluvial sediments.

TABLE VI

TYPICAL GRAIN SIZE AND CALCIUM CARBONATE VALUES
FOR MAJOR GLACIOFLUVIAL LITHOLOGIES
BENEATH 241-SX TANK FARM

Lithology	% Pebbles & Cobbles	% Sand					% Silt & Clay	% CaCO_3
		Very Coarse	Coarse	Medium	Fine	Very Fine		
Slightly Silty Medium to Very Fine Sand to Medium to Fine Sand	0	3	11	21	25	21	19	1.6
Pebbly Very Coarse to Coarse Sand to Sandy Medium to Very Fine Pebble	25	23	25	11	8	6	2	1.4
Slightly Silty Medium to Very Fine Sand to Medium to Very Fine Sand	1	4	12	20	23	24	16	1.6
Silty Medium to Very Fine Sand	0	0	3	18	25	26	28	2.0

CLASTIC DIKES

Throughout the Pasco Basin, clastic dikes are found cross-cutting the Ringold Formation and glaciofluvial sediments. These dikes, which range from a few inches to several feet in width, are known to exist to depths of more than 100 feet below the ground surface. Generally, the dikes are composed of fine silts to coarse sands. The origin of the clastic dikes is still in refute and will not be discussed here (see Selected References). Identification of clastic dikes by drilling is difficult and although some dikes were detected in the 241-SX Tank Farm, they could not be mapped.

BACKFILL MATERIAL

In preparation for tank construction, glaciofluvial material was excavated at the 241-SX Tank Farm site. This material, consisting predominantly of cobbles, pebbles, and coarse to medium sands to silts, was subsequently used as backfill from the base of the completed tanks (609 feet) to the ground surface (662 feet). An inherent characteristic of the backfill is its poor sorting. Grain size and CaCO_3 values for the backfill are found in Table VII.

TABLE VII

TYPICAL GRAIN SIZE AND CALCIUM CARBONATE VALUES FOR THE 241-SX TANK FARM BACKFILL

Lithology	%Pebbles & Cobbles	% Sand					% Silt & Clay	% CaCO_3
		Very Coarse	Coarse	Medium	Fine	Very Fine		
Slightly Pebbly Sand to Slightly Silty Sand	6	14	23	18	16	15	8	1.6

WATER TABLE

The water table beneath the 241-SX Tank Farm is located within the middle Ringold unit at an elevation of 476 feet, 133 feet below the base of the tanks. For further information concerning contours on the water table beneath 200 West Area the reader is referred to drawings H-2-38397 (200 West Area Water Table Map) and H-2-38877 (200 West Area Depth to Water Map).

GLOSSARY

Basalt. Fine-grained, dark-colored, extrusive igneous rock.

Calcareous. Containing calcium carbonate.

Caliche. Gravel, sand, or silt cemented by calcium carbonate.

Cement. Chemically precipitated material occurring in the interstices between particles of gravel, sand, or silt.

Clastic. A textural term applied to rocks composed of fragmental material derived from pre-existing rocks.

Clastic dike. A tabular body of clastic material transecting the bedding of a sedimentary formation, representing extraneous material that has invaded the containing formation along a crack.

Dip. The angle at which a stratum or any planar feature is inclined from the horizontal.

Eolian. A formation formed by, or deposited from, the wind or currents of air.

Fluvial. Produced by the action of a river or stream.

Formation. The ordinary unit of geologic mapping consisting of a large and persistent stratum of some one kind of rock.

Glaciofluvial. Pertaining to streams flowing from glaciers or to the deposits made by such streams.

Grain. The particles or discrete crystals which comprise a rock or sediment.

Group. A local or provincial subdivision of a series, based on lithologic features and contains two or more formations.

Lacustrine. A formation deposited in a lake environment.

Lava. Fluid rock such as that which issues from a volcano or a fissure in the earth's surface and the same material solidified by cooling.

Lithology. The description of rocks or sediments on the basis of such characteristics as color, minerologic composition and grain size.

Sediment. Descriptive term for gravel, sand, and silt transported from their sources and deposited by air, water, or ice.

Sieve. A utensil having many small perforated openings, used to separate fine particles from coarser ones.

Siliceous. Containing silica.

Silt. Fine grained material between sand and clay in size.

Sorting. The grain size range of the sediments.

Stratigraphy. The part of descriptive geology of an area that pertains to the discrimination, character, thickness, sequence, age and correlation of the sediments and rocks of the area.

Subaerial. Formed, existing, or taking place on the land surface.

Unconformity. A surface of erosion or nondeposition that separates younger strata from older strata.

Water table. The upper surface of a zone of saturation except where that surface is formed by an impermeable body.

Winnowing. Separation of fine particles from coarser ones by wind action.

SELECTED REFERENCES

1. J. A. Alwin, Clastic Dikes of Touchet Beds, Southeastern Washington, Washington State University Masters Thesis (1970).
2. V. R. Baker, Paleohydrology and Sedimentology of Lake Missoula Flooding in Eastern Washington, Geological Society of America Special Paper 144, (1973).
3. J. H. Bretz, Washington's Channeled Scabland, Washington Division of Mines and Geology, Bull. 45, (1959).
4. D. J. Brown, Subsurface Geology of the Hanford Separations Areas, HW-61780 (1959).
5. D. J. Brown, An Eolian Deposit Beneath 200 West Area, HW-67549 (1960).
6. D. J. Brown, and R. E. Brown, Touchet Clastic Dikes in the Ringold Formation, HW-SA-2851 (1962).
7. D. J. Brown, G. T. Lobdell, and G. E. Neff, Hydrology and Engineering Geology of the Columbia Basin, Geological Society of America, Cordilleran Section, 72nd Annual Meeting, Field Guide No. 3 (1976).
8. R. L. Folk, "Petrology of Sedimentary Rocks," University of Texas Press (1968).
9. R. Fryxell, and E. F. Cook, A Field Guide to the Loess Deposits and Channeled Scablands of the Palouse Area, Eastern Washington, Laboratory of Anthropology Report 27, Pullman, Washington (1964).
10. E. H. Gilmour, and D. Stradling, Proceedings of the Second Columbia River Basalt Symposium, EWSC Press, Cheney, Washington (1969).
11. E. Gustafson, A Revised Chronology for Vertebrate Fossil Faunas of Eastern Washington, Geological Society of America, Cordilleran Section, 72nd Annual Meeting (1976).
12. W. Horwitz, Official Methods of Analysis of the Association of Official Analytical Chemists, 11th Edition, Association of Official Analytical Chemists, p. 139, (1970).
13. R. K. Ledgerwood, D. J. Brown, C. W. Meyers, and A. C. Waters, Identification of Yakima Basalt Flows in the Pasco Basin, ARH-27-68 (1973).
14. R. L. Lupton, Clastic Dikes of the Columbia Basin Region, Washington and Idaho, Geological Society of America Bull., V55, 1431-1462 (1944).

15. M. W. McGonia, Deformation of the Ringold Formation, HW-36373 (1955).
16. B. McKee, Cascadia the Geologic Evolution of the Pacific Northwest, McGraw-Hill Book Co. (1972).
17. R. C. Newcomb, J. R. Strand, and F. J. Frank, Geology and Groundwater Characteristics of the Hanford Reservation of the U.S. Atomic Energy Commission, Washington, U.S. Geological Survey Prof. Paper 717 (1972).
18. J. M. Parr, Sieve Analysis Program, Atlantic Richfield Hanford Company, Unpublished.
19. G. D. Webster, V. R. Barber, and C. Gustafson, Channeled Scabland of Southeastern Washington A Road Log Via Spokane - Coulee City - Vantage Washtucna - Lewiston - Pullman, Geological Society of America, Cordilleran Section, 72nd Annual Meeting, Field Guide No. 2 (1976).
20. C. K. Wentworth, A Scale of Grade and Class Terms for Clastic Sediments, Journal of Geology, V. 30, 377-392 (1922).

DISTRIBUTIONEnergy Research and Development
Administration - Richland Operations Office

O.J. Elgert Fed 700
J.A. Fernandez Fed 700
A.G. Lasila Fed 700

Battelle-Northwest

R.L. Brodzinski
J.R. Eliason
V.L. McGhan
S.J. Phillips
J. Raymond
R.W. Wallace

Atlantic Richfield Hanford Company

B.W. Anderson
J. Anderson
H. Babad
G.E. Backman
L.D. Bockstanz
D.G. Bouse
D.J. Brown
L.E. Bruns
G. Burton, Jr.
R.A. Deju
F.R. Dornheim
G.T. Dukelow
P.G. Easley
K.R. Fecht
R.D. Fox
D.G. Harlow
W.M. Harty
O.F. Hill
H.F. Jensen
M.W. Legatski
B.J. McMurray
P.W. Metz
W.H. Price (2)
R.C. Roal
B.J. Saueressig
V.D. Schrag
H.P. Shaw
J.A. Teal
R.E. Van der Cook
R.L. Walser

1- WELL DESIGNATION
WELL NUMBERS PREFIXED BY 299-

PLOT PLAN VIEW

CROSS-SECTION VIEW

2- COORDINATES
BASED ON HANFORD COORDINATE SYSTEM.

3- PLANE OF CROSS-SECTION

PLOT PLAN VIEW

CROSS-SECTION VIEW

4- TANK DESIGNATION
TANKS PREFIXED BY 241-

5- CONTACT BETWEEN LITHOLOGIES

SOLID LINE WHERE ACCURATELY KNOWN
DASHED LINE IF APPROXIMATELY KNOWN
QUERIED DASHED LINE WHERE INFERRED
BASE OF BACKFILL

6- LENSES OR STRINGERS

DISCONTINUOUS SEDIMENTS LESS THAN TWO FEET THICK
DISCONTINUOUS SEDIMENTS GREATER THAN TWO FEET THICK

7- WATER TABLE

CROSS-SECTION VIEW
DATUM - MEAN SEA LEVEL

8- HORIZONTAL AND VERTICAL SCALES

VERTICAL EXAGGERATION - 1X
VERTICAL SCALE - FEET ABOVE MEAN SEA LEVEL

9- SEDIMENT DESCRIPTION

SEDIMENTS BENEATH THE TANK FARMS ARE CLASSIFIED ON THE BASIS OF ONE OF NINETEEN SEDIMENT TYPES (SEDIMENT CLASSIFICATION). FURTHER DETAIL IS GIVEN USING MODIFIERS FROM THE GRAIN SIZE NOMENCLATURE. SEDIMENTS WITH CHEMICALLY PRECIPITATED MATERIALS OCCURRING IN THE INTERSTICES BETWEEN GRAINS ARE PREFIXED BY THE TERM CEMENTED. SEDIMENTS WITH GREATER THAN 10% CALCIUM CARBONATE ARE PREFIXED BY THE MODIFIER CALCAREOUS. SEDIMENTS CONTAINING SILICA IN THE INTERSTICES BETWEEN GRAINS ARE MODIFIED BY THE TERM SILICEOUS.

SEDIMENT CLASSIFICATION (MODIFIED AFTER R.L.FOLK, 1968)

GRAIN SIZE NOMENCLATURE (MODIFIED AFTER C.K.WENTWORTH, 1922)

PARTICLE DESIGNATION		PARTICLE DIAMETER (MM)
GRAVEL	BOULDER	> 256
	COBBLE LARGE	256 - 128
	COBBLE SMALL	128 - 64
	PEBBLE VERY COARSE	64 - 32
	PEBBLE COARSE	32 - 16
SAND	PEBBLE MEDIUM	16 - 8
	PEBBLE FINE	8 - 4
	PEBBLE VERY FINE	4 - 2
	COARSE	2 - 1
SILT + CLAY	COARSE	1 - 0.5
	MEDIUM	0.5 - 0.25
	FINE	0.25 - 0.125
	VERY FINE	0.125 - 0.0625

200 WEST AREA

APPROVED FOR CONSTRUCTION DATE 12/1/75 BY [Signature]	DATE 12/1/75 BY [Signature]	ENERGY RESEARCH & DEVELOPMENT ADMINISTRATION RICHLAND OPERATIONS OFFICE
VITRO ENGINEERING & ARCHITECTS, INC. A Division of AUTOMATION INDUSTRIES, INC.		241-SX TANK FARM GEOLOGIC MAP LEGEND AND PLOT PLAN
SCALE NONE		PRED. NO. CK-0067
NOT REQUIRED		DATE 241-SX
NONE		H-2389785

APPRO. FOR CONFORMANCE WITH DESIGN CRITERIA BY <u>W. J. F. B</u> DATE <u>4/1/76</u> <u>AR/CO</u>		ENERGY RESEARCH & DEVELOPMENT ADMINISTRATION HIGHLAND OPERATIONS OFFICE	
APPRO. DATE <u>4/1/76</u> <u>AR/CO</u>		VITRO ENGINEERING & CONSTRUCTORS a division of AUTOMATION INDUSTRIES, INC.	
APPRO. DATE <u>4/1/76</u> <u>AR/CO</u>		241-5X TANK FARM	
CHECKED BY <u>W. J. F. B</u> DATE <u>4/1/76</u> <u>AR/CO</u>		GEOLOGIC CHARACTERIZATION	
ON APPRO. DATE <u>4/1/76</u> <u>AR/CO</u>		CROSS SECTION C-C'	
DRAWN BY <u>ERICKSON</u> DATE <u>4/1/76</u>		PROJECT NO. <u>WD-0065</u> PROJECT TITLE <u>GEOLOGIC CHARACTERIZATION</u>	
SCALE <u>1" = 10'-0"</u>		SHEET NO. <u>241-5X</u> SHEET NO. <u>0002, 0501</u>	
CLASSIFICATION <u>NOT REQUIRED</u> DATE		DWS NO.	
CLASSIFICATION <u>NONE</u>		<u>H-2-38925</u>	
LAST 0		SHEET NO. <u>00</u> OF <u>21</u>

CROSS SECTION F-F'

APPROVED FOR CONFORMANCE WITH COMPANY STANDARD		DATE 12/1/75	ENERGY RESEARCH & DEVELOPMENT ADMINISTRATION NICKELAM OPERATIONS OFFICE	
BY [Signature]		DATE 12/1/75	VITRO ENGINEERING + ARCHITECTS + ENGINEERS A DIVISION OF AUTOMATION INDUSTRIES, INC.	
FOR [Signature]		DATE 12/1/75	241-SX TANK FARM GEOLOGIC CHARACTERIZATION CROSS SECTION F-F'	
CHECKED [Signature]		DATE 12/1/75	PROJECT TITLE GEOLOGIC CHARACTERIZATION	
SCALE 1" = 16'-0"		DATE 12/1/75	SHEET NO. H-2-38928	
CLASSIFICATION NOT REQUIRED		DATE 12/1/75	SHEET NO. OF TOTAL SHEETS 1 OF 1	
REFERENCE DRAWINGS		DATE 12/1/75	DRAWING STATUS	
NEXT USED ON		DATE 12/1/75	DRAWING STATUS

APPROVED FOR CONFORMANCE WITH DESIGN CRITERIA		DATE	1/16/76
BY	THH	DATE	1/16/76
FOR	THH	DATE	1/16/76
APPD	THH	DATE	1/16/76
CHKD	THH	DATE	1/16/76
INSD	THH	DATE	1/16/76
SA APPD	THH	DATE	1/16/76
CHECKED	THH	DATE	1/16/76
ENERGY RESEARCH & DEVELOPMENT ADMINISTRATION RICHLAND OPERATIONS OFFICE		VITRO ENGINEERING & ARCHITECTS A DIVISION OF AUTOMATION INDUSTRIES, INC.	
241-SX TANK FARM		GEOLOGIC CHARACTERIZATION	
CROSS SECTION I-I'		GEOLOGIC CHARACTERIZATION	
SCALE 1"=16'-0"		PROJ NO. 241-SX	
NOT REQUIRED		DATE 1/16/76	
NONE		H-2-38931