DOE/OR/21548-411
CONTRACT NO. DE-AC05-86OR21548

CONCEPTUAL DESIGN REPORT FOR REMEDIAL ACTION AT THE CHEMICAL PLANT AREA OF THE WELDON SPRING SITE, VOLUME II TECHNICAL INFORMATION DOCUMENT BOOK 3 OF 5

Weldon Spring Site Remedial Action Project
Weldon Spring, Missouri

JANUARY 1994

REV. 0

U.S. Department of Energy
Oak Ridge Operations Office
Weldon Spring Site Remedial Action Project

Printed in the United States of America. Available from the National Technical Information Service, NTIS, U.S. Department of Commerce, 5285 Port Royal Road, Springfield, Virginia 22161

NTIS Price Codes -	Printed copy:	A01
	Microfiche:	A99

DOE/OR/21548-411

Conceptual Design Report, for Remedial Action at the Chemical Plant Area of the Weldon Spring Site, Volume II Technical Information Document

Book 1 of 5 contains Sections 1-5

Book 2 of 5 contains Sections 6-12

Book 3 of 5 contains the figures for all sections

Book 4 of 5 contains the tables for all sections

Book 5 of 5 contains Appendix A, Unpublished Documents, and Appendix B, Acronyms

DOE/OR/21548-411

Weldon Spring Site Remedial Action Project

Conceptual Design Report, for Remedial Action at the Chemical Plant Area of the Weldon Spring Site, Volume II Technical Information Document
Figures
Book 3 of 5

Revision 0

January 1994

Prepared by

MK-FERGUSON COMPANY
and
JACOBS ENGINEERING GROUP
7295 Highway 94 South
St. Charles, Missouri 63304

for the

U.S. DEPARTMENT OF ENERGY
Oak Ridge Operations Office
Under Contract DE-AC05-86OR21548

m:\users\joanne\cdr\titlepg.cdr

LIST OF FIGURES

NUMBER		PAGE
1-1	Area and Vicinity Map of the Weldon Spring Site, Weldon Spring, Missouri	1
1-2	Weldon Spring Site and Vicinity Map	2
1-3	Site Layout Prior to Remediation Activities	3
2-1	Primary Surface Data Components	4
2-2	Primary Subsurface Data Components	5
2-3	Contaminated Areas at the Weldon Spring Site	6
5.1.2-1	Waste Area Locations Chemical Plant	7
5.1.2-2	Vicinity Property Contaminated Area Locations	8
5.1.2-3	Contaminated Soils Approximate Depths and Boundaries	9
5.1.2-4	Foundations Locations - Major Underground Piping Routes.	10
5.1.2-5	Raffinate Pit Cross-Sectional View	11
5.1.2-6	Material Removal Sequence 1	12
5.1.2-7	Material Removal Sequence 2	13
5.1.2-8	Material Removal Sequence 3	14
5.1.2-9	Material Removal Sequence 4	15
5.1.2-10	Material Removal Sequence 5	16
5.1.2-11	CSS Schedule	17
5.1.2-12	VIT Schedule	18
5.1.4-1	Proposed Construction Materials Staging Area (CMSA) Locations (1 of 3)	19
5.1.4-2	Proposed Construction Materials Staging Area (CMSA) Locations (2 of 3)	20
5.1.4-3	Proposed Construction Materials Staging Area (CMSA) Locations (3 of 3) Description of Areas	21
5.1.4-4	Construction Materials Staging Area (CMSA) Site Layout	22
5.1.5-1	Existing Roadway System	23
5.1.5-2	Areas of Contamination Prior to Disposal Cell Construction	24
5.1.5-3	Construction of Disposal Cell (Sequence 1)	25
5.1.5-4	Construction of Disposal Cell (Sequence 2)	26
5.1.5-5	Construction of Disposal Cell (Sequence 3)	27

NUMBER		PAGE
5.1.5-6	Construction of Disposal Cell (Sequence 4)	28
5.1.5-7	Construction of Disposal Cell (Sequence 5)	29
5.1.5-8	CSS Alternative Construction of Disposal Cell (Closure Phase) 1.5 Million C.Y. of Waste	30
5.1.5-9	VIT Alternative Construction of Disposal Cell (Closure Phase) 1 Million C.Y. of Waste	31
5.1.5-10	Radiologically Contaminated Vicinity Property Locations	32
5.1.5-11	Alternative Haul Road Alignments	33
5.1.5-12	Alternative Conveyor System Alignments	34
5.1.5-13	Alternative No. 1 Truck Alignment Missouri State Route 94 Borrow Haul Road Crossing	35
5.1.5-14	Alternative No. 2 Truck Alignment Missouri State Route 94 Borrow Haul Road Crossing	36
5.1.5-15	Borrow Haul Road Typical Cross Sections Highway and Off-Highway Trucks (Section A-A)	37
5.1.5-16	Missouri State Route 94 Borrow Haul Road Crossing - Section B-B	38
5.1.5-17	Conveyor System Typical Cross Sections	39
5.1.5-18	Required CBR vs. Design Thickness	40
5.1.5-19	Typical Roadway Cross Sections for Highway Vehicle Loading	41
5.1.5-20	Typical Roadway Cross Sections for Expected Construction Vehicle Loads	42
5.1.6-1	Surface Water Features and Drainages at the WSS	43
5.1.6-2	Proposed Sedimentation Basins and Watersheds at the Weldon Spring Chemical Plant Site	44
5.1.6-3	Site Drainage Details - Ditches	45
5.1.6-4	Site Drainage System During Disposal Cell Construction (End of Sequence One)	46
5.1.6-5	Site Drainage System During Disposal Cell Construction (End of Sequence Two)	47
5.1.6-6	Site Drainage System During Disposal Cell Construction (End of Sequence Three)	48
5.1.6-7	Site Drainage System During Disposal Cell Construction (End of Sequence Four)	49

NUMBER		PAGE
5.1.6-8	Site Drainage System During Disposal Cell Construction (End of Sequence Five)	50
5.1.6-9	Site Drainage Detail Retention Ponds and Permanent Channels	51
5.1.6-10	Site Drainage Details Temporary Channels	52
5.1.6-11	Site Drainage Details Drop Structure	53
5.1.6-12	Permanent Drainage Structures	54
5.1.6-13	Drainage Areas with VIT Disposal Cell	55
5.1.7-1	Conceptual Borrow Material Delivery Schedule	56
5.1.7-2	Locations of Potential Low Permeability Borrow Source Areas Considered (Areas 1 and 2)	57
5.1.7-3	Locations of Potential Low Permeability Borrow Areas Considered (Continued) (Area 3)	58
5.1.7-4	Location of Potential Borrow Source Area For Low Permeability Material and General Fill (Area 3-Expanded)	59
5.1.7-5	Typical Soil Profile at the Weldon Spring Wildlife Area (WSWA) Site	60
5.1.7-6	Quarry Locations Investigated for Borrow Materials (Sand, Gravel, and Rock)	61
5.1.8-1	Electrical Distribution System	62
5.1.8-2	Water Utilities Site Plan	63
5.1.8-3	Sewer Utilities Site Plan	64
5.1.8-4	Laboratory Location Plan	65
5.1.8-5	Analytical Radio-Chemistry Lab	66
5.1.8-6	QC/Physical Testing Trailer	67
5.1.8-7	Geotechnical Testing Trailer	68
5.1.8-8	Controlled Area Parking	69
5.1.8-9	Access Control Facilities	70
5.1.8-10	Contaminated Construction Equipment Maintenance Area	71
5.1.8-11	Vicinity Property Support Locations	72
5.1.8-12	Radiological Training Center	73
5.2.1-1	Details of Disposal Cell Cross Section North Side	74
5.2.2-1	Cell, Site, Waste, and State Suitability Area and Boundaries (Schematic)	75
5.2.2-2	Cell Siting Layout	76

NUMBER PAGE

5.2.2-3 Isopach Map of Ferrelview Clay and Clay Till 77
5.2.3-1 CSS Disposal Cell Foundation Plan Minimum Excavation Configuration . . 78
5.2.3-2 CSS Disposal Cell Foundation Plan Partially Below Grade or Deep Excavation Configuration 79
5.2.3-3 Waste Thickness Versus Waste Storage Volume for CSS Disposal Cell . . 80
5.2.3-4 Comparison of Total Disposal Cell Thickness 81
5.2.3-5 Details of Waste and Clean-Fill Dike Interface (Schematic) 82
5.2.3-6 Typical Geologic Profile: Section F 83
5.2.3-7 Disposal Cell Configuration Minimum Excavation: Section L 84
5.2.3-8 Disposal Cell Configuration Minimum Excavation: Section M 85
5.2.3-9 Disposal Cell Configuration Minimum Excavation: Section N 86
5.2.3-10 Disposal Cell Configuration Minimum Excavation: Section O 87
5.2.3-11 Disposal Cell Configuration Partially Below Grade: Section L 88
5.2.3-12 Disposal Cell Configuration Partially Below Grade: Section M 89
5.2.3-13 Disposal Cell Configuration Partially Below Grade: Section N 90
5.2.3-14 Disposal Cell Configuration Partially Below Grade: Section O 91
5.2.3-15 Plan View of CSS Disposal Cell Minimum Excavation Configuration . . . 92
5.2.3-16 Plan View of CSS Disposal Cell Partially Below Grade Configuration . . . 93
5.2.3-17 VIT Disposal Cell Foundation Plan Minimum Excavation Configuration . . 94
5.2.3-18 VIT Disposal Cell Foundation Plan Partially Below Grade Configuration 95
5.2.3-19 Plan View of VIT Disposal Cell Minimum Excavation Configuration 96
5.2.3-20 Plan View of VIT Disposal Cell Partially Below Grade Configuration . . . 97
5.2.5-1 Liner System Schematic Plan and Section CSS Cell 98
5.2.5-2 Liner System Schematic Plan and Section VIT Cell 99
5.2.5-3 Liner System Section and Details 100
5.2.5-4 Liner System Schematic Plan and Section CSS Cell 101
5.2.5-5 LCRS Details 102
5.2.5-6 Liner System Schematic Plan and Section VIT Cell 103
5.2.6-1 Schematic Plan of Waste Placement Week 1/Day 1 104
5.2.6-2 Schematic Plan of Waste Placement Week 1/Day 2 105
5.2.6-3 Schematic Plan of Waste Placement Week 1/Day 3 106
5.2.6-4 Schematic Plan of Waste Placement Week 1/Day 4 107

LIST OF FIGURES (Continued)

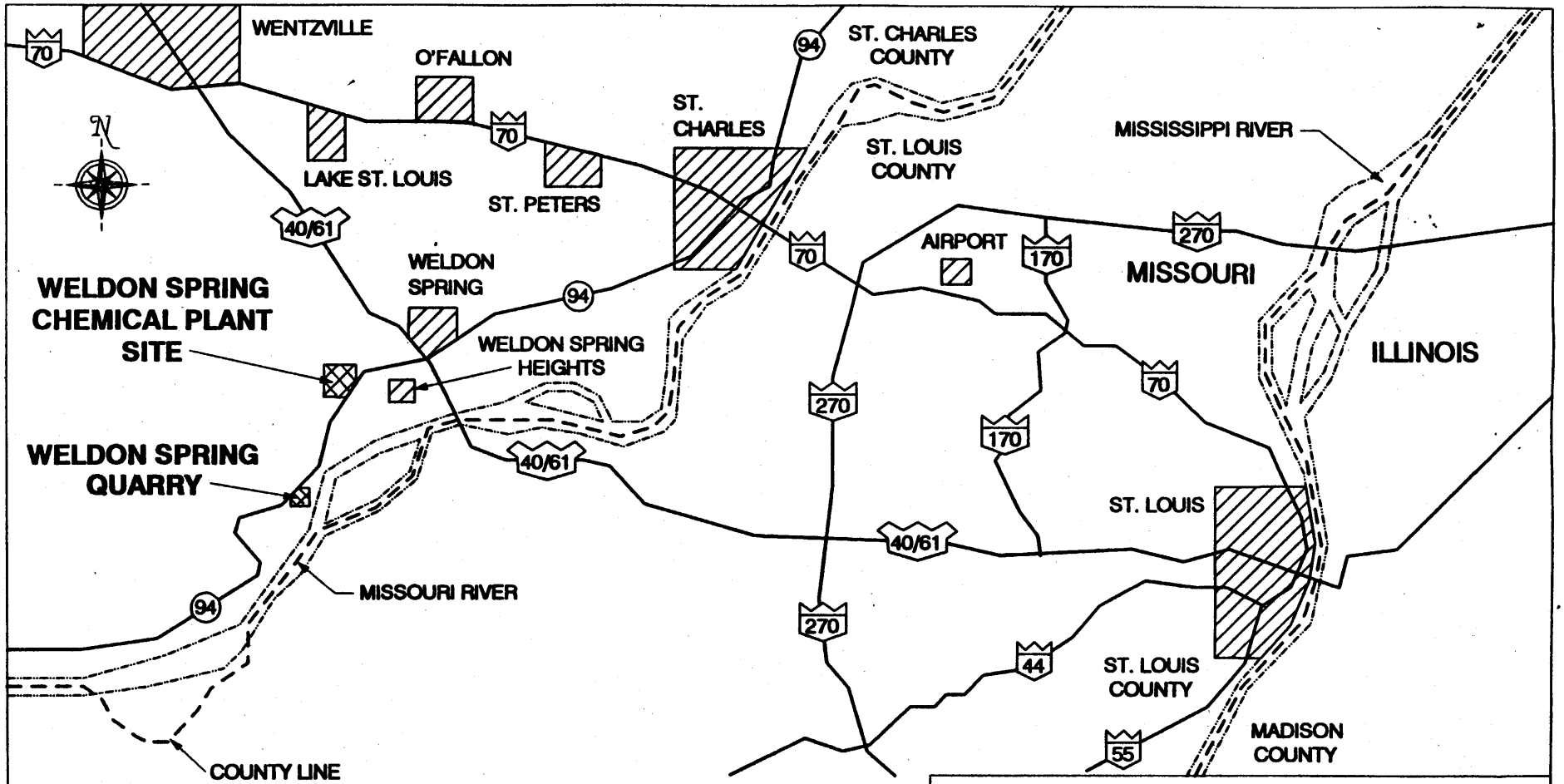
NUMBER		PAGE
5.2.6-5	Schematic Section of CSS Waste Placement Sequence	108
5.2.6-6	Schematic Section of VIT Waste Placement Sequence	109
5.2.7-1	Waste Encapsulation System Components	110
5.2.7-2	Alternative Cover 1: The Simple Vegetated/Rock Cover	111
5.2.7-3	Alternative Cover 2: The RCRA Cover	112
5.2.7-4	Alternative Cover 3: The Double Drain Cover	113
5.2.7-5	Alternative Cover 4: The Multi-Component Cover	114
5.2.7-6	Alternative Cover 5: The Erosion Resister	115
5.2.7-7	Top Slope Cover	116
5.2.7-8	Top Cover Erosion - Alternative Performance Scenarios	117
5.2.7-9	Vegetation Penetration Failure Scenarios	118
5.2.7-10	Animal and Human Intrusion Failure Scenarios	119
5.2.7-11	Infiltration Barrier Components: Their Nature and Function	120
5.2.7-12	Cover Drain Clogging Scenario Analysis	121
5.2.7-13	Perimeter Encapsulation	122
5.2.7-14	Vertical Face Clean-Fill Dike	123
5.2.7-15	Vegetation Growth and Rooting Patterns	124
5.2.7-16	Clean-Fill Dike Layout	125
5.2.7-17	Clean-Fill Dike Erosion Gully Geometry	126
5.2.7-18	Clean-Fill Dike Water Balance Model for Rock Cover	127
5.2.7-19	Cell Types	128
5.2.7-20	Dike Potential Slope Failure Modes	129
5.2.8-1	Drainage Collection at Edge of Phases I and II (Alternatives A-A, B-B, C-C)	130
5.2.8-2	Drainage Collection Edges of Phases I and II (Alternative D-D)	131
5.2.8-3	Placement of Initial Lifts of Disposal Cell Cover	132
5.2.9-1	CSS Simplified Schedule	133
5.2.9-2	VIT Simplified Schedule (Page 1 of 2: 1993-1999)	134
5.2.9-3	VIT Simplified Schedule (Page 2 of 2: 1997-2003)	135
5.3.1-1	Major Components of the WSS Waste Treatment Process	136
5.3.2-1	Material Balance, Raffinate Pits 1, 2, 3, and 4, Grout-Like Product (Raffinate Sludge and Binder)	137
5.3.2-2	Material Balance, Soil-Like Product	138

NUMBER PAGE

5.3.2-3	CSS-Related Process Capacities and Timing	139
5.3.2-4	Proposed Overall CSS Process	140
5.3.2-5	Conceptual Design Chemical Stabilization/Solidification General Arrangement	141
5.3.2-6	Conceptual Design Chemical Stabilization/Solidification Material Preparation General Arrangement	142
5.3.2-7	Solid Material Preparation (Soil-Like Product)	143
5.3.2-8	Liquid Material Preparation (Grout-Like Product)	144
5.3.2-9	Radon Emission Control (Functional Diagram)	145
5.3.2-10	Product Storage System (Functional Diagram)	146
5.3.2-11	Mechanical Feed System (Functional Diagram)	147
5.3.2-12	Pneumatic Binder Feed System Combination with Mechanical System (Functional Diagram)	148
5.3.2-13	Mixing System (Functional Diagram)	149
5.3.2-14	Location of CSS Plant and Dewatering Facility	150
5.3.3-1	Conceptual Flow Chart for Vitrification Treatment System	151
5.3.3-2	General Arrangement of Raffinate Pretreatment Circuits (Preferred Design)	152
5.3.3-3	General Arrangement of Soil/Clay Pretreatment Circuits (Preferred Design)	153
5.3.3-4	General Arrangement of Waste Storage, Mixing, Feeding, Melting and Product Discharge Circuits (Preferred Design)	154
5.3.3-5	General Flow Diagram of Melter Circuits	155
5.3.3-6	General Flow Diagram of Raffinate Pretreatment Circuits	156
5.3.3-7	General Flow Diagram of Soil/Clay Pretreatment Circuit	157
5.3.3-8	General Flow Diagram of Waste Storage, Mixing, and Feeding Circuits	158
5.3.3-9	General Flow Diagram of Product Discharge Circuit	159
5.3.3-10	General Flow Diagram for Off-Gas Treatment Circuits	160
5.3.3-11	Location of Vitrification Facility	161
5.3.5-1	Conceptual Dewatering Process for the Raffinate Sludges	162
5.3.5-2	Conceptual Selection of Dewatering Processing Equipment for Raffinate Sludges	163
5.3.5-3	Proposed Locations of Raffinate Sludge Dewatering Plant	164

NUMBER		PAGE
5.3.6-1	Decontamination Facility Location	165
5.4-1	Weldon Spring Site (Prior to Site Closure Activities)	166
5.4-2	Weldon Spring Site Final Layout (CSS Cell-1.5 Million C.Y. waste)	167
5.4-3	Weldon Spring Site Final Layout (VIT Cell-1.0 Million C.Y. Waste)	168
5.4-4	Surface of the Shallow Groundwater Table	169
5.4-5	Locations of Monitoring Wells	170
5.4-6	Location of Monitoring Wells to Remain for Post-Closure Monitoring	171
5.4-7	Locations of Additional Post-Closure Monitoring Wells	172
5.4-8	Typical Monitoring Well Construction	173
5.4-9	Surface Water Features and Drainages Near the WSS	174
5.4-10	Surface Runoff Drainage Plan	175
5.5-1	Project Surveillance and Monitoring Program	176
5.5-2	Surveillance and Monitoring: Routine Site Inspection	177
5.5-3	Surveillance and Monitoring: Groundwater Monitoring Program	178
5.5-4	Surveillance and Monitoring: Custodial Maintenance or Repair	179
5.5-5	Surveillance and Monitoring: Contingency Response	180
5.5-6	Surveillance and Monitoring: Corrective Action	181
6.1.2-1	Typical Foundations	182
6.1.2-2	Temporary Storage Area Stockpile Plan View	183
6.1.2-3	Temporary Storage Area Stockpile Removal Scenarios	184
6.1.2-4	MSA Stockpile Arrangement	185
6.1.2-5	Material Staging Area Stockpile Cross-Section View	186
6.1.2-6	Department of Army Property 1 Excavation Limits	187
6.1.2-7	Department of Army Property 2 Excavation Limits	188
6.1.2-8	Department of Army Property 3 Excavation Limits	189
6.1.2-9	Department of Army Property 5 Excavation Limits	190
6.1.2-10	Department of Army Property 6 Excavation Limits	191
6.1.2-11	Missouri Department of Conservation (Busch) Property 3	192
6.1.2-12	Missouri Department of Conservation (Busch) Property 4 Excavation Limits	193
6.1.2-13	Missouri Department of Conservation (Busch) Property 5 Excavation Limits	194
6.1.2-14	Ash Pond Spoils Area Development Sequence	195

NUMBER		PAGE
6.1.2-15	Ash Pond Spoils Area Alternate Development Sequence	196
6.1.3-1	Raffinate Pit Sludge Flow Diagram	197
6.1.4-1	Sketch of Construction Materials Staging Area Traffic Patterns	198
6.1.4-2	Sketch of Construction Materials Staging Area (CMSA) Site Layout Run-Off and Drainage	199
6.1.6-1	Order of Construction of Sedimentation Basins and Retention Ponds	200
6.1.6-2	Drainage Controls Construction Schedule	201
6.1.7-1	Conceptual Plan for Borrow Operations at the WSWA Borrow Source	202
6.2.3-1	Top of Bedrock Elevation Contours	203
6.2.3-2	Isopach Map of Ferrelview Clay to Bedrock	204
6.2.6-1	Clean-Fill Dike Construction: Alternative Phases	205
6.3.2-1	CSS Plant Operations	206
6.3.2-2	CSS Plant Capacity Chart (Parallel Plant not Included)	207
6.3.2-3	CSS Material Balance	208
6.3.6-1	Decontamination Flow Diagram (Process rate per day)	209
8-1	Plan View of CSS Cell Configuration	210
8-2	Disposal Cell Configuration	211
8-3	Disposal Facility Performance Periods	212
8-4	Disposal Cell Top Cover Hydrologic Model	213
8-5	Clean-Fill Dike Water Balance Model for Rock Cover	214
8-6	Soil Clean-Fill Dike Erosion Models	215
8-7	Long-Term Through Flow Models	216
8-8	Deformation-Induced Cracking of the Radon Barrier	217
8-9	NEIS Design Disposal Cell Section	218
8-10	NEIS Design - Cover and Liner System Details	219
8-11	Moving Average Monthly Discharge from Primary Leachate Collection System	220
8-12	Monthly Discharge from NEIS LCRS, in Gallons	221

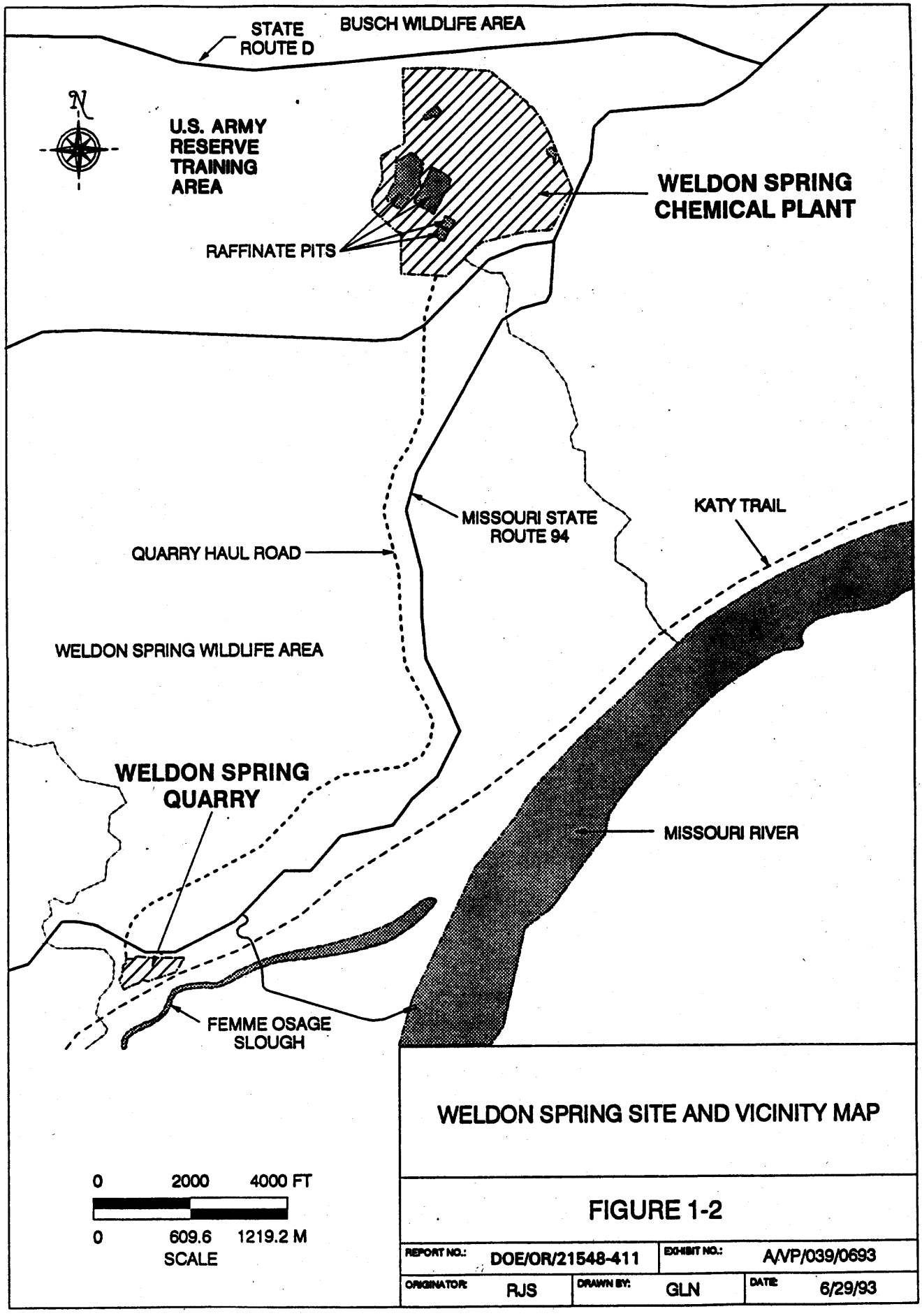


SOURCE : MKF AND JEG, 1990

AREA AND VICINITY MAP OF THE WELDON SPRING SITE, WELDON SPRING, MISSOURI

FIGURE 1-1

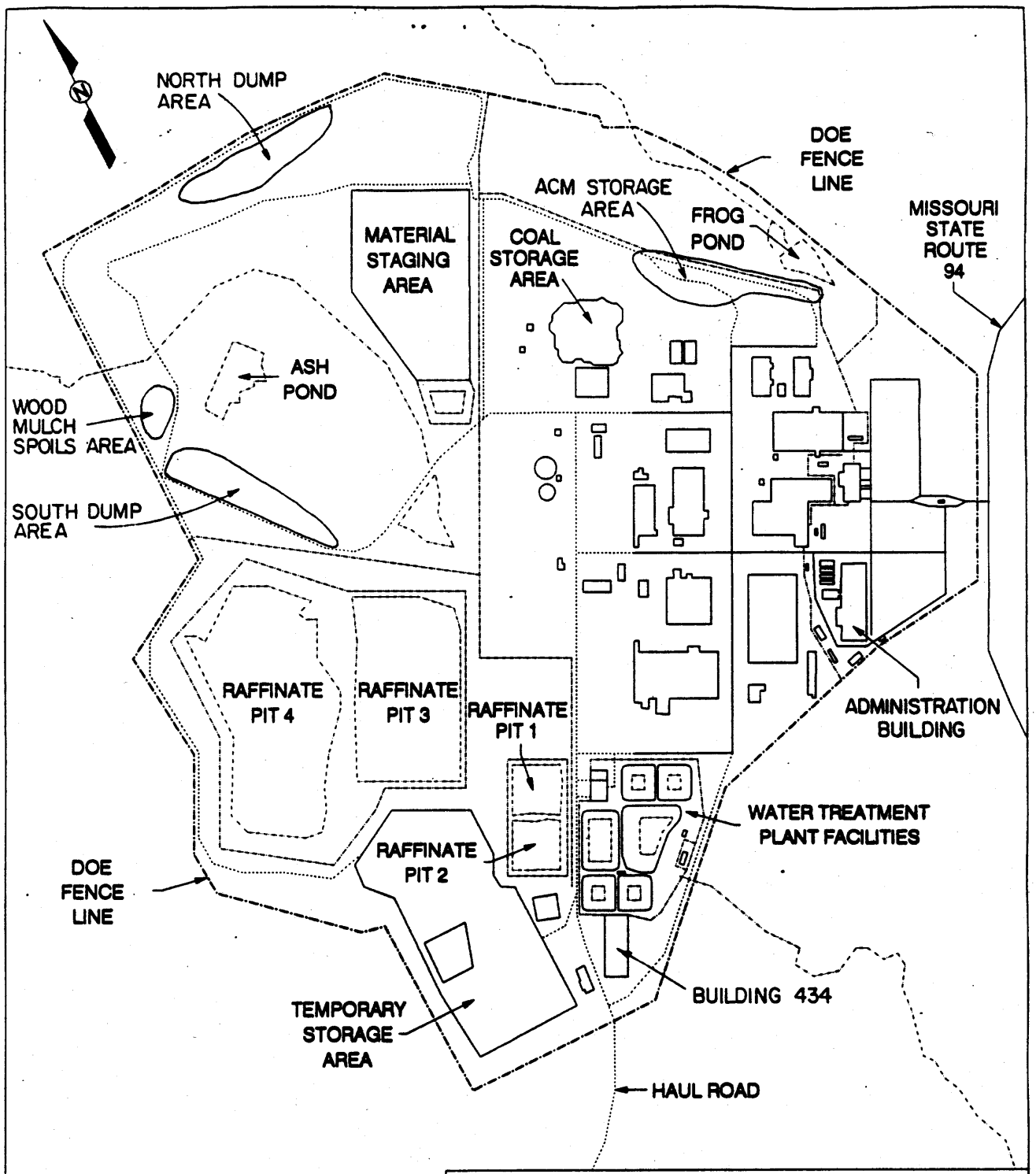
REPORT NO.: DOE/OR/21548-411		EXHIBIT NO.: A/VP/038/0693	
ORIGINATOR: RJS	DRAWN BY: GLN	DATE: 6/28/93	



WELDON SPRING SITE AND VICINITY MAP

FIGURE 1-2

REPORT NO.:	DOE/OR/21548-411	EXHIBIT NO.:	A/VP/039/0693		
ORIGINATOR:	RJS	DRAWN BY:	GLN	DATE:	6/29/93



0 500 1000 FT

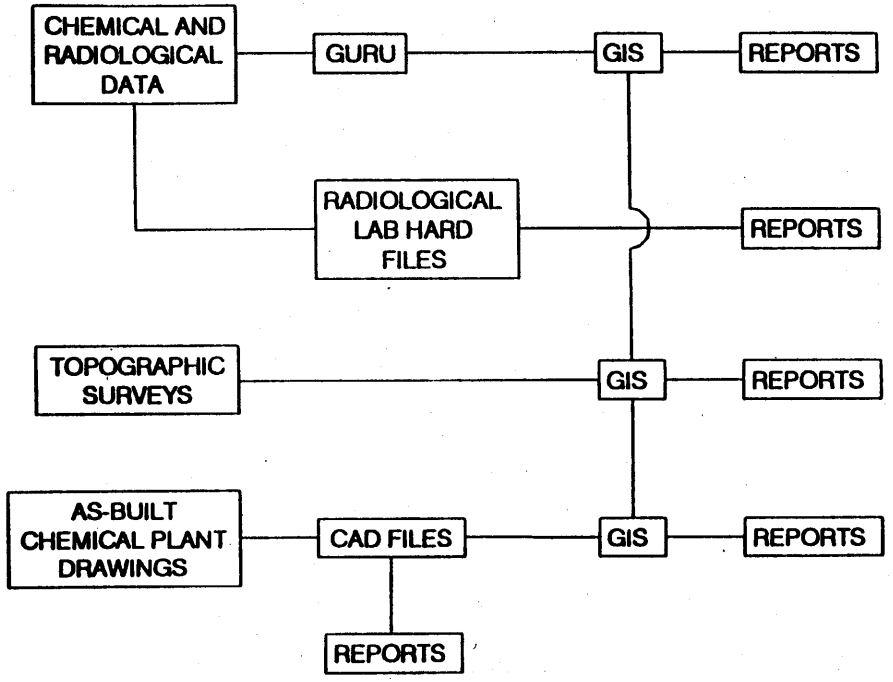
0 152.4 304.8 M

SCALE

SITE LAYOUT PRIOR TO REMEDIATION ACTIVITIES

FIGURE 1-3

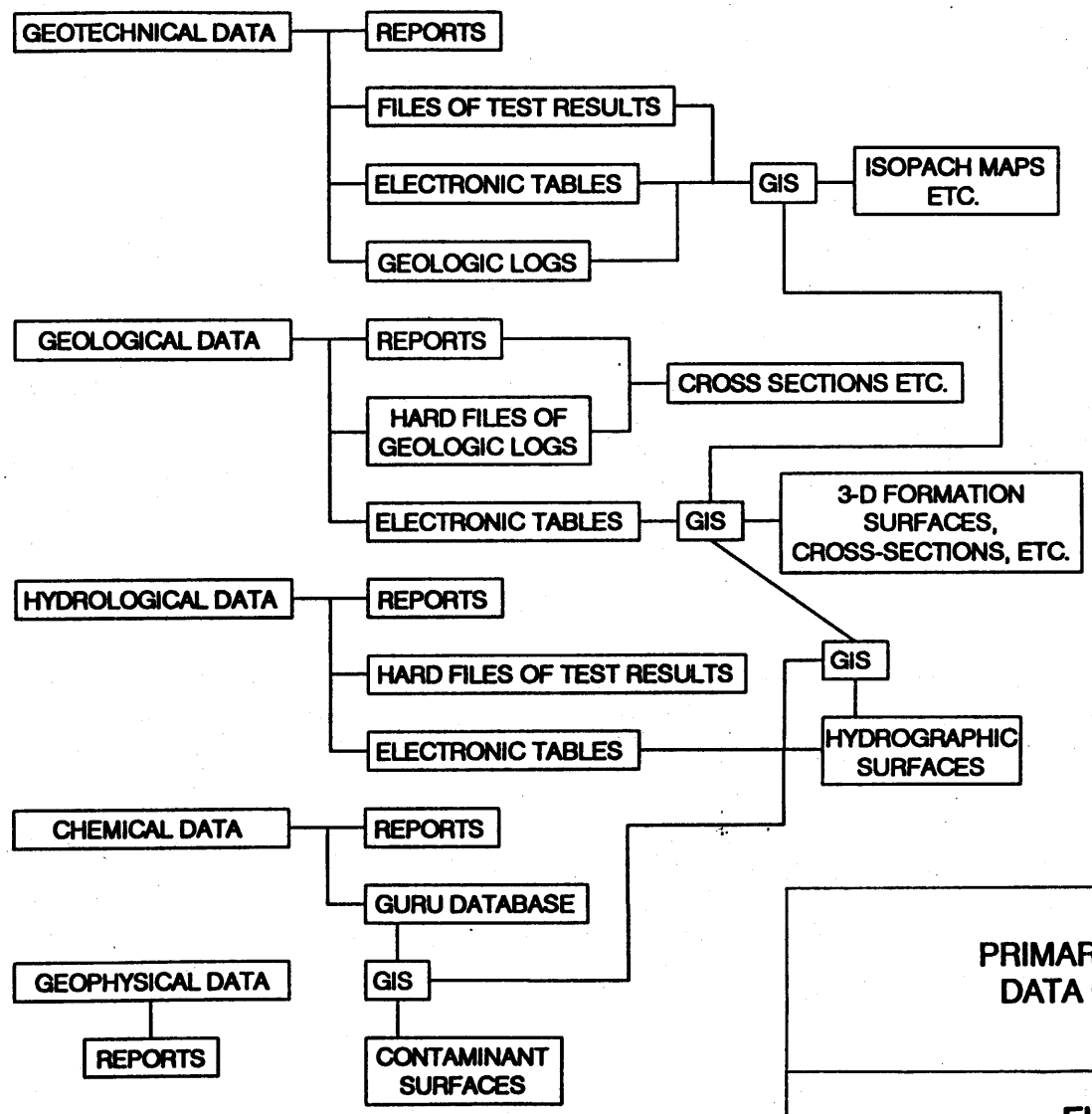
REPORT NO.: DOE/OR/21548-411		EXHIBIT NO.: A/CP/061/0693	
ORIGINATOR: RJS	DRAWN BY: GLN	DATE: 6/29/93	



PRIMARY SURFACE DATA COMPONENTS

FIGURE 2-1

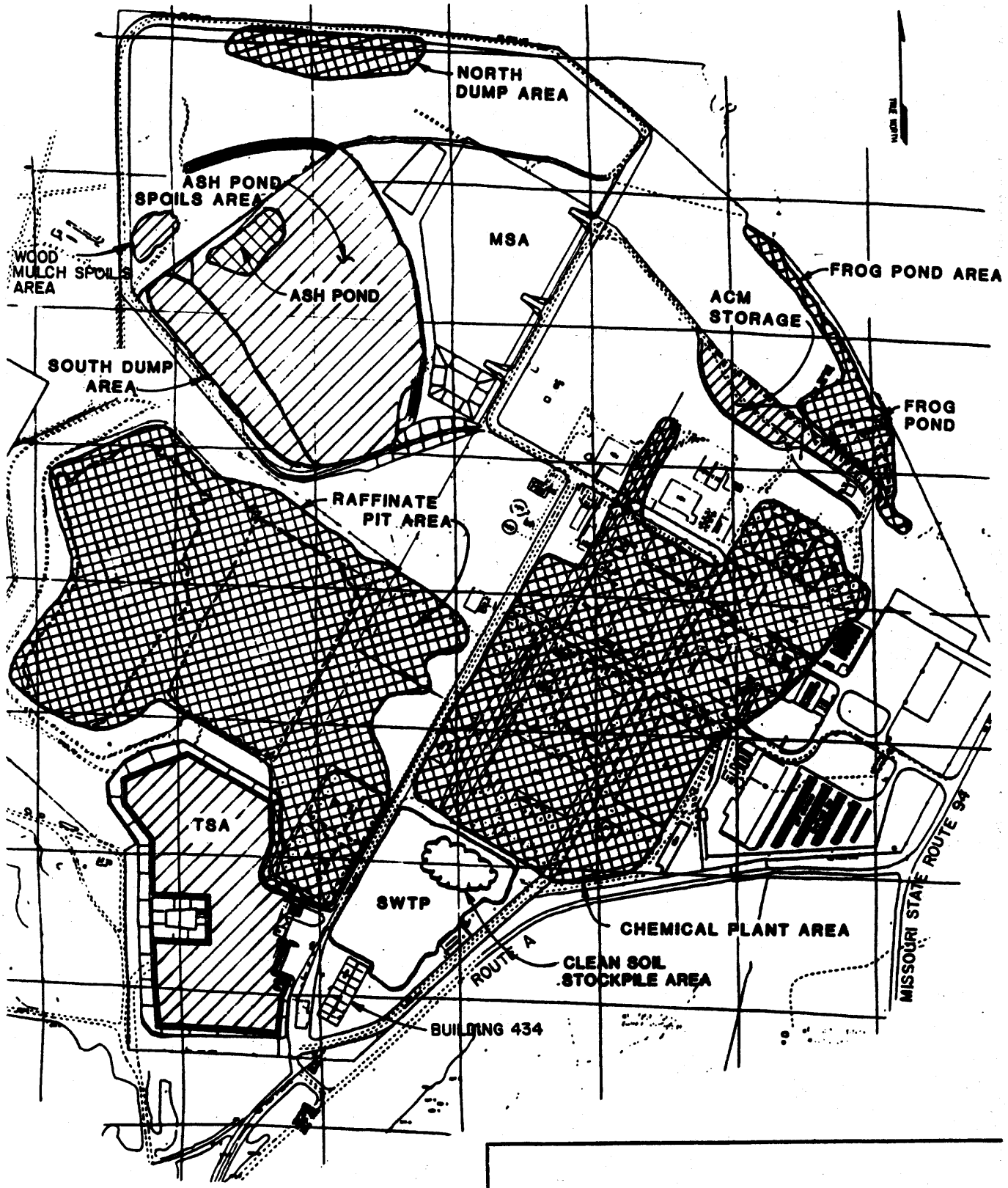
REPORT NO.: DOE/OR/21548-411		EXHIBIT NO.: A/PI/057/0493	
ORIGINATOR: JDC	DRAWN BY: GLN	DATE: 4/93	



PRIMARY SUBSURFACE DATA COMPONENTS

FIGURE 2-2

REPORT NO.: DOE/OR/21548-411		EXHIBIT NO.: A/PI/058/0493	
ORIGINATOR: JDC	DRAWN BY: GLN	DATE: 8/12/93	



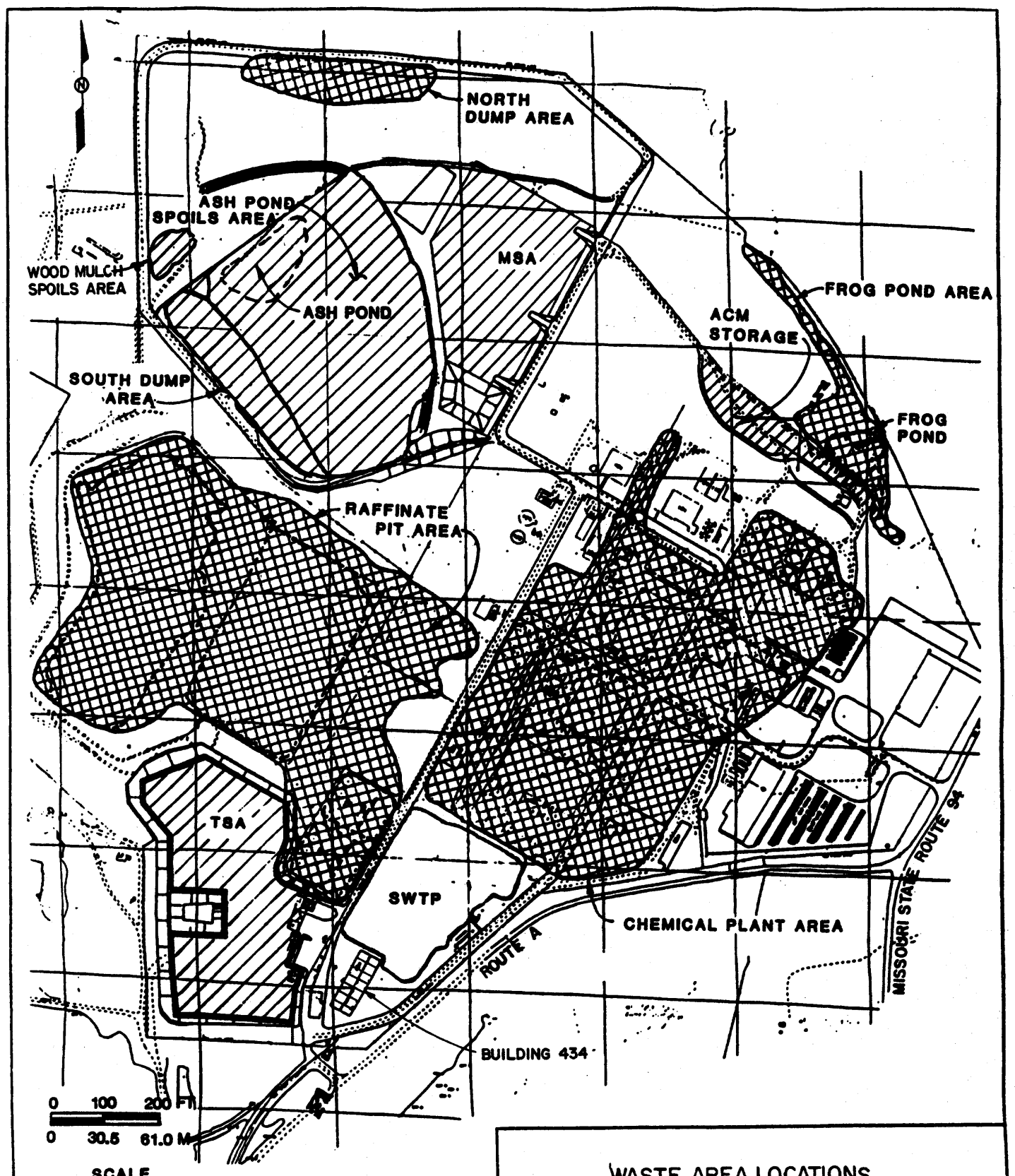
IN-SITU WASTE

STOCKPILED WASTE

CONTAMINATED AREAS AT THE WELDON SPRING SITE

FIGURE 2-3

REPORT NO DOE/OR/21548-411		DRAWING NO
ORIGINATOR	DRAWING BY	DATE



LEGEND

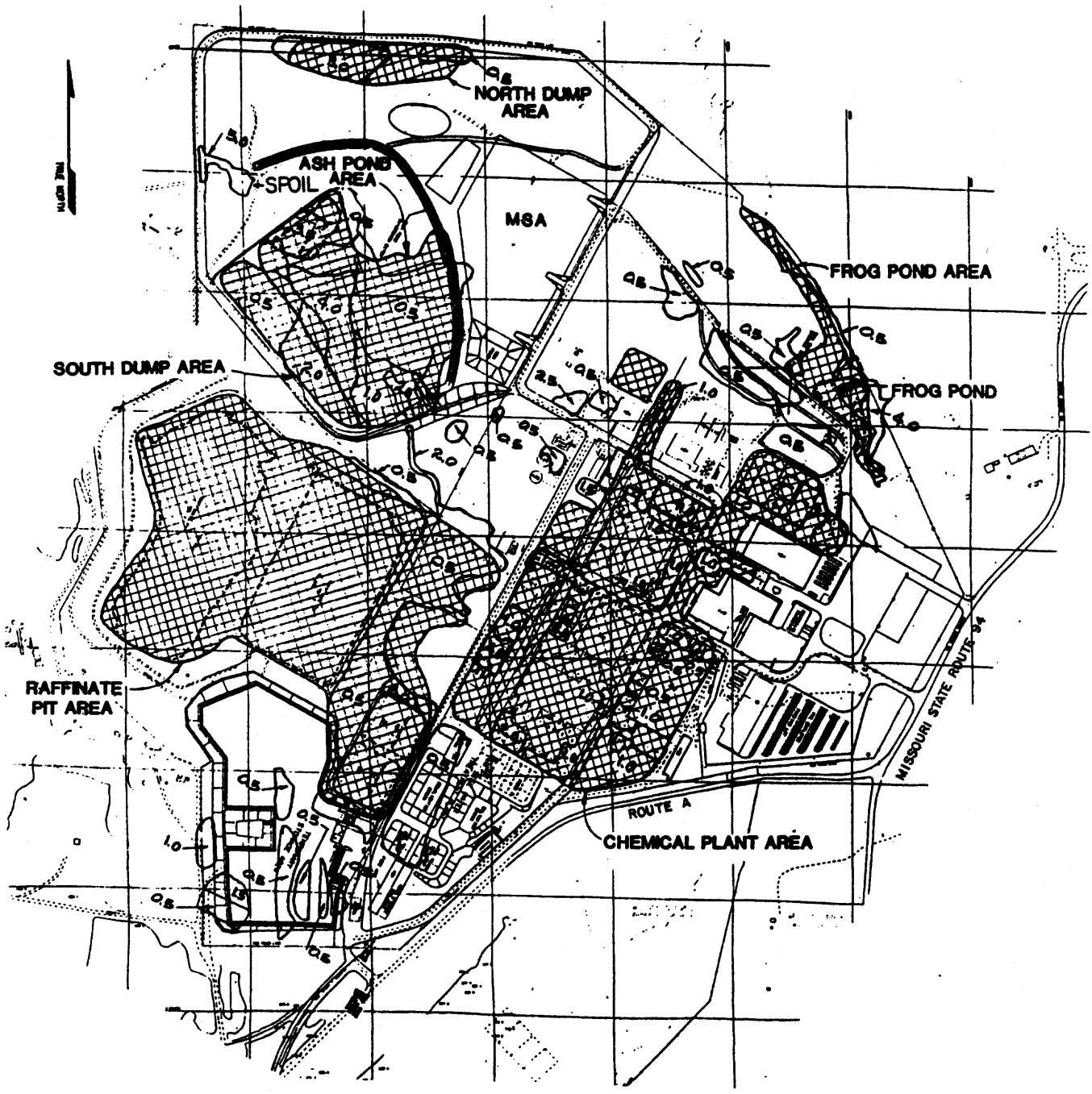
IN SITU WASTE

STOCKPILED WASTE

WASTE AREA LOCATIONS
CHEMICAL PLANT

FIGURE 5.1.2-1

REPORT NO	DOE/OR/21548-411	DRAWING NO	
ORIGINATOR	RJS	DRAWING BY	DATE: 6/29/93



LEGEND:

CONTAMINATED AREA

REMOVED CONTAMINATION

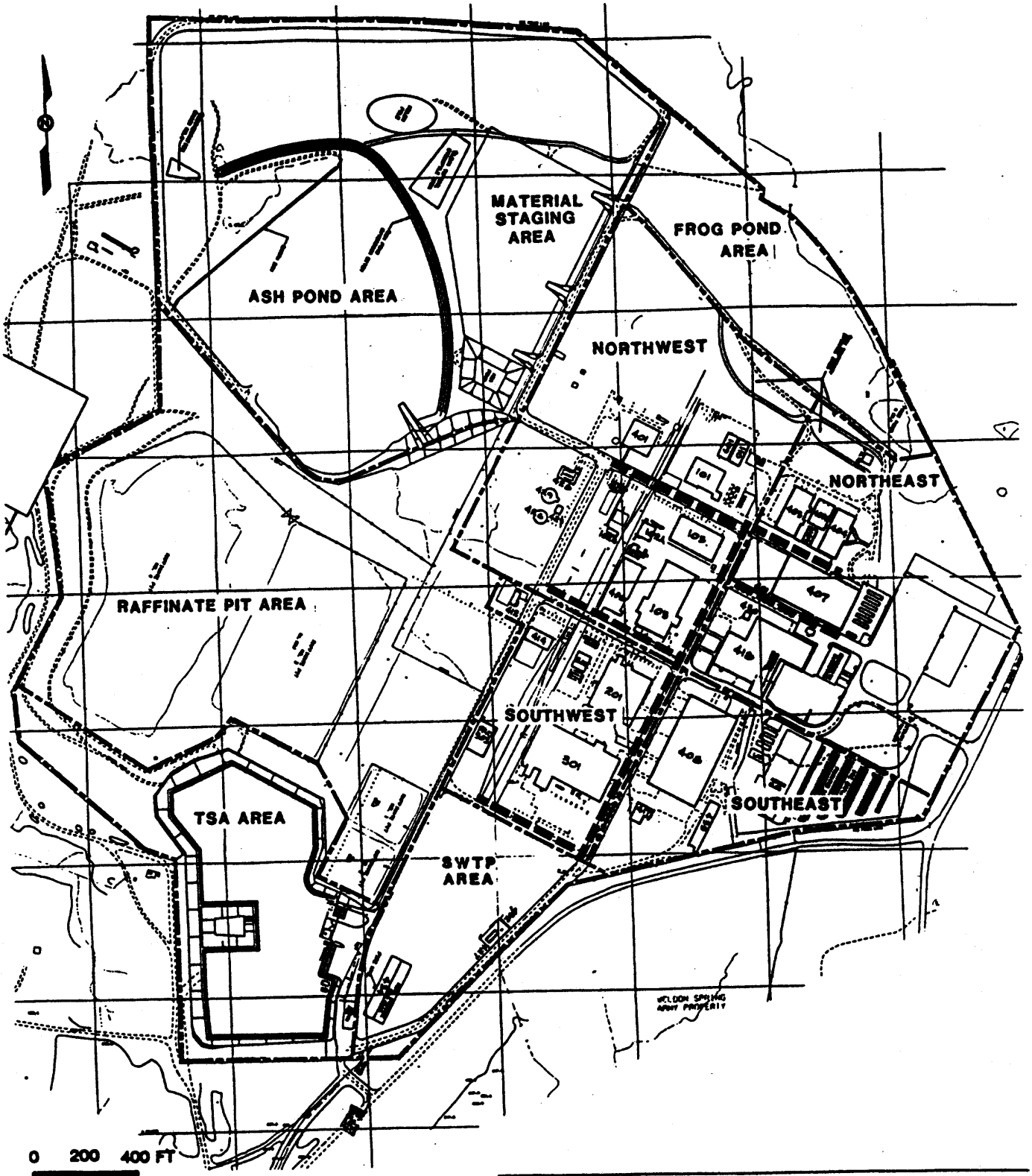
1.0 DEPTH IN FEET

REFERENCE: MKF & JEG 1992

CONTAMINATED SOILS APPROXIMATE DEPTHS & BOUNDARIES

FIGURE 5.1.2-3

REPORT NO: DOE/OR/21548-411		DRAWING NO:
ORIGINATOR:	DRAWING BY:	DATE:



0 200 400 FT

0 61.0 121.9 M

SCALE

LEGEND

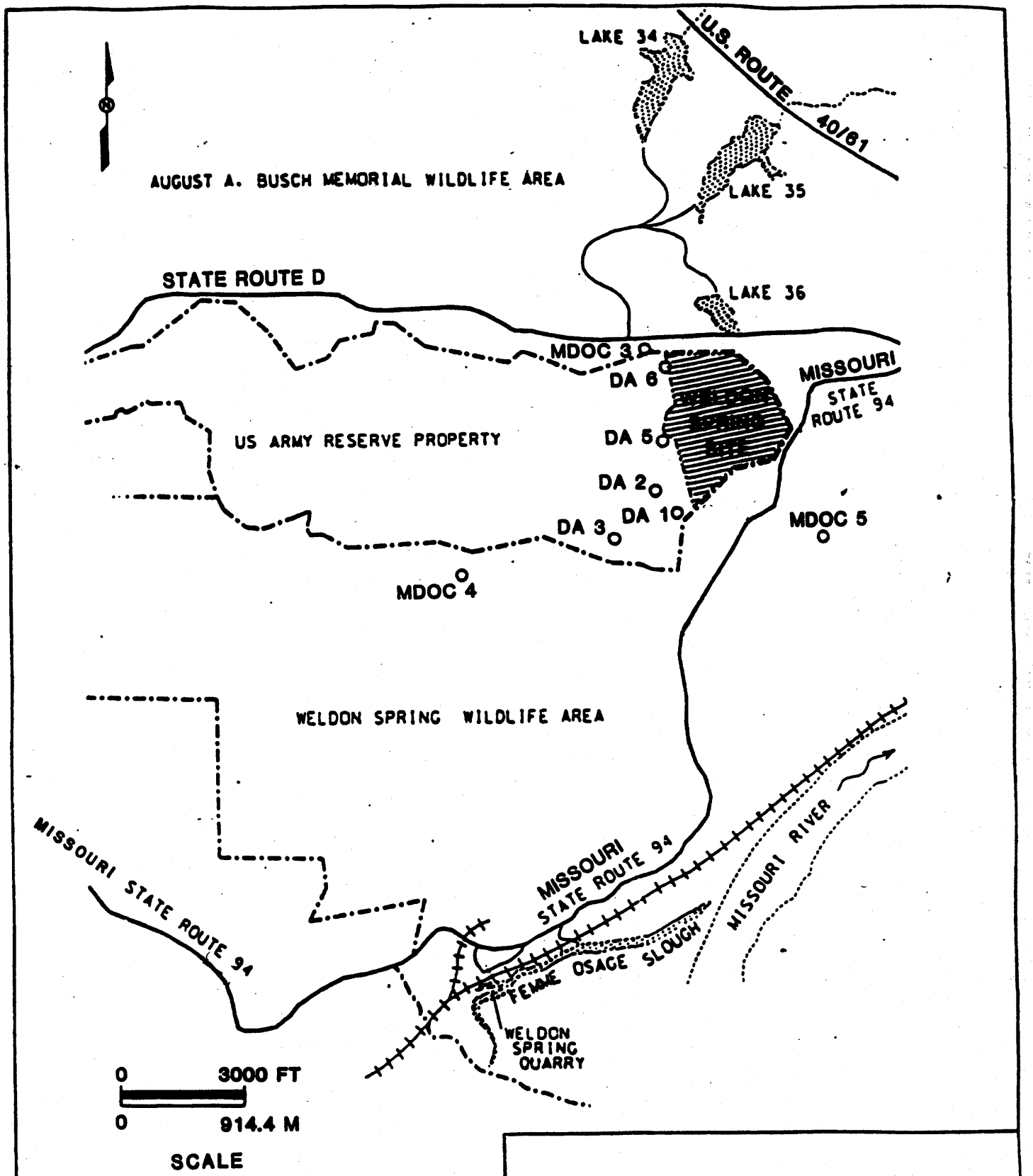
QUADRANT BOUNDARY

MAJOR UNDERGROUND PIPING ROUTE

FOUNDATIONS LOCATIONS
MAJOR UNDERGROUND PIPING ROUTES

FIGURE 5.1.2-4

REPORT NO: DOE/OR/21548-411	DRAWING NO:	
ORIGINATOR:	DRAWING BY:	DATE:



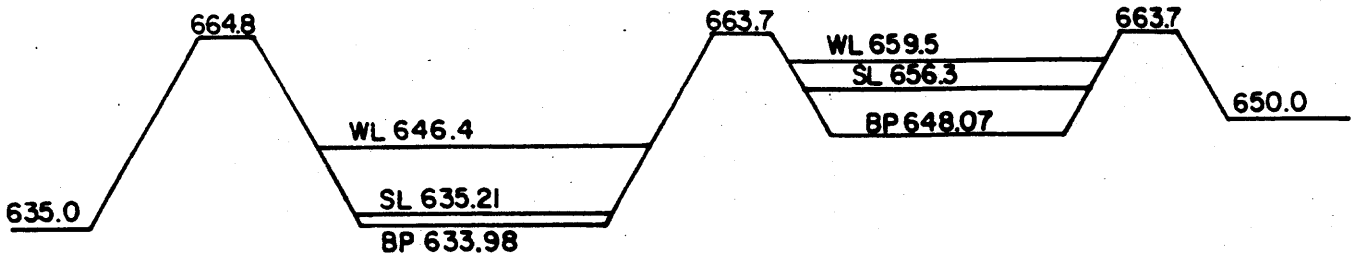
LEGEND

- ○ DA — DEPARTMENT OF ARMY
- ○ MDOC — DEPARTMENT OF CONSERVATION
- CONTAMINATED LAKE

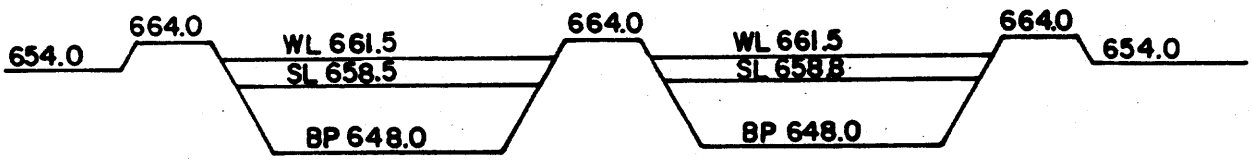
VICINITY PROPERTY CONTAMINATED AREA LOCATIONS

FIGURE 5.1.2-2

DOE/OR/21548-411		
		4/93



RAFFINATE PIT 4 RAFFINATE PIT 3

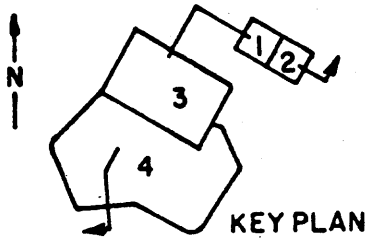


RAFFINATE PIT 1 RAFFINATE PIT 2

NO SCALE

LEGEND:

CROSS SECTION
WL MEAN WATER LEVEL
SL MEAN SLUDGE LEVEL
BP BOTTOM OF PIT
650 ELEVATION



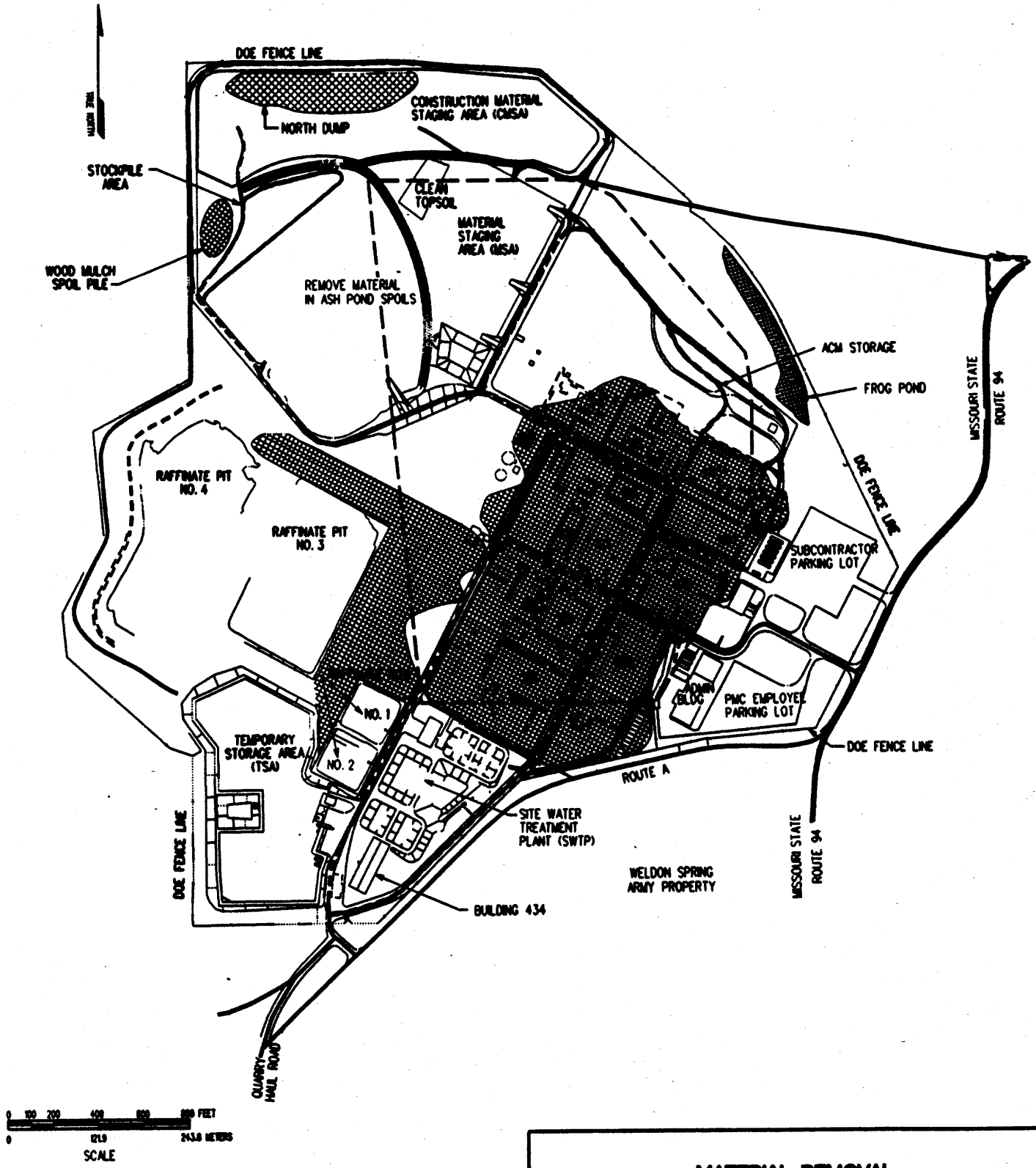
KEY PLAN

REFERENCE: SEPTEMBER 8, 1992 I.O.C. SLUDGE VOLUME CALC'S.

RAFFINATE PIT CROSS-SECTIONAL VIEW

FIGURE 5.1.2-5

REPORT NO DOE/OR/21548-411	DRAWING NO	
DESIGNATOR FJH	DRAWING BY HMK	DATE



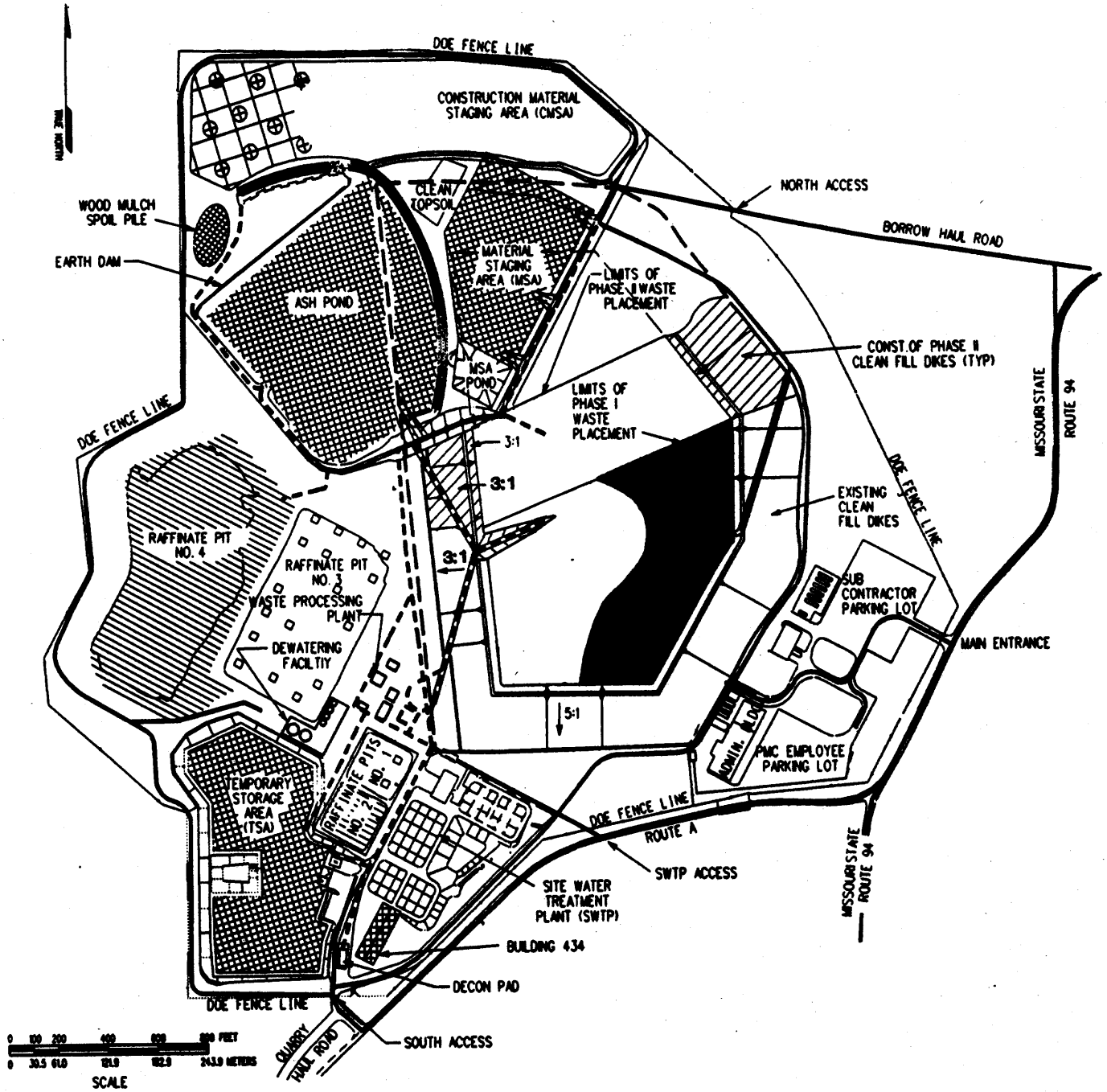
LEGEND

- DIRTY HAUL ROADS
- CLEAN HAUL ROADS
- REMOVING STOCKPILED MATERIAL AND PLACEING INTO DISPOSAL CELL
- OUTLINE OF DISPOSAL CELL (TO BE CONSTRUCTED LATER)

MATERIAL REMOVAL SEQUENCE 1

FIGURE 5.1.2-6

REPORT NO. DOE/OR/21548-411		DRAWING NO. 3840/FRAN1.DGN	
ORIGINATOR FJH	DRAWING BY AMF	DATE: 08/31/93	



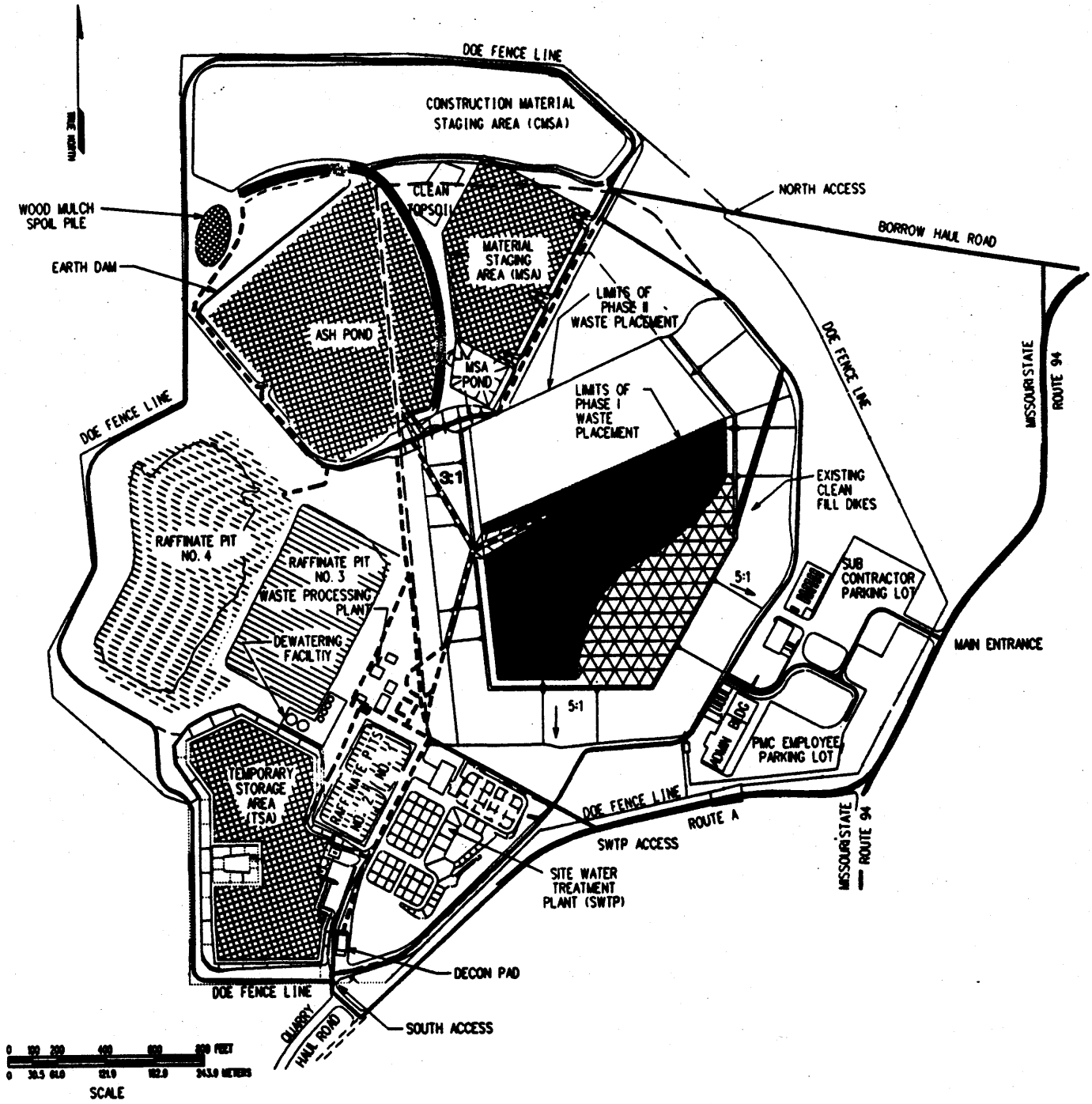
LEGEND

- EXISTING OR PROPOSED DIRTY ROADS
- EXISTING OR PROPOSED CLEAN ROADS
- OUTLINE OF DISPOSAL CELL TO BE CONSTRUCTED LATER
- REMOVING STOCKPILE MATERIAL AND PLACING INTO DISPOSAL CELL
- WASTE PLACEMENT IN CELL
- DREDGE WASTE FROM RAFFINATE PITS
- EXISTING CONTAMINATED MATERIALS TO BE REMOVED LATER
- REMOVING STOCKPILE MATERIAL TO BUILD CLEAN FILL DIKES
- CONSTRUCTION OF CLEAN FILL DIKES

MATERIAL REMOVAL SEQUENCE 2

FIGURE 5.1.2-7

REPORT NO. DOE/OR/21548-411	DRAWING NO. 3840/FRAN2.DGN	
ORIGINATOR FJH	DRAWING BY AMF	DATE: 08/31/93



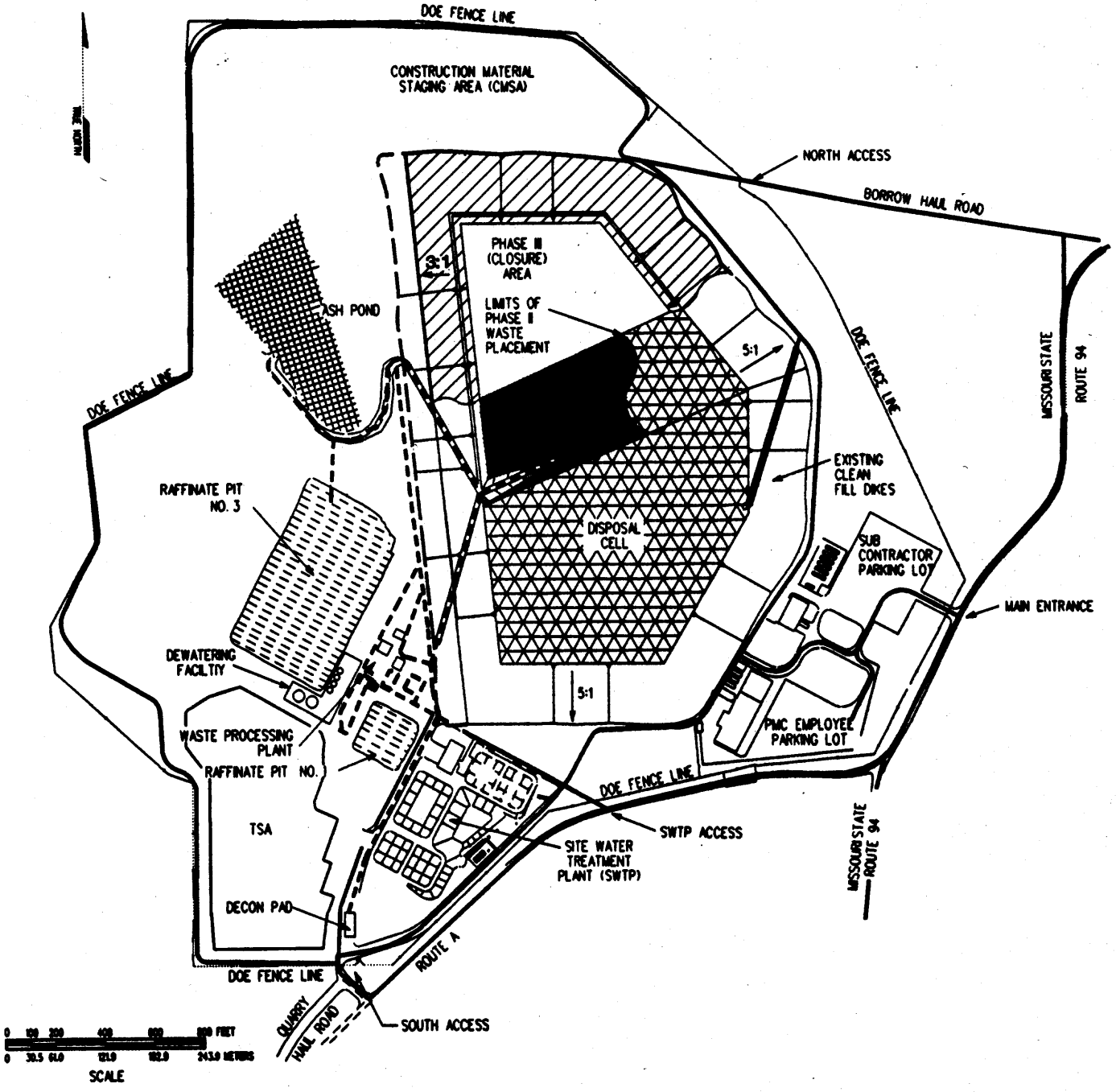
LEGEND

- EXISTING OR PROPOSED DIRTY ROADS
- EXISTING OR PROPOSED CLEAN ROADS
- OUTLINE OF DISPOSAL CELL TO BE CONSTRUCTED LATER
- REMOVING STOCKPILE MATERIAL AND PLACING INTO DISPOSAL CELL
- WASTE PLACEMENT IN CELL
- DREDGE WASTE FROM RAFFINATE PITS
- TOP & BOTTOM LINER REMOVAL OF REFFINATE PITS
- CELL CLOSURE (COVER)

MATERIAL REMOVAL SEQUENCE 3

FIGURE 5.1.2-8

REPORT NO. DOE/OR/21548-411	DRAWING NO. 3840/FRAN3.DGN	
ORIGINATOR FJH	DRAWING BY AMF	DATE: 08/31/93



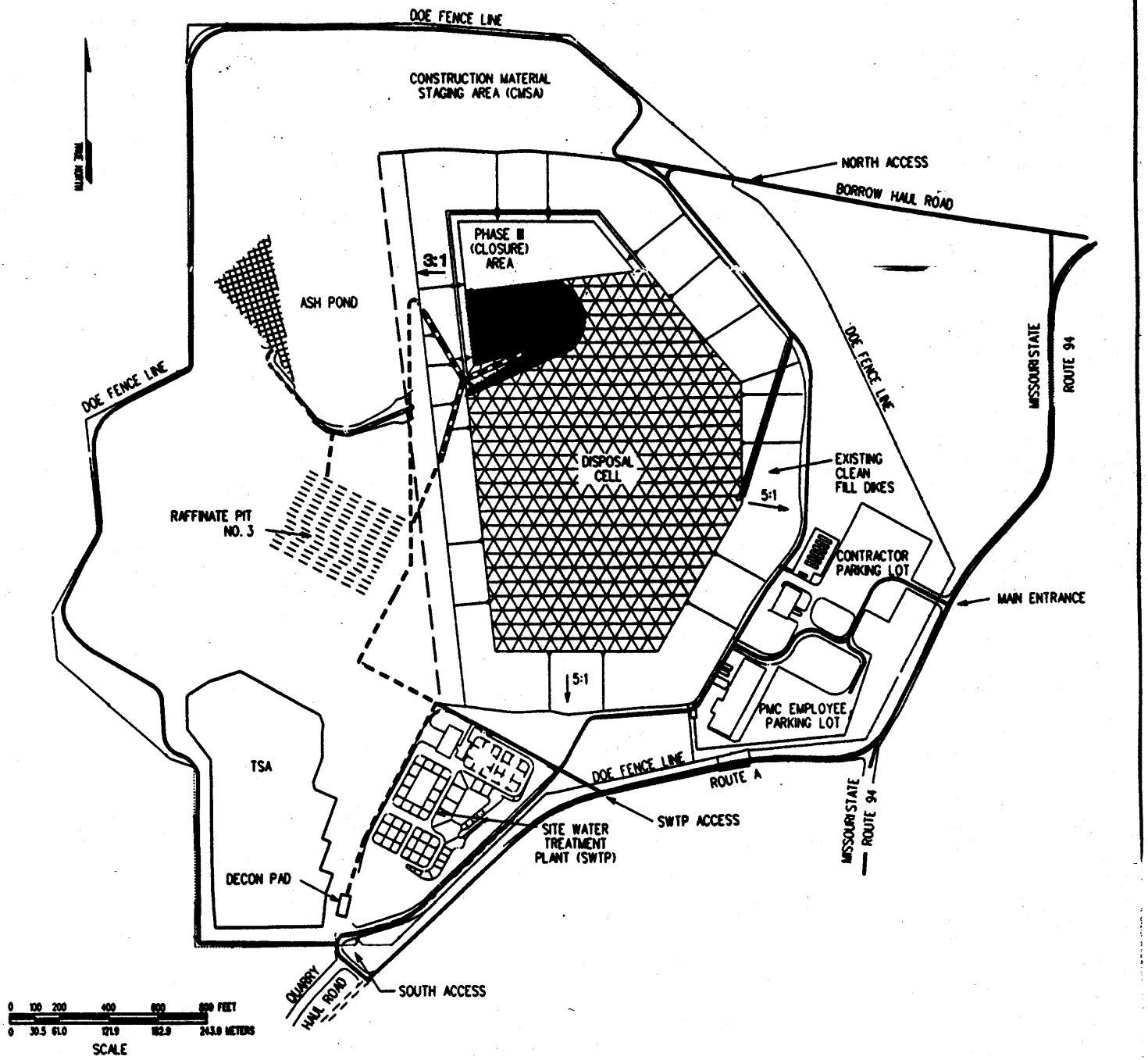
LEGEND

- EXISTING OR PROPOSED DIRTY ROADS
- EXISTING OR PROPOSED CLEAN ROADS
- OUTLINE OF DISPOSAL CELL TO BE CONSTRUCTED LATER
- REMOVING STOCKPILE MATERIAL AND PLACING INTO DISPOSAL CELL
- WASTE PLACEMENT IN CELL
- CONSTRUCTION OF CLEAN FILL DIKES
- TOP & BOTTOM LINER REMOVAL OF RAFFINATE PITS
- CELL CLOSURE (COVER)

MATERIAL REMOVAL SEQUENCE 4

FIGURE 5.1.2-9

REPORT NO. DOE/OR/21548-411	DRAWING NO. 3840/FRAN4.DGN	
ORIGINATOR FJH	DRAWING BY AMF	DATE: 09/01/93



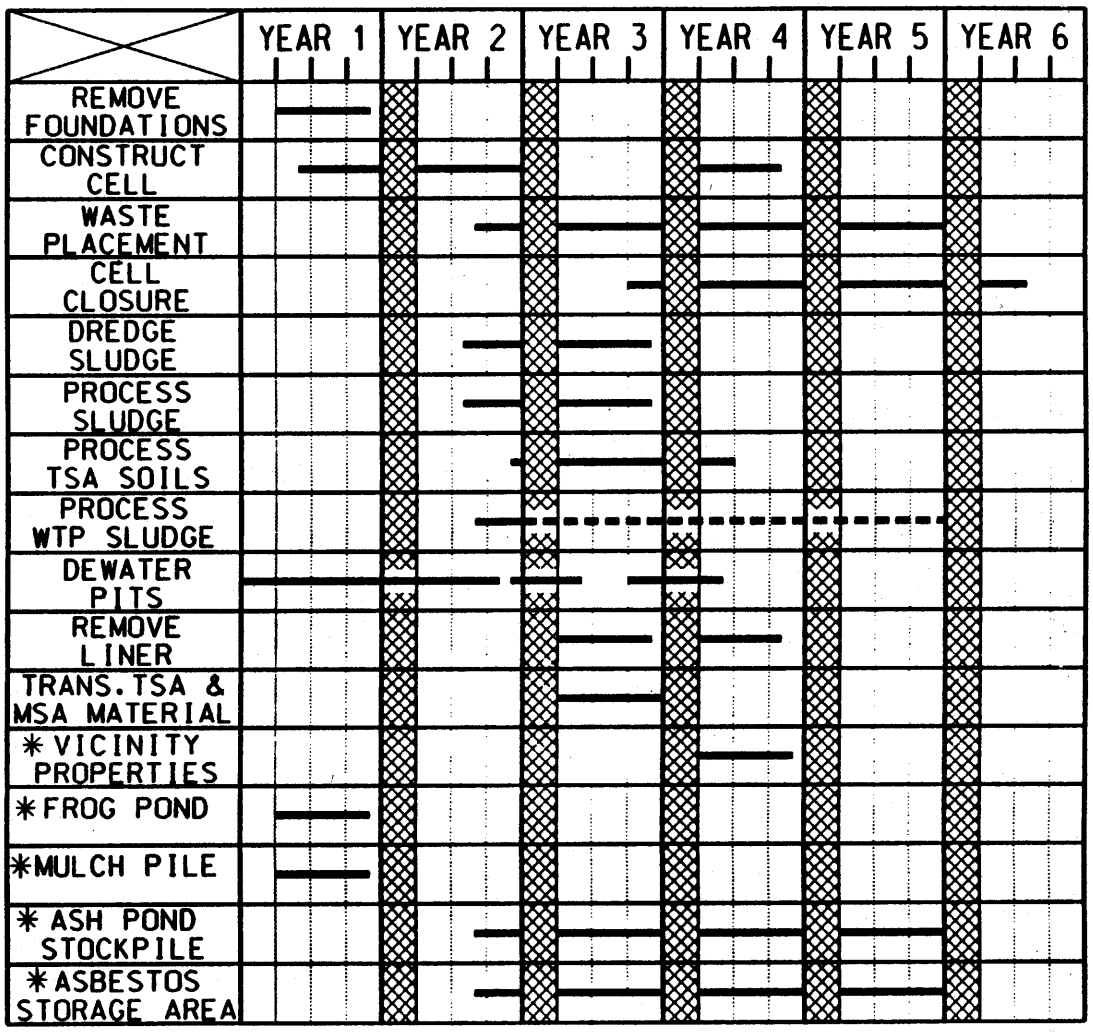
LEGEND

- EXISTING OR PROPOSED DIRTY ROADS
- EXISTING OR PROPOSED CLEAN ROADS
- OUTLINE OF DISPOSAL CELL TO BE CONSTRUCTED LATER
- REMOVING STOCKPILE MATERIAL AND PLACING INTO DISPOSAL CELL
- WASTE PLACEMENT IN CELL
- TOP & BOTTOM LINER REMOVAL OF RAFFINATE PITS
- CELL CLOSURE (COVER)

MATERIAL REMOVAL SEQUENCE 5

FIGURE 5.1.2-10

REPORT NO. DOE/OR/21548-411		DRAWING NO. 3840/FRAN5.DGN	
ORIGINATOR FJH	DRAWING BY AMF	DATE: 09/01/93	



* MATERIAL REMOVAL & TRANSPORTATION

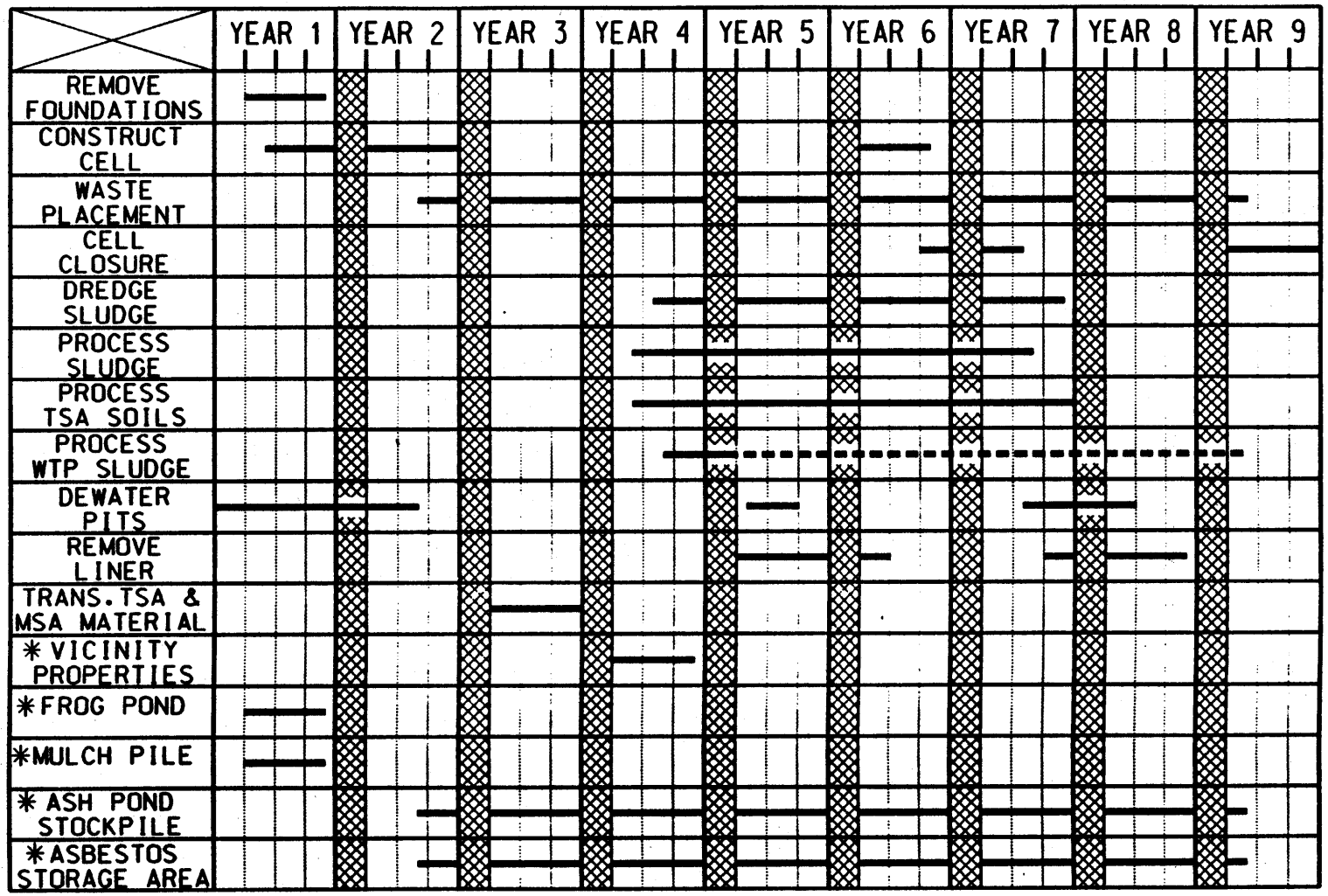
WINTER SHUTDOWN PERIOD

REFERENCE: REPPOND D., 1992

CSS SCHEDULE

FIGURE 5.1.2-11

REPORT NO. DOE/OR/21548-411		DRAWING NO. 3840/FRAN-SCH.DGN	
ORIGINATOR FJH	DRAWING BY AMF	DATE: 09/01/93	



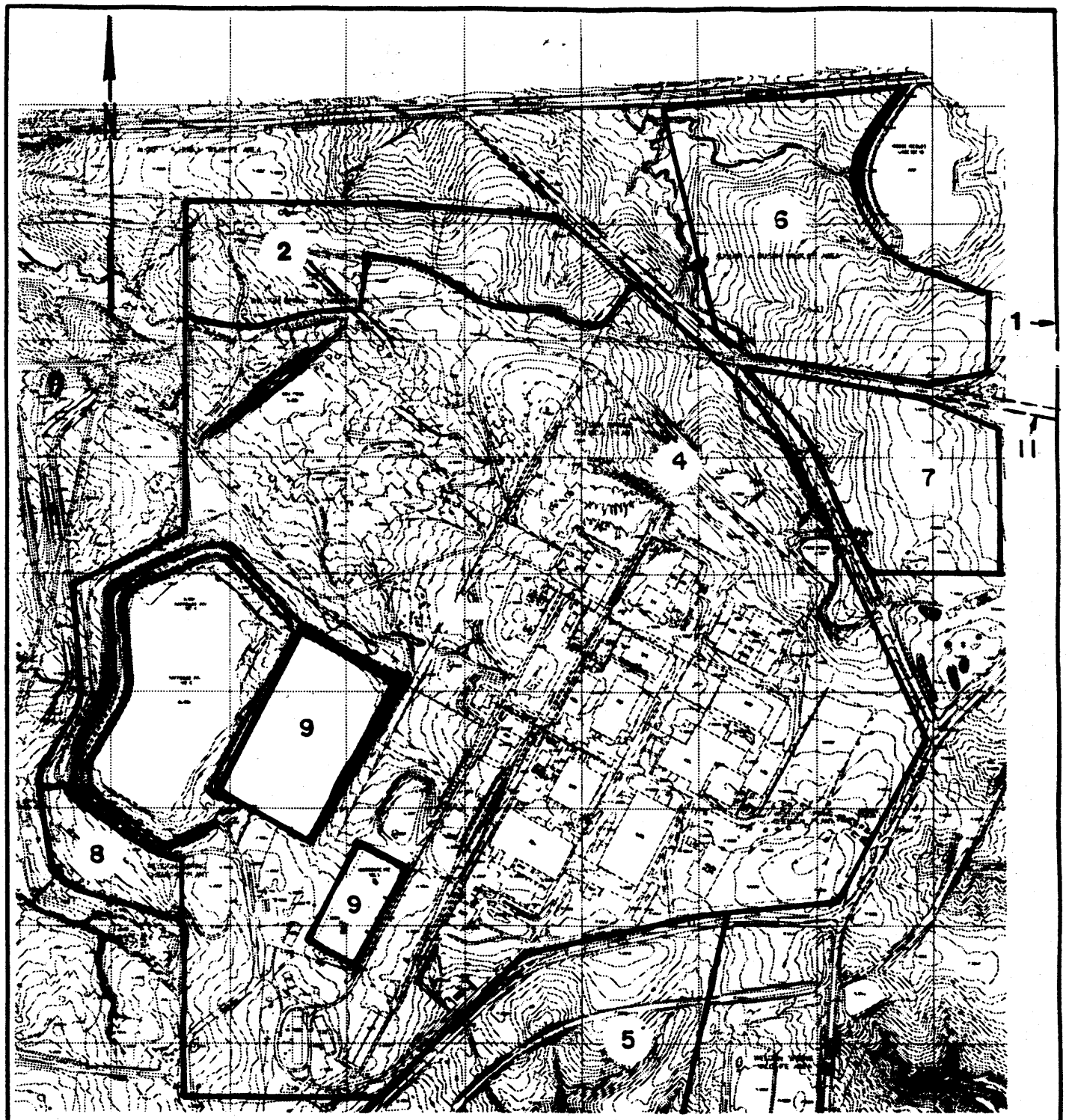
* MATERIAL REMOVAL & TRANSPORTATION

WINTER SHUTDOWN PERIOD
REFERENCE: REPPOND D.. 1992

VIT SCHEDULE

FIGURE 5.1.2-12

REPORT NO. DOE/OR/21548-411	DRAWING NO. 3840/FRAN-SCH.DGN	
ORIGINATOR FJH	DRAWING BY AMF	DATE: 09/01/93



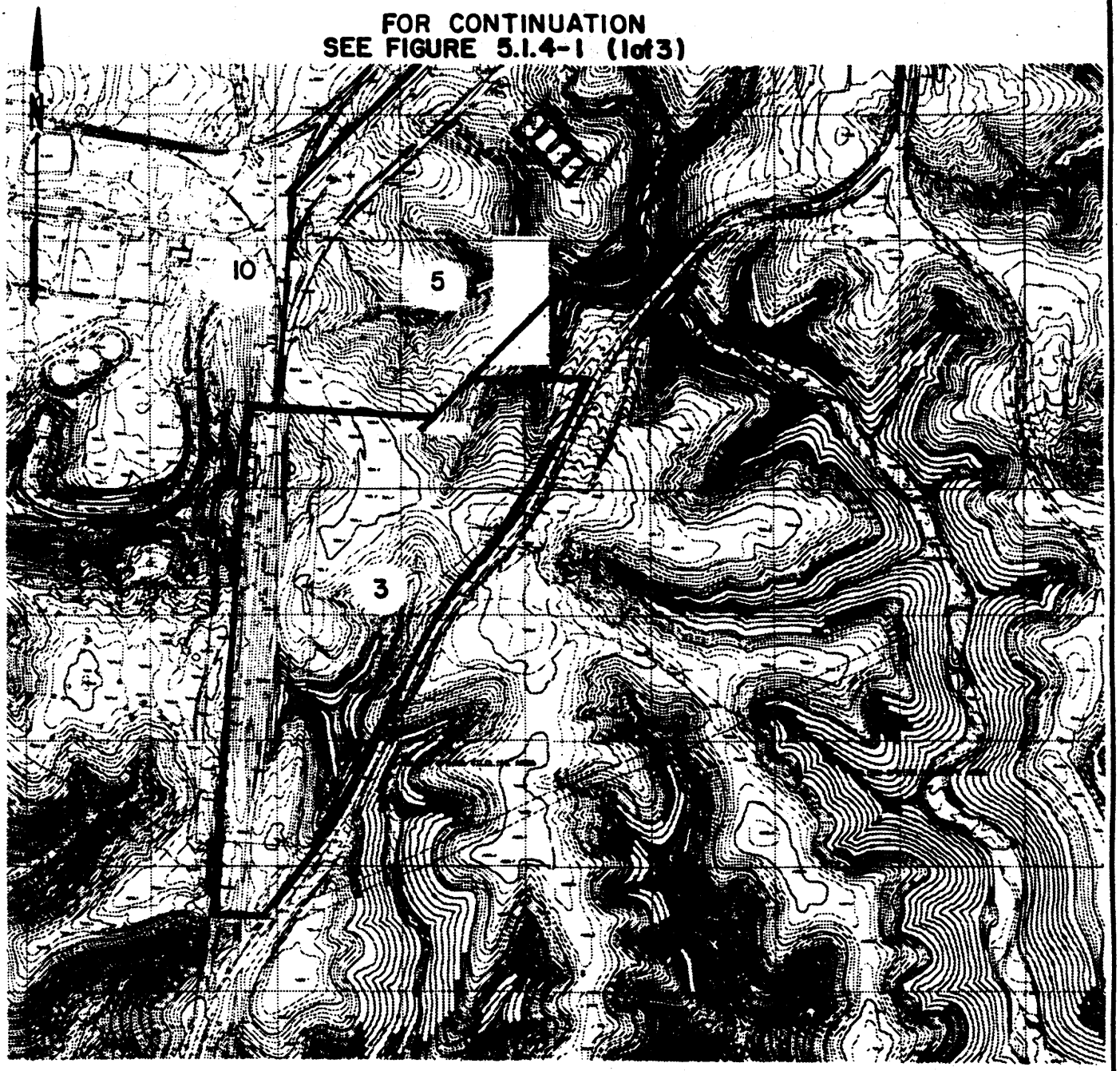
SEE FIGURE 5.1.4-2(2 of 3) FOR CONTINUATION

NOTE:
SEE FIGURE 5.1.4-3(3 of 3) FOR DESCRIPTION OF AREA NUMBERS

PROPOSED CONSTRUCTION MATERIALS STAGING AREA (CMSA) LOCATIONS (1 OF 3)

FIGURE 5.1.4-1

REPORT NO: DOE/OR/21548-411	DRAWING NO:	
ORIGINATOR: MLB	DRAWN BY: HK	DATE: NOV. 92



NOTE:
SEE FIGURE 5.1.4-3 (3of3)
FOR DESCRIPTION OF
AREA NUMBERS

PROPOSED CONSTRUCTION MATERIALS STAGING AREA (CMSA) LOCATIONS (2 OF 3)

FIGURE 5.1.4-2

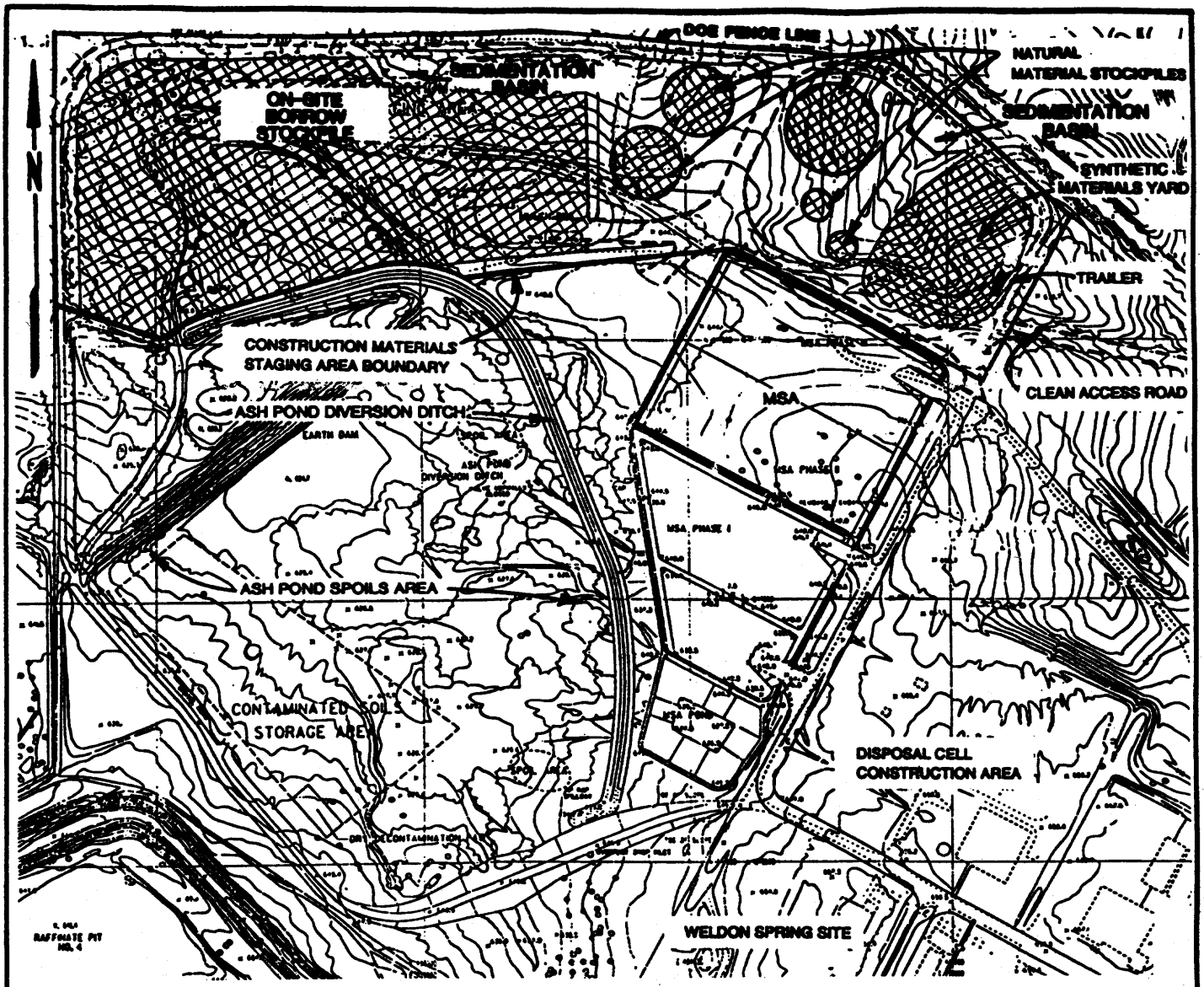
REPORT NO: DOE/OR/21548-411	DRAWING NO:	
ORIGINATOR: MLB	DRAWN BY: HK	DATE: NOV. 92

AREA NO.	DESCRIPTION
(1)	BORROW SOURCE, AN AREA AT OR ADJACENT TO THE OFF-SITE BORROW SOURCE. SOUTHEAST OF FRANCIS HOWELL HIGH SCHOOL.
(2)	NORTH OF ASH POND. AREA CURRENTLY PROPOSED AS CMSA.
(3)	MARSHALLING YARD. AREA ADJACENT TO THE QUARRY HAUL ROAD AT OLD RAILROAD STAGING AREA SOUTH OF THE WELDON SPRING CHEMICAL PLANT.
(4)	DISPOSAL CELL SITING AREA. WITHIN THE DISPOSAL CELL SITING AREA CURRENTLY DEFINED, NORTHERN PORTION.
(5)	ARMY PROPERTY. AREA SOUTH OF ROUTE A.
(6)	MDOC-NORTH: SOUTH OF MISSOURI STATE ROUTE D AND NORTH OF WELDON SPRING CHEMICAL PLANT FENCE LINE.
(7)	HIGHWAY DEPARTMENT PROPERTY (MDOC-SOUTH). TRIANGULAR PROPERTY ON MDOC LAND SOUTH OF ABANDONED ROAD, WEST OF MISSOURI STATE ROUTE 94, NORTHEAST OF WELDON SPRING CHEMICAL PLANT FENCE LINE, NORTH OF EXISTING HIGHWAY DEPARTMENT MAINTENANCE FACILITY.
(8)	SOUTH OF RAFFINATE PITS. SOUTH OF RAFFINATE PITS 3 AND 4.
(9)	IN RAFFINATE PITS. IN RAFFINATE PITS 1, 2, AND 3 AFTER WASTE REMOVAL.
(10)	QUARRY HAUL ROAD EASEMENT. AREA WITHIN QUARRY HAUL ROAD 100-FT. EASEMENT.

PROPOSED CONSTRUCTION MATERIALS STAGING AREA (CMSA) LOCATIONS (3 OF 3) DESCRIPTION OF AREAS

FIGURE 5.1.4-3

REPORT NO.	DRAWING NO.	
DOE/OR/21548-411	A/P1/093/0693	
ORIGINATOR RJS	DRAWN BY GLN	DATE 6/28/93



0 200 400 FT

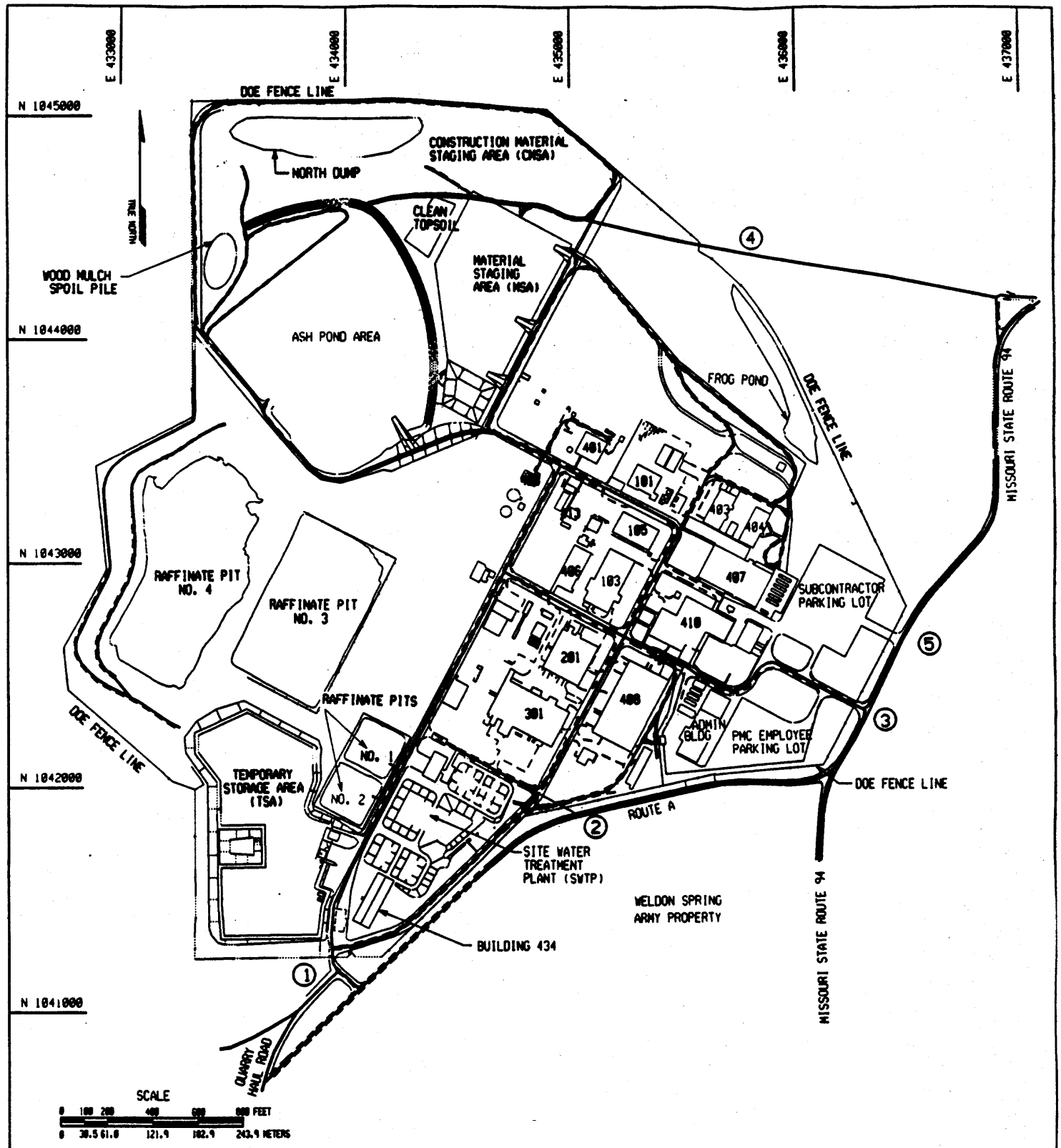
0 61.0 121.9 M

SCALE

CONSTRUCTION MATERIALS STAGING AREA (CMSA) SITE LAYOUT

FIGURE 5.1.4-4

REPORT NO: DOE/OR/21548-411	DRAWING NO:	
ORIGINATOR: MLB	DRAWN BY: HK	DATE: NOV. 92



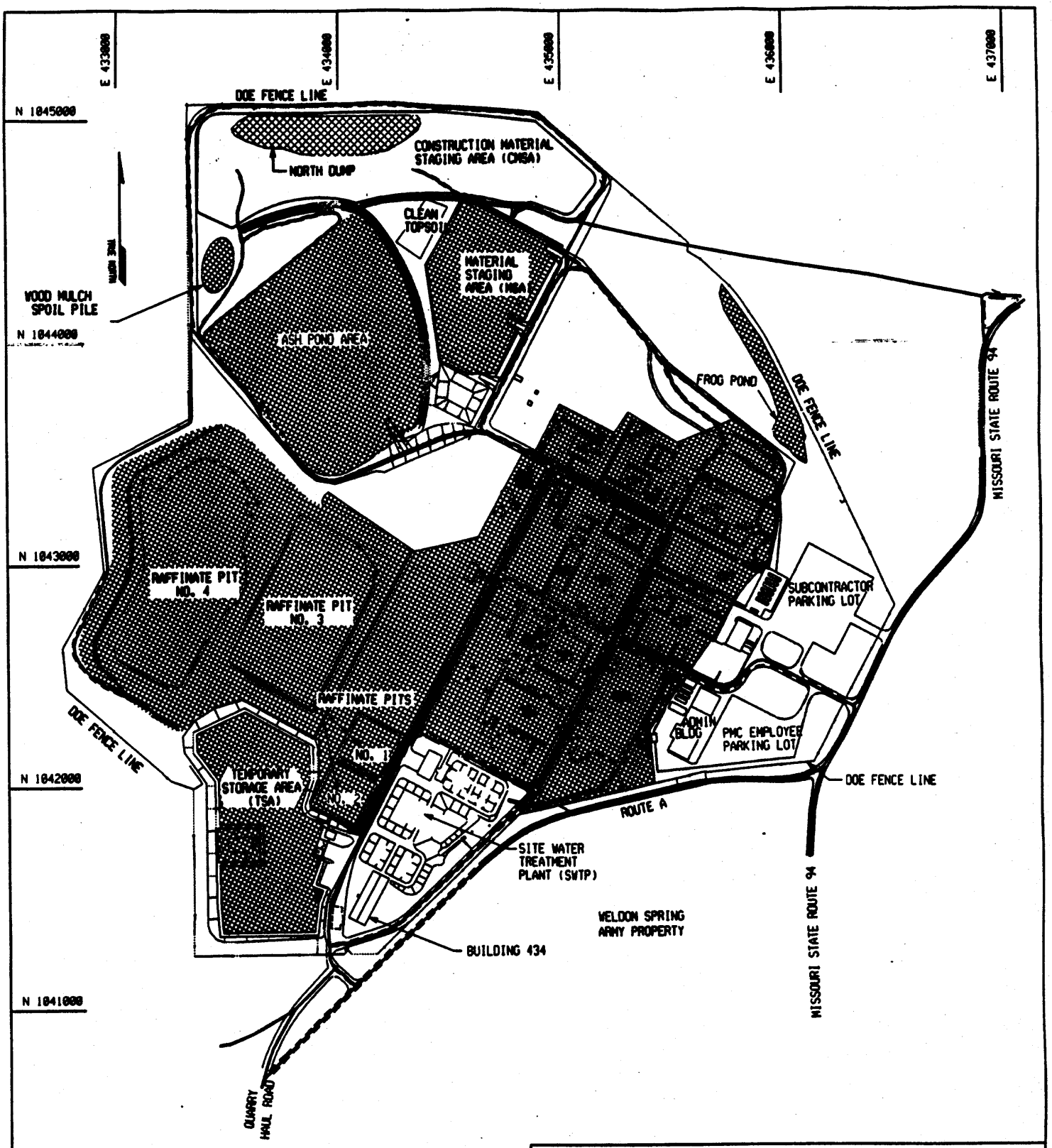
LEGEND

1	EXISTING SOUTH ACCESS (QUARRY HAUL ROAD)
2	EXISTING SWTP ACCESS FROM ROUTE A
3	EXISTING PMC EMPLOYEE SUBCONTRACTOR ACCESS
4	PROPOSED NORTH ACCESS (OFFSITE BORROW HAUL ROAD)
5	PROPOSED EMPLOYEE/CONTRACTOR/ SUBCONTRACTOR ACCESS (EXISTING ACCESS WOULD BE ABANDONED)
———	EXISTING ROADWAY SYSTEM

EXISTING ROADWAY SYSTEM

FIGURE 5.1.5-1

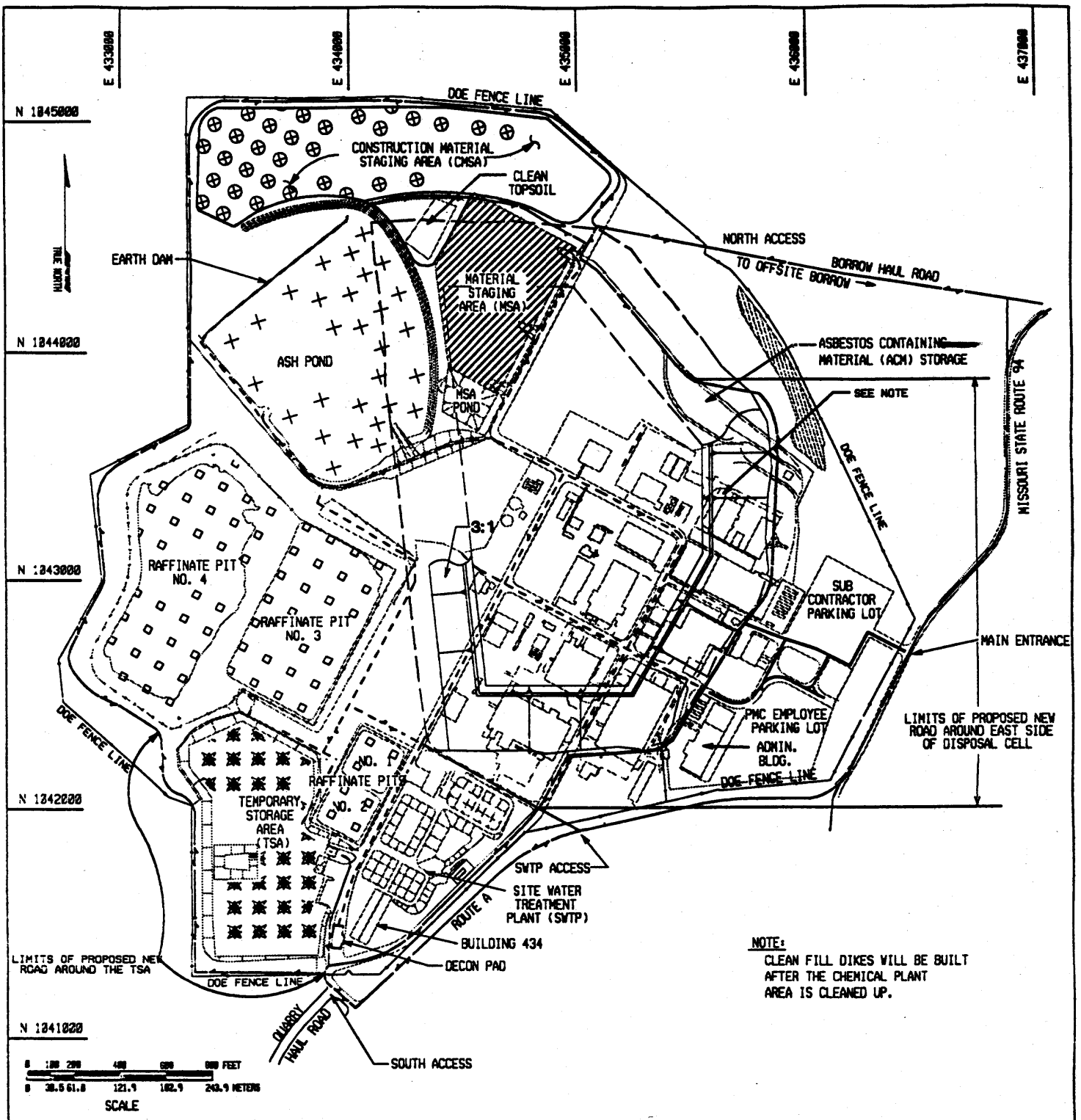
REPORT NO: DOE/OR/21548-411		DRAWING NO: 3840/SE01.DGN	
ORIGINATOR: MLB / FJH	DRAWING BY: S.HART	DATE: 09/07/93	



AREAS OF CONTAMINATION PRIOR TO DISPOSAL CELL CONSTRUCTION

FIGURE 5.1.5-2

REPORT NO: DOE/OR/21548-411		DRAWING NO: 3840/SEQ1.DGN	
ORIGINATOR: MLB / FJH	DRAWING BY: S.HART		DATE: 09/03/93



NOTE:
CLEAN FILL DIKES WILL BE BUILT AFTER THE CHEMICAL PLANT AREA IS CLEANED UP.

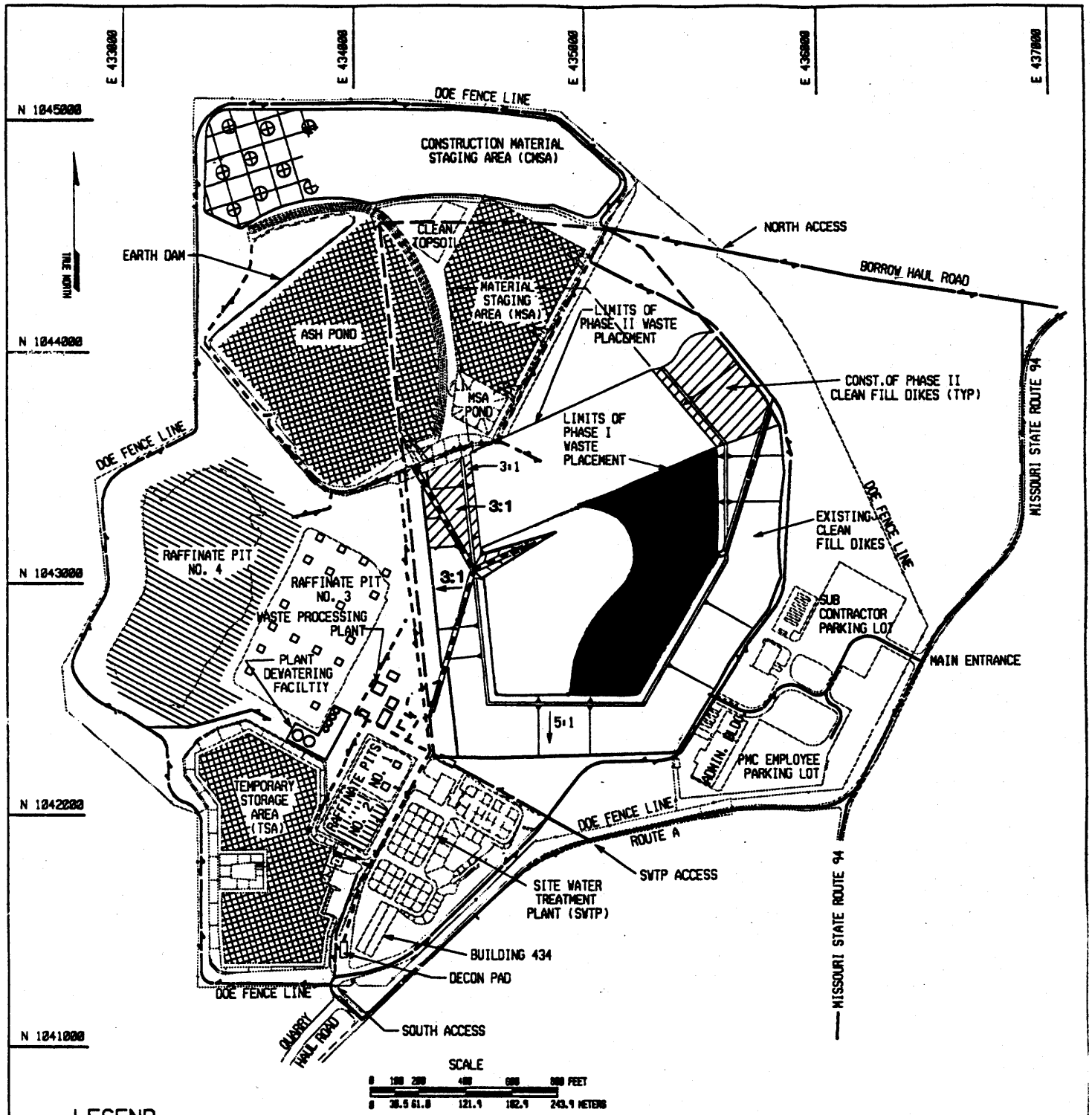
LEGEND

- EXISTING OR PROPOSED DIRTY ROADS
- EXISTING OR PROPOSED CLEAN ROADS
- OUTLINE OF DISPOSAL CELL TO BE CONSTRUCTED LATER
- EXCAVATION OF CONTAMINATED MATERIALS, SOIL, CONCRETE, METAL & PIPING
- CONTAMINATED SOIL AND/OR CONCRETE
- STOCKPILE CONTAMINATED MATERIAL FROM QUARRY TO BE REMOVED LATER
- STOCKPILE OF CLEAN SOIL FROM THE CHEMICAL PLANT AREA
- EXISTING CONTAMINATED MATERIAL TO BE REMOVED LATER

CONSTRUCTION OF DISPOSAL CELL (SEQUENCE 1)

FIGURE 5.1.5-3

REPORT NO: DOE/OR/21548-411		DRAWING NO: 384001/SEQ2.DGN
ORIGINATOR: MLB / FJH	DRAWING BY: AMF	DATE: 09/27/93



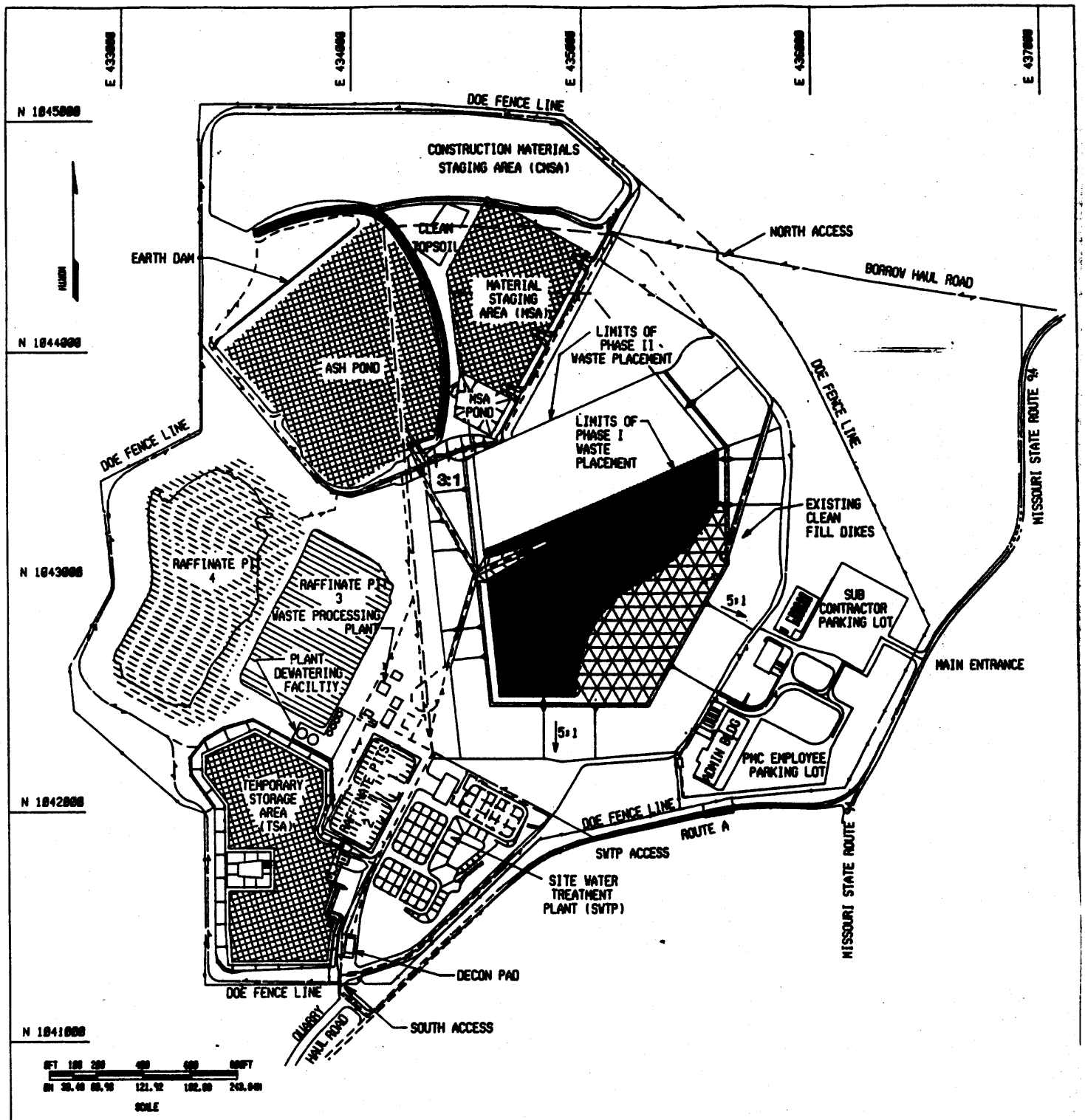
LEGEND

- EXISTING OR PROPOSED DIRTY ROADS
- EXISTING OR PROPOSED CLEAN ROADS
- OUTLINE OF DISPOSAL CELL TO BE CONSTRUCTED LATER
- REMOVING STOCKPILE MATERIAL AND PLACING INTO DISPOSAL CELL
- WASTE PLACEMENT IN CELL
- DREDGE WASTE FROM RAFFINATE PITS
- EXISTING CONTAMINATED MATERIALS TO BE REMOVED LATER
- REMOVING STOCKPILE MATERIAL TO BUILD CLEAN FILL DIKES
- CONSTRUCTION OF CLEAN FILL DIKES

CONSTRUCTION OF DISPOSAL CELL (SEQUENCE 2)

FIGURE 5.1.5-4

REPORT NO: DOE/OR/21548-411		DRAWING NO: 384001/SEQ3.DGN
ORIGINATOR: MLB / FOH	DRAWING BY: AMF	DATE: 11/20/92



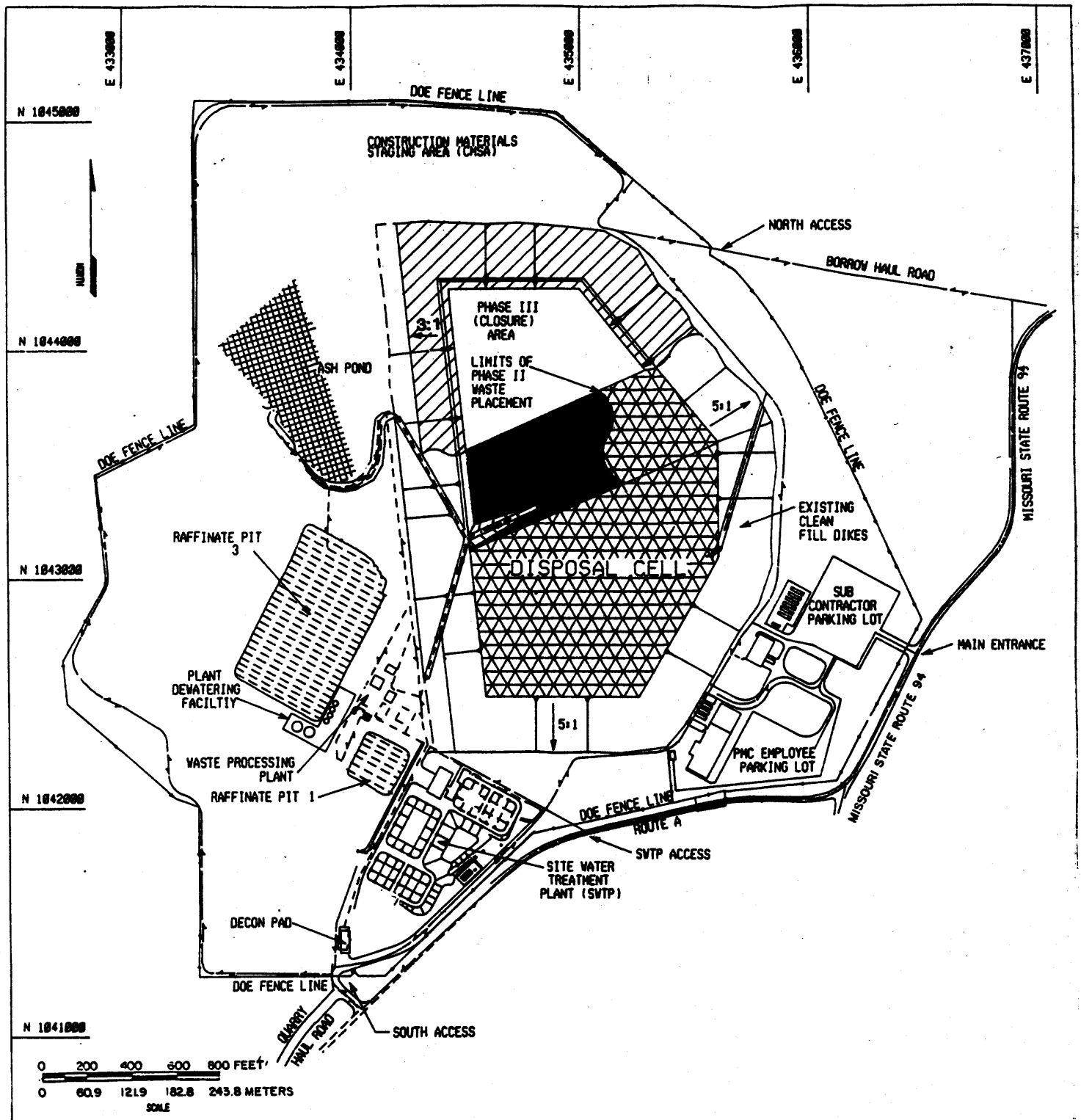
LEGEND

- EXISTING OR PROPOSED DIRTY ROADS
- EXISTING OR PROPOSED CLEAN ROADS
- OUTLINE OF DISPOSAL CELL (TO BE CONSTRUCTED LATER)
- REMOVAL OF STOCKPILE MATERIAL AND PLACEMENT INTO DISPOSAL CELL
- WASTE PLACEMENT IN DISPOSAL CELL
- DREDGE WASTE FROM RAFFINATE PITS
- REMOVAL OF CLAY BOTTOM FROM RAFFINATE PITS
- DISPOSAL CELL CLOSURE (COVER)

CONSTRUCTION OF DISPOSAL CELL (SEQUENCE 3)

FIGURE 5.1.5-5

REPORT NO: DOE/OR/21548-411		DRAWING NO:	
ORIGINATOR: MLB / FJH	DRAWING BY: AMF		DATE: 3/10/93



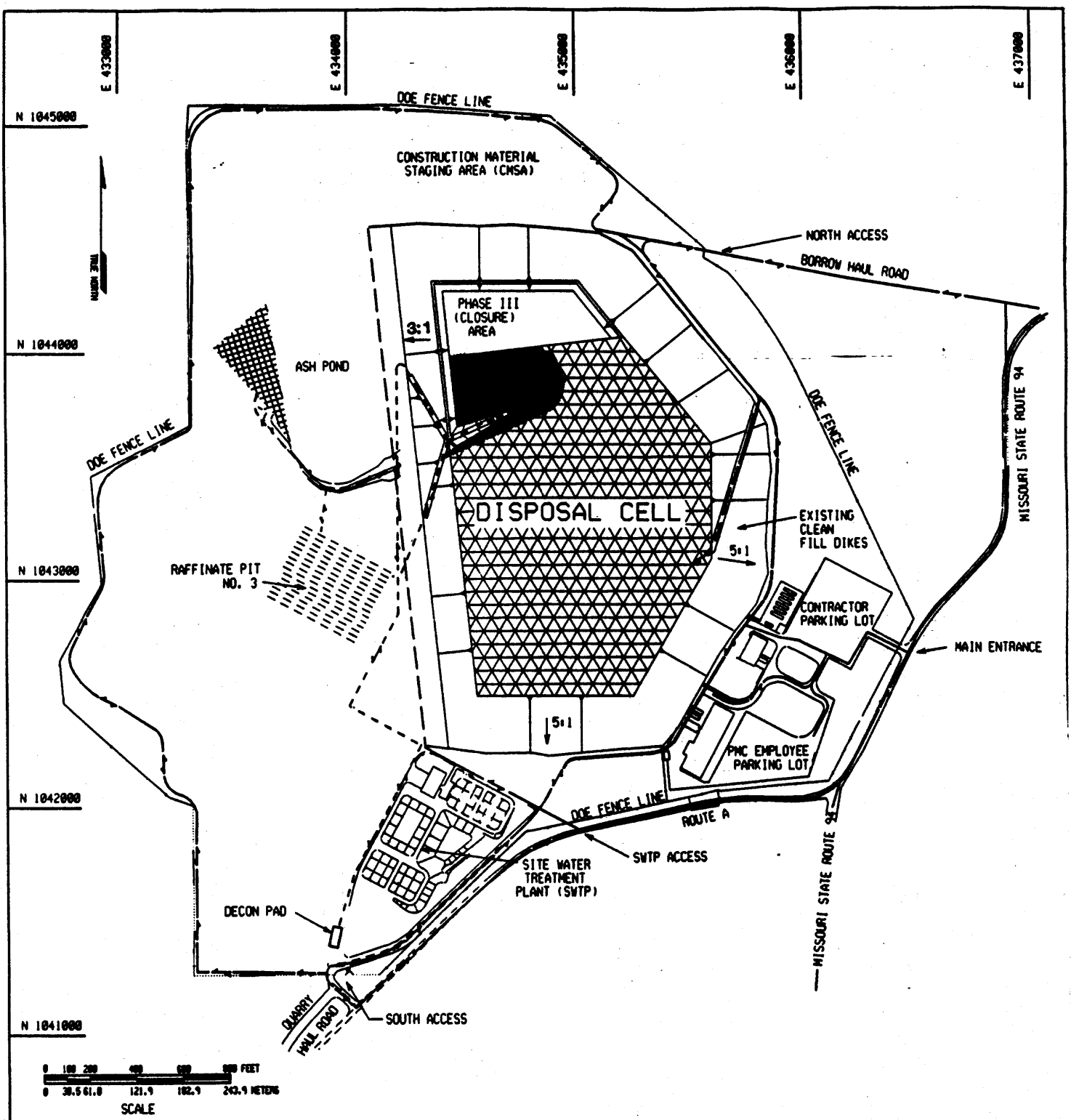
LEGEND

- EXISTING OR PROPOSED DIRTY ROADS
- EXISTING OR PROPOSED CLEAN ROADS
- OUTLINE OF DISPOSAL CELL (TO BE CONSTRUCTED LATER)
- REMOVAL OF STOCKPILE MATERIAL AND PLACEMENT INTO DISPOSAL CELL
- WASTE PLACEMENT IN DISPOSAL CELL
- CONSTRUCTION OF CLEAN-FILL DIKES
- REMOVAL OF CLAY BOTTOM FROM RAFFINATE PITS
- DISPOSAL CELL CLOSURE (COVER)

CONSTRUCTION OF DISPOSAL CELL (SEQUENCE 4)

FIGURE 5.1.5-6

REPORT NO: DOE/OR/21548-411		DRAWING NO:
ORIGINATOR: MLB / FJH	DRAWING BY: AMF	DATE: 3/10/93



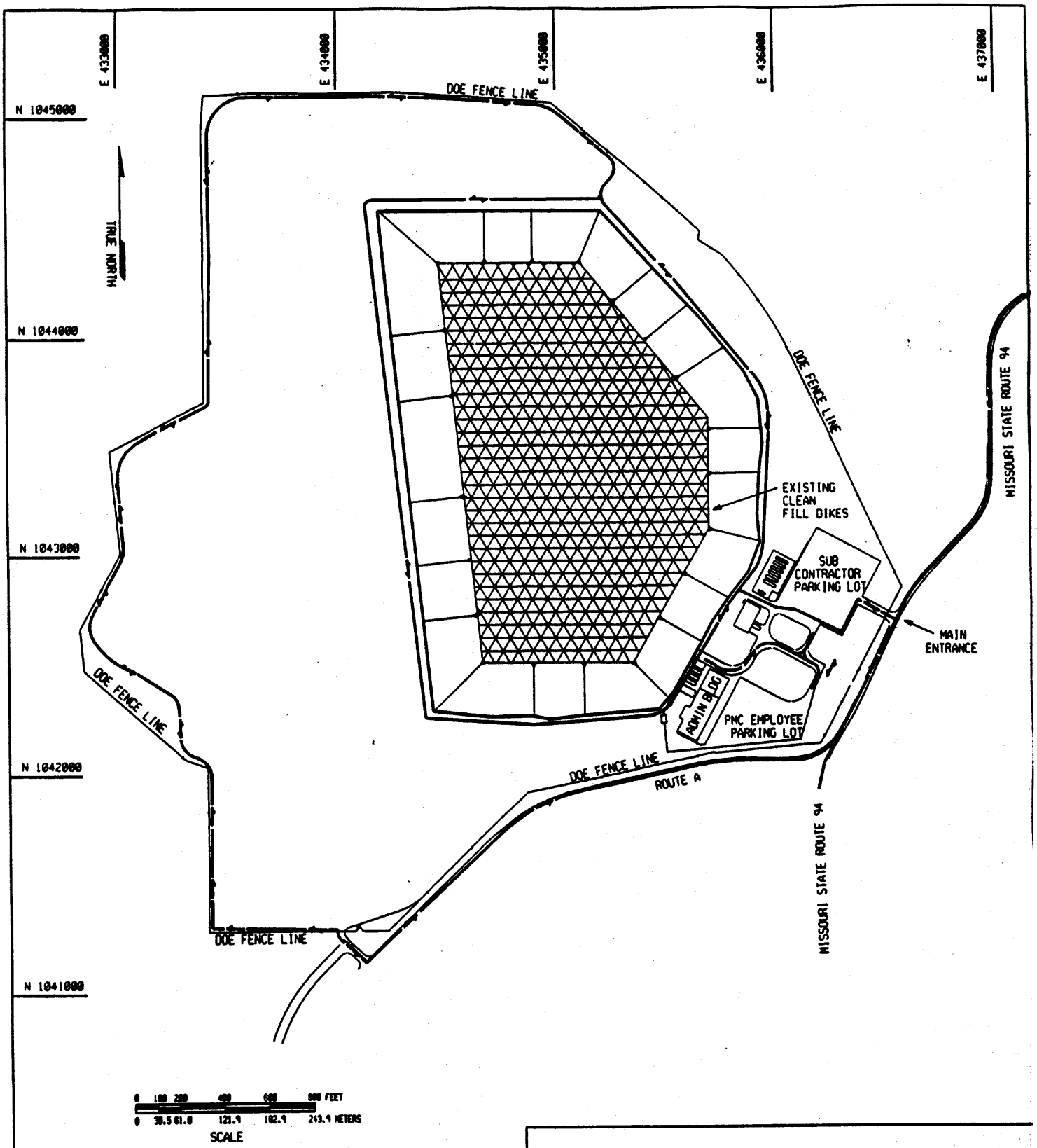
LEGEND

- EXISTING OR PROPOSED DIRTY ROADS
- EXISTING OR PROPOSED CLEAN ROADS
- OUTLINE OF DISPOSAL CELL TO BE CONSTRUCTED LATER
- REMOVING STOCKPILE MATERIAL AND PLACING INTO DISPOSAL CELL
- WASTE PLACEMENT IN CELL
- TOP & BOTTOM LINER REMOVAL OF RAFFINATE PITS
- CELL CLOSURE (COVER)

CONSTRUCTION OF DISPOSAL CELL (SEQUENCE 5)

FIGURE 5.1.5-7

REPORT NO:	DRAWING NO:	
DOE/OR/21548-411	384001/SE06.DGN	
ORIGINATOR: MLB / FJH	DRAWING BY: AMF	DATE: 09/07/93



0 100 200 400 600 800 FEET
0 30.5 61.0 121.9 182.9 243.9 METERS
SCALE

LEGEND

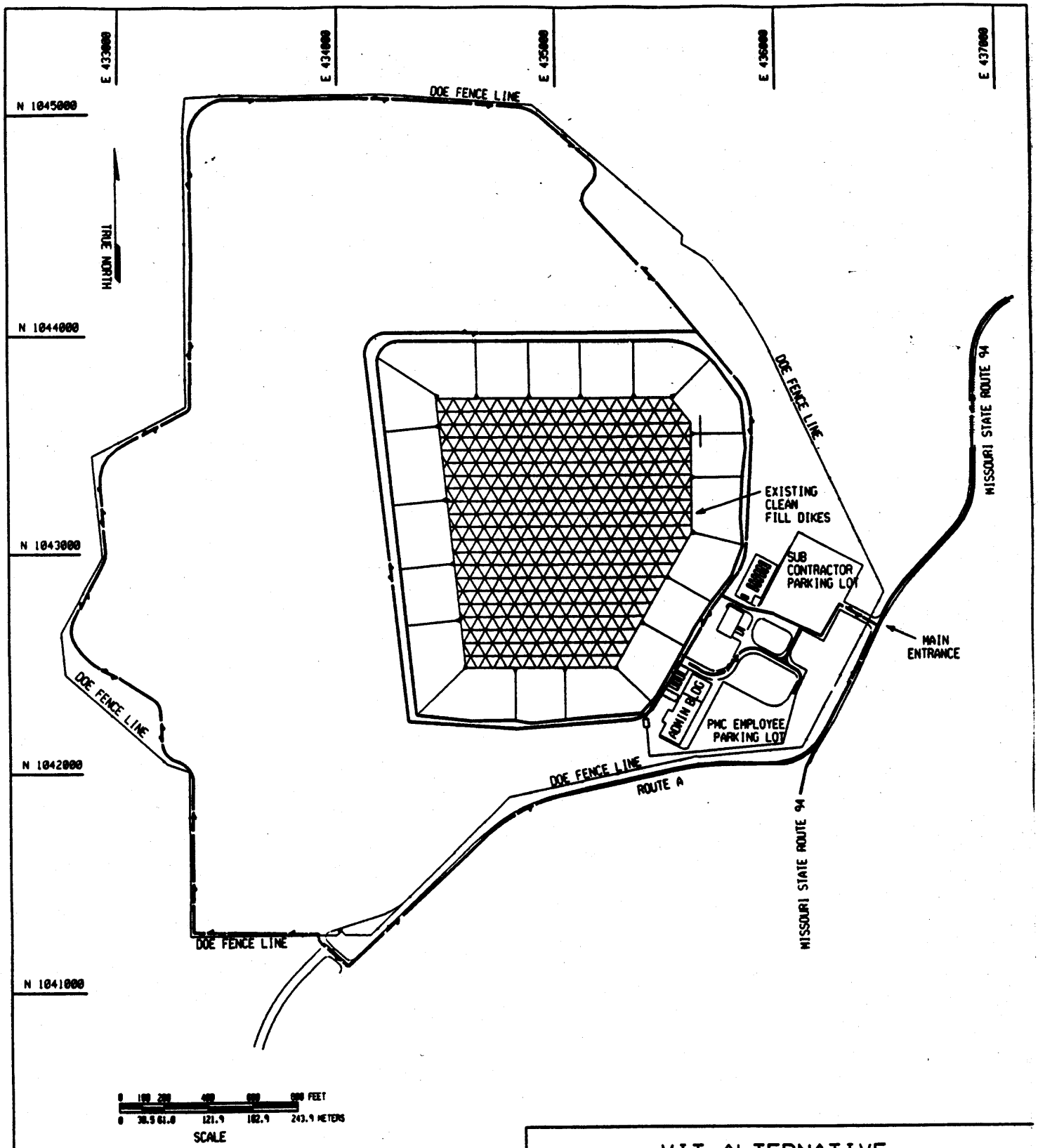
CELL CLOSURE (COVER)

CLEAN ROADS

CSS ALTERNATIVE
CONSTRUCTION OF DISPOSAL CELL
1.5 MILLION C.Y. OF WASTE
(CLOSURE PHASE)

FIGURE 5.1.5-8

REPORT NO: DOE/OR/21548-411		DRAWING NO: 384001/SE07.DGN
ORIGINATOR: MLB / FJH	DRAWING BY: AMF	DATE: 09/07/93



0 100 200 400 600 800 FEET
0 30.5 61.0 121.9 182.9 243.9 METERS
SCALE

LEGEND

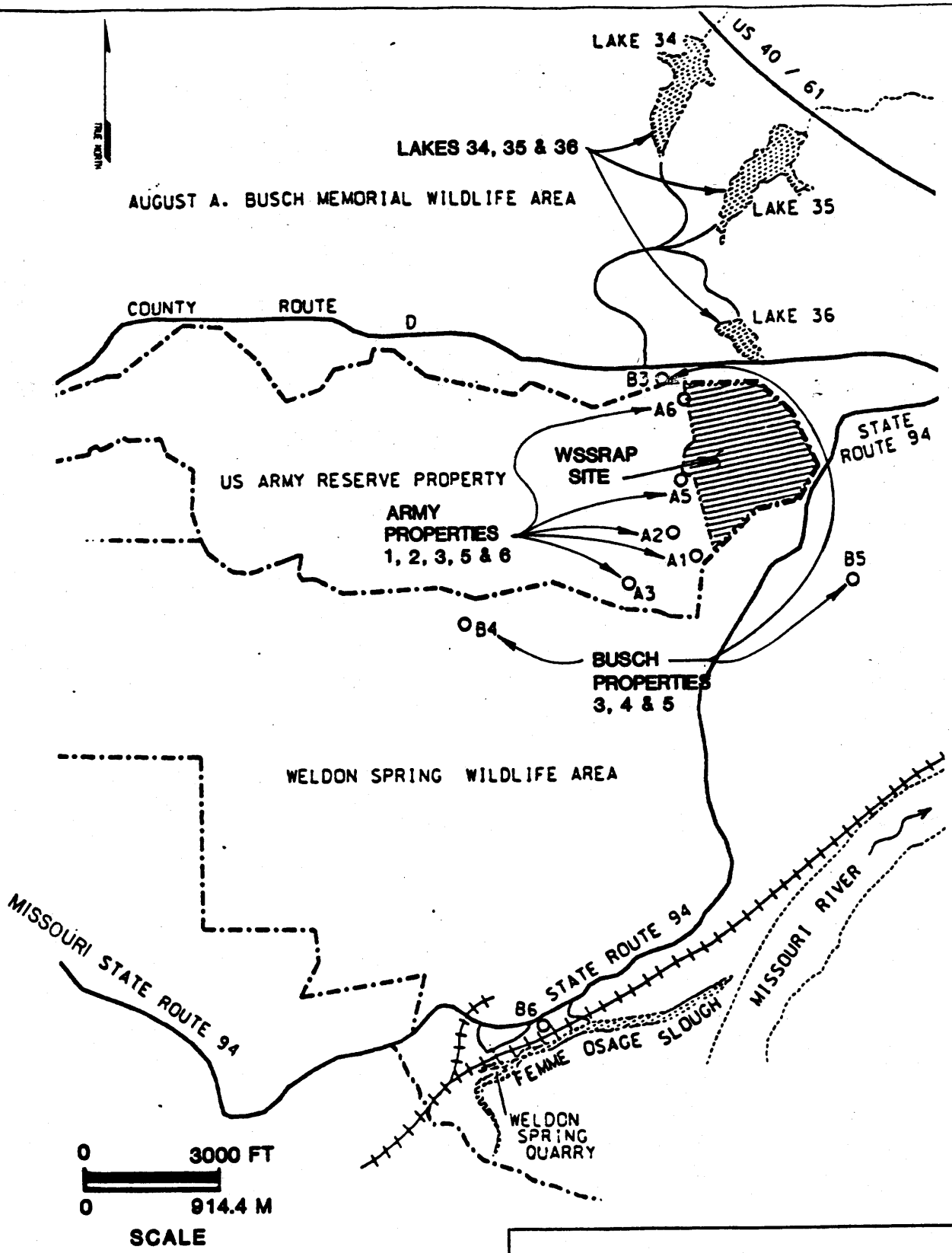
CELL CLOSURE (COVER)

CLEAN ROADS

VIT ALTERNATIVE
CONSTRUCTION OF DISPOSAL CELL
1 MILLION C.Y. OF WASTE
(CLOSURE PHASE)

FIGURE 5.1.5-9

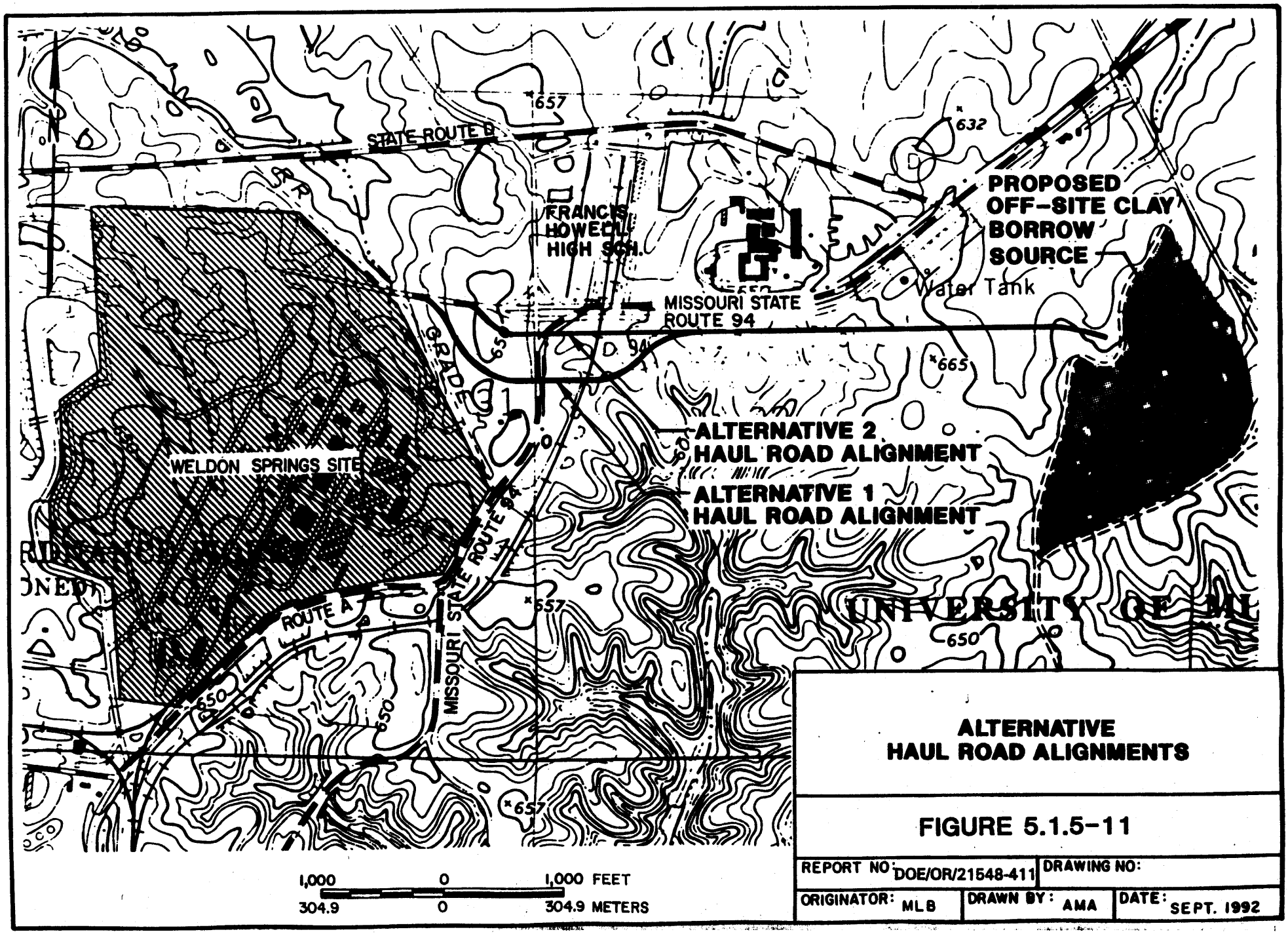
REPORT NO: DOE/OR/21548-411		DRAWING NO: 384001/SE07.DGN
ORIGINATOR: MLB / FJH	DRAWING BY: AMF	DATE: 09/07/93



RADIOLOGICALLY CONTAMINATED VICINITY PROPERTY LOCATIONS

FIGURE 5.1.5-10

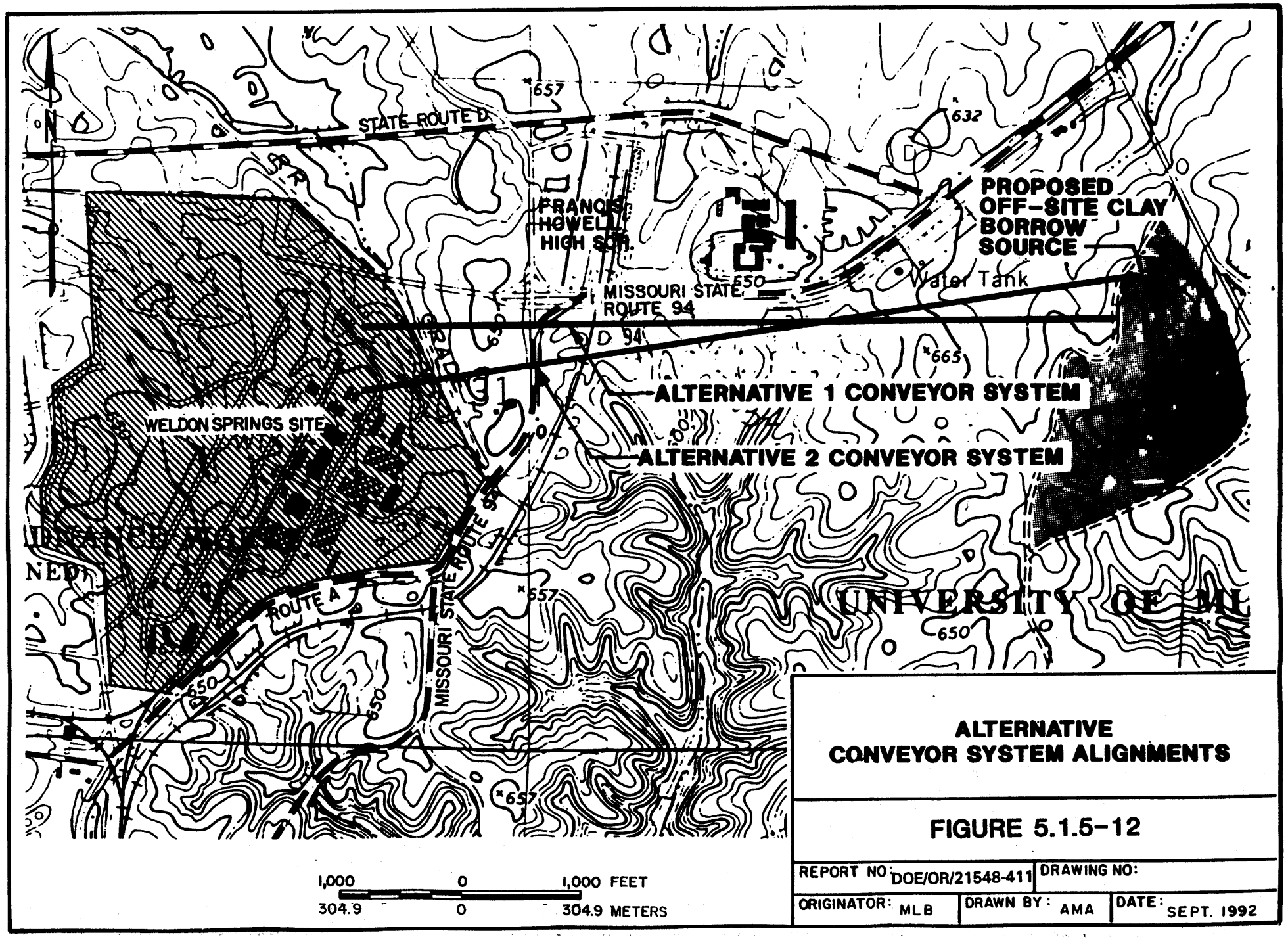
REPORT NO DOE/OR/21548-411		DRAWING NO
ORIGINATOR	DRAWING BY	DATE



ALTERNATIVE HAUL ROAD ALIGNMENTS

FIGURE 5.1.5-11

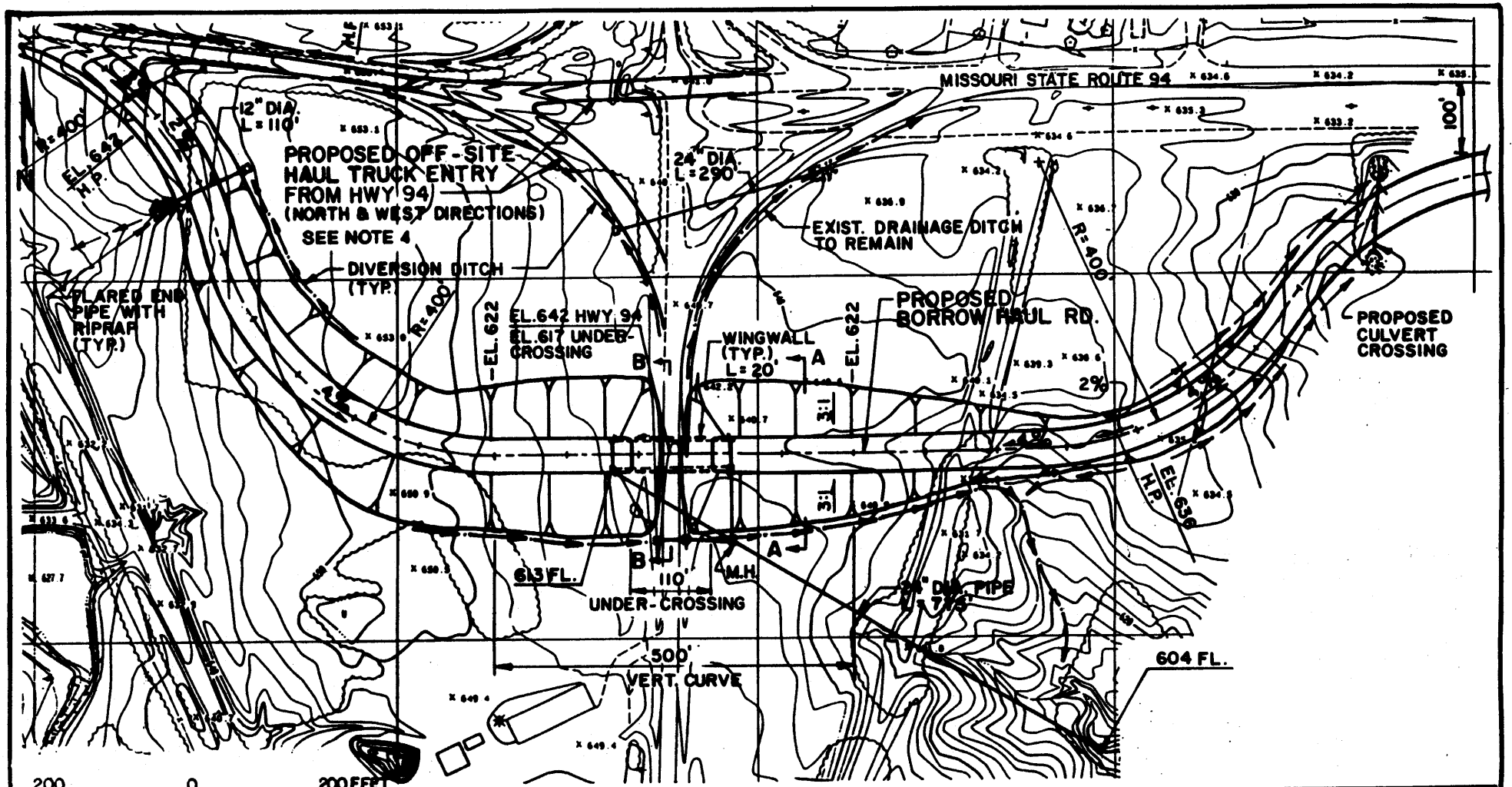
REPORT NO: DOE/OR/21548-411	DRAWING NO:	
ORIGINATOR: MLB	DRAWN BY: AMA	DATE: SEPT. 1992



ALTERNATIVE CONVEYOR SYSTEM ALIGNMENTS

FIGURE 5.1.5-12

REPORT NO: DOE/OR/21548-411	DRAWING NO:	
ORIGINATOR: MLB	DRAWN BY: AMA	DATE: SEPT. 1992



LEGEND

◻	PROPOSED DRAINAGE STRUCTURE
M.H.	MANHOLE
EL.	ELEVATION
R	RADIUS
L	LENGTH
FL.	FLOWLINE ELEVATION
H.P.	HIGH POINT
⊤⊤	CUT / EXCAVATION

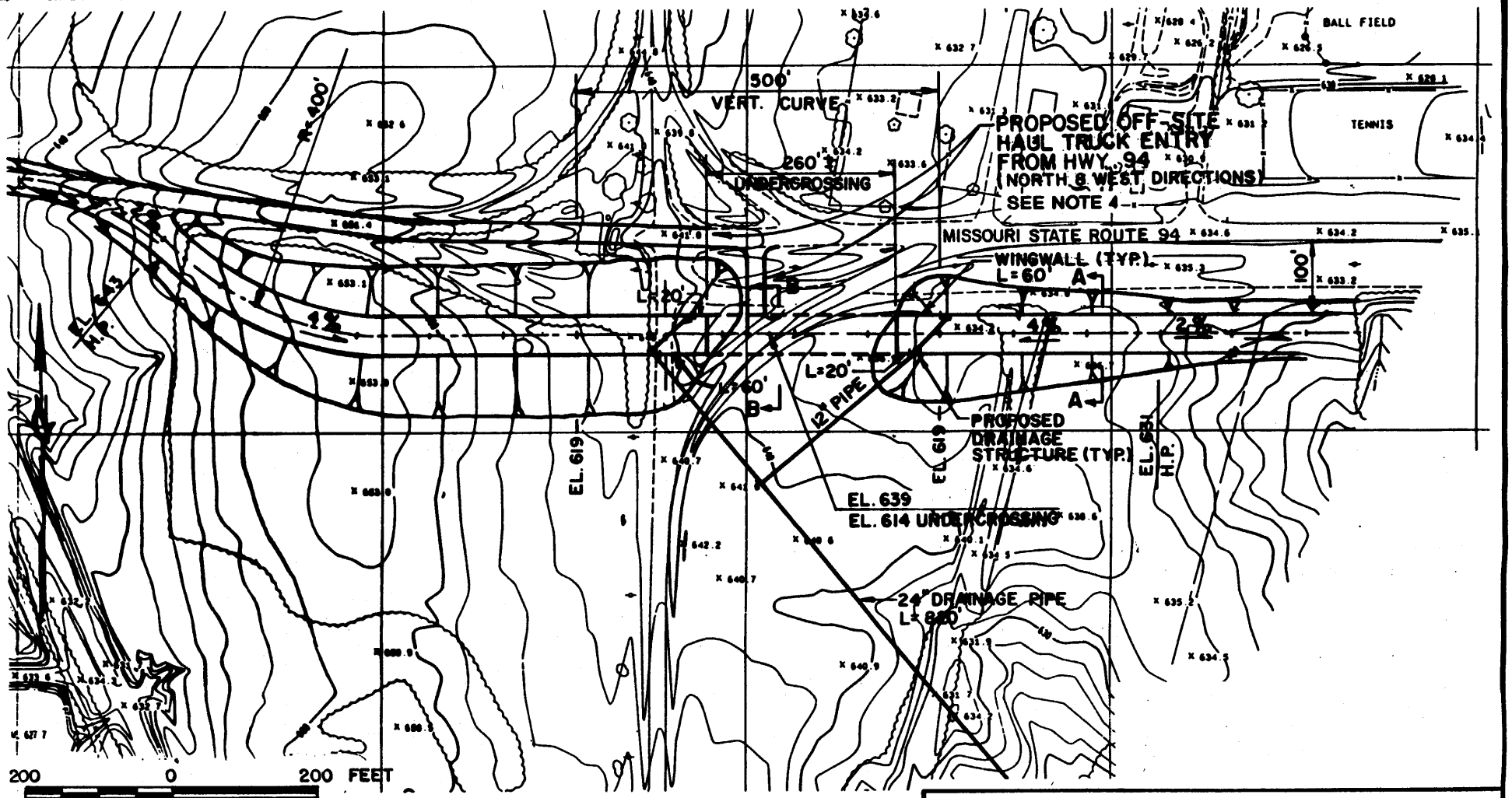
NOTES

1. EXISTING UTILITIES ALONG MSR. 94 TO BE RELOCATED AS NECESSARY.
2. SEE FIGURE 5.1.5-16 FOR SECTION B-B
3. SEE FIGURE 5.1.5-15 FOR SECTION A-A
4. ACCESS ROADS FROM HIGHWAY 94 TO BE PROVIDED, AS SHOWN, FOR DELIVERY TRUCKS TO EXIT OFF OF HIGHWAY 94 AND ENTER ONTO THE HAUL ROAD

ALTERNATIVE NO.1
TRUCK ALIGNMENT
MISSOURI STATE ROUTE 94
BORROW HAUL ROAD CROSSING

FIGURE 5.1.5-13

REPORT NO: DOE/OR/21548-411	DRAWING NO:	
ORIGINATOR: MLB	DRAWN BY: AMA	DATE: SEPT. 1992



LEGEND:

▫	PROPOSED DRAINAGE STRUCTURE
M.H.	MANHOLE
EL.	ELEVATION
R	RADIUS
L	LENGTH
FL.	FLOWLINE ELEVATION
H.P.	HIGH POINT
⊤⊤	CUT / EXCAVATION

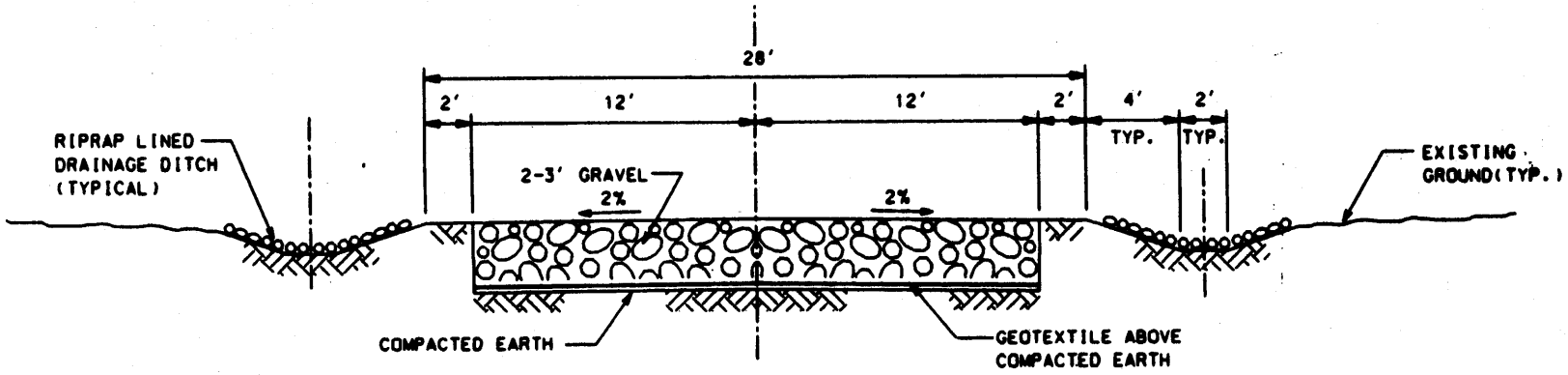
NOTES:

1. EXISTING UTILITIES ALONG M.S.R. 94 TO BE RELOCATED AS NECESSARY.
2. SEE FIGURE 5.1.5-16 FOR SECTION B-B
3. SEE FIGURE 5.1.5-15 FOR SECTION A-A
4. ACCESS ROADS FROM HIGHWAY 94 TO BE PROVIDED, AS SHOWN, FOR DELIVERY TRUCKS TO EXIT OFF OF HIGHWAY 94 AND ENTER ONTO THE HAUL ROAD

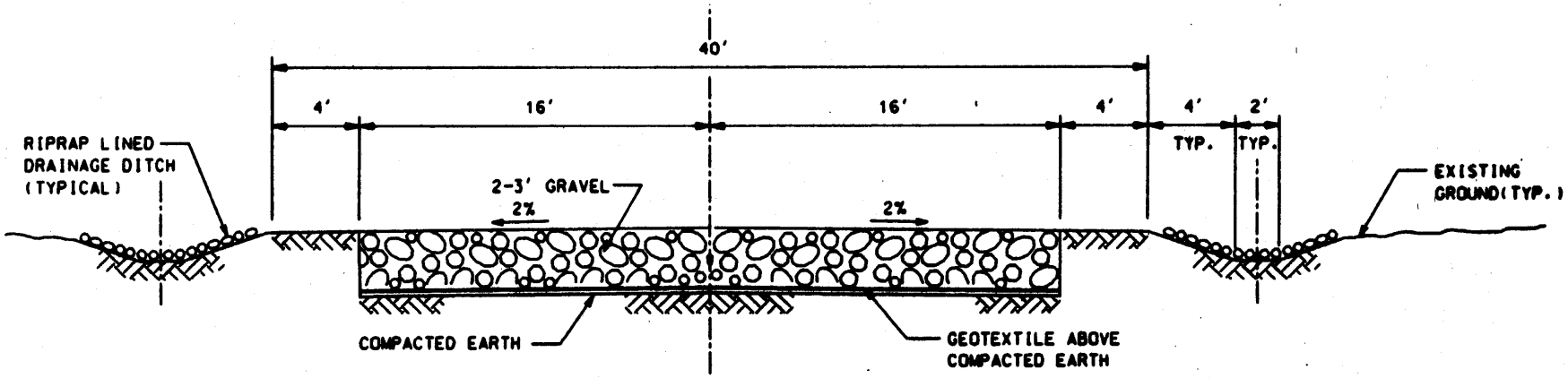
ALTERNATIVE NO.2
TRUCK ALIGNMENT
MISSOURI STATE ROUTE 94
BORROW HAUL ROAD CROSSING

FIGURE 5.1.5-14

REPORT NO: DOE/OR/21548-411	DRAWING NO:	
ORIGINATOR: MLB	DRAWN BY: AMA	DATE: SEPT. 1992



TWO WAY TRAFFIC
HIGHWAY TRUCK

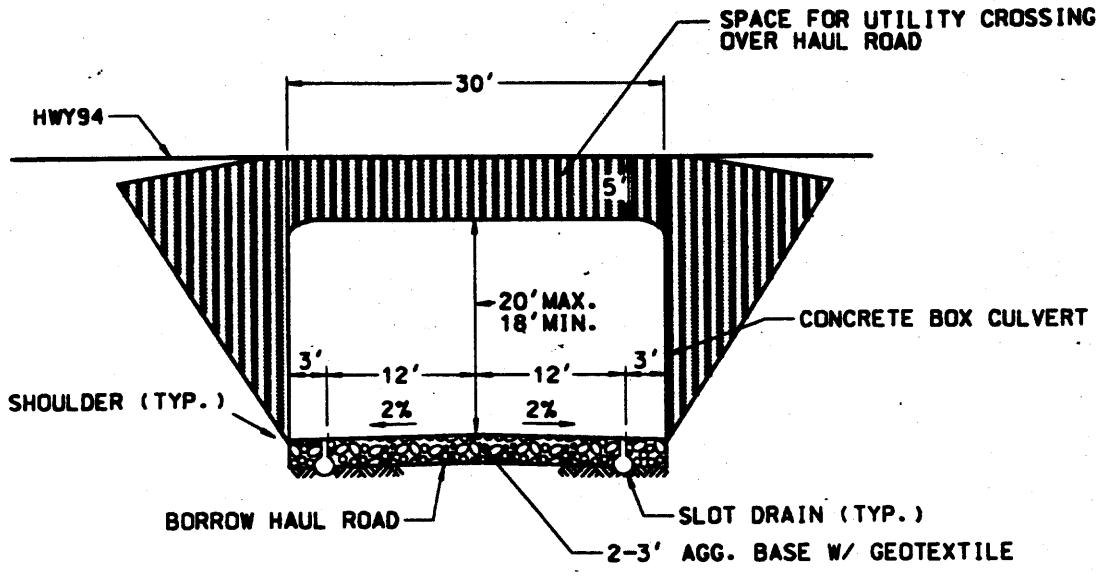


TWO WAY TRAFFIC
OFF-HIGHWAY TRUCK

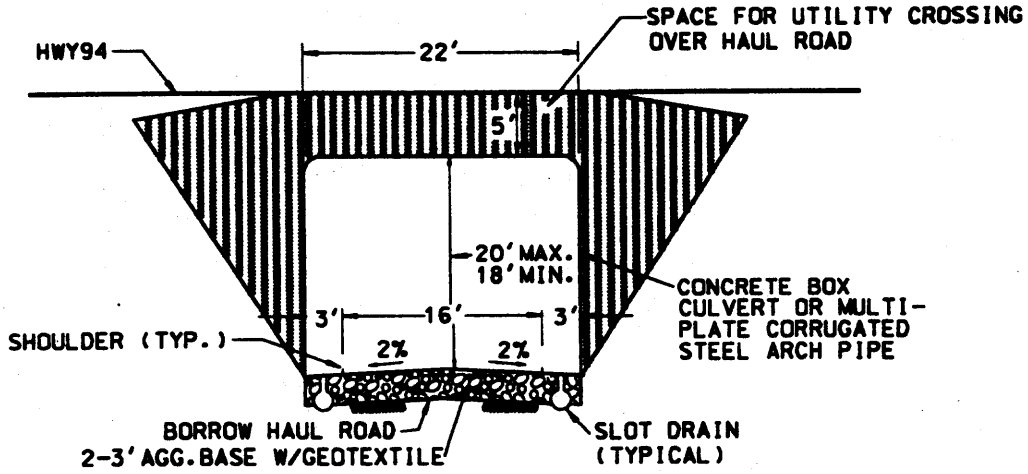
BORROW HAUL ROAD
TYPICAL CROSS SECTIONS
HIGHWAY & OFF-HIGHWAY TRUCKS
(SECTION A-A)

FIGURE 5.1.5-15

REPORT NO.: DOE/OR/21548-411		DRAWING NO.:	
ORIGINATOR: MLB	DRAWN BY: KSR		DATE: SEPT. 92



TWO-WAY OFF-HIGHWAY TRUCK UNDERCROSSING



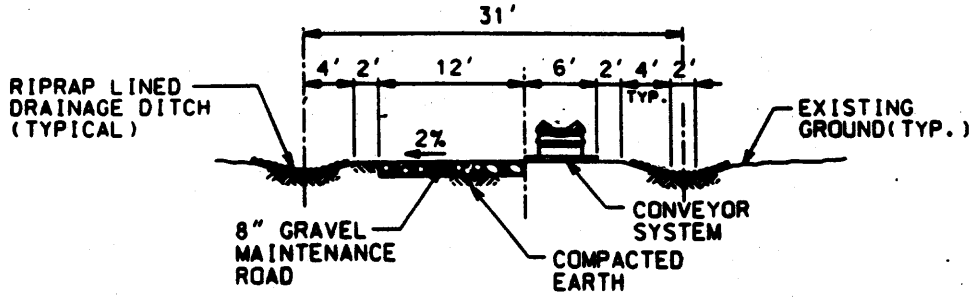
ONE-WAY OFF-HIGHWAY TRUCK UNDERCROSSING

NO SCALE

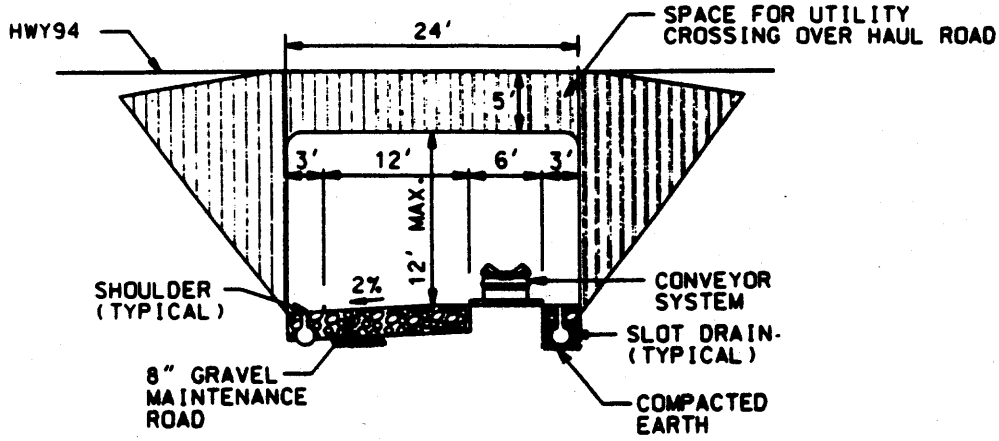
MISSOURI STATE ROUTE 94/BORROW HAUL ROAD CROSSING - SECTION B-B

FIGURE 5.1.5-16

REPORT NO: DOE/OR/21548-411	DRAWING NO:	
ORIGINATOR: MLB / FJH	DRAWING BY: AMF	DATE: SEPT. 92



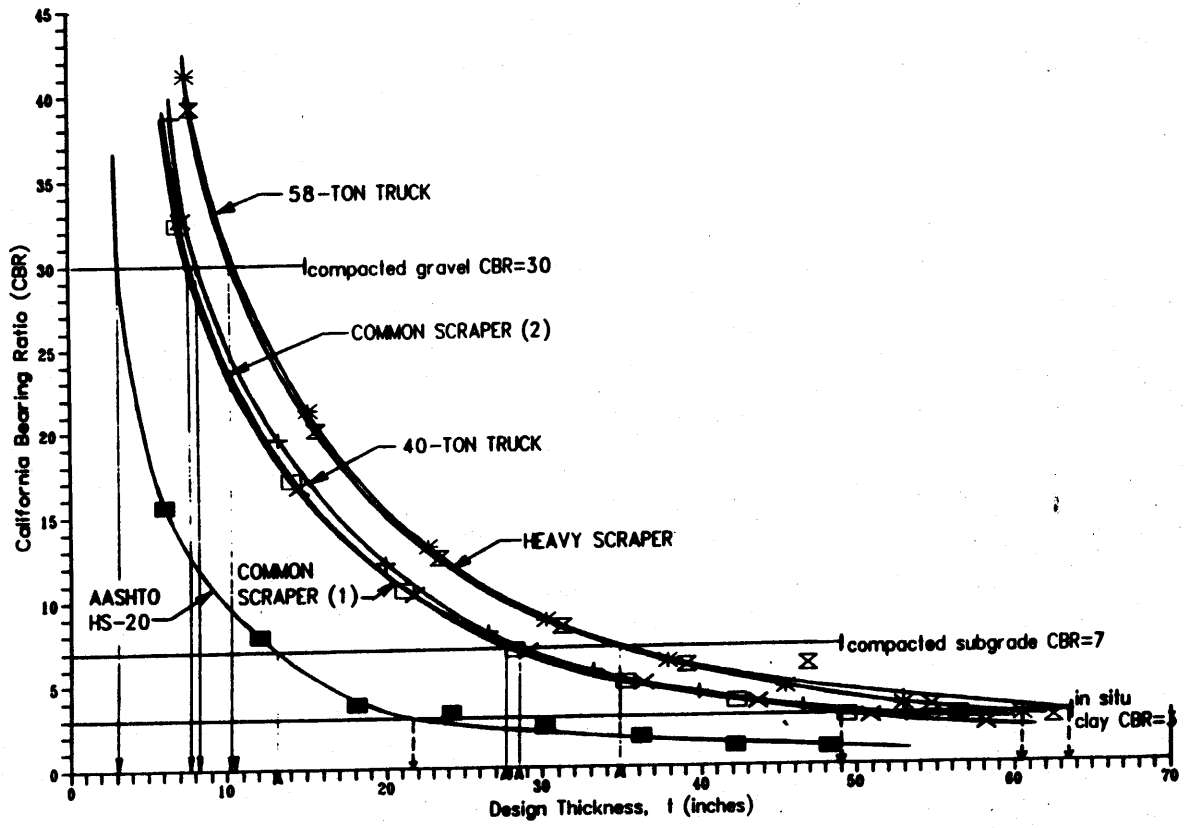
TYPICAL OVERLAND CONVEYOR INSTALLATION AT GRADE



CONVEYOR SYSTEM UNDERCROSSING AT MISSOURI STATE ROUTE 94

NOT TO SCALE

CONVEYOR SYSTEM TYPICAL CROSS SECTIONS		
FIGURE 5.1.5-17		
REPORT NO.: DOE/OR/21548-411	DRAWING NO.:	
ORIGINATOR: MLB	DRAWN BY: KSR	DATE: SEPT. 92



LEGEND

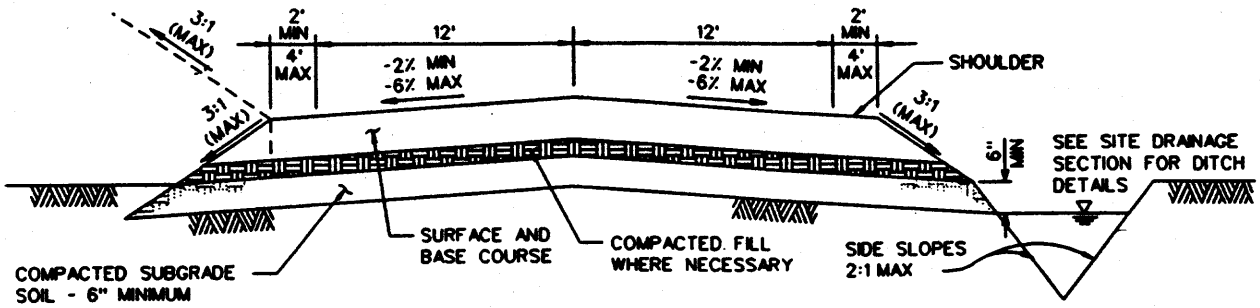
- ■ HS-20 LOADING
- + 40-TON TRUCK
- ✳ 58-TON TRUCK
- □ COMMON SCRAPER (1)
- × COMMON SCRAPER (2)
- ⧖ HEAVY SCRAPER

Required CBR vs. Design Thickness

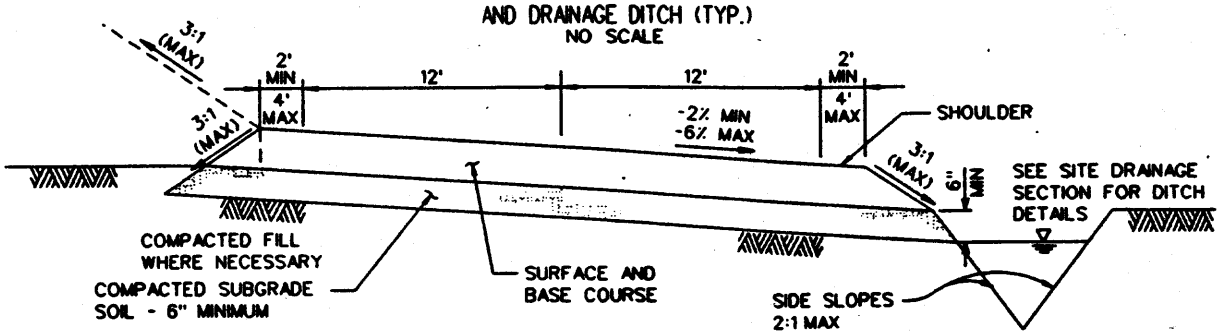
FIGURE 5.1.5-18

REPORT NO.	DRAWING NO.
DOE/OR/21548-411	

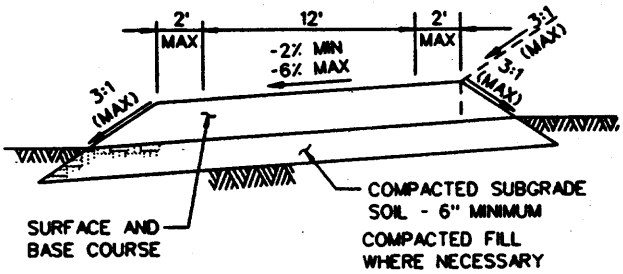
DESIGNATOR	DRAWN BY	DATE



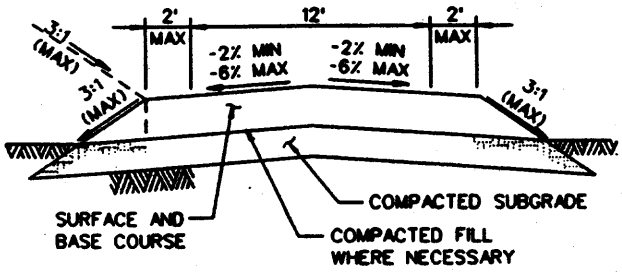
TWO-WAY DOUBLE-LANE WITH 2 TO 6% CROWN SLOPE
AND DRAINAGE DITCH (TYP.)
NO SCALE



TWO-WAY DOUBLE-LANE WITH 2 TO 6% CROSS SLOPE
AND DRAINAGE DITCH (TYP.)
NO SCALE

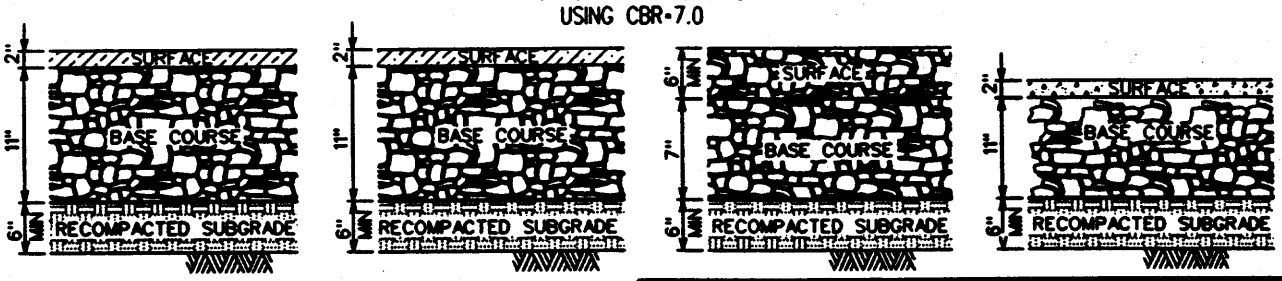


ONE-WAY SINGLE-LANE WITH 2 TO 6% CROSS SLOPE
NO SCALE



ONE-WAY SINGLE-LANE WITH 2 TO 6% CROWN SLOPE
NO SCALE

ALTERNATIVE PAVEMENT SECTIONS
(AASHTO HS-20 LOADING):
USING CBR-7.0



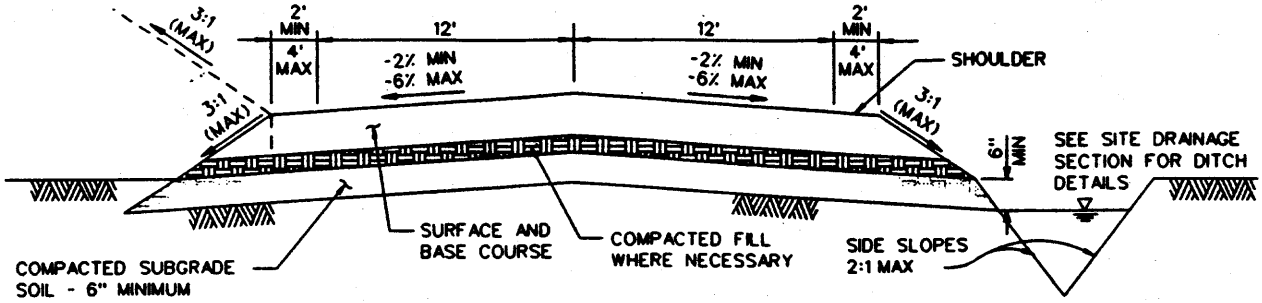
LEGEND:

- ASPHALT CONCRETE
- COMPACTED SUBGRADE SOIL
- PORTLAND CEMENT CONCRETE
- OIL/ROCK SURFACE
- COMPACTED GRAVEL
- GEOTEXTILE

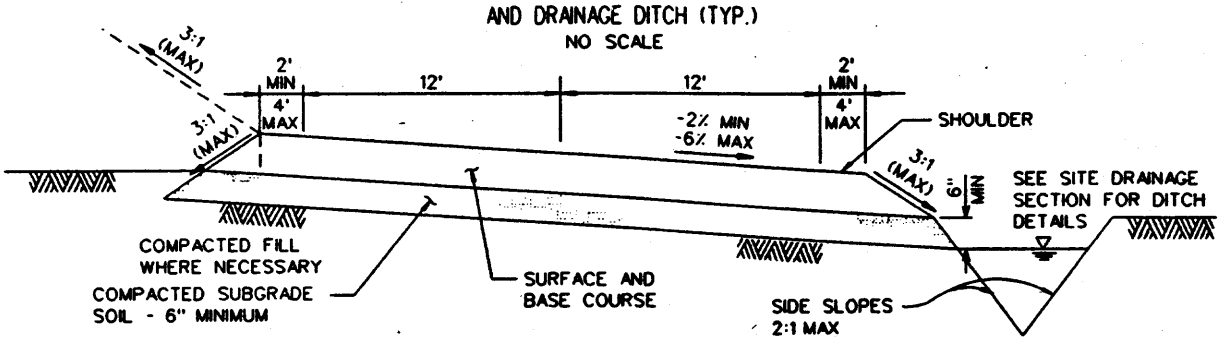
TYPICAL ROADWAY CROSS SECTIONS FOR HIGHWAY VEHICLE LOADING

FIGURE 5.1.5-19

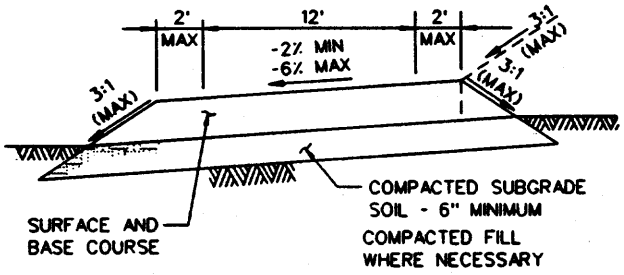
REPORT NO: DOE/OR/21548-411	DRAWING NO: 713PFIG.DGN	
ORIGINATOR: MLB	DRAWING BY: AMF	DATE: 09/07/93



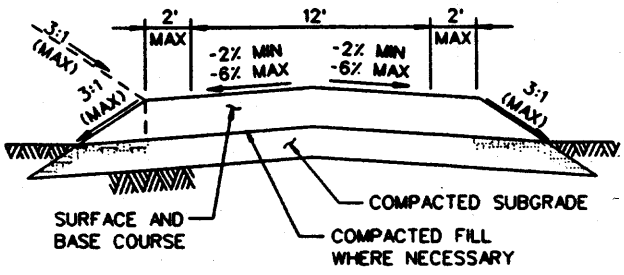
TWO-WAY DOUBLE-LANE WITH 2 TO 6% CROWN SLOPE
AND DRAINAGE DITCH (TYP.)
NO SCALE



TWO-WAY DOUBLE-LANE WITH 2 TO 6% CROSS SLOPE
AND DRAINAGE DITCH (TYP.)
NO SCALE

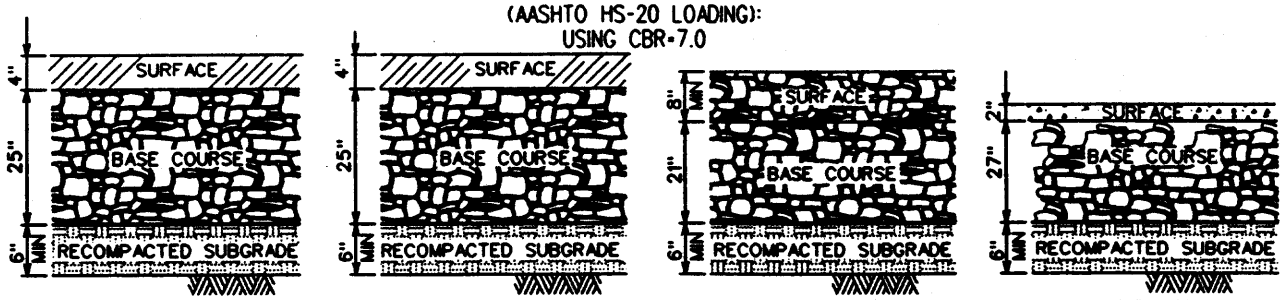


ONE-WAY SINGLE-LANE WITH 2 TO 6% CROSS SLOPE
NO SCALE



ONE-WAY SINGLE-LANE WITH 2 TO 6% CROWN SLOPE
NO SCALE

ALTERNATIVE PAVEMENT SECTIONS
(AASHTO HS-20 LOADING):
USING CBR=7.0



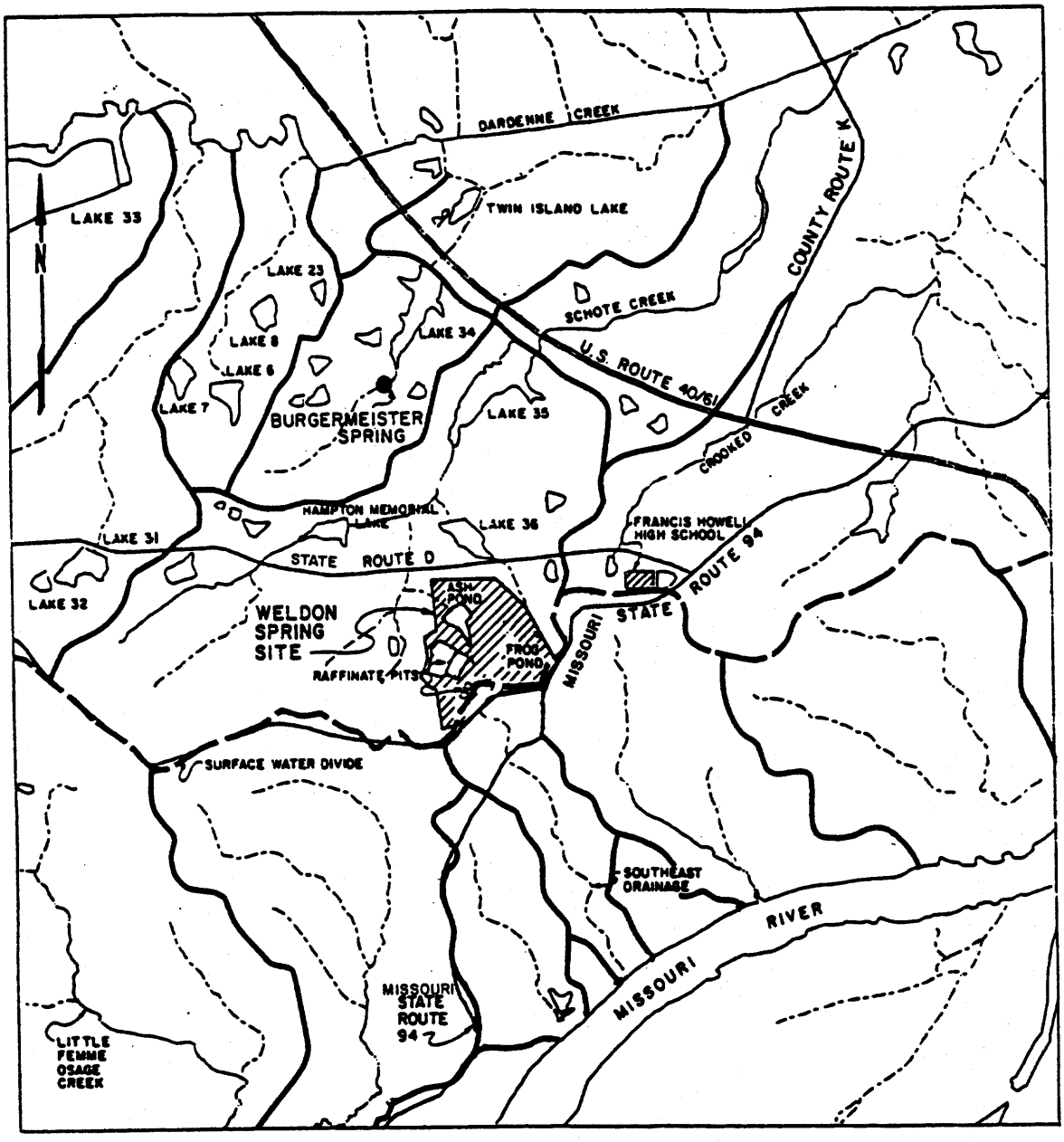
LEGEND:

- ASPHALT CONCRETE
- COMPACTED SUBGRADE SOIL
- PORTLAND CEMENT CONCRETE
- OIL/ROCK SURFACE
- COMPACTED GRAVEL
- GEOTEXTILE

TYPICAL ROADWAY CROSS SECTIONS FOR EXPECTED CONSTRUCTION VEHICLE LOADS

FIGURE 5.1.5-20

REPORT NO: DOE/OR/21548-411	DRAWING NO: 713PFIG.DGN	
ORIGINATOR: MLB	DRAWING BY: AMF	DATE: 09/07/93



0 3200 6400 FEET

0 975.4 1950.7 METERS

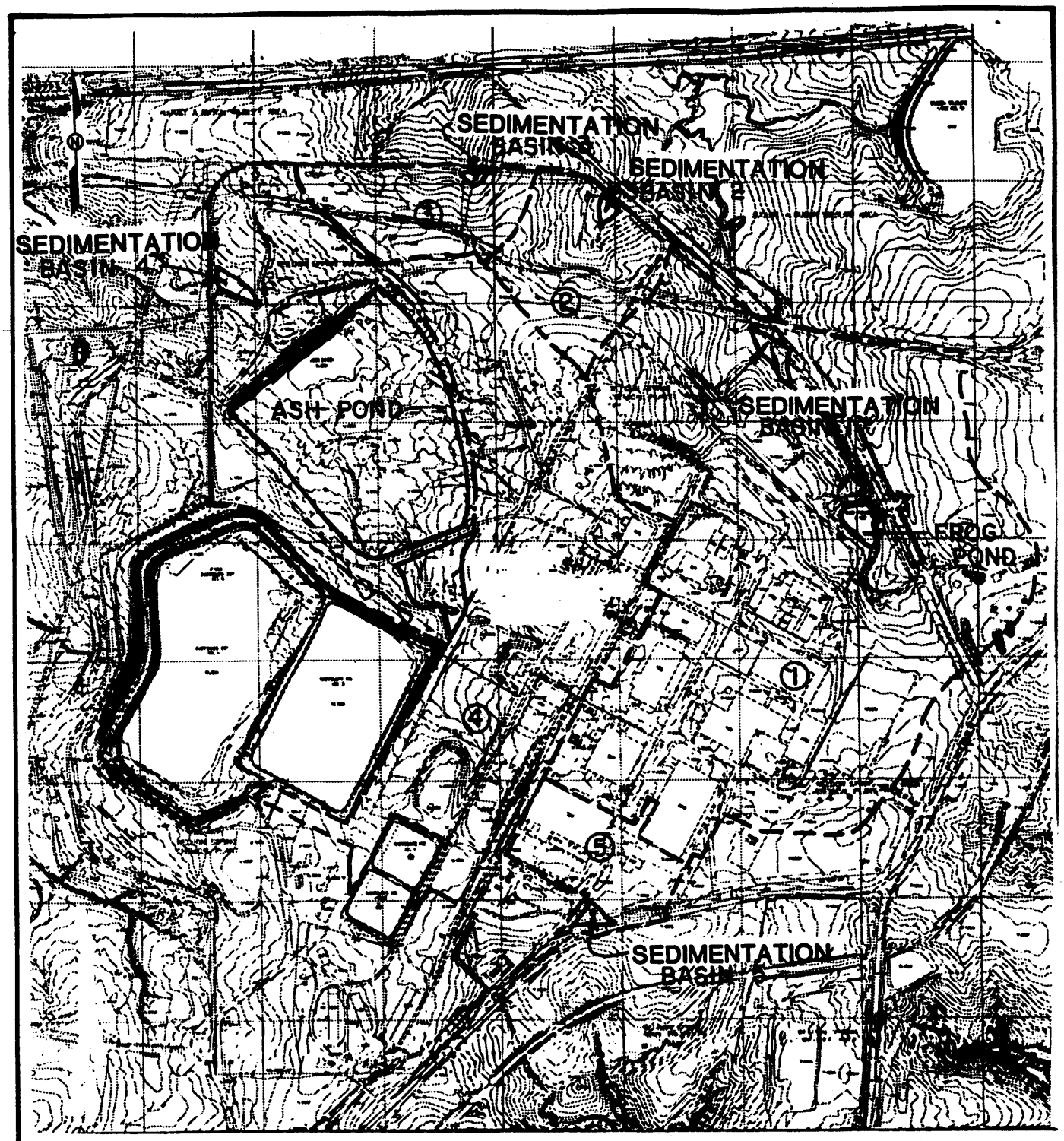
LEGEND

- SURFACE WATER DIVIDE BETWEEN MISSISSIPPI RIVER AND MISSOURI RIVER
- DRAINAGE BOUNDARY
- CREEK OR SURFACE DRAINAGE
- POND OR LAKE

SURFACE WATER FEATURES AND DRAINAGES AT THE WSS

FIGURE 5.1.6-1

REPORT NO.: DOE/OR/21548-411	DRAWING NO.:	
ORIGINATOR: S.B.	DRAWN BY: K.W.	DATE: NOV., 1992



LEGEND

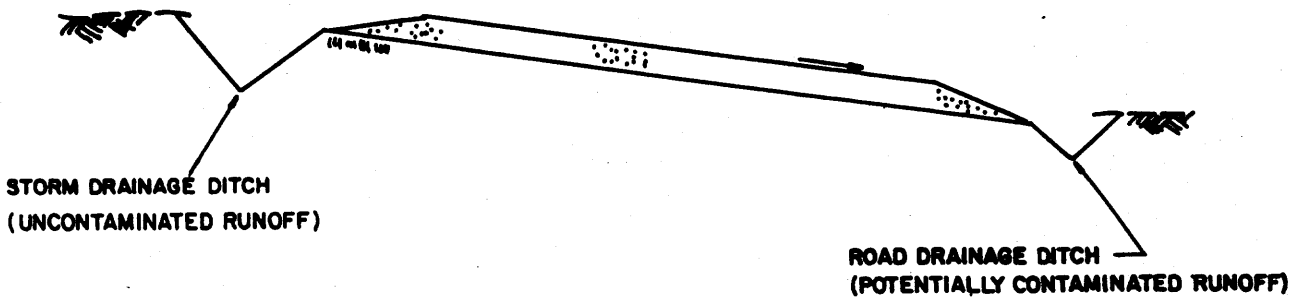
DRAINAGE DIVIDE

④ WATERSHED NUMBER

PROPOSED SEDIMENTATION BASINS AND WATERSHEDS AT THE WELDON SPRING CHEMICAL PLANT SITE

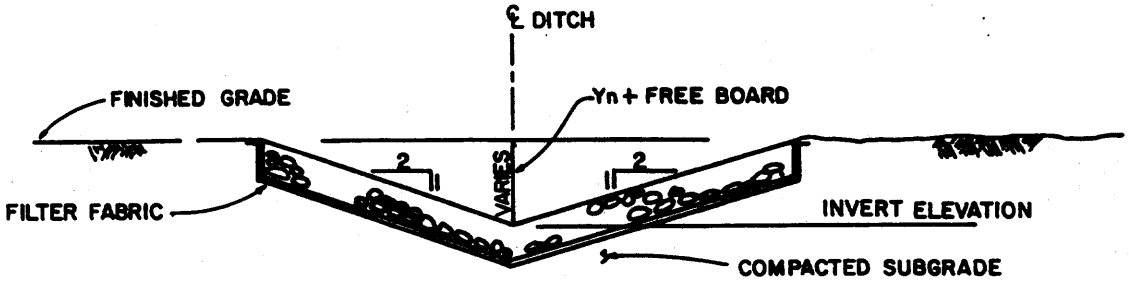
FIGURE 5.1.6-2

REPORT NO.: DOE/OR/21548-411		DRAWING NO.:
ORIGINATOR: S.B.	DRAWN BY: K.W.	DATE: NOV., 1992



DRAINAGE ON DIRTY HAUL ROADS

NOT TO SCALE



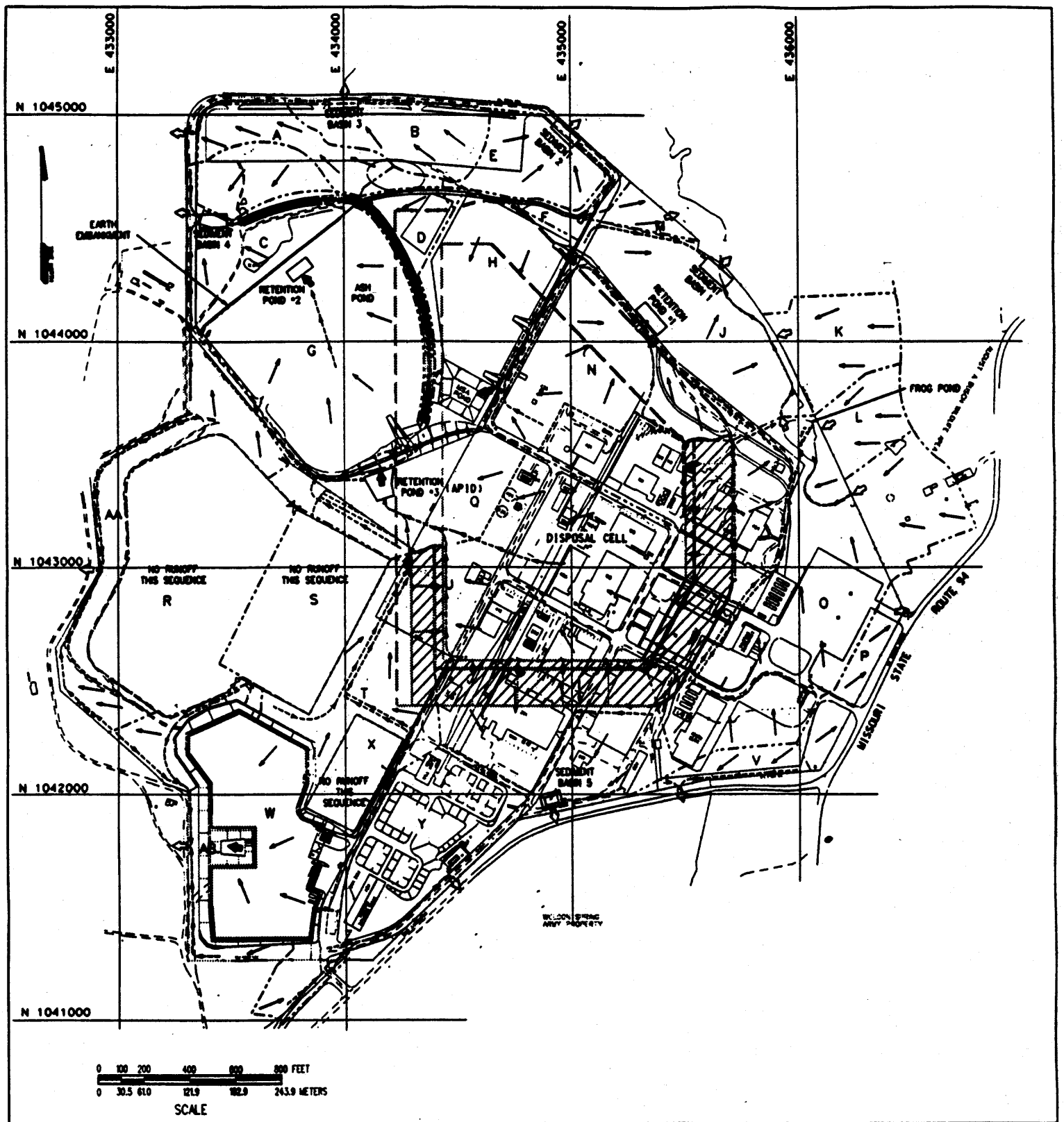
TYPICAL RIPRAP DIVERSION DITCH SECTION

NOT TO SCALE

VARIABLES

Yn = NORMAL DEPTH

SITE DRAINAGE DETAILS-DITCHES		
FIGURE 5.1.6- 3		
REPORT NO.: DOE/OR/21548-411	DRAWING NO.:	
ORIGINATOR: S.B.	DRAWN BY: K.W.	DATE: NOV., 1992



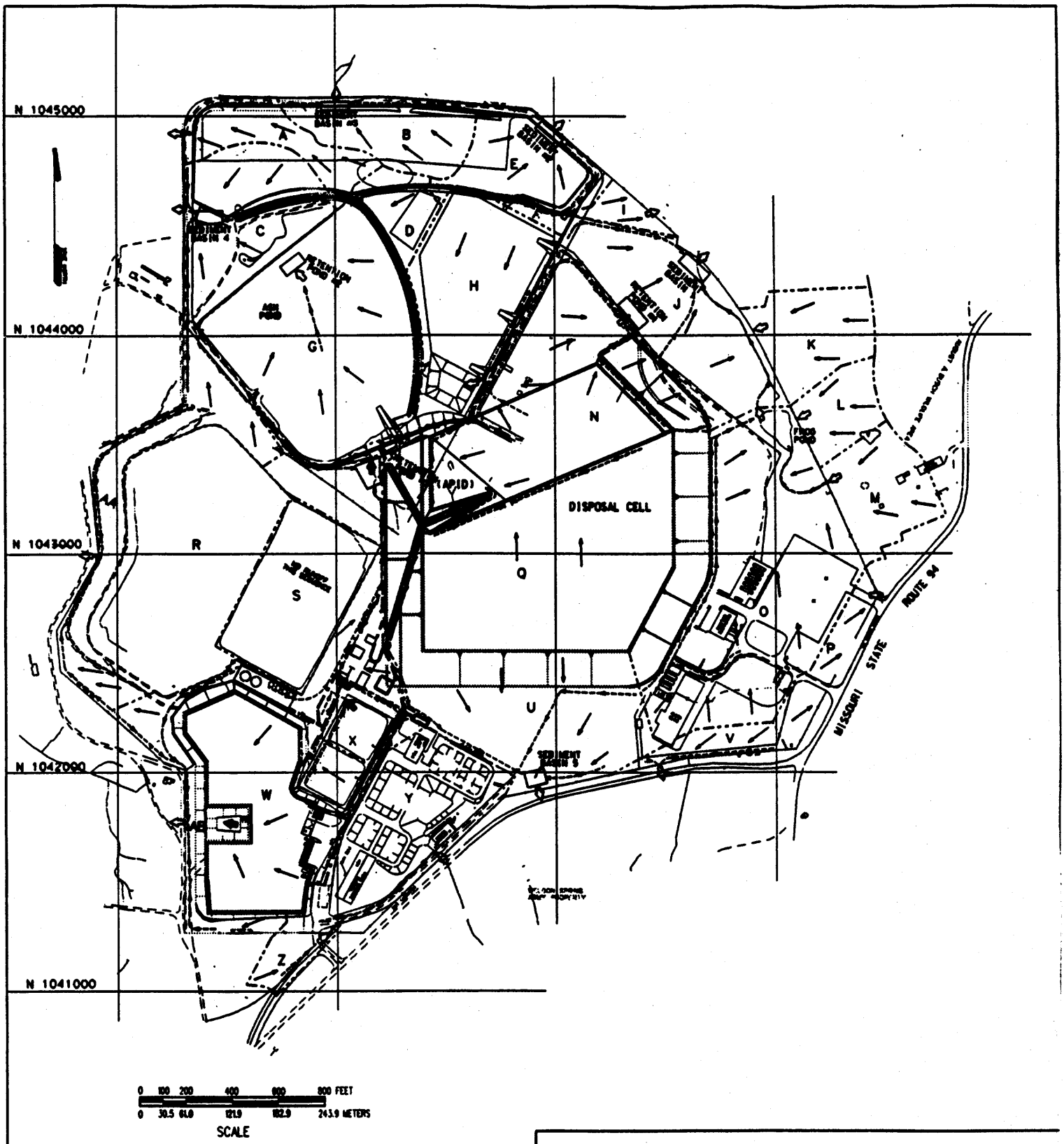
LEGEND :

A-Z, AA, AB	WATERSHED
	WATERSHED BOUNDARY
	OVERLAND FLOW DIRECTION
	DIRECTED FLOW
	CONTAMINATED DISCHARGE LOCATION
	UNCONTAMINATED DISCHARGE LOCATION
	CULVERT

SITE DRAINAGE SYSTEM DURING DISPOSAL CELL CONSTRUCTION (END OF SEQUENCE ONE)

FIGURE 5.1.6-4

REPORT NO.: DOE/OR/21548-411		DRAWING NO.: 384001/564-1a	
ORIGINATOR: SCB	DRAWN BY: Cwf	DATE: 09/01/93	



0 100 200 400 600 800 FEET
0 30.5 61.0 121.9 182.9 243.9 METERS
SCALE

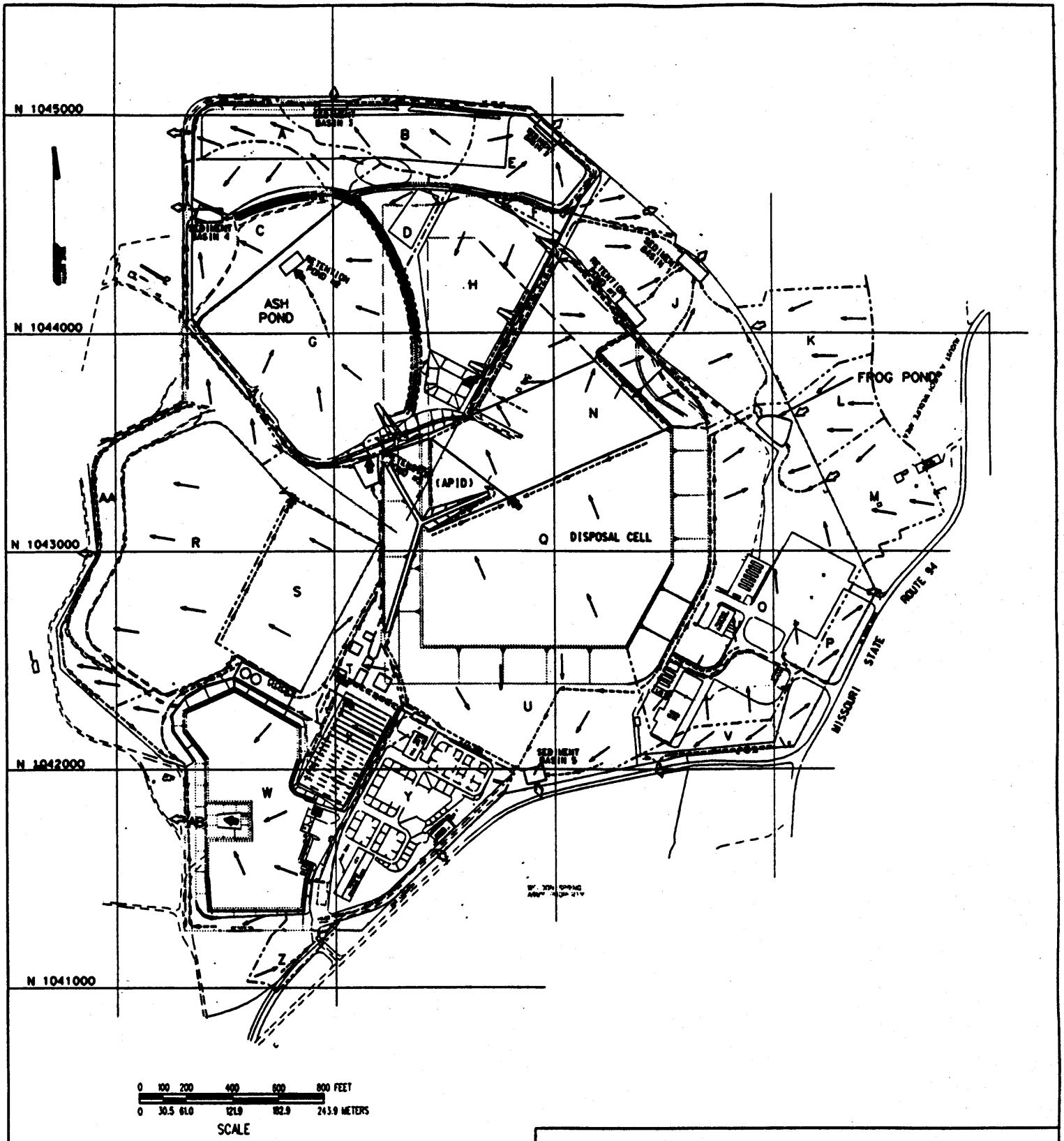
LEGEND :

A-Z. AA. AB	WATERSHED
---·---·---	WATERSHED BOUNDARY
—→	OVERLAND FLOW DIRECTION
---→	DIRECTED FLOW
⇨	CONTAMINATED DISCHARGE LOCATION
⇨	UNCONTAMINATED DISCHARGE LOCATION
⊢⊣	CULVERT

SITE DRAINAGE SYSTEM DURING DISPOSAL CELL CONSTRUCTION (END OF SEQUENCE TWO)

FIGURE 5.1.6-5

REPORT NO.: DOE/OR/21548-411		DRAWING NO.: 384001/564-1b	
ORIGINATOR: SCB	DRAWN BY: Cwf	DATE: 09/02/93	



0 100 200 400 600 800 FEET
0 30.5 61.0 121.9 182.9 243.9 METERS
SCALE

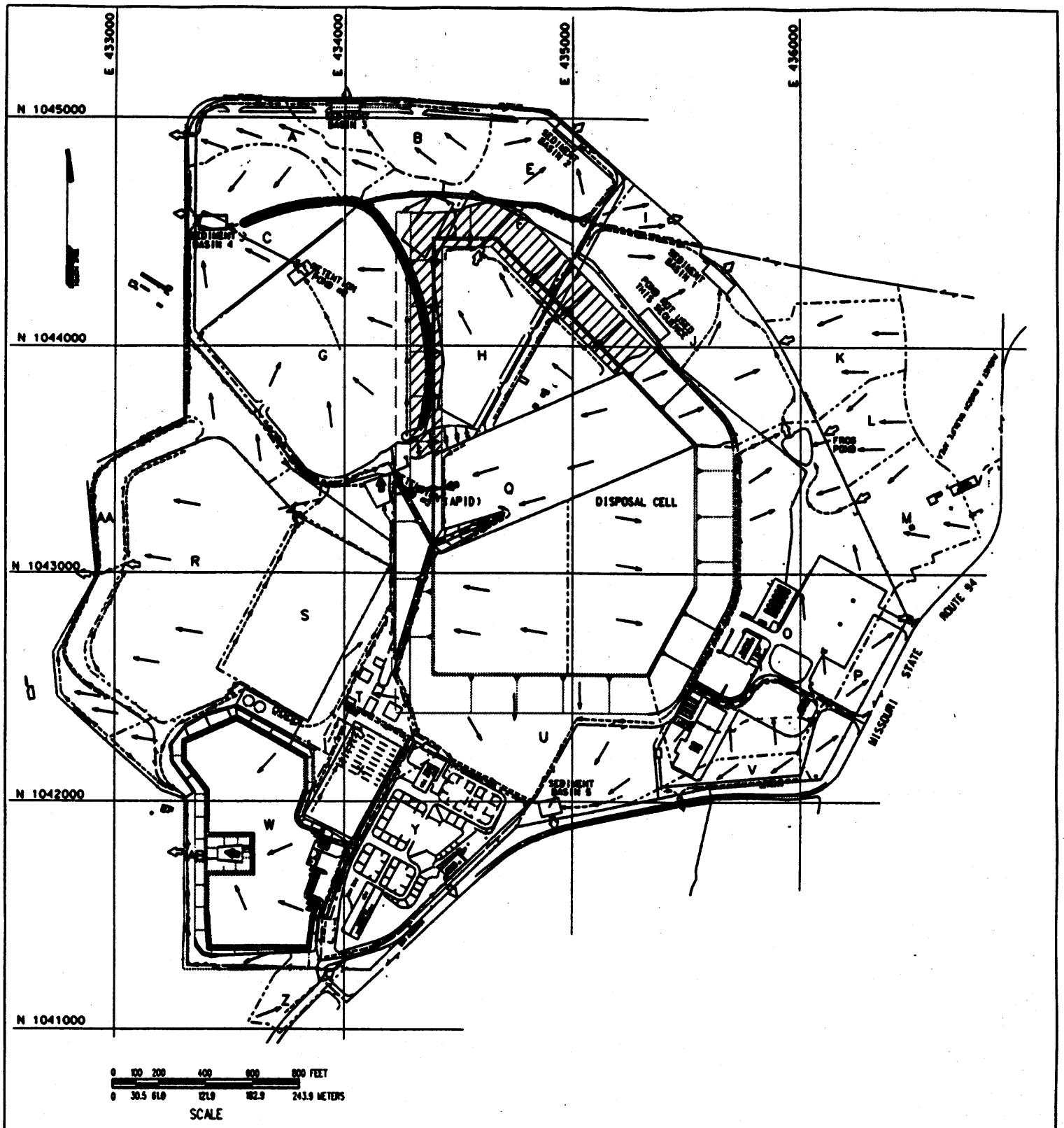
LEGEND :

A-Z, AA, AB	WATERSHED
---·---·---	WATERSHED BOUNDARY
⟶	OVERLAND FLOW DIRECTION
----→----	DIRECTED FLOW
➡	CONTAMINATED DISCHARGE LOCATION
⇨	UNCONTAMINATED DISCHARGE LOCATION
⟩—⟨	CULVERT

SITE DRAINAGE SYSTEM DURING DISPOSAL CELL CONSTRUCTION (END OF SEQUENCE THREE)

FIGURE 5.1.6-6

REPORT NO.: DOE/OR/21548-411	DRAWING NO.: 384001/564-1c	
ORIGINATOR: SCB	DRAWN BY: Cwf	DATE: 09/02/93



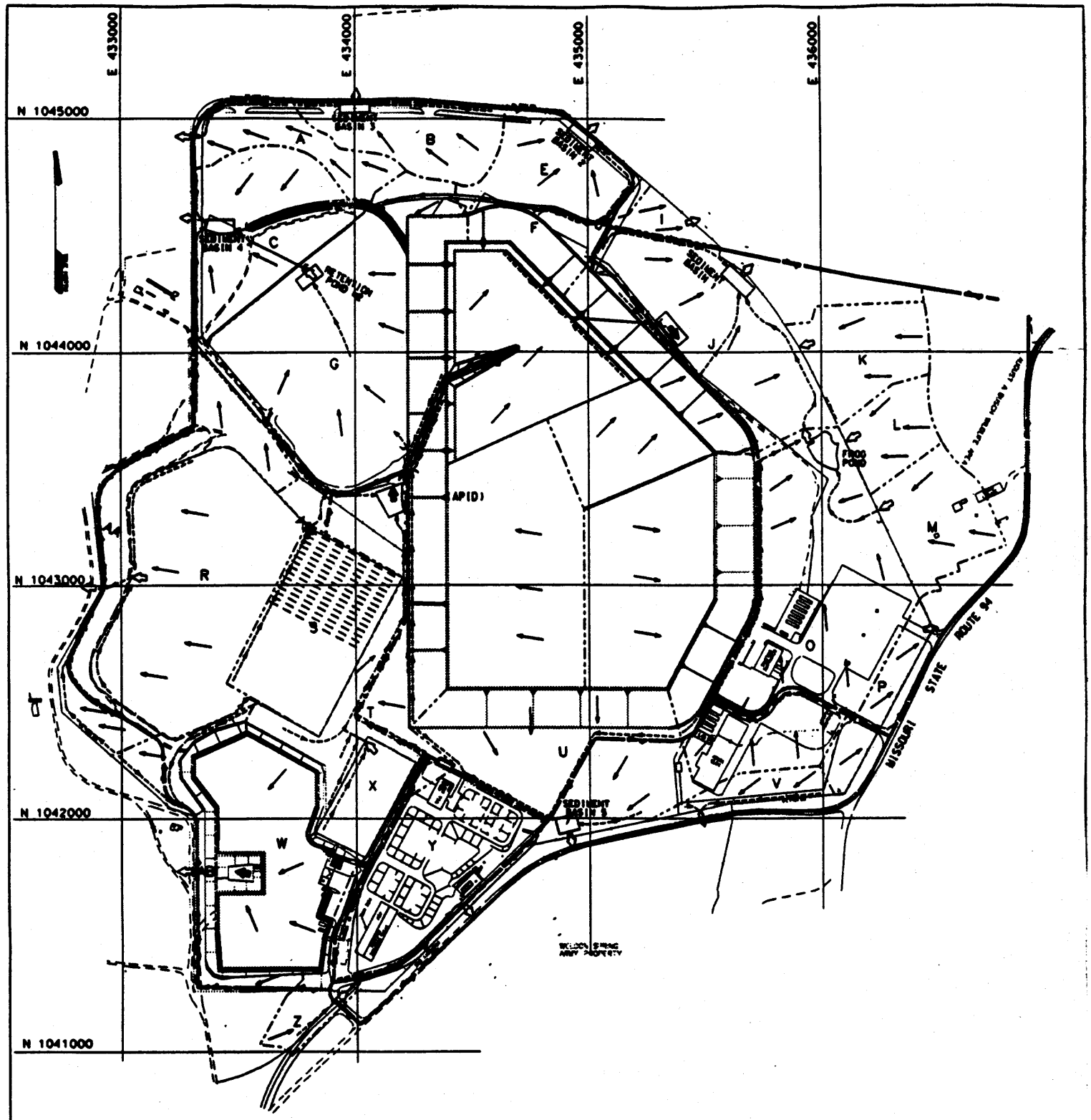
LEGEND :

A-Z, AA, AB	WATERSHED
---·---·---	WATERSHED BOUNDARY
⟶	OVERLAND FLOW DIRECTION
---•--•---	DIRECTED FLOW
➡	CONTAMINATED DISCHARGE LOCATION
⇨	UNCONTAMINATED DISCHARGE LOCATION
)—(	CULVERT

SITE DRAINAGE SYSTEM DURING DISPOSAL CELL CONSTRUCTION (END OF SEQUENCE FOUR)

FIGURE 5.1.6-7

REPORT NO.: DOE/OR/21548-411		DRAWING NO.: 384001/564-1d
ORIGINATOR: SCB	DRAWN BY: Cwf	DATE: 09/02/93



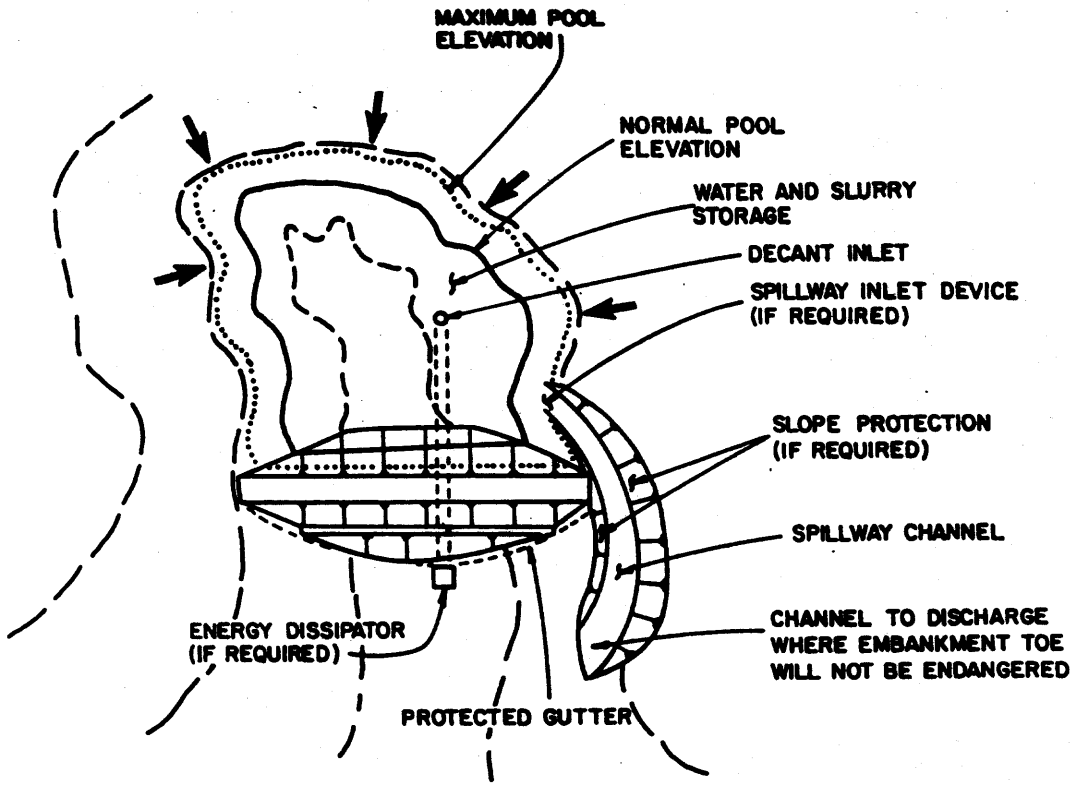
LEGEND :

- WATERSHED BOUNDARY
- OVERLAND FLOW DIRECTION
- DIRECTED FLOW
- CONTAMINATED DISCHARGE LOCATION
- UNCONTAMINATED DISCHARGE LOCATION
- CULVERT

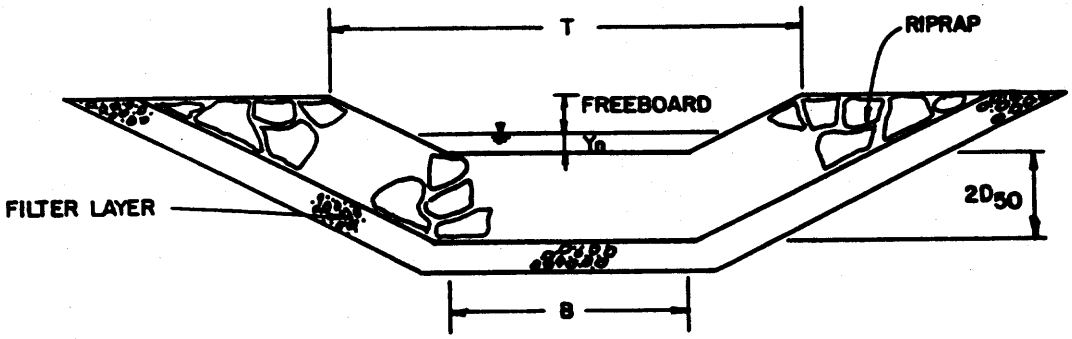
SITE DRAINAGE SYSTEM DURING DISPOSAL CELL CONSTRUCTION (END OF SEQUENCE FIVE)

FIGURE 5.1.6-8

REPORT NO.: DOE/OR/21548-411		DRAWING NO.: 384001/564-1e
ORIGINATOR: SCB	DRAWN BY: Cwf	DATE: 09/02/93



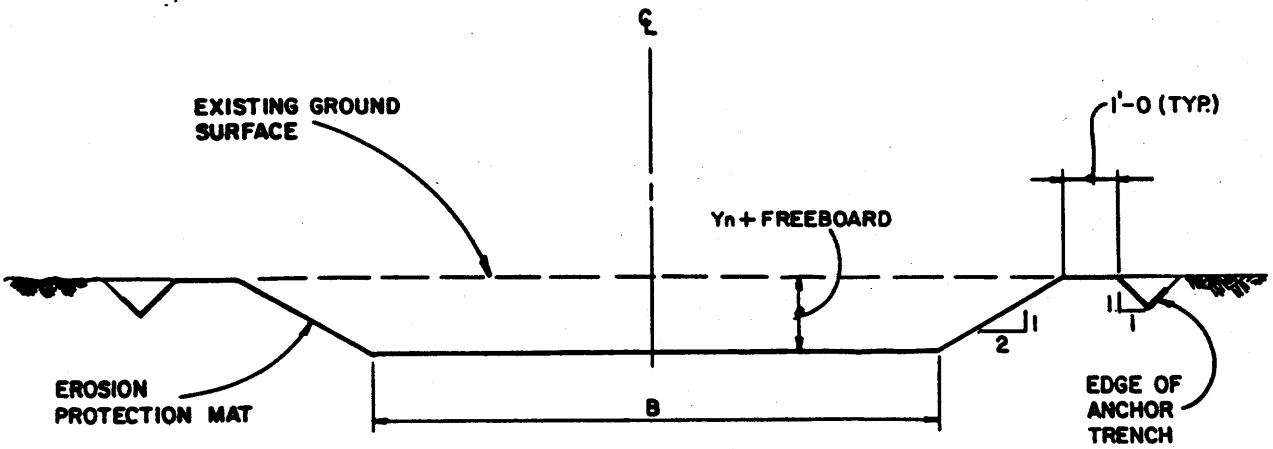
TYPICAL RETENTION POND
NOT TO SCALE



TYPICAL PERMANENT CHANNEL
NOT TO SCALE

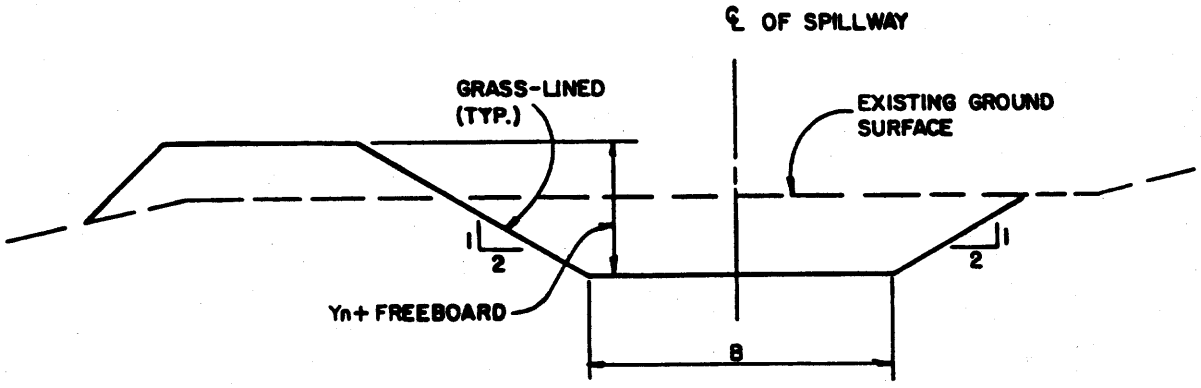
VARIABLES
Yn = NORMAL DEPTHS
B = BOTTOM WIDTH
T = TOP WIDTH
D_{50} = MEDIAN RIPRAP SIZE
→ = RUNOFF

SITE DRAINAGE DETAIL RETENTION PONDS AND PERMANENT CHANNELS		
FIGURE 5.1.6-9		
REPORT NO.: DOE/OR/21548-411	DRAWING NO.:	
ORIGINATOR: S.B.	DRAWN BY: K.W.	DATE: NOV., 1992



TYPICAL LINED (EROSION PROTECTION MAT) TEMPORARY CHANNEL

NOT TO SCALE



TYPICAL GRASS LINED TEMPORARY CHANNEL

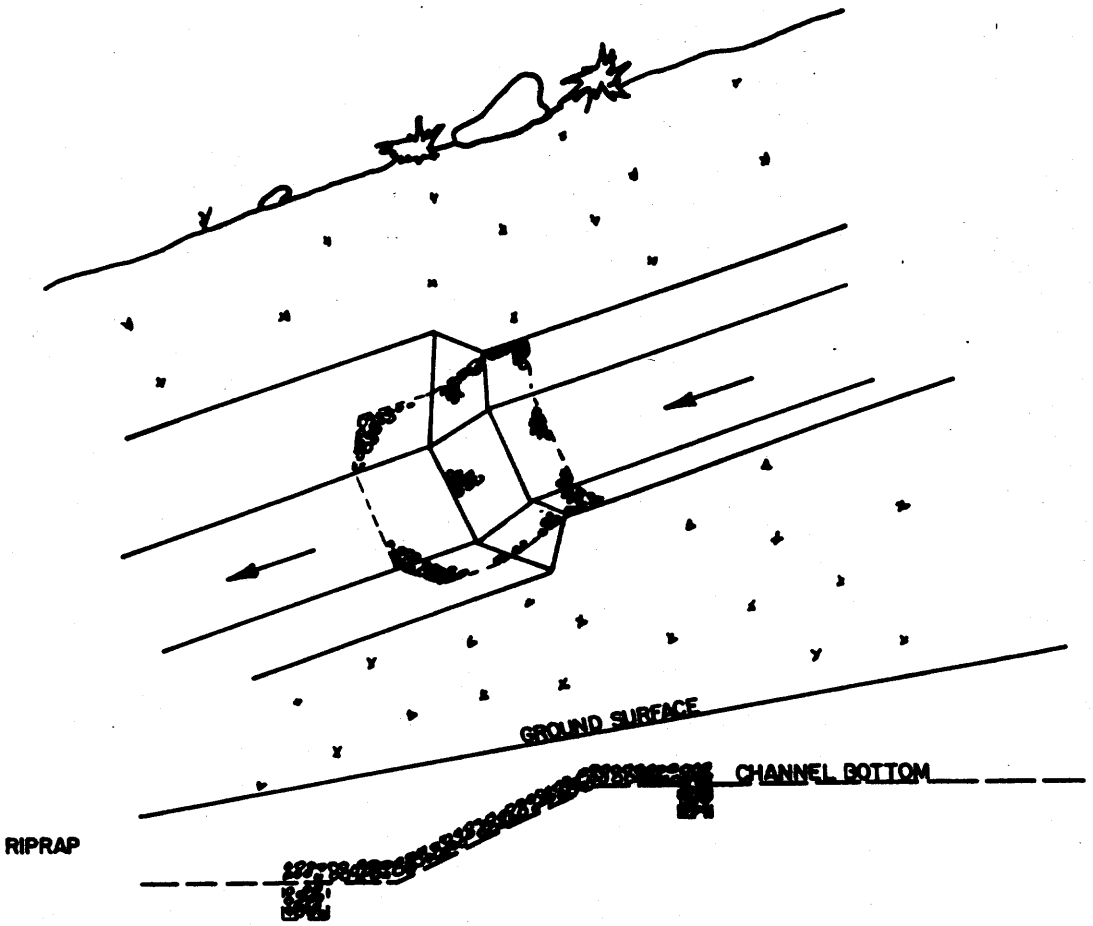
NOT TO SCALE

VARIABLES

Yn = NORMAL DEPTH

B = BOTTOM WIDTH

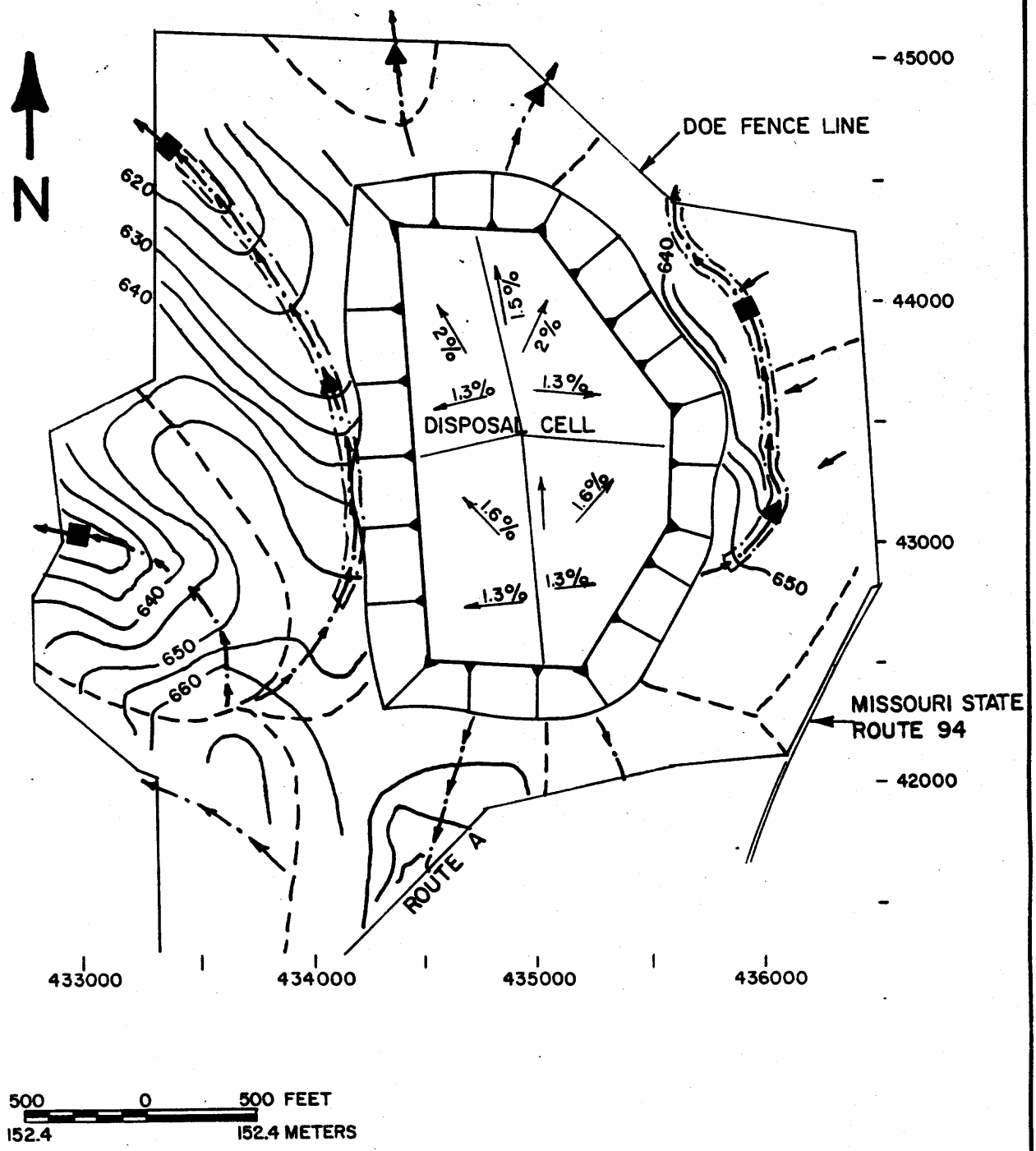
SITE DRAINAGE DETAILS TEMPORARY CHANNELS		
FIGURE 5.1.6-10		
REPORT NO.: DOE/OR/21548-411	DRAWING NO.:	
ORIGINATOR: S.B.	DRAWN BY: K.W.	DATE: NOV., 1992



ROCK RIPRAP DROP STRUCTURE
(PROTECTION UPSTREAM AND DOWNSTREAM)

NOT TO SCALE

SITE DRAINAGE DETAILS DROP STRUCTURE		
FIGURE 5.1.6-11		
REPORT NO.: DOE/OR/21548-411	DRAWING NO.:	
ORIGINATOR: S.B.	DRAWN BY: K.W.	DATE: NOV., 1992



500 0 500 FEET
152.4 152.4 METERS

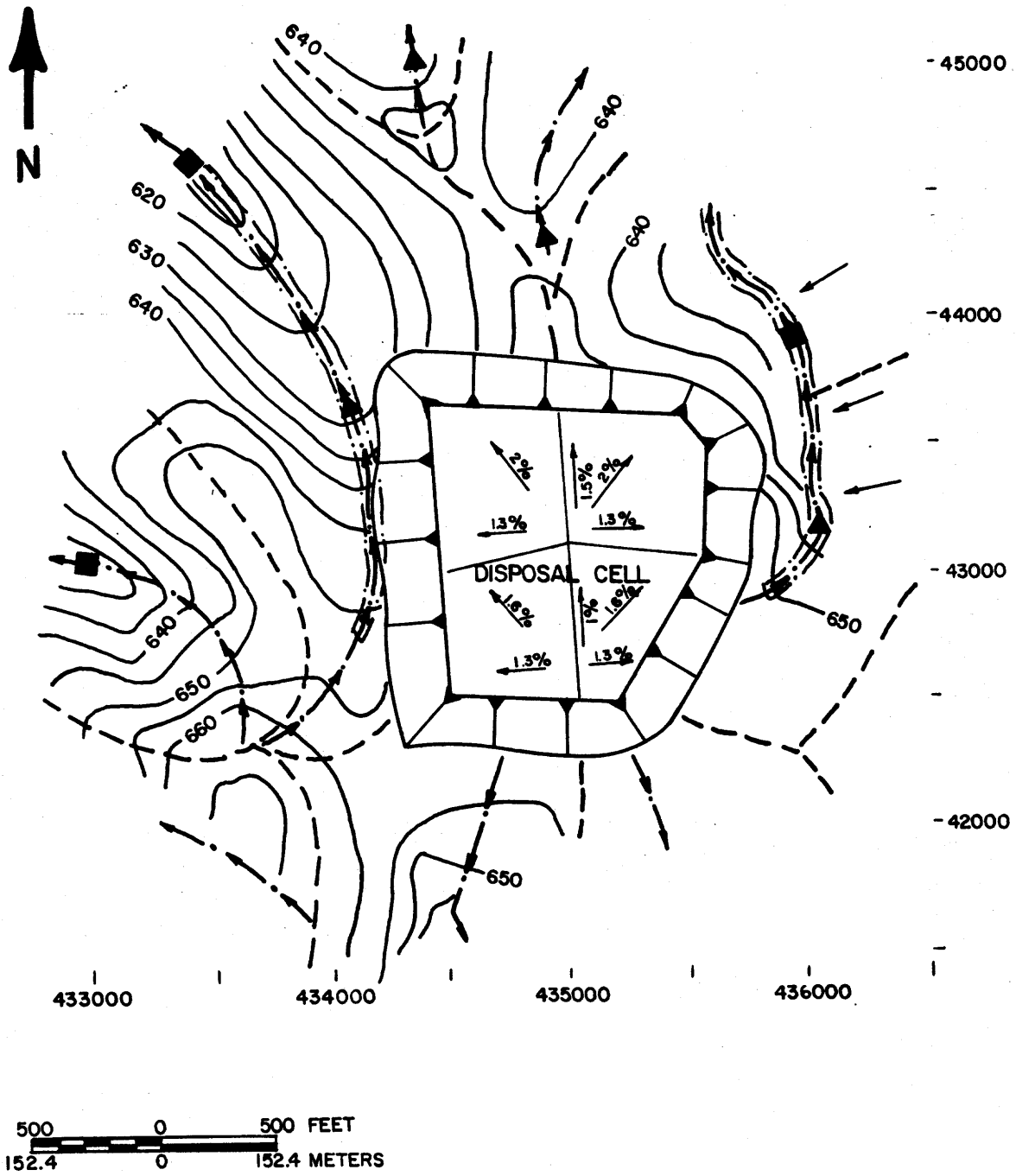
LEGEND

- ▲ POTENTIAL HEADCUTTING LOCATIONS
- UNLINED CHANNEL
- ■ GRADE CONTROL STRUCTURE
- REACHES REQUIRING STABILIZATION

PERMANENT DRAINAGE STRUCTURES

FIGURE 5.1.6-12

REPORT NO.: DOE/OR/21548-411	DRAWING NO.:	
ORIGINATOR: S.B.	DRAWN BY: K.W.	DATE: NOV., 1992



500 0 500 FEET
152.4 0 152.4 METERS

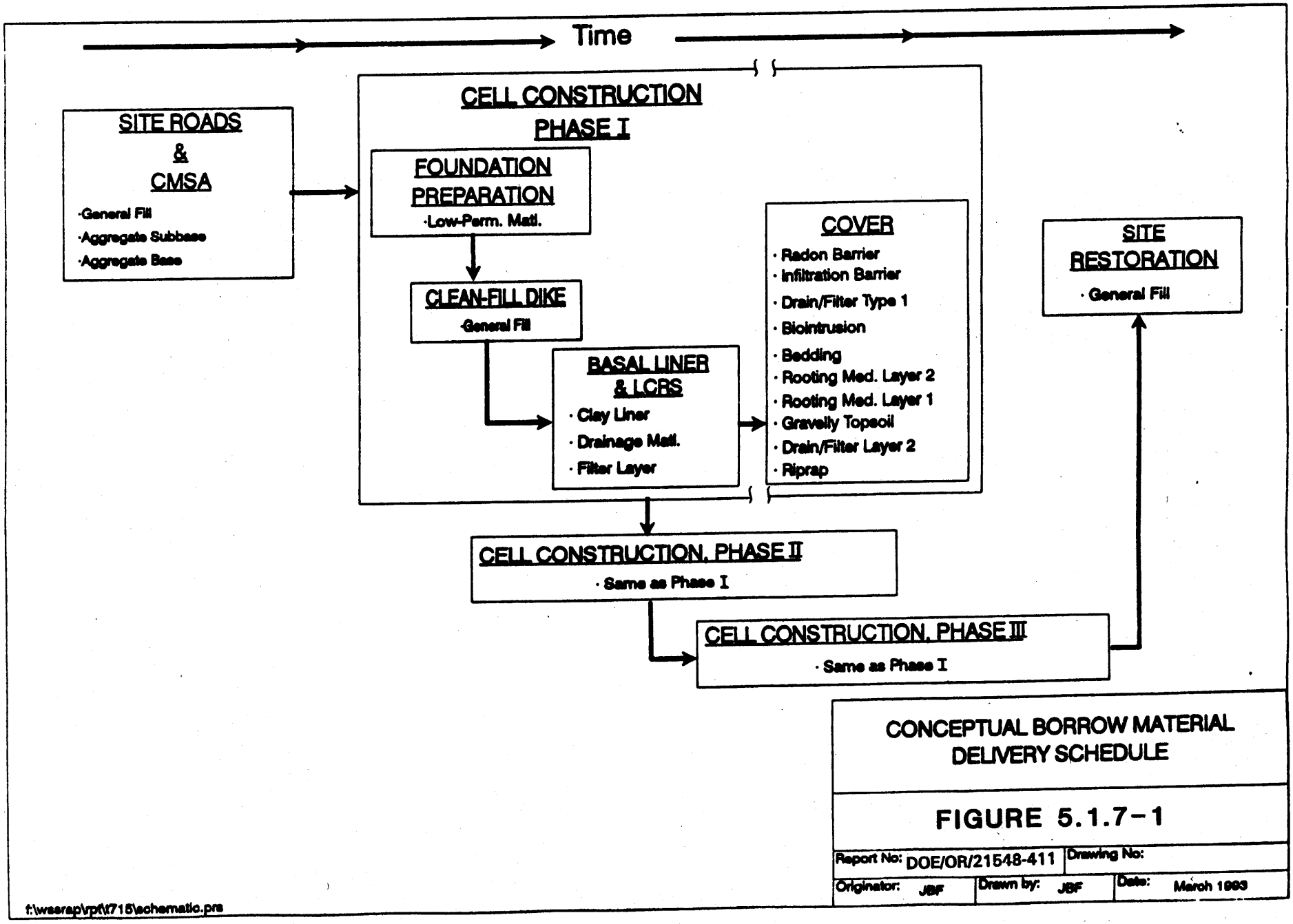
LEGEND

- ▲ POTENTIAL HEADCUTTING LOCATIONS
- UNLINED CHANNEL
- ■ GRADE CONTROL STRUCTURE
- REACHES REQUIRING STABILIZATION

DRAINAGE AREAS WITH VIT DISPOSAL CELL

FIGURE 5.1.6-13

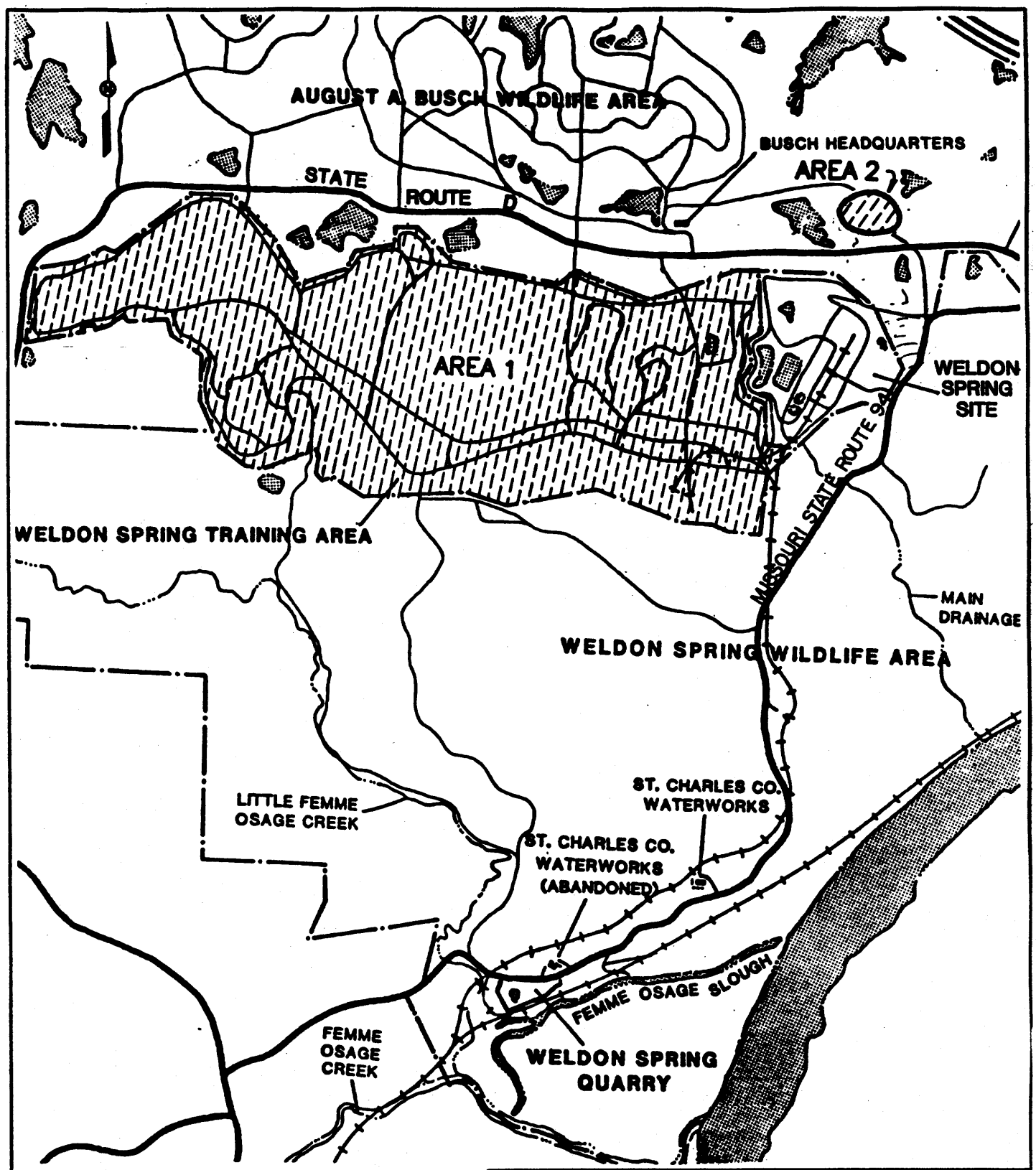
REPORT NO: DOE/OR/21548-411	DRAWING NO.:	
ORIGINATOR S.B.	DRAWN BY: K.W.	DATE: NOV., 1992



CONCEPTUAL BORROW MATERIAL DELIVERY SCHEDULE

FIGURE 5.1.7-1

Report No: DOE/OR/21548-411		Drawing No:	
Originator: JBF	Drawn by: JBF	Date: March 1993	



LEGEND

POTENTIAL LOW - PERMEABILITY BORROW SOURCE AREAS

SCALE

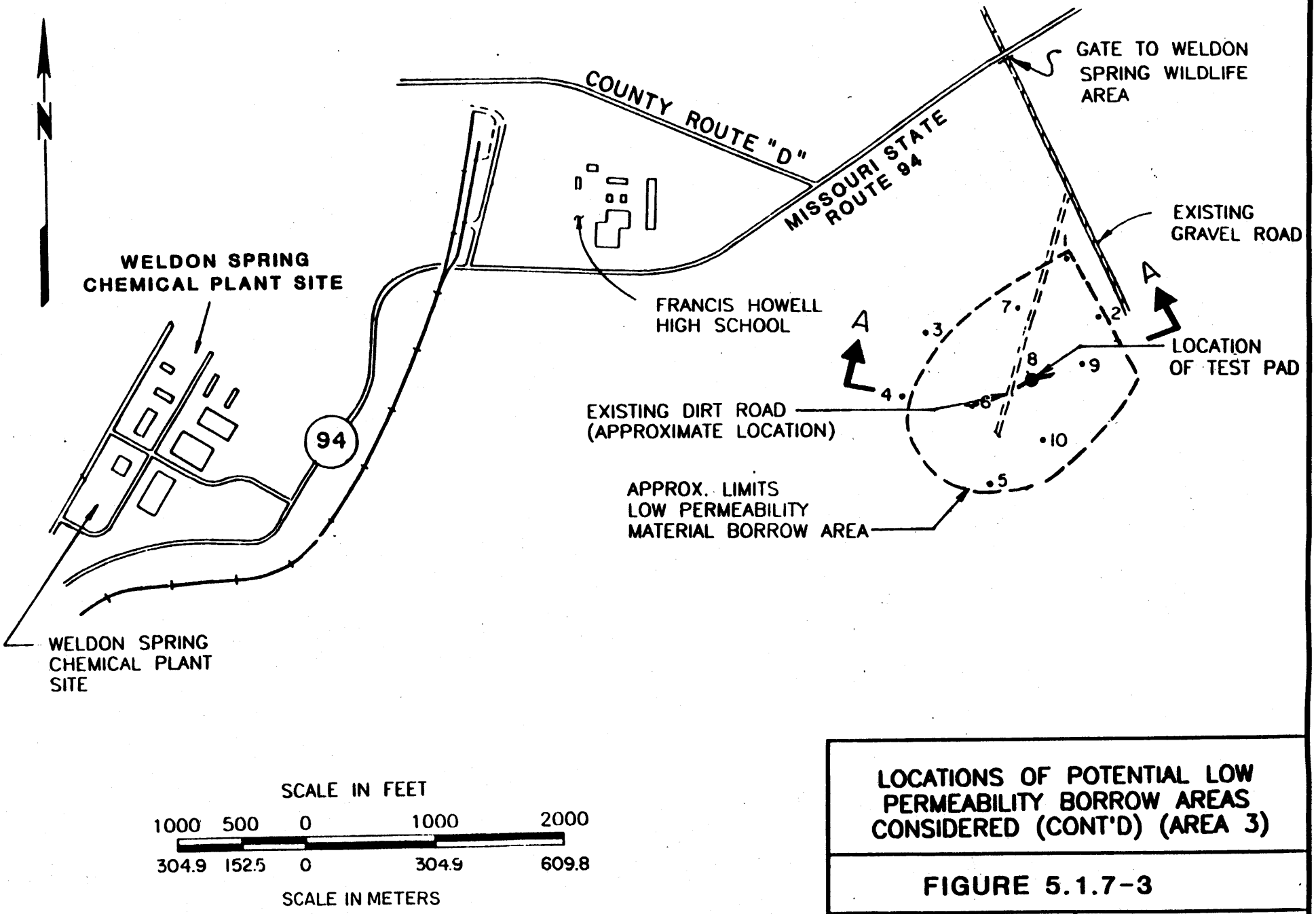
0 3000 6000 FT

0 914.4 18200 M

LOCATIONS OF POTENTIAL LOW PERMEABILITY BORROW SOURCE AREAS CONSIDERED (AREAS 1 & 2)

FIGURE 5.1.7-2

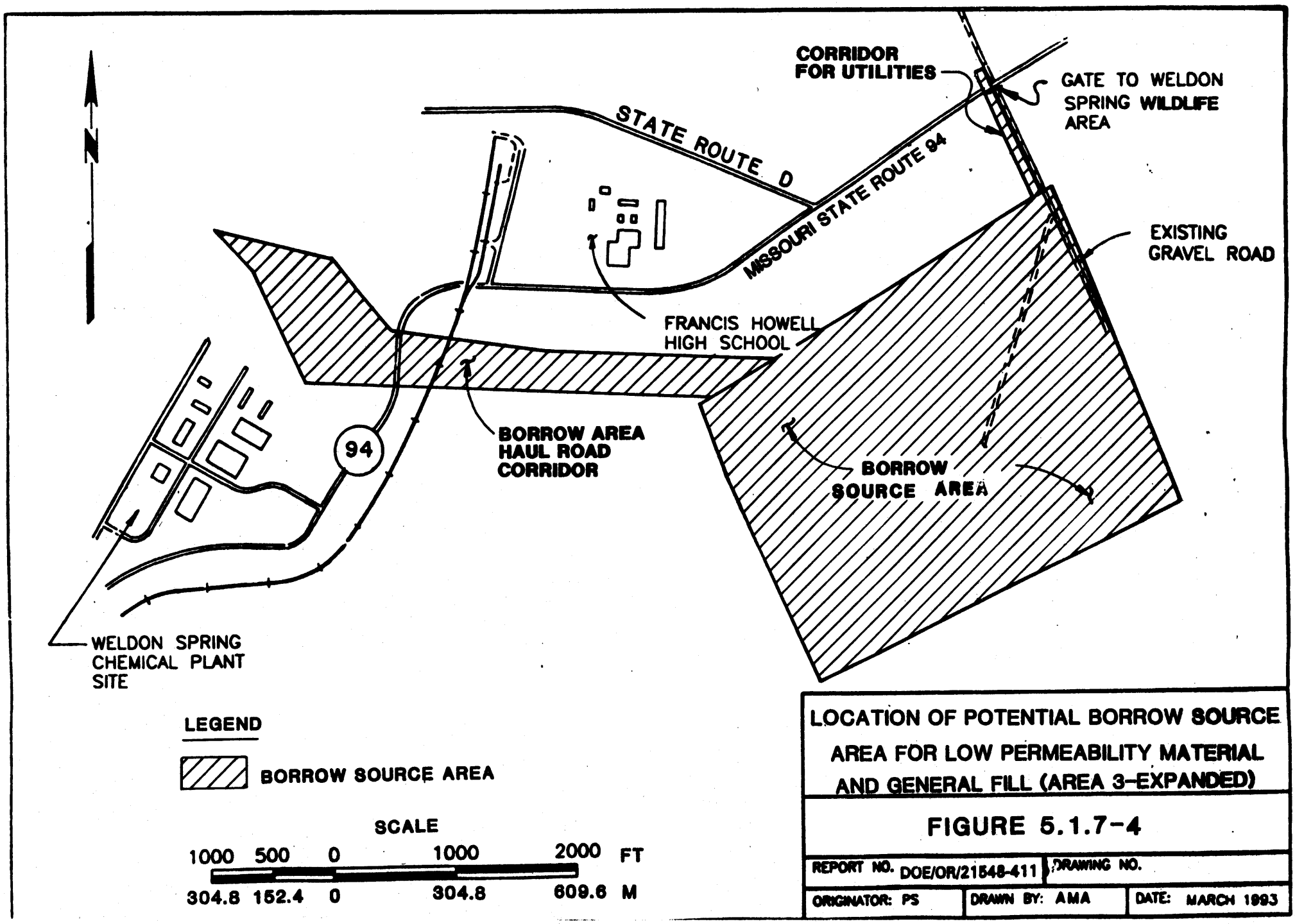
REPORT NO. DOE/OR/21548-411	DRAWING NO.	
ORIGINATOR: KWL	DRAWN BY: JRM	DATE: MARCH 1993



LOCATIONS OF POTENTIAL LOW PERMEABILITY BORROW AREAS CONSIDERED (CONT'D) (AREA 3)

FIGURE 5.1.7-3

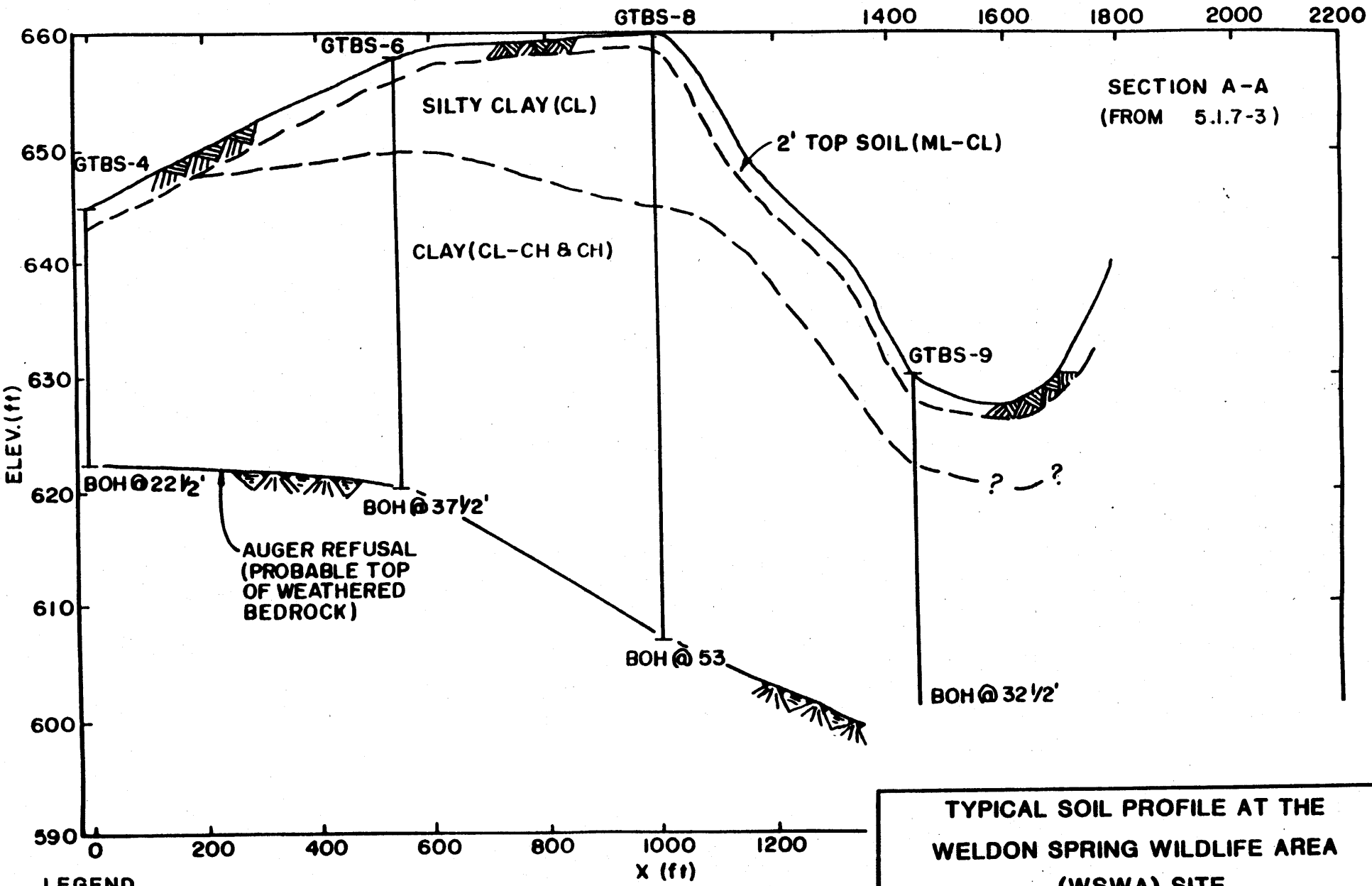
REPORT NO. DOE/OR/21548-411		DRAWING NO.	
ORIGINATOR PS	DRAWN BY JRM		DATE MARCH 1993



LOCATION OF POTENTIAL BORROW SOURCE AREA FOR LOW PERMEABILITY MATERIAL AND GENERAL FILL (AREA 3-EXPANDED)

FIGURE 5.1.7-4

REPORT NO. DOE/OR/21548-411	DRAWING NO.	
ORIGINATOR: PS	DRAWN BY: AMA	DATE: MARCH 1993



LEGEND

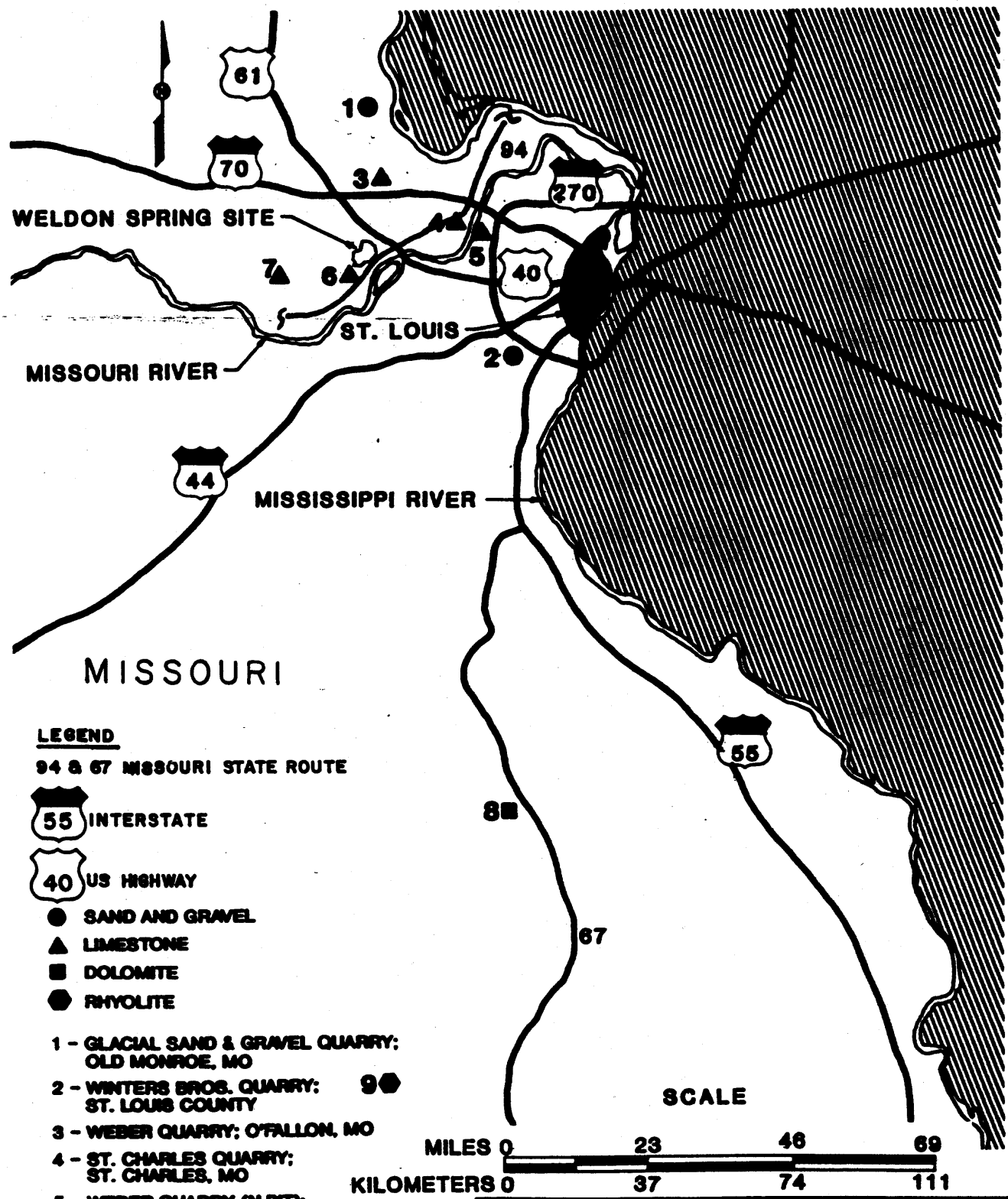
GTBS - GEOTECHNICAL BOREHOLE, BORROW SOURCE

BOH - BOTTOM OF HOLE

TYPICAL SOIL PROFILE AT THE WELDON SPRING WILDLIFE AREA (WSWA) SITE

FIGURE 5.1.7-5

REPORT NO. DOE/OR/21548-411		DRAWING NO.	
DESIGNATOR PS	DRAWN BY BH		DATE MARCH 1993



LEGEND

94 & 67 MISSOURI STATE ROUTE

55 INTERSTATE

40 US HIGHWAY

● SAND AND GRAVEL

▲ LIMESTONE

■ DOLOMITE

⬢ RHYOLITE

1 - GLACIAL SAND & GRAVEL QUARRY: OLD MONROE, MO

2 - WINTERS BROS. QUARRY: ST. LOUIS COUNTY

3 - WEBER QUARRY: O'FALLON, MO

4 - ST. CHARLES QUARRY: ST. CHARLES, MO

5 - WEBER QUARRY (N.PIT): ST. LOUIS COUNTY

6 - DEFIANCE QUARRY: DEFIANCE, MO

7 - JOERLING QUARRY: NEW MELLE, MO

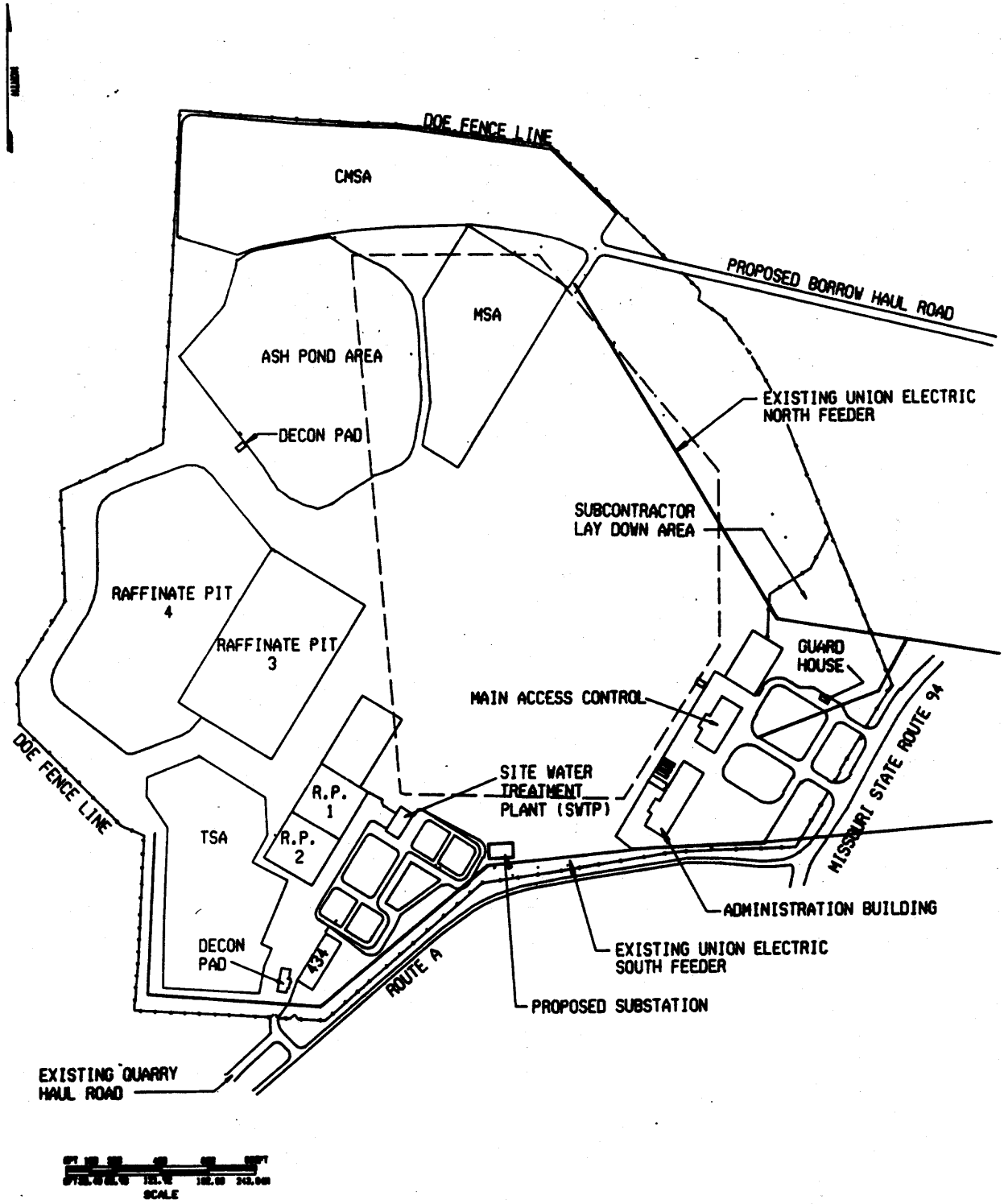
8 - ST. FRANCOIS QUARRY: FARMINGTON, MO

9 - QUALITY AGG QUARRY: PIEDMONT, MO

QUARRY LOCATIONS INVESTIGATED FOR BORROW MATERIALS (SAND, GRAVEL AND ROCK)

FIGURE 5.1.7-6

REPORT NO. DOE/OR/21548-411	DRAWING NO.	
ORIGINATOR: PS	DRAWN BY: JRM	DATE: MARCH 1993



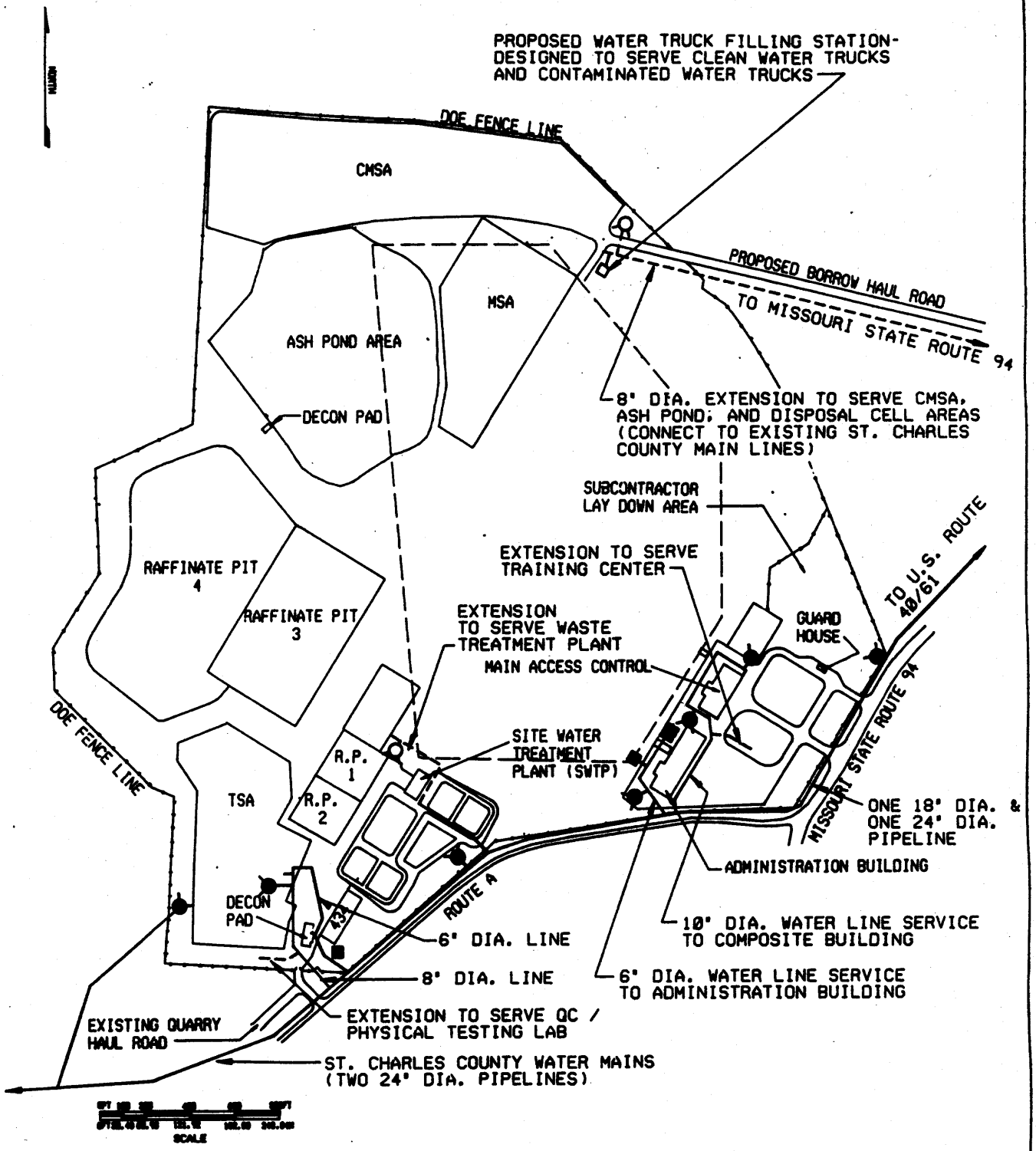
LEGEND

OUTLINE OF DISPOSAL CELL (TO BE CONSTRUCTED) — — — —

ELECTRICAL DISTRIBUTION SYSTEM

FIGURE 5.1.8-1

REPORT NO: DOE/OR/21548-411		DRAWING NO:	
ORIGINATOR: E.G.C.	DRAWING BY: G.W.R	DATE: APRIL 1993	



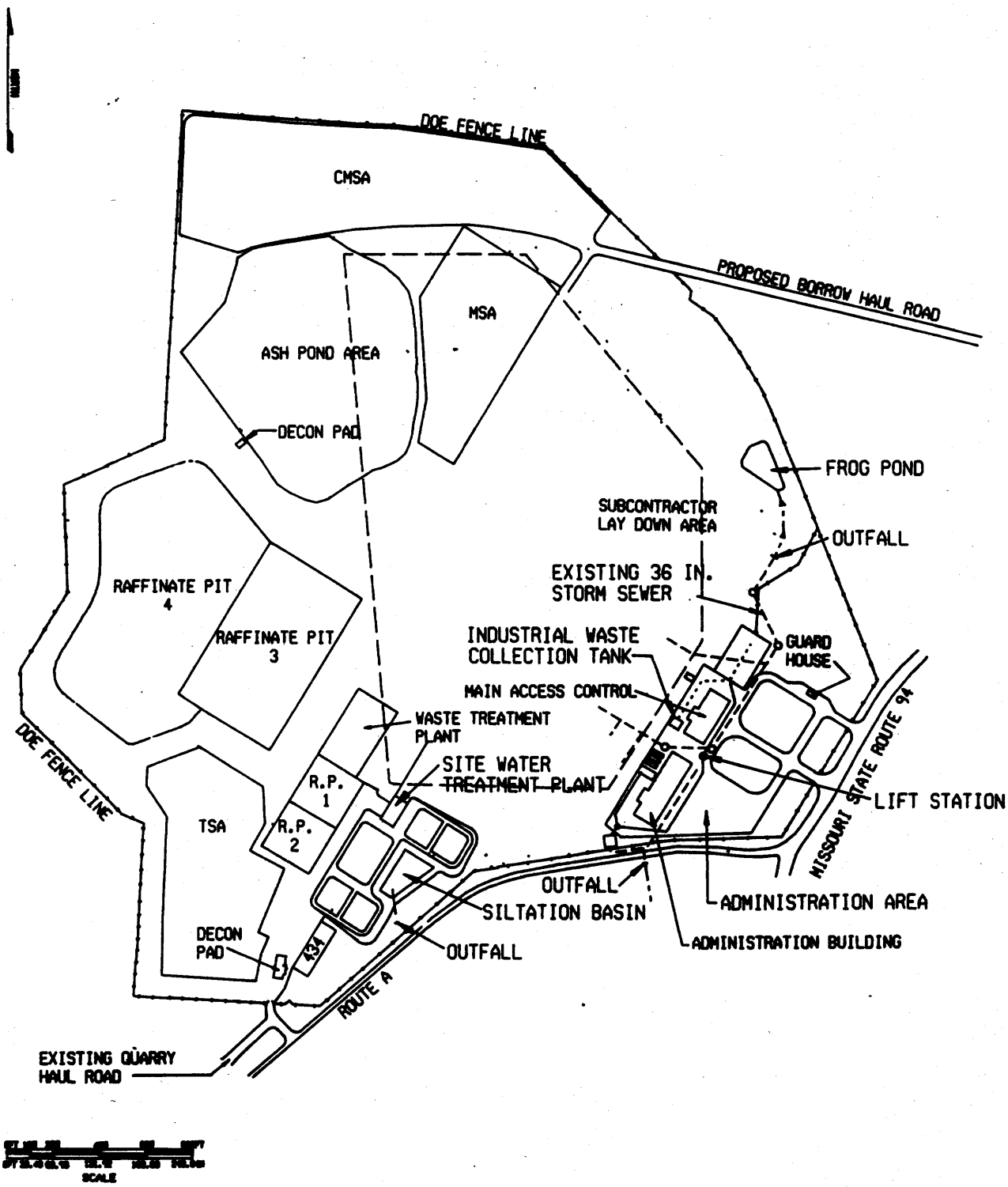
LEGEND

OUTLINE OF DISPOSAL CELL (TO BE CONSTRUCTED)	— — — — —
EXISTING WATERLINE	———
PROPOSED WATERLINE	- - - - - - - -
EXISTING FIRE HYDRANT	●
PROPOSED FIRE HYDRANT	○
EXISTING WATER TRUCK FILLING STATION	■
PROPOSED WATER TRUCK FILLING STATION	□

WATER UTILITIES SITE PLAN

FIGURE 5.1.8-2

REPORT NO: DOE/OR/21548-411	DRAWING NO:	
ORIGINATOR: E.G.C.	DRAWING BY: G.W.R	DATE: APRIL 1993



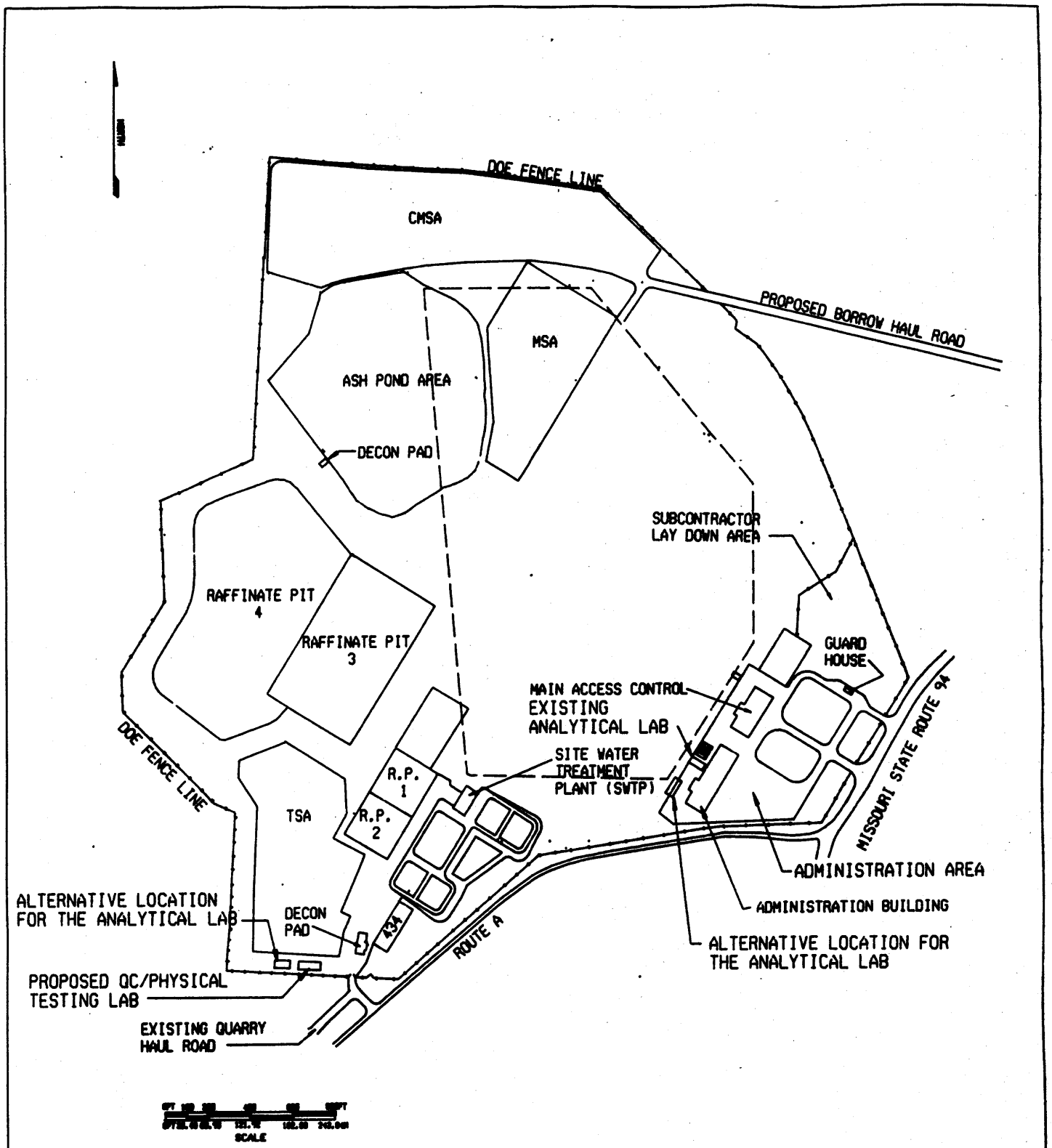
LEGEND

OUTLINE OF DISPOSAL CELL (TO BE CONSTRUCTED)	— — — —
EXISTING STORM SEWER	- - - - - - - -
EXISTING SANITARY SEWER	————
EXISTING MANHOLE	o
SURFACE DRAINAGE	—·—←—·—
INDUSTRIAL WASTE SEWER	.....

SEWER UTILITIES SITE PLAN

FIGURE 5.1.8-3

REPORT NO: DOE/OR/21548-411	DRAWING NO:	
ORIGINATOR: E.G.C.	DRAWING BY: G.W.R	DATE: APRIL 1993



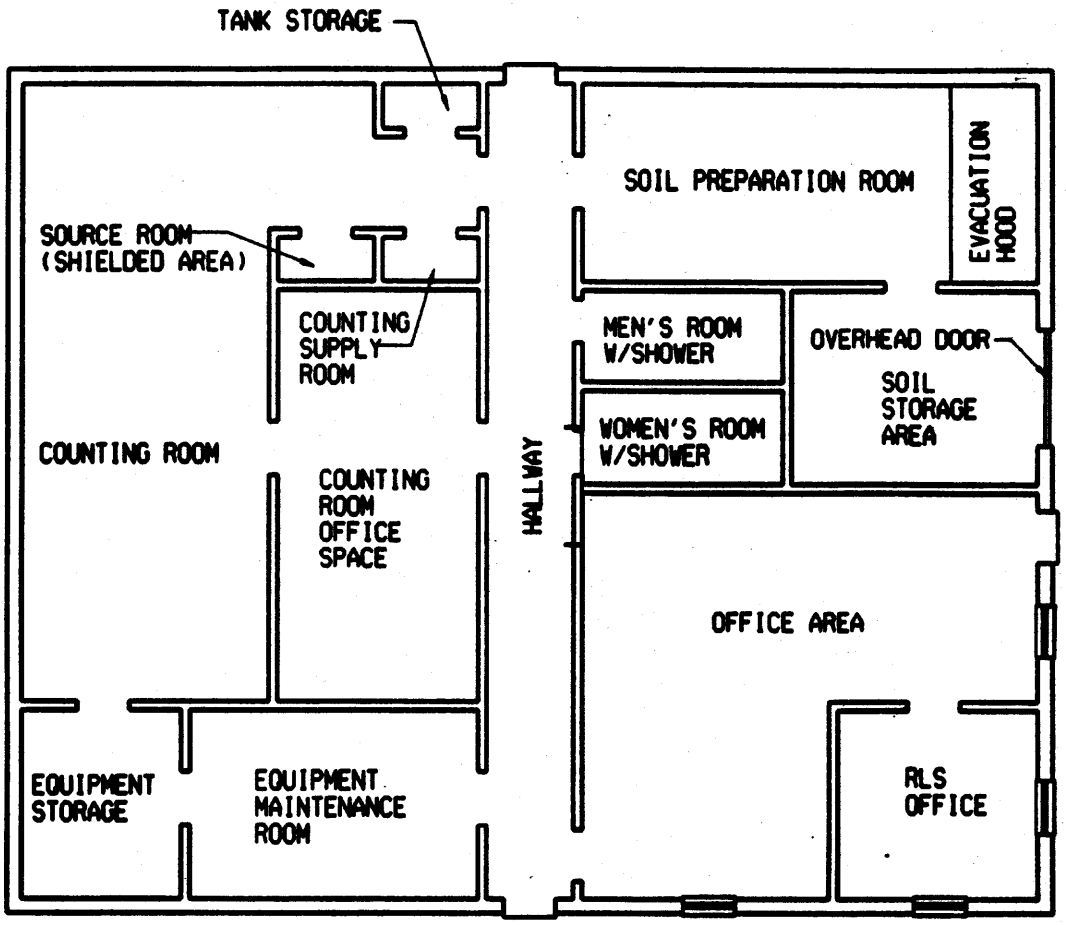
LEGEND

OUTLINE OF DISPOSAL CELL (TO BE CONSTRUCTED) — — — —

LABORATORY LOCATION PLAN

FIGURE 5.1.8-4

REPORT NO: DOE/OR/21548-411	DRAWING NO:	
ORIGINATOR: E.G.C.	DRAWING BY: G.W.R	DATE: APRIL 1993



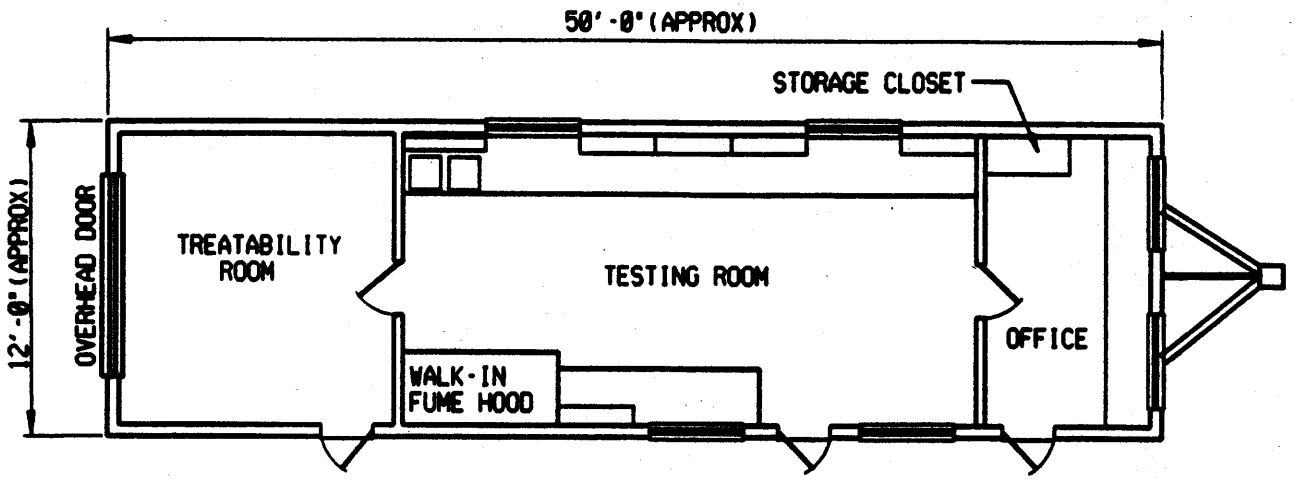
PLAN VIEW

NOT TO SCALE

ANALYTICAL RADIO-CHEMISTRY LAB

FIGURE 5.1.8-5

REPORT NO: DOE/OR/21548-411	DRAWING NO: W03840/EC51052.DGN	
ORIGINATOR: E.G.C.	DRAWING BY: G.W.R	DATE: APRIL 1993



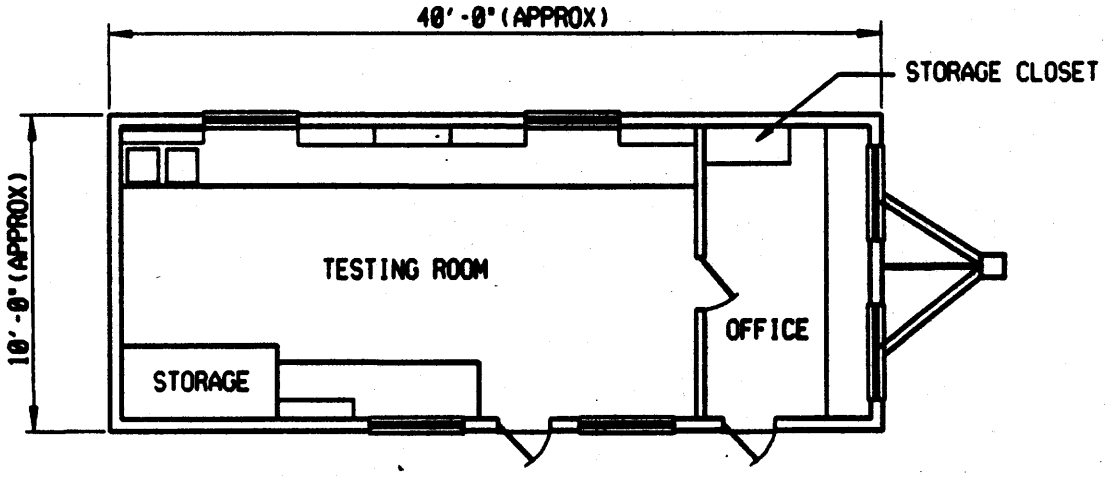
TYPICAL PLAN VIEW

NOT TO SCALE

QC/PHYSICAL TESTING TRAILER

FIGURE 5.1.8-6

REPORT NO: DOE/OR/21548-411	DRAWING NO: W03840/EC51053.DGN	
ORIGINATOR: E.G.C.	DRAWING BY: G.W.R	DATE: APRIL 1993



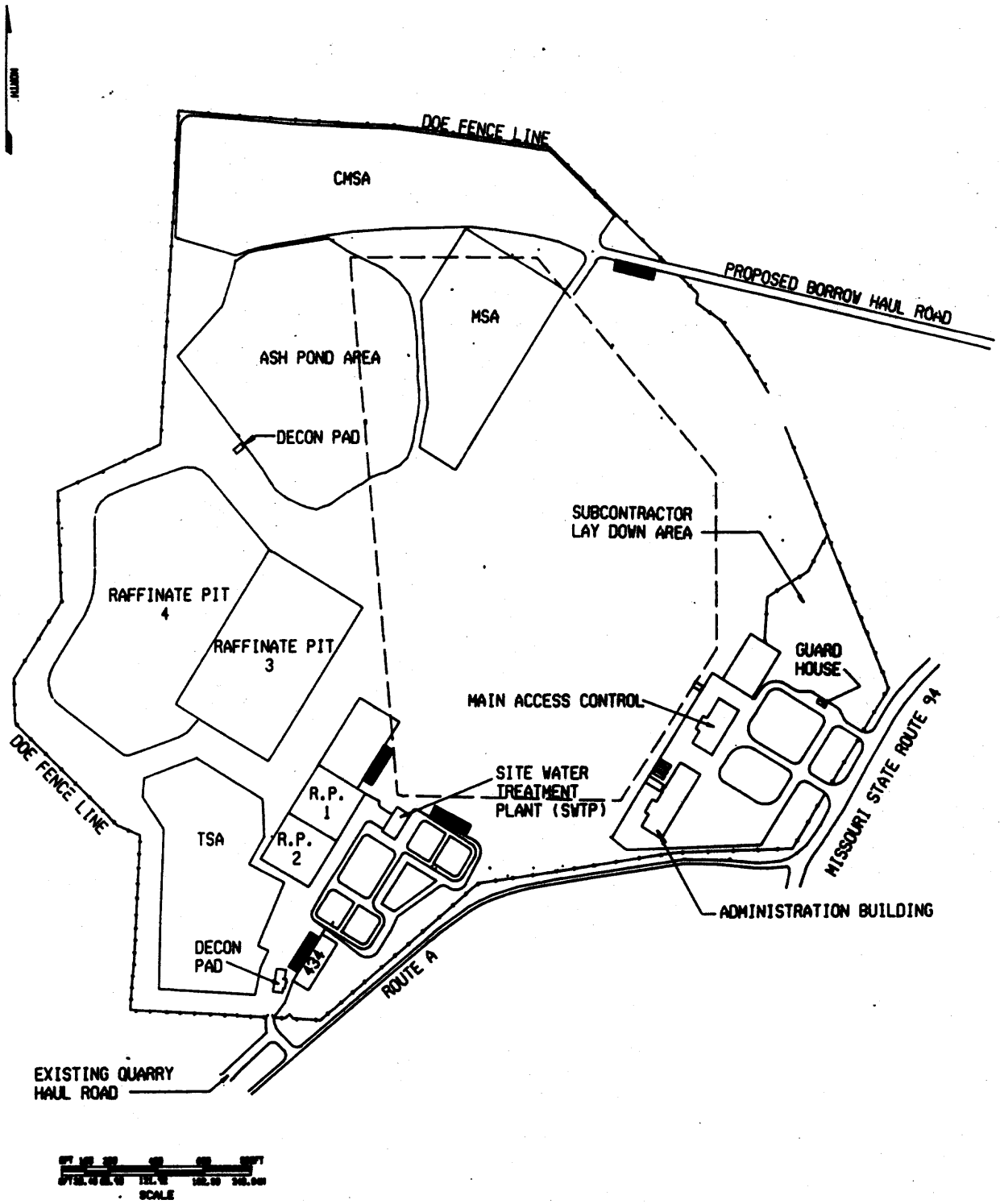
TYPICAL PLAN VIEW

NOT TO SCALE

GEOTECHNICAL TESTING TRAILER

FIGURE 5.1.8-7

REPORT NO: DOE/OR/21548-411		DRAWING NO: W03840/EC51054.DGN	
ORIGINATOR: E.G.C.	DRAWING BY: G.W.R	DATE: MARCH 1993	



LEGEND

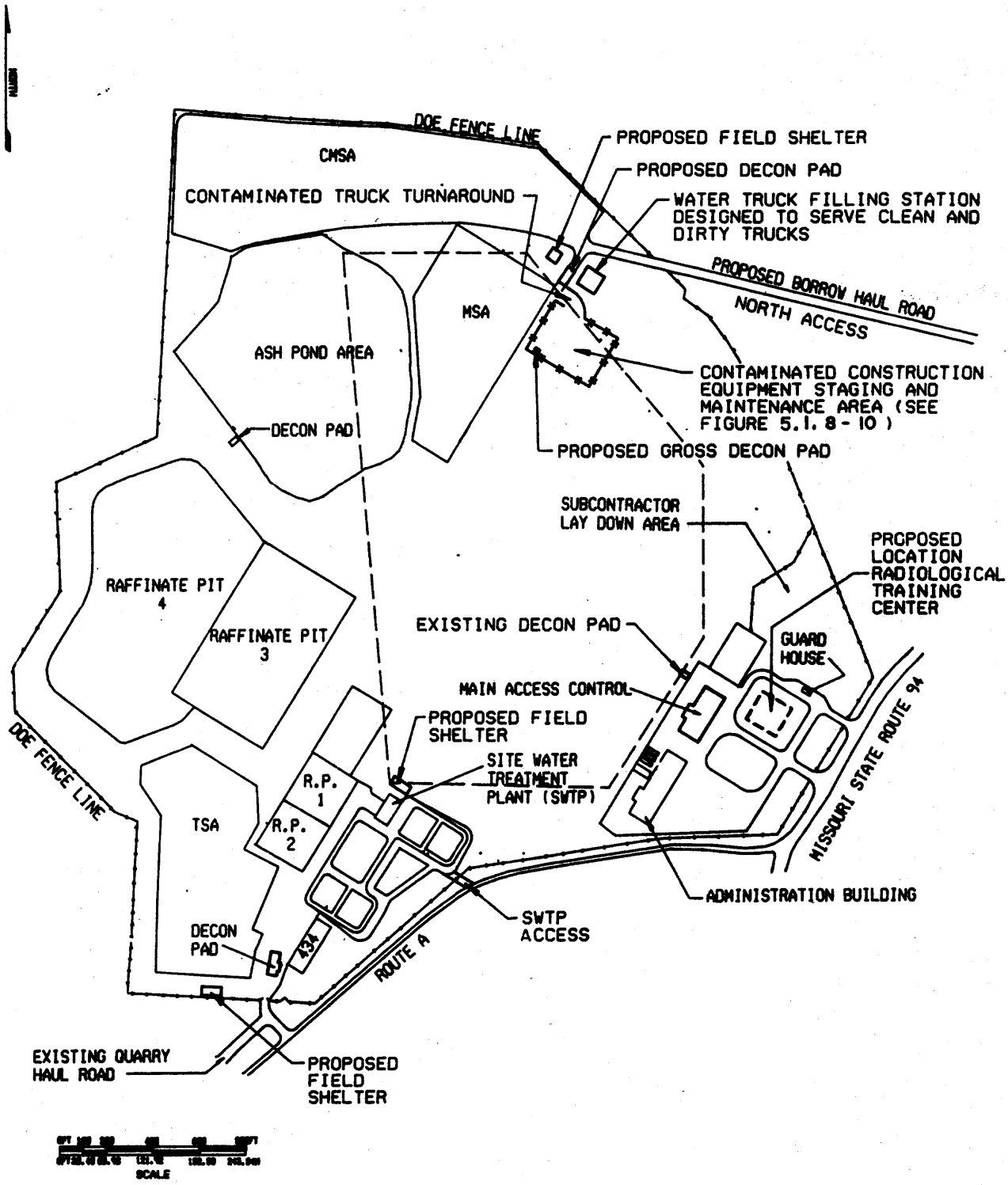
OUTLINE OF DISPOSAL CELL (TO BE CONSTRUCTED) — — — —

PROPOSED LOCATION FOR PARKING ■

CONTROLLED AREA PARKING

FIGURE 5.1.8-8

REPORT NO: DOE/OR/21548-411	DRAWING NO:	
ORIGINATOR: E.G.C.	DRAWING BY: G.W.R	DATE: APRIL 1993



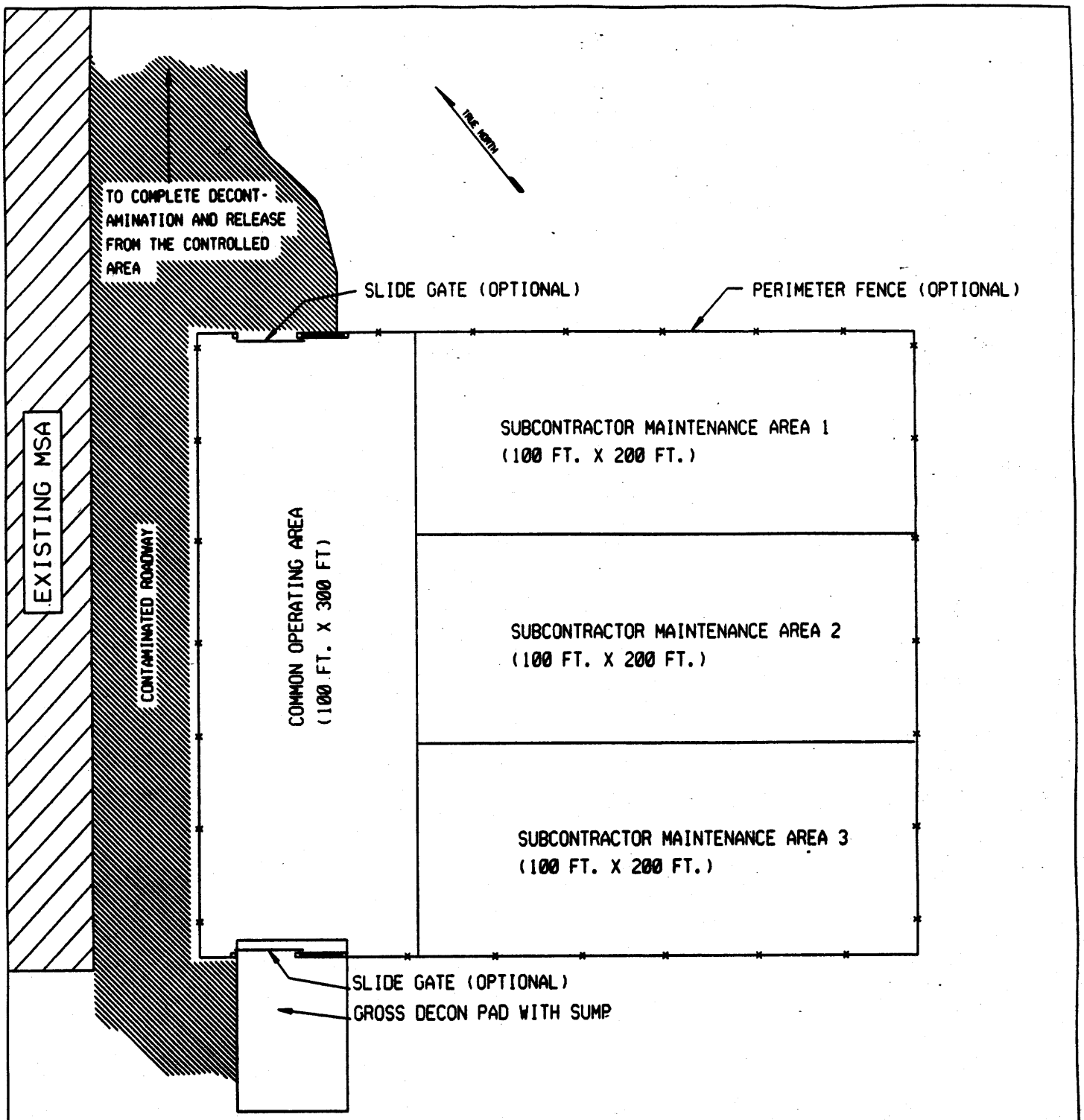
LEGEND

OUTLINE OF DISPOSAL CELL (TO BE CONSTRUCTED) — — — — —

ACCESS CONTROL FACILITIES

FIGURE 5.1.8-9

REPORT NO: DOE/OR/21548-411	DRAWING NO:	
ORIGINATOR: E.G.C.	DRAWING BY: G.W.R	DATE: APRIL 1993



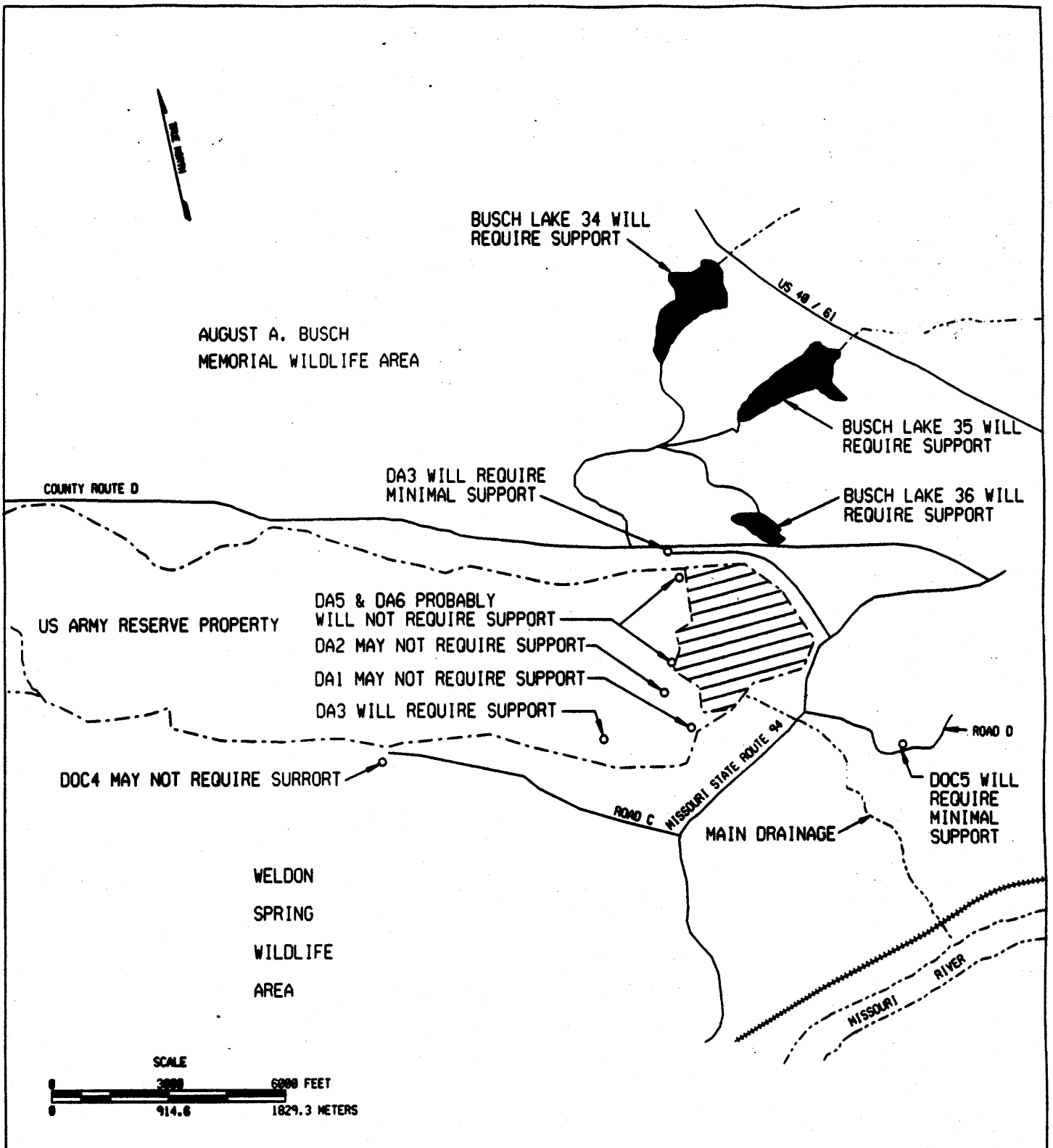
NOTES

1. APPROXIMATE SIZE - 2 ACRES
2. SURFACING IS AGGREGATE
3. SEE FIGURE 5.1.8-9 FOR LOCATION

CONTAMINATED CONSTRUCTION EQUIPMENT MAINTENANCE AREA

FIGURE 5.1.8-10

REPORT NO: DOE/OR/21548-411		DRAWING NO: W03840/EC510101.DGN	
ORIGINATOR: E.G.C.	DRAWING BY: G.W.R	DATE: APRIL 1993	



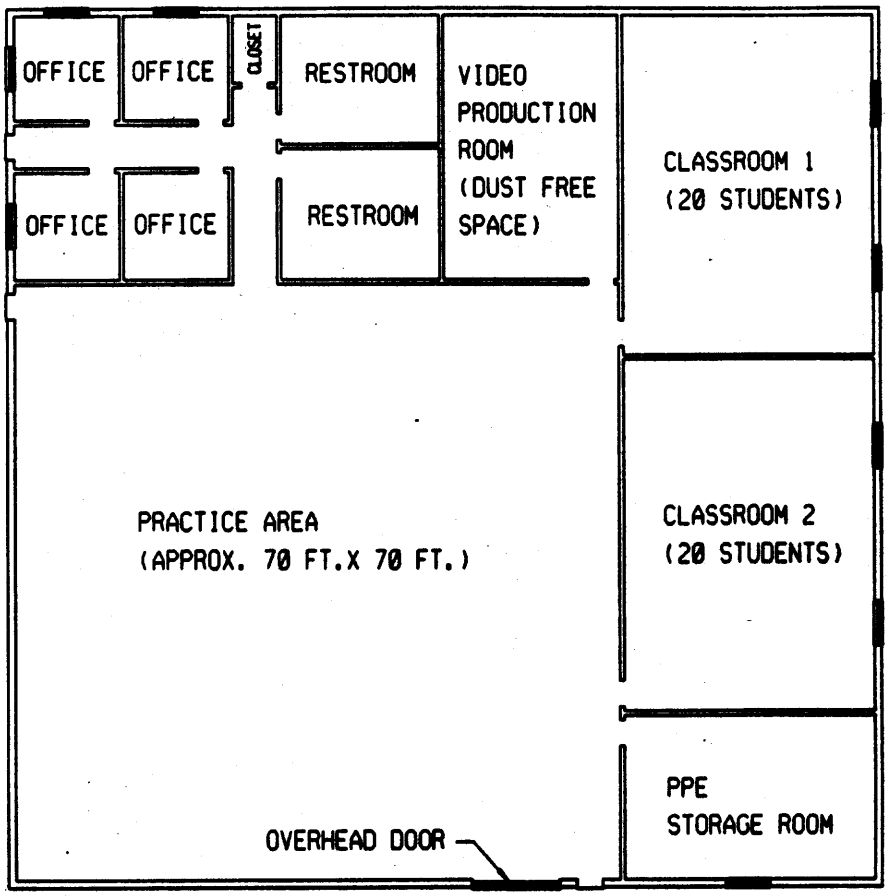
LEGEND

DEPARTMENT OF ARMY	DA
DEPARTMENT OF CONSERVATION	DOC
CONTAMINATED LAKE	

VICINITY PROPERTY SUPPORT LOCATIONS

FIGURE 5.1.8-11

REPORT NO: DOE/OR/21548-411		DRAWING NO: W03840/EC510141.DGN
ORIGINATOR: E.G.C.	DRAWING BY: G.W.R	DATE: APRIL 1993



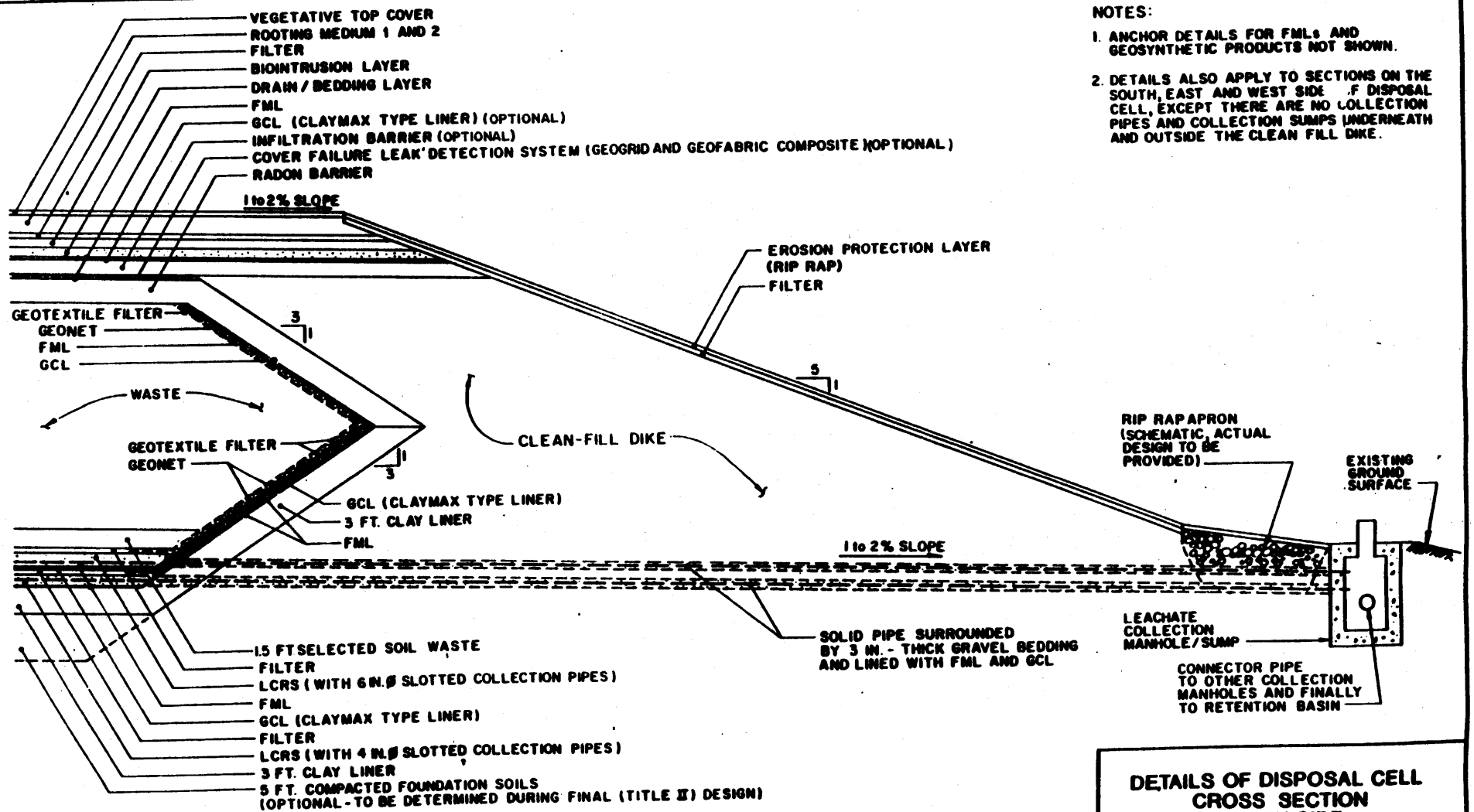
PLAN VIEW

(SEE FIGURE 5.1.8-9 FOR PROPOSED TRAINING CENTER LOCATION)

RADIOLOGICAL TRAINING CENTER

FIGURE 5.1.8-12

REPORT NO: DOE/OR/21548-411		DRAWING NO: W03840/EC510151.DGN
ORIGINATOR: E.G.C.	DRAWING BY: G.W.R	DATE: MARCH 1993



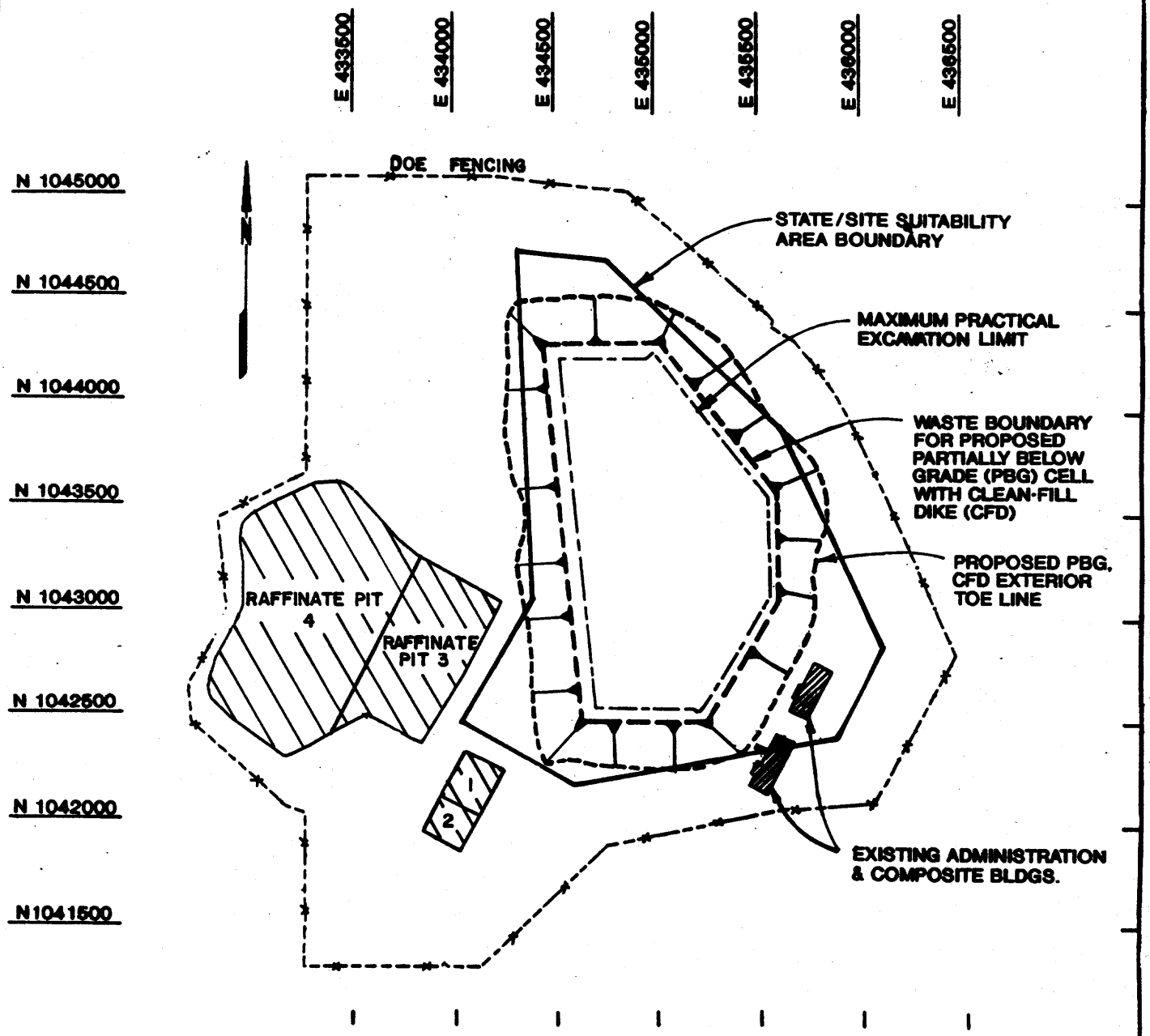
NOTES:

1. ANCHOR DETAILS FOR FMLs AND GEOSYNTHETIC PRODUCTS NOT SHOWN.
2. DETAILS ALSO APPLY TO SECTIONS ON THE SOUTH, EAST AND WEST SIDE .F DISPOSAL CELL, EXCEPT THERE ARE NO COLLECTION PIPES AND COLLECTION SUMPS UNDERNEATH AND OUTSIDE THE CLEAN FILL DIKE.

DETAILS OF DISPOSAL CELL CROSS SECTION NORTH SIDE

FIGURE 5.2.1-1

REPORT NO. DOE/OR/21548-411	DRAWING NO.	
ORIGINATOR KWL	DRAWN BY AMA	DATE:



500 0 500 FEET
152.4 0 152.4 METERS
SCALE

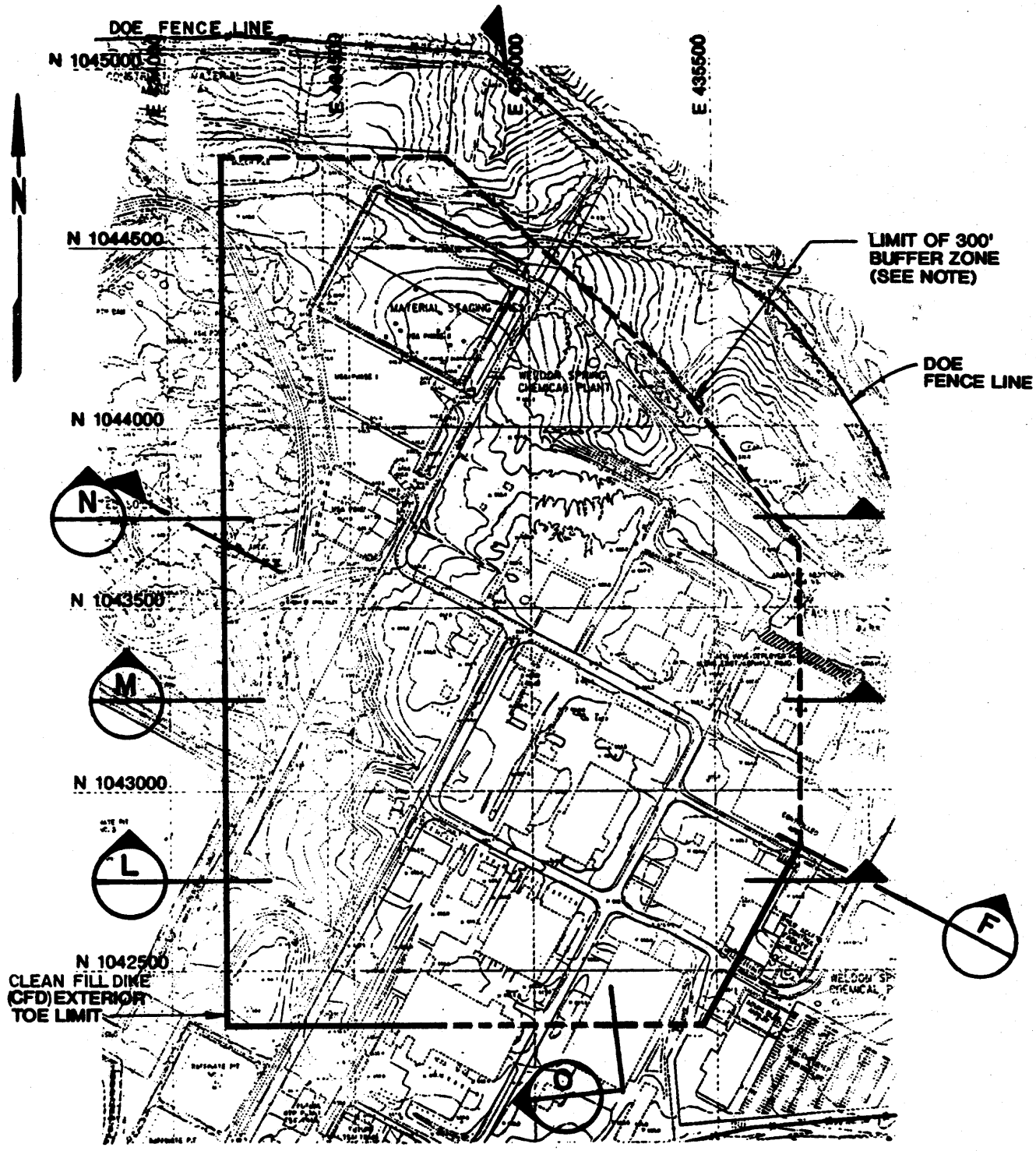
LEGEND

2 RAFFINATE PIT

CELL, SITE, WASTE, AND STATE SUITABILITY AREA AND BOUNDARIES (SCHEMATIC)

FIGURE 5.2.2-1

REPORT NO.: DOE/OR/21548-411	DRAWING NO.:	
ORIGINATOR: KWL	DRAWN BY: AMA	DATE:



NOTE:

THE LIMIT OF 300-FOOT BUFFER ZONE IS THE TOE LINE OF AN IMAGINARY 3H:1V SLOPE PROJECTED OUTWARD FROM THE OUTERMOST LIMIT OF THE WASTE.

LEGEND

F — GEOLOGIC CROSS SECTION

FEET 400 0 400

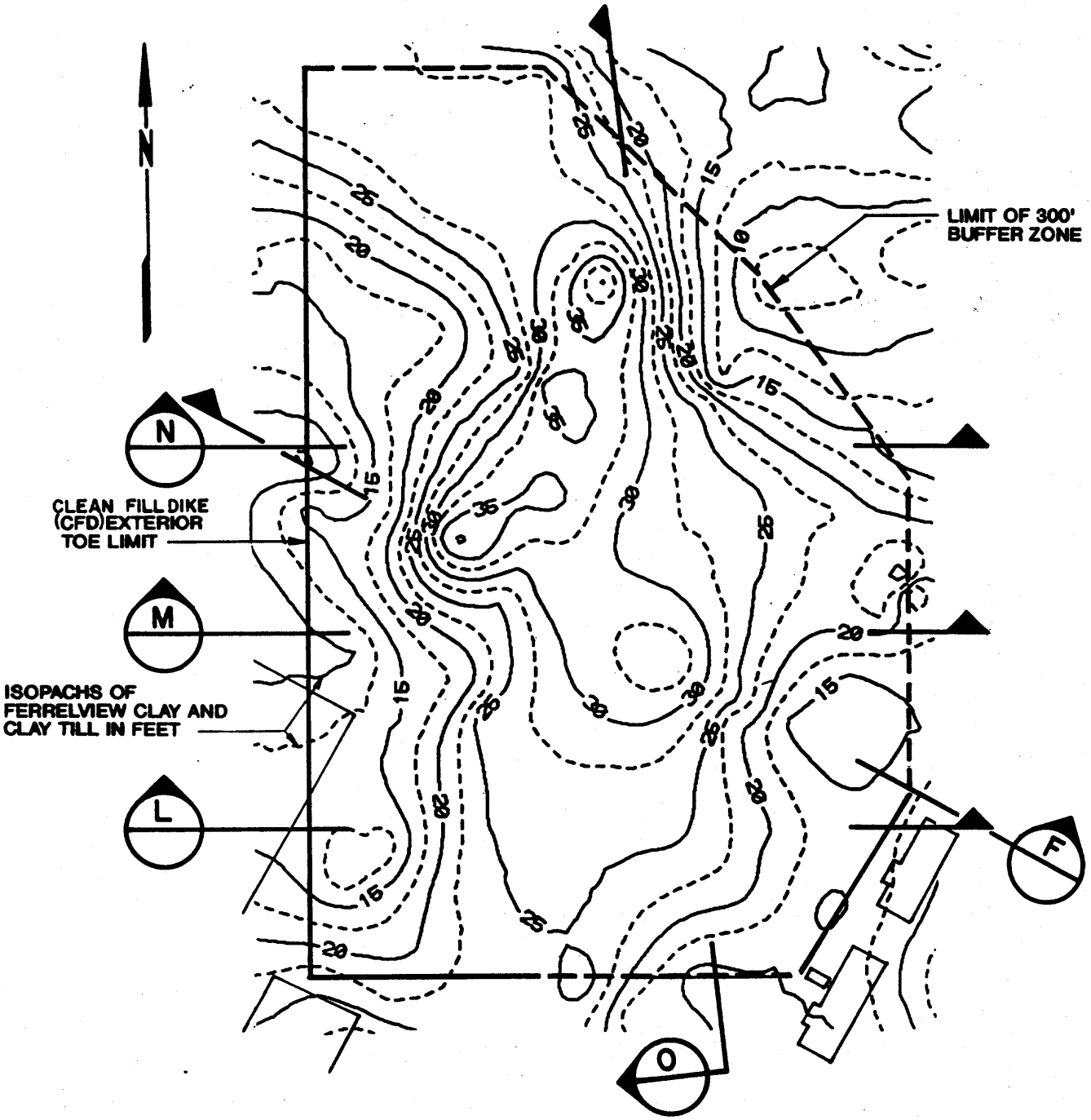
METERS 121.9 0 121.9

SCALE

CELL SITING LAYOUT

FIGURE 5.2.2-2

REPORT NO: DOE/OR/21548-411	DRAWING NO:	
ORIGINATOR: KWL	DRAWN BY: AMA	DATE:



400 0 400 FEET
121.9 0 121.9 METERS
SCALE

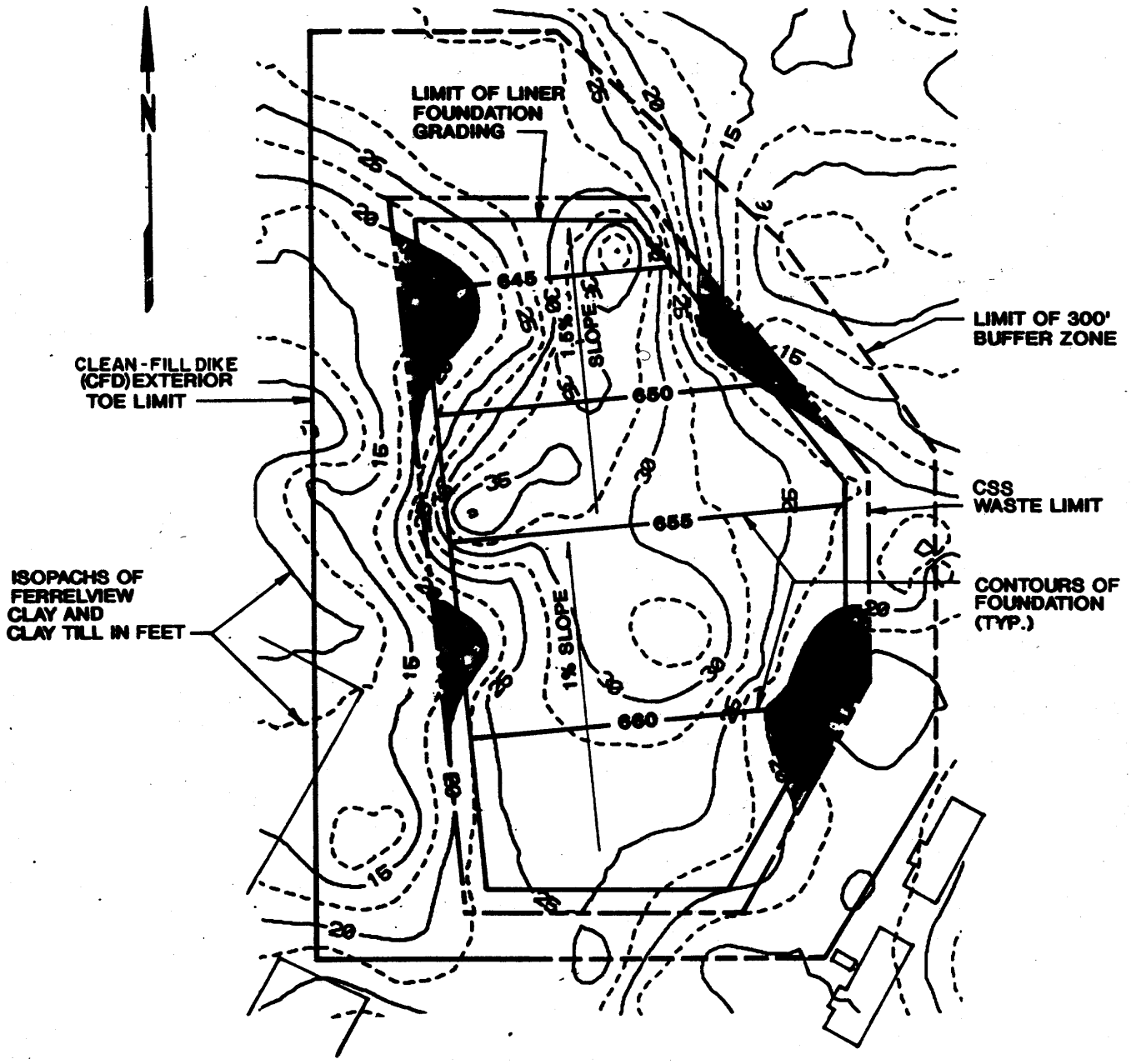
LEGEND

F GEOLOGIC CROSS SECTION

ISOPACH MAP OF FERRELVIEW CLAY AND CLAY TILL

FIGURE 5.2.2-3

REPORT NO: DOE/OR/21548-411	DRAWING NO:	
ORIGINATOR: KWL	DRAWN BY: AMA	DATE:



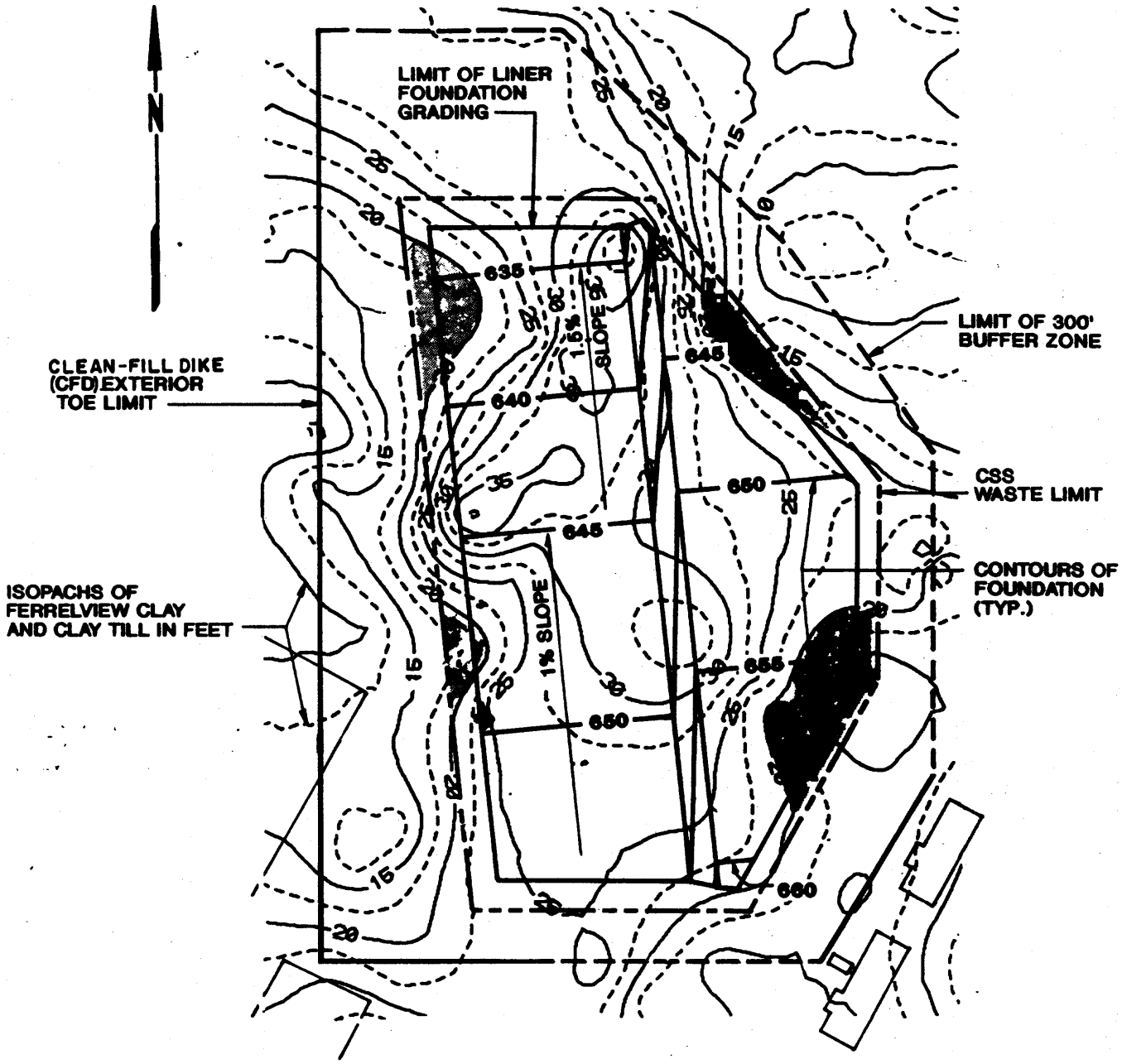
LEGEND

AREA WITH LESS 20 FEET OF FERRELLVIEW CLAY AND CLAY TILL

CSS DISPOSAL CELL FOUNDATION PLAN
MINIMUM EXCAVATION
CONFIGURATION

FIGURE 5.2.3-1

REPORT NO: DOE/OR/21548-411	DRAWING NO:	
ORIGINATOR: KWL	DRAWN BY: AMA	DATE:



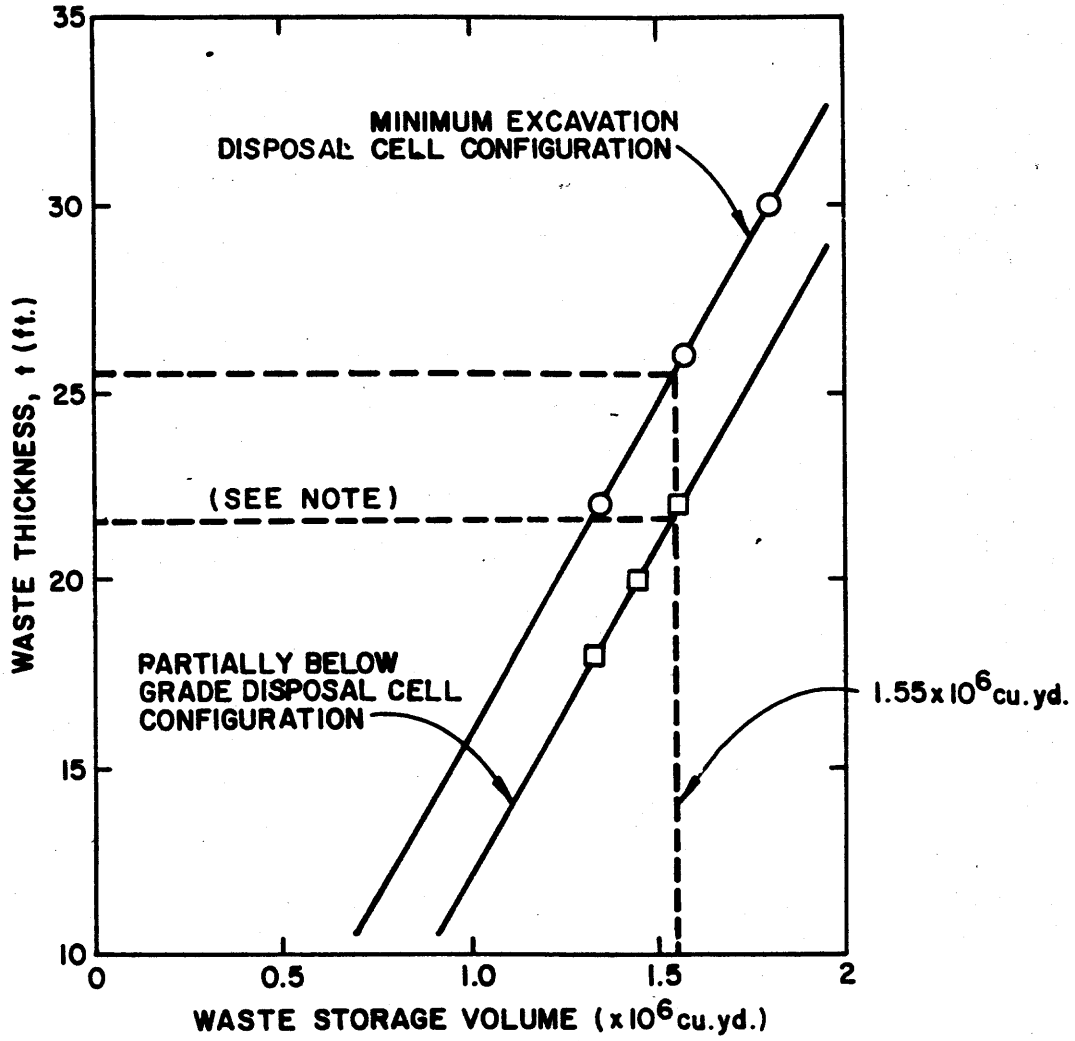
LEGEND

AREA WITH LESS THAN 20 FEET OF FERRELLVIEW CLAY AND CLAY TILL

CSS DISPOSAL CELL FOUNDATON PLAN PARTIALLY BELOW GRADE OR DEEP EXCAVATION CONFIGURATION

FIGURE 5.2.3-2

REPORT NO: DOE/OR/21548-411	DRAWING NO:	
ORIGINATOR: KWL	DRAWN BY: AMA	DATE:

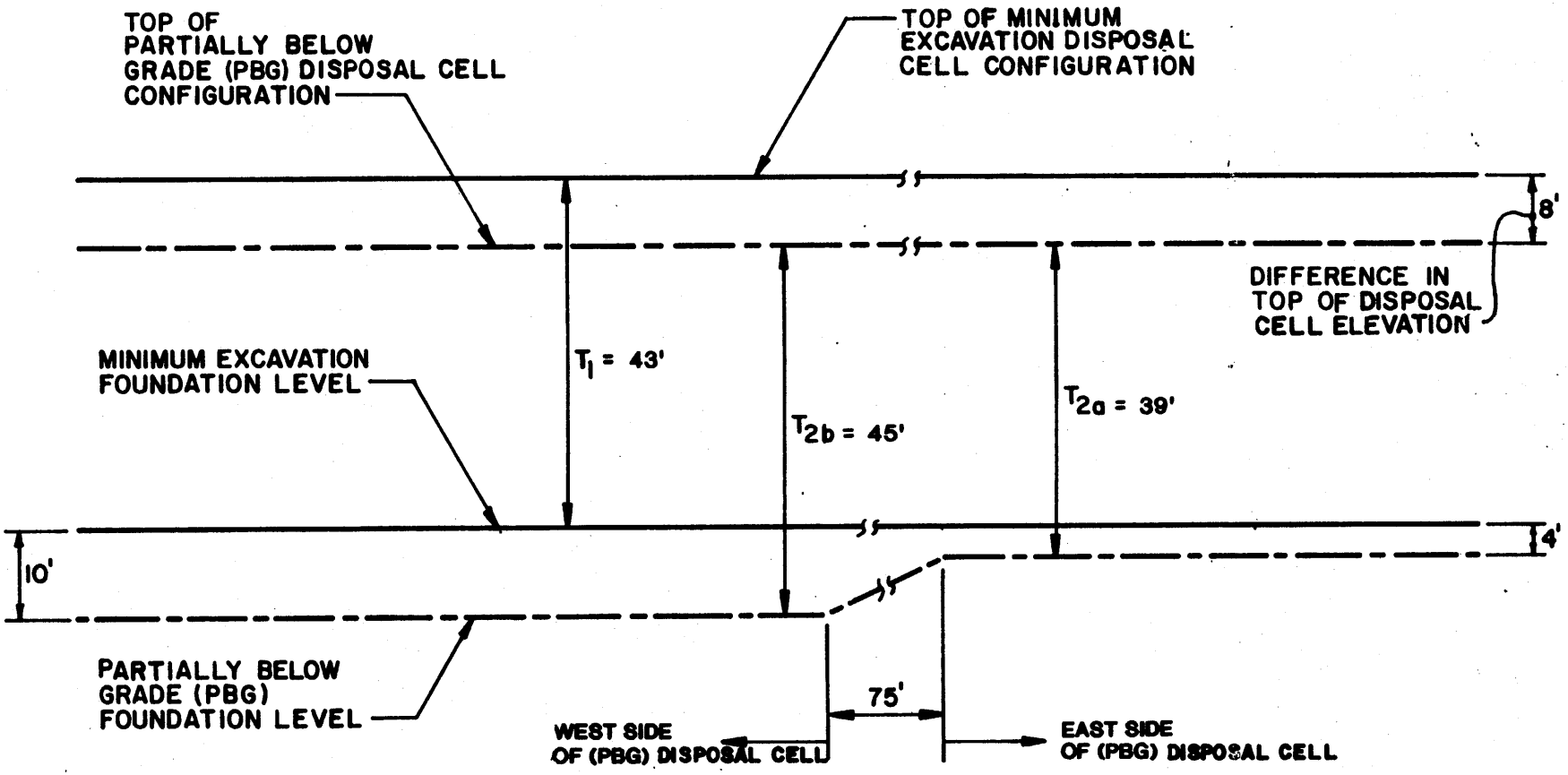


NOTE: WASTE THICKNESS BASED ON THE EASTERN HALF OF THE DISPOSAL CELL

WASTE THICKNESS VERSUS WASTE STORAGE VOLUME FOR CSS DISPOSAL CELL

FIGURE 5.2.3-3

REPORT NO: DOE/OR/21548-411	DRAWING NO:	
ORIGINATOR: KWL	DRAWN BY: AMA	DATE:



NOT TO SCALE

NOTES:

T_1 = TOTAL DISPOSAL CELL THICKNESS FOR MINIMUM EXCAVATION CELL CONFIGURATION

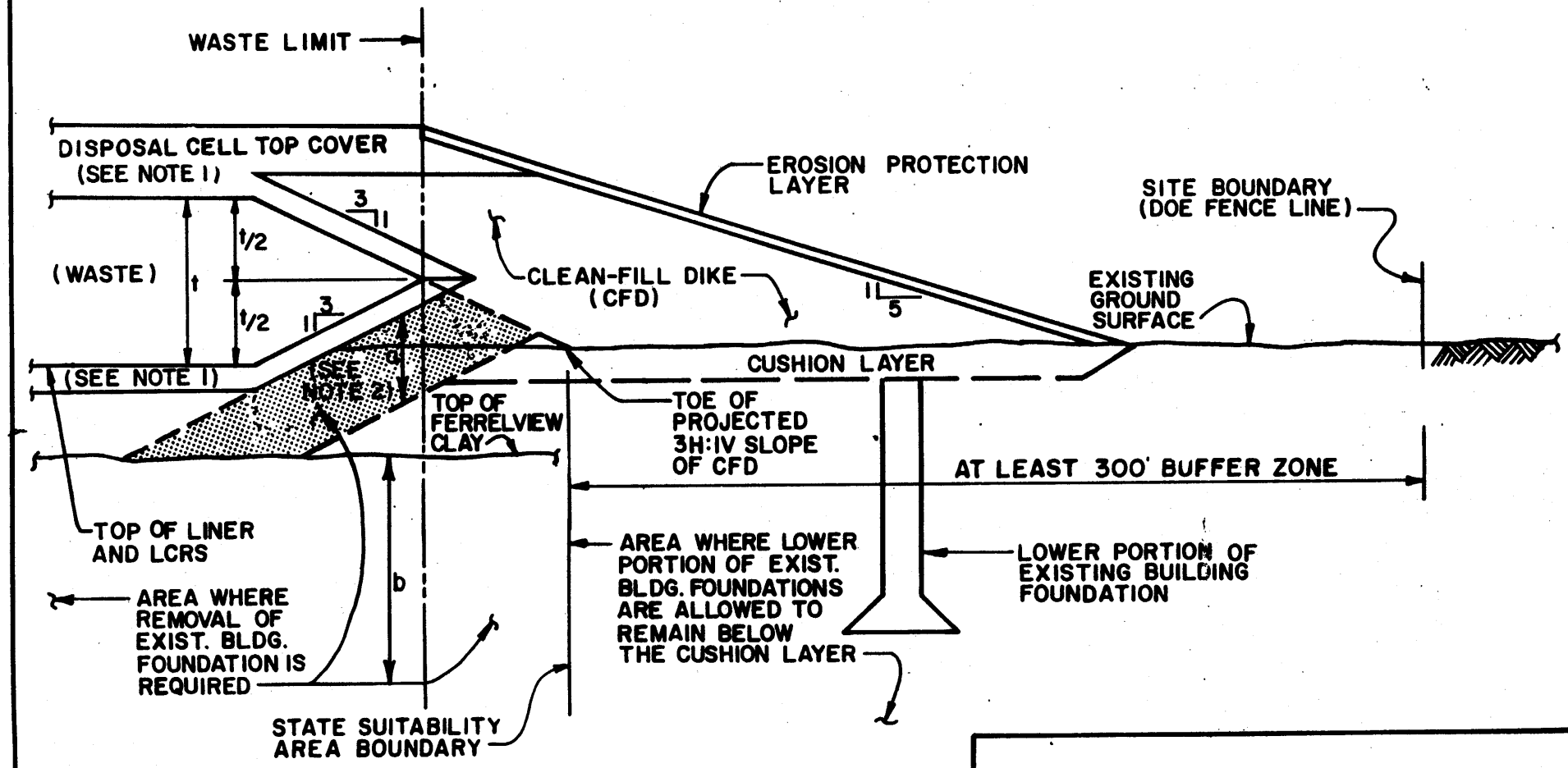
T_{2a} = TOTAL DISPOSAL CELL THICKNESS FOR THE EAST SIDE OF PARTIALLY BELOW GRADE CELL CONFIGURATION

T_{2b} = TOTAL DISPOSAL CELL THICKNESS FOR THE WEST SIDE OF PARTIALLY BELOW GRADE CELL CONFIGURATION

COMPARISON OF TOTAL
DISPOSAL CELL THICKNESS

FIGURE 5.2.3-4

REPORT NO.: DOE/OR/21548-411	DRAWING NO.:	
ORIGINATOR: KWL	DRAWN BY: AMA	DATE:



NOT TO SCALE

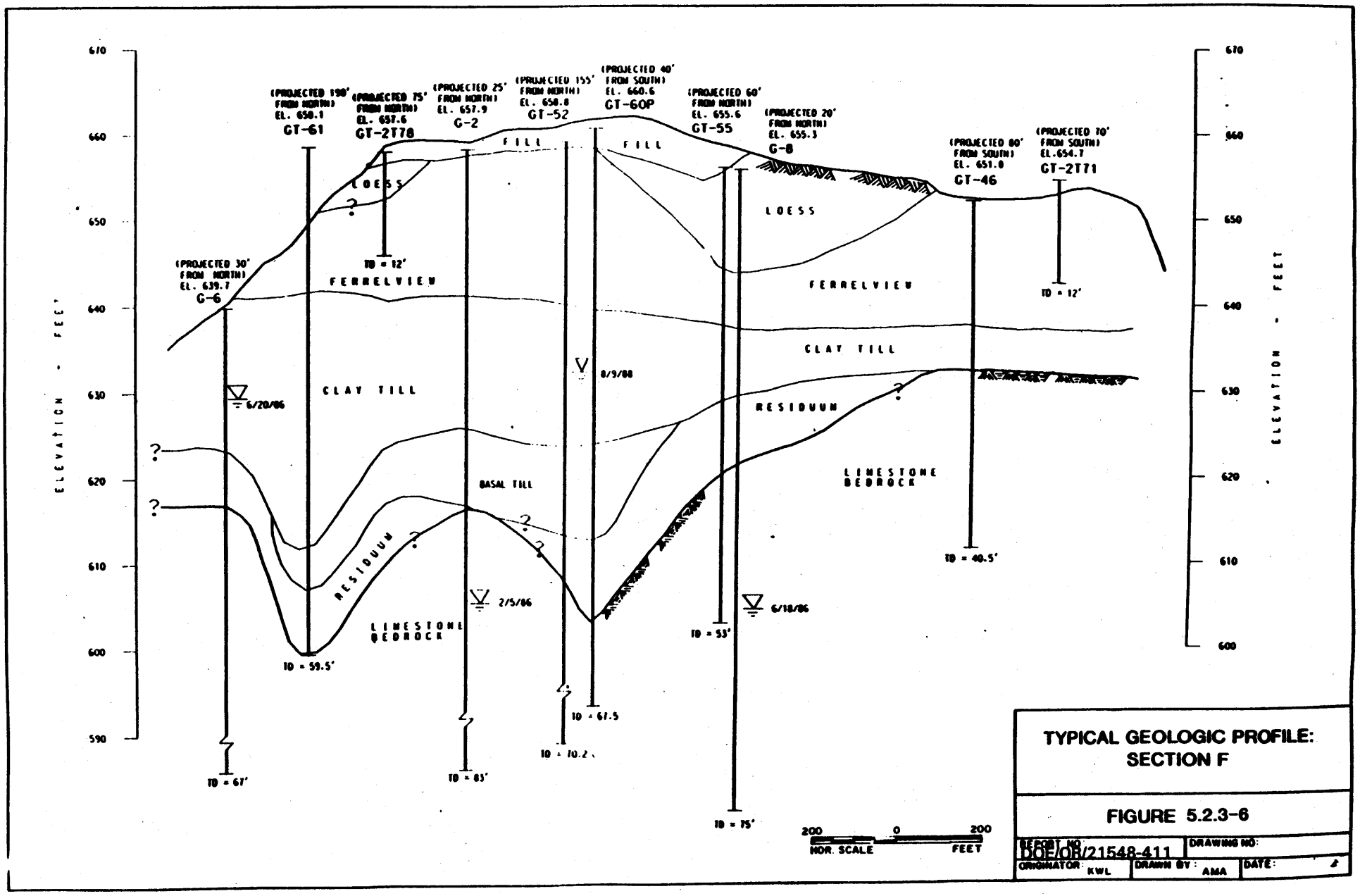
NOTES:

1. SEE DETAILS IN FIGURE 5.2.5-3
2. THE MINIMUM 20 FT. THICKNESS SHOWN (a + b) IS EQUIVALENT TO 30 FT. OF 1×10^{-7} cm/s PERMEABILITY MATERIAL AND IS INCLUDED IN THE SUM OF THE COMPACTED LOW-PERMEABILITY FILL BENEATH THE ENGINEERED LINER AND EXISTING LOW-PERMEABILITY SOIL ABOVE THE UPPERMOST REGIONAL AQUIFER.

DETAILS OF WASTE AND CLEAN-FILL DIKE INTERFACE (SCHEMATIC)

FIGURE 5.2.3-5

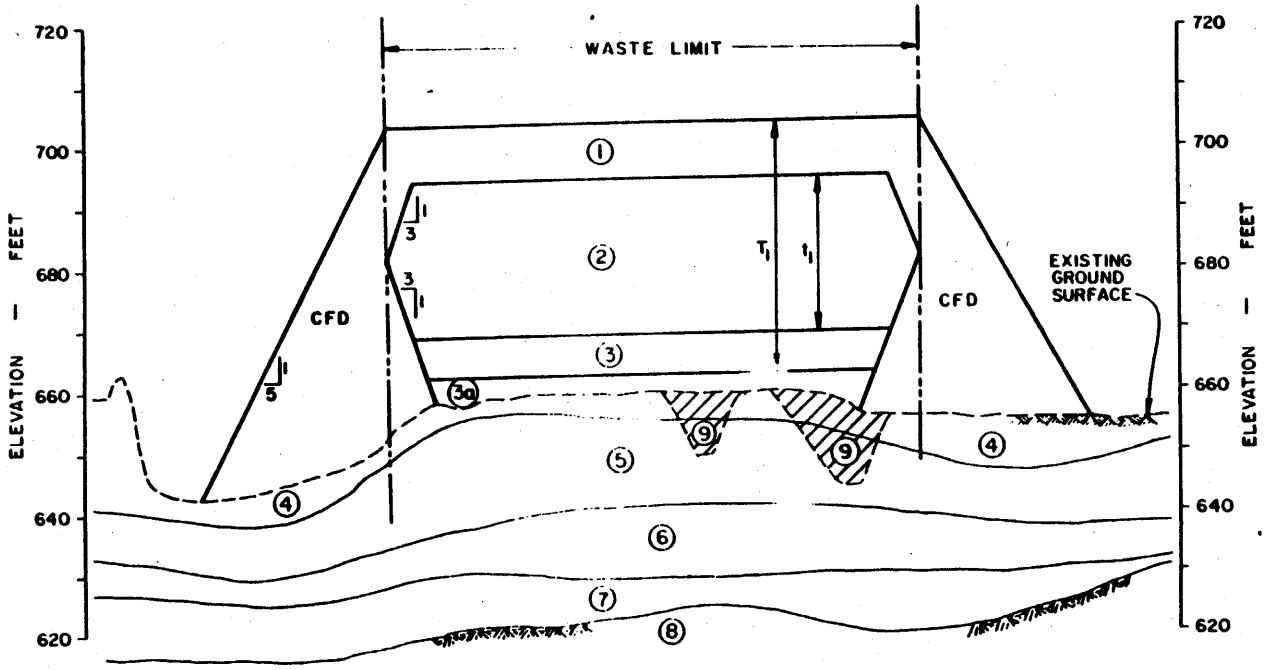
REPORT NO.: DOE/OR/21548-411	DRAWING NO.:	
ORIGINATOR: KWL	DRAWN BY: AMA	DATE:



TYPICAL GEOLOGIC PROFILE: SECTION F

FIGURE 5.2.3-6

REPORT NO: DOE/OR/21548-411	DRAWING NO:	
ORIGINATOR: KWL	DRAWN BY: AMA	DATE:



NOTES:

T_1 = TOTAL CELL THICKNESS FOR MINIMUM EXCAVATION CELL CONFIGURATION = 43 FT.
t_1 = WASTE THICKNESS FOR MINIMUM EXCAVATION CELL CONFIGURATION = 26 FT.

LEGEND:

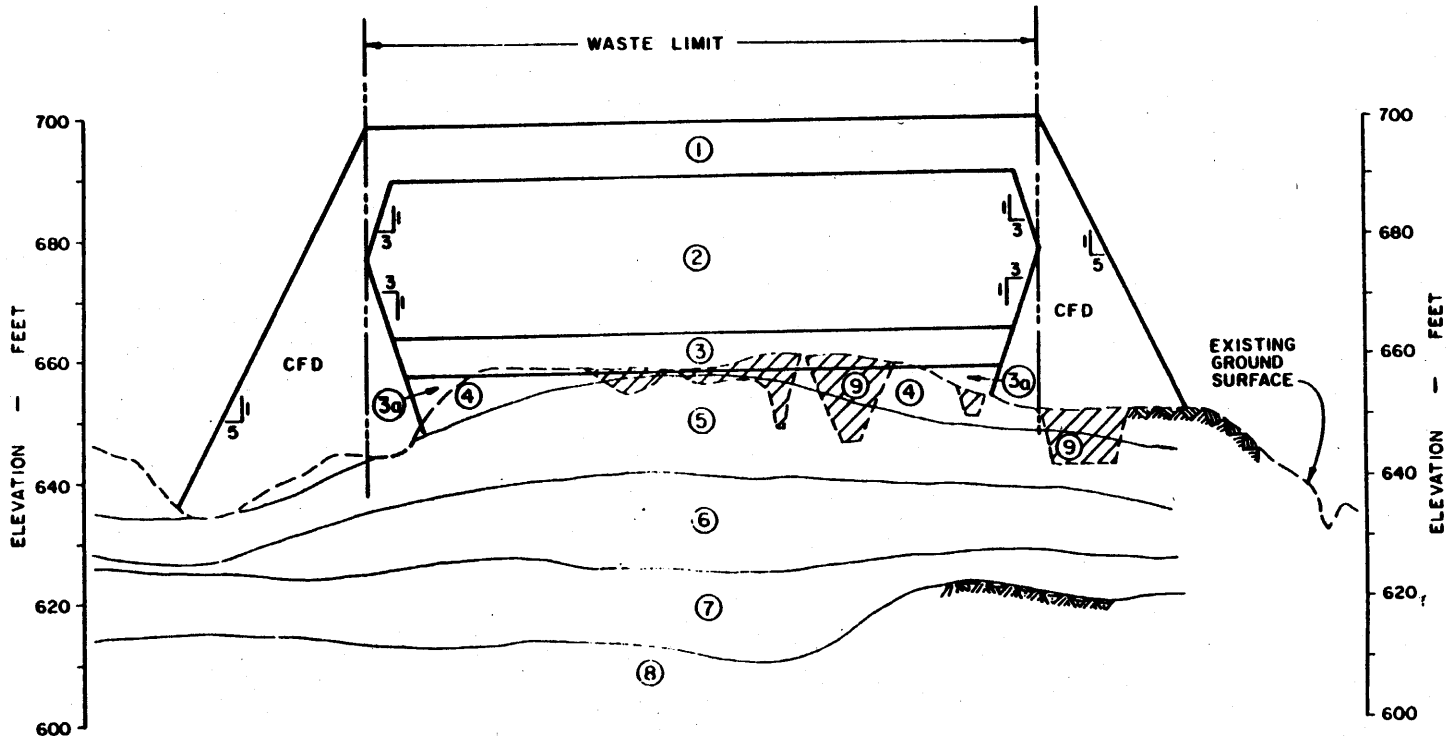
① COVER & CLEAN FILL DIKE (CFD) ENCAPSULATION SYSTEM
② WASTE
③ LINER & LEACHATE COLLECTION REMOVAL SYSTEM
③a FOUNDATION FILL
④ EXISTING FILL AND/OR LOESS
⑤ FERRELVIEW CLAY
⑥ CLAY TILL
⑦ BASAL TILL AND/OR RESIDUUM
⑧ WEATHERED BEDROCK (LIMESTONE)
⑨ EXCAVATION REQUIRED FOR CONTAMINATED SOILS AND BUILDING FOUNDATIONS DEMOLITION

200 0 200
HORIZ SCALE FEET

DISPOSAL CELL CONFIGURATION
MINIMUM EXCAVATION:
SECTION L

FIGURE 5.2.3-7

RECORD NO. DOE/OR/21548-411	DRAWING NO.	
ORIGINATOR KWL	DRAWN BY AMA	DATE



LEGEND:

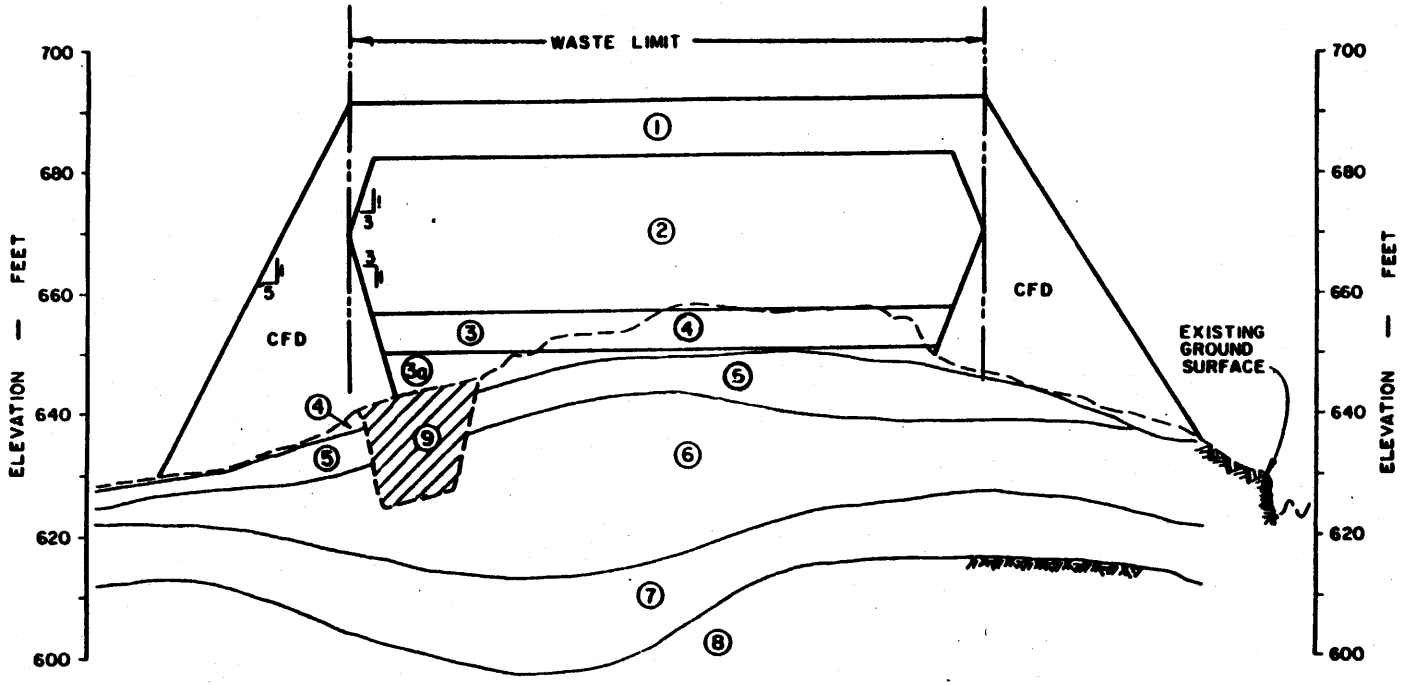
1. COVER & CLEAN FILL DIKE (CFD) ENCAPSULATION SYSTEM
2. WASTE
3. LINER & LEACHATE COLLECTION REMOVAL SYSTEM
3a. FOUNDATION FILL
4. EXISTING FILL AND/OR LOESS
5. FERRELVIEW CLAY
6. CLAY TILL
7. BASAL TILL AND/OR RESIDUUM
8. WEATHERED BEDROCK (LIMESTONE)
9. EXCAVATION REQUIRED FOR CONTAMINATED SOILS AND BUILDING FOUNDATIONS DEMOLITION

200 0 200
HORIZ SCALE FEET

DISPOSAL CELL CONFIGURATION MINIMUM EXCAVATION: SECTION M

FIGURE 5.2.3-8

REPORT NO. DOE/OR/21548-411	DRAWING NO	
ORIGINATOR KWL	DRAWN BY AMA	DATE



HORIZ. SCALE

200 0 200 Feet

60.9 0 60.9 Meters

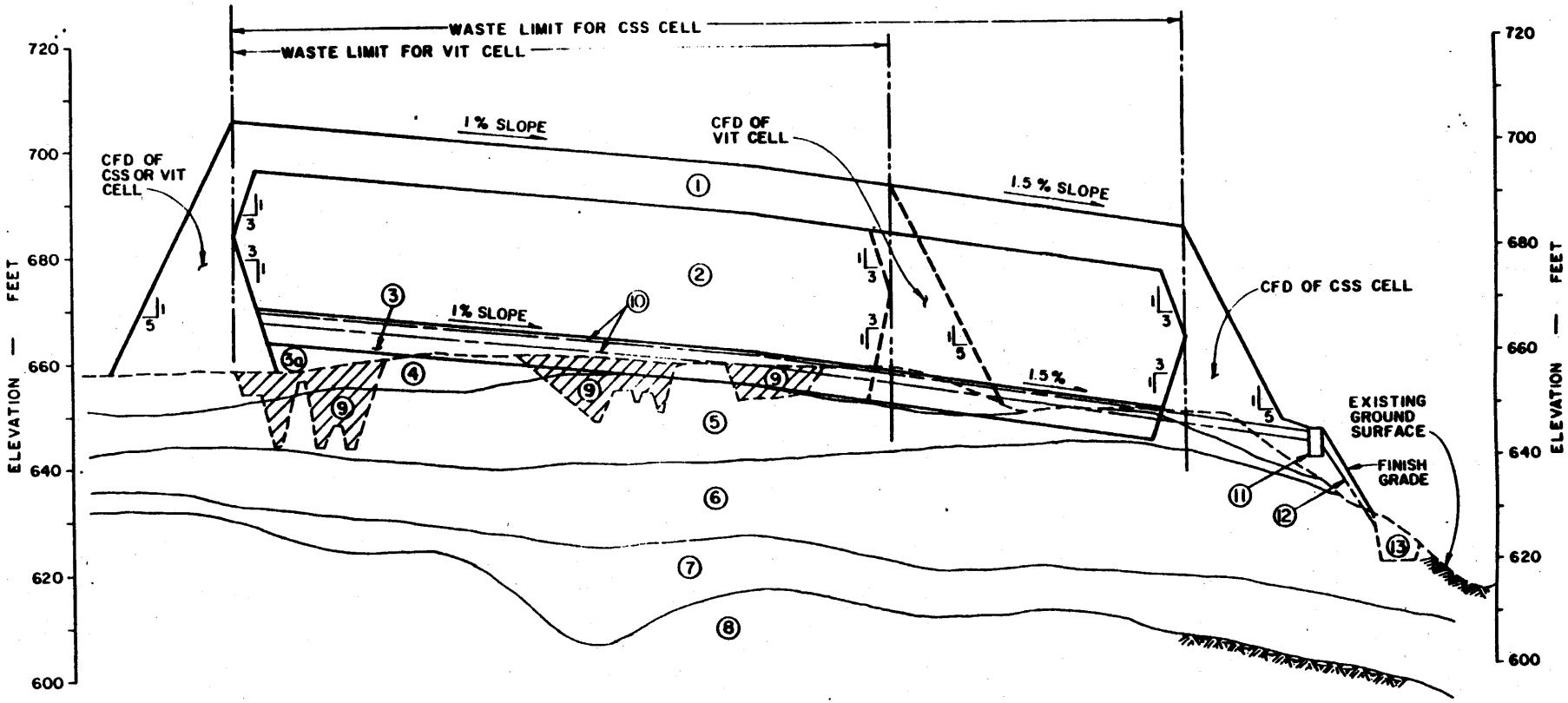
LEGEND:

① COVER & CLEAN FILL DIKE (CFD) ENCAPSULATION SYSTEM
② WASTE
③ LINER & LEACHATE COLLECTION REMOVAL SYSTEM
3a FOUNDATION FILL
④ EXISTING FILL AND/OR LOESS
⑤ FERRELVIEW CLAY
⑥ CLAY TILL
⑦ BASAL TILL AND/OR RESIDUUM
⑧ WEATHERED BEDROCK (LIMESTONE)
⑨ EXCAVATION FOR EXISTING MSA POND

DISPOSAL CELL CONFIGURATION MINIMUM EXCAVATION: SECTION N

FIGURE 5.2.3-9

REPORT NO. DOE/OR/21548-411	DRAWING NO.	
ORIGINATOR KWL	DRAWN BY AMA	DATE



NOTE:

FOR VIT CELL, THE LEACHATE COLLECTION RETENTION BASIN MAY BE RELOCATED, AND EXCAVATED DITCH OR BURIED PIPE WILL BE REQUIRED TO DIVERT LEACHATE TO A POSITIVE DRAIN AREA WHERE THE RETENTION BASIN WILL BE LOCATED.

200 0 200
HORIZ. SCALE FEET

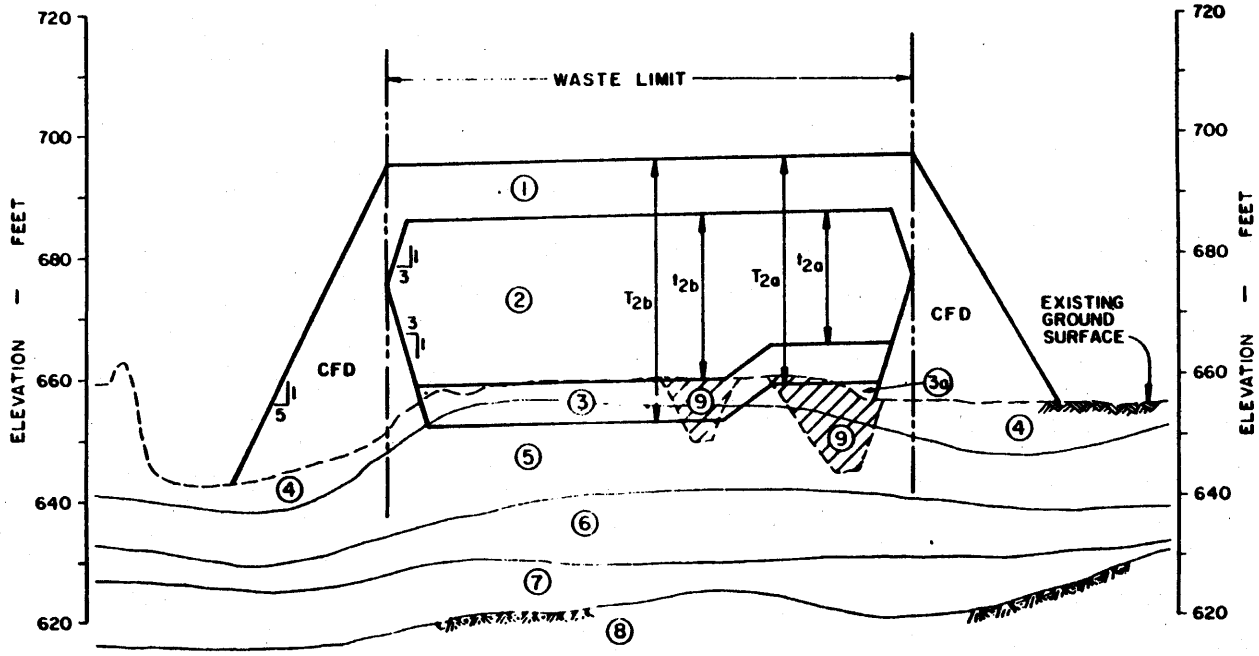
LEGEND:

1. COVER & CLEAN FILL DIKE (CFD) ENCAPSULATION SYSTEM
2. WASTE
3. LINER & LEACHATE COLLECTION REMOVAL SYSTEM
3a. FOUNDATION FILL
4. EXISTING FILL AND/OR LOESS
5. FERRELVIEW CLAY
6. CLAY TILL
7. BASAL TILL AND/OR RESIDUUM
8. WEATHERED BEDROCK (LIMESTONE)
9. EXCAVATION REQUIRED FOR CONTAMINATED SOILS AND BUILDING FOUNDATIONS DEMOLITION.
10. COLLECTION PIPES
11. COLLECTION SUMP
12. CONNECTOR PIPE
13. POTENTIAL AREA FOR LEACHATE COLLECTION RETENTION BASIN FOR CSS CELL (PROJECTED APPROX. 200 FT. FROM WEST) (SEE NOTE FOR VIT CELL)

DISPOSAL CELL CONFIGURATION MINIMUM EXCAVATION: SECTION O

FIGURE 5.2.3-10

REPORT NO. DOE/OR/21548-411	DRAWING NO:	
ORIGINATOR: KWL	DRAWN BY: AMA	DATE:



NOTES:

T2a = TOTAL CELL THICKNESS FOR THE EAST SIDE OF PARTIALLY BELOW GRADE CELL CONFIGURATION = 39 FT.
t2a = WASTE THICKNESS FOR THE EAST SIDE OF PARTIALLY BELOW GRADE CELL CONFIGURATION = 22 FT.
T2b = TOTAL CELL THICKNESS FOR THE WEST SIDE OF PARTIALLY BELOW GRADE CELL CONFIGURATION = 45 FT.
t2b = WASTE THICKNESS FOR THE WEST SIDE OF PARTIALLY BELOW GRADE CELL CONFIGURATION = 28 FT.

LEGEND:

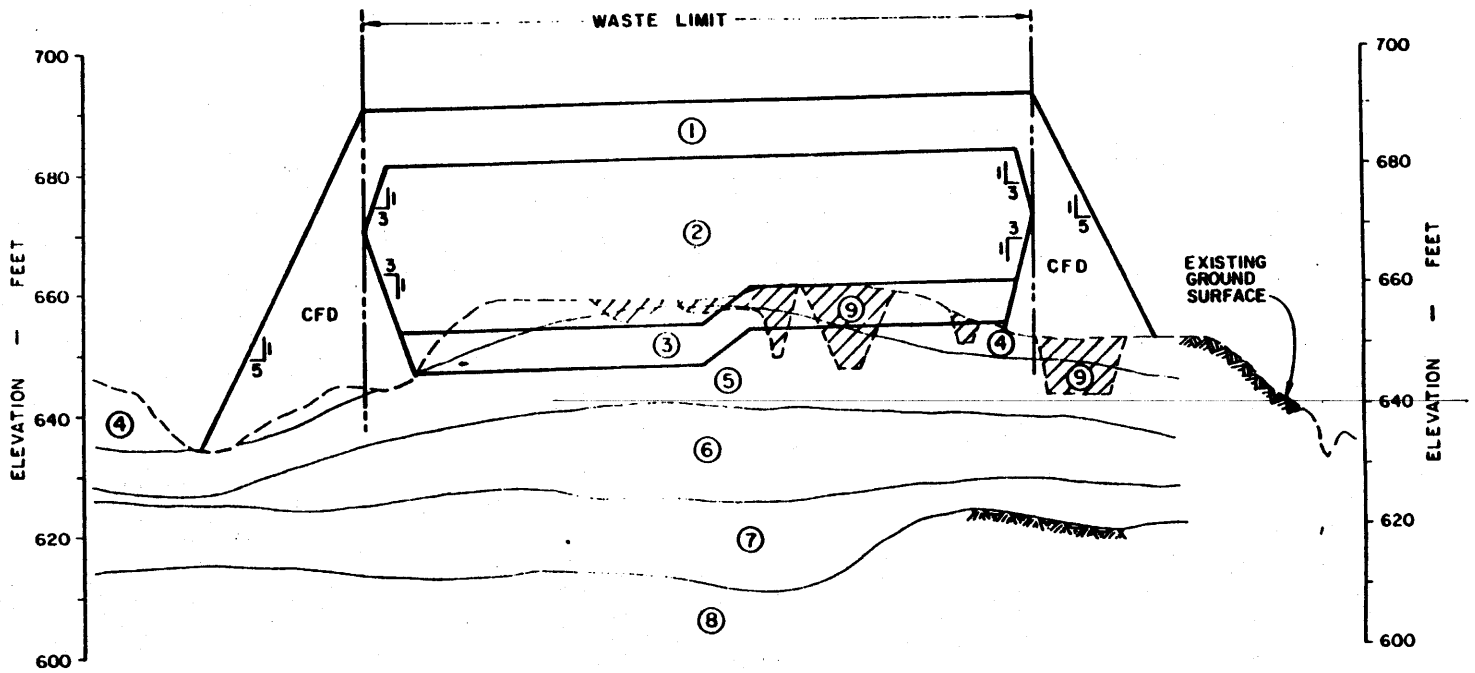
① COVER & CLEAN FILL DIKE (CFD) ENCAPSULATION SYSTEM
② WASTE
③ LINER & LEACHATE COLLECTION REMOVAL SYSTEM
③a FOUNDATION FILL
④ EXISTING FILL AND/OR LOESS
⑤ FERRELVIEW CLAY
⑥ CLAY TILL
⑦ BASAL TILL AND/OR RESIDUUM
⑧ WEATHERED BEDROCK (LIMESTONE)
⑨ EXCAVATION REQUIRED FOR CONTAMINATED SOILS AND BUILDING FOUNDATIONS DEMOLITION

200 0 200
HORIZ SCALE FEET

DISPOSAL CELL CONFIGURATION PARTIALLY BELOW GRADE: SECTION L

FIGURE 5.2.3-11

REPORT NO DOE/OR/21548-411	DRAWING NO	
ORIGINATOR KWL	DRAWN BY AMA	DATE



LEGEND:

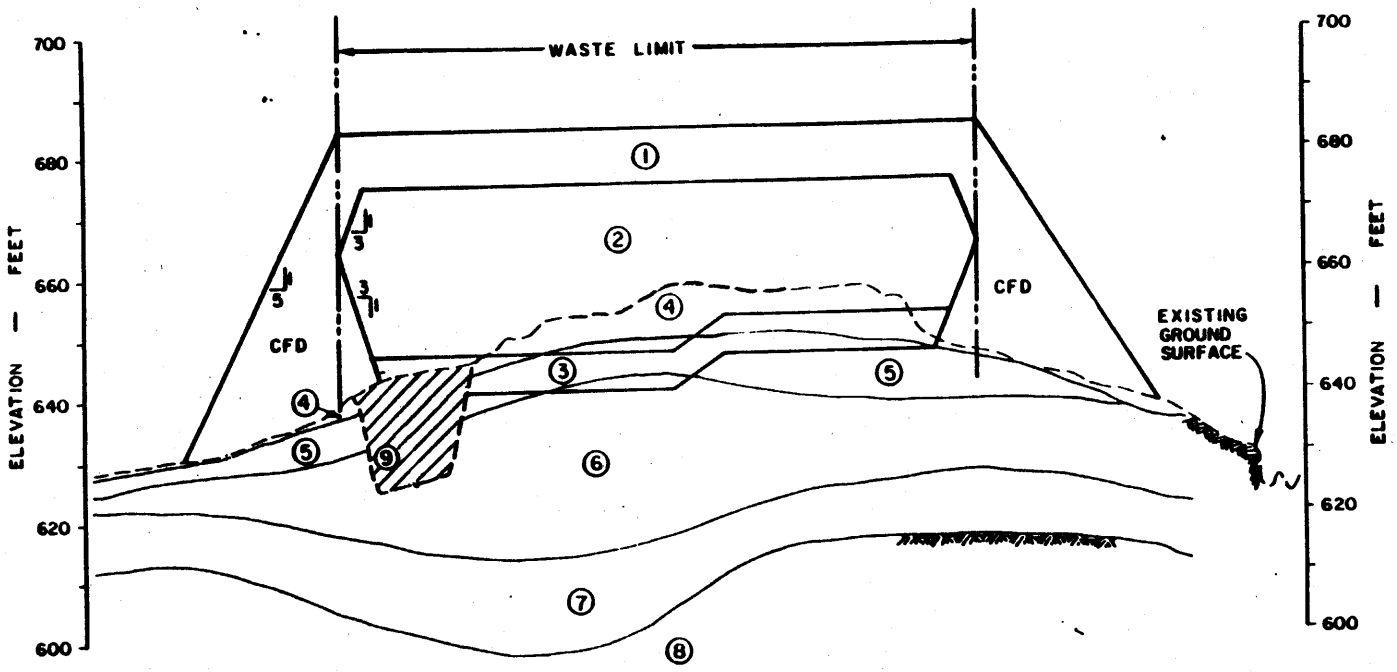
1. COVER & CLEAN FILL DIKE (CFD) ENCAPSULATION SYSTEM
2. WASTE
3. LINER & LEACHATE COLLECTION REMOVAL SYSTEM
4. EXISTING FILL AND/ OR LOESS
5. FERRELVIEW CLAY
6. CLAY TILL
7. BASAL TILL AND/ OR RESIDUUM
8. WEATHERED BEDROCK (LIMESTONE)
9. EXCAVATION REQUIRED FOR CONTAMINATED SOILS AND BUILDING FOUNDATIONS DEMOLITION

200 0 200
HORIZ SCALE FEET

DISPOSAL CELL CONFIGURATION PARTIALLY BELOW GRADE: SECTION M

FIGURE 5.2.3-12

REPORT NO DOE/OR/215-18-411	DRAWING NO	
ORIGINATOR KWL	DRAWN BY AMA	DATE



HORIZ. SCALE

200 0 200 Feet

60.9 0 60.9 Meters

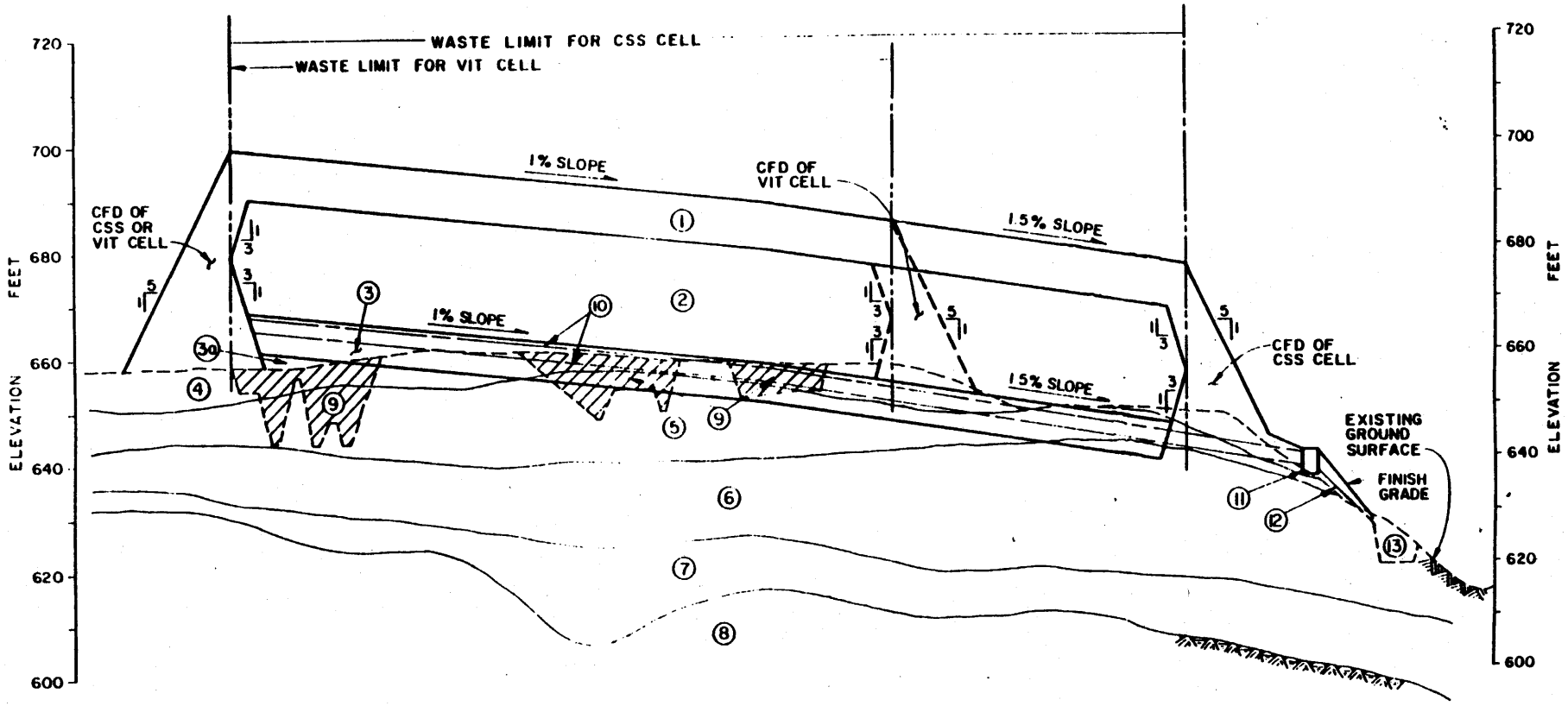
LEGEND:

1. COVER & CLEAN FILL DIKE (CFD) ENCAPSULATION SYSTEM
2. WASTE
3. LINER & LEACHATE COLLECTION REMOVAL SYSTEM
4. FOUNDATION FILL
5. EXISTING FILL AND/OR LOESS
6. FERRELVIEW CLAY
7. CLAY TILL
8. BASAL TILL AND/OR RESIDUUM
9. WEATHERED BEDROCK (LIMESTONE)
9. EXCAVATION FOR EXISTING MSA POND

DISPOSAL CELL CONFIGURATION PARTIALLY BELOW GRADE: SECTION N

FIGURE 5.2.3-13

REPORT NO. DOE/OR/21548-411	DRAWING NO.	
ORIGINATOR KWL	DRAWN BY: AMA	DATE:



NOTE:

FOR VIT CELL, THE LEACHATE COLLECTION RETENTION BASIN MAY BE RELOCATED, AND EXCAVATED DITCH OR BURIED PIPE WILL BE REQUIRED TO DIVERT LEACHATE TO A POSITIVE DRAIN AREA WHERE THE RETENTION BASIN WILL BE LOCATED

LEGEND:

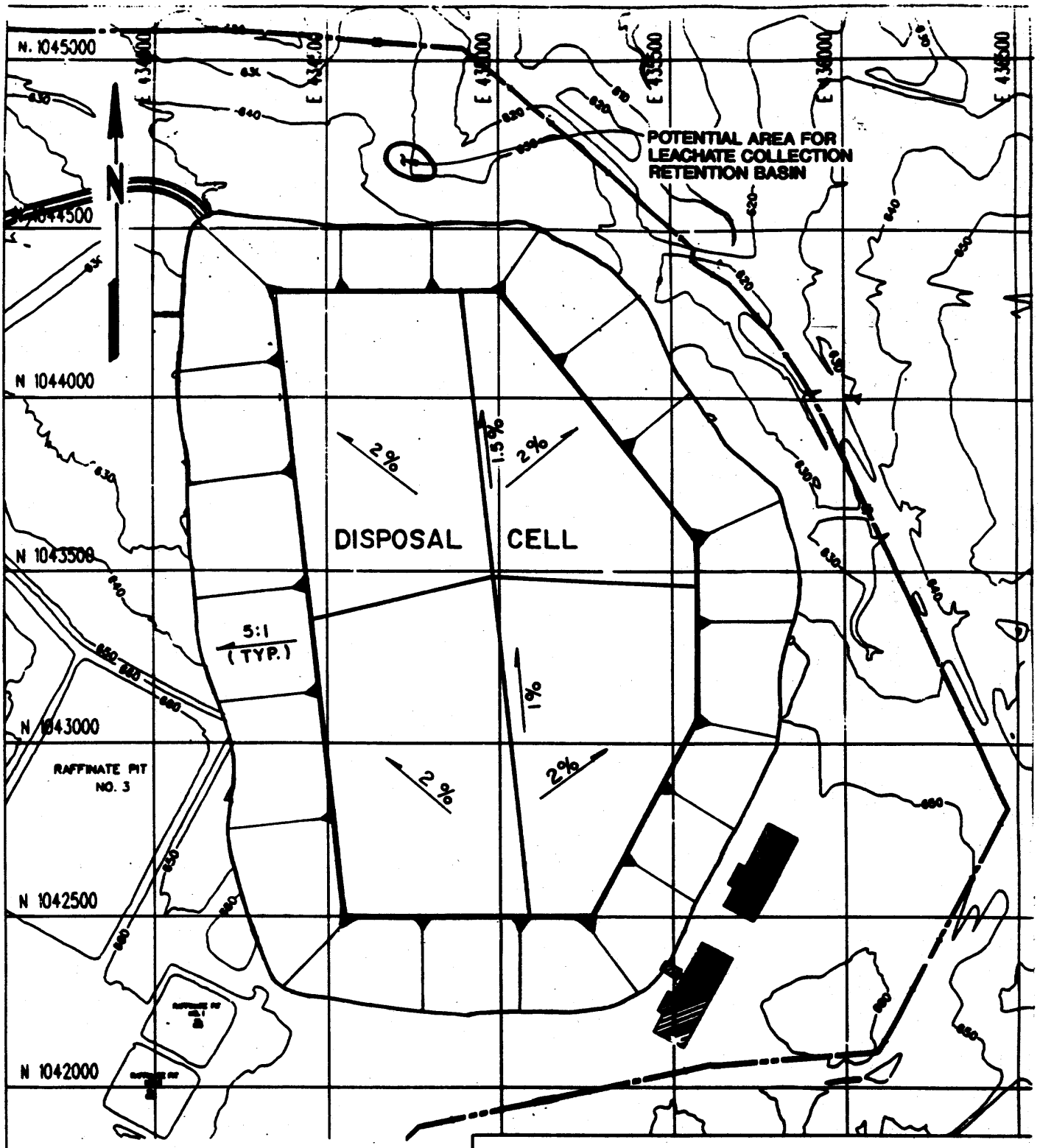
1. COVER & CLEAN FILL DIKE (CFD) ENCAPSULATION SYSTEM
2. WASTE
3. LINER & LEACHATE COLLECTION REMOVAL SYSTEM
3a. FOUNDATION FILL
4. EXISTING FILL AND/OR LOESS
5. FERRELVIEW CLAY
6. CLAY TILL
7. BASAL TILL AND/OR RESIDUUM
8. WEATHERED BEDROCK (LIMESTONE)
9. EXCAVATION REQUIRED FOR CONTAMINATED SOILS AND BUILDING FOUNDATIONS DEMOLITION
10. COLLECTION PIPES
11. COLLECTION SUMP
12. CONNECTOR PIPE
13. POTENTIAL AREA FOR LEACHATE COLLECTION RETENTION BASIN FOR CSS CELL (PROJECTED APPROX 200 FT. FROM WEST) (SEE NOTE FOR VIT CELL)

200 0 200
HORIZ SCALE FEET

DISPOSAL CELL CONFIGURATION PARTIALLY BELOW GRADE: SECTION O

FIGURE 5.2.3-14

REFERENCE NO. DOE/OR/21548-411	DRAWING NO	
ORIGINATOR KWL	DRAWN BY AMA	DATE:



400 0 400 FEET
121.9 0 121.9 METERS
SCALE

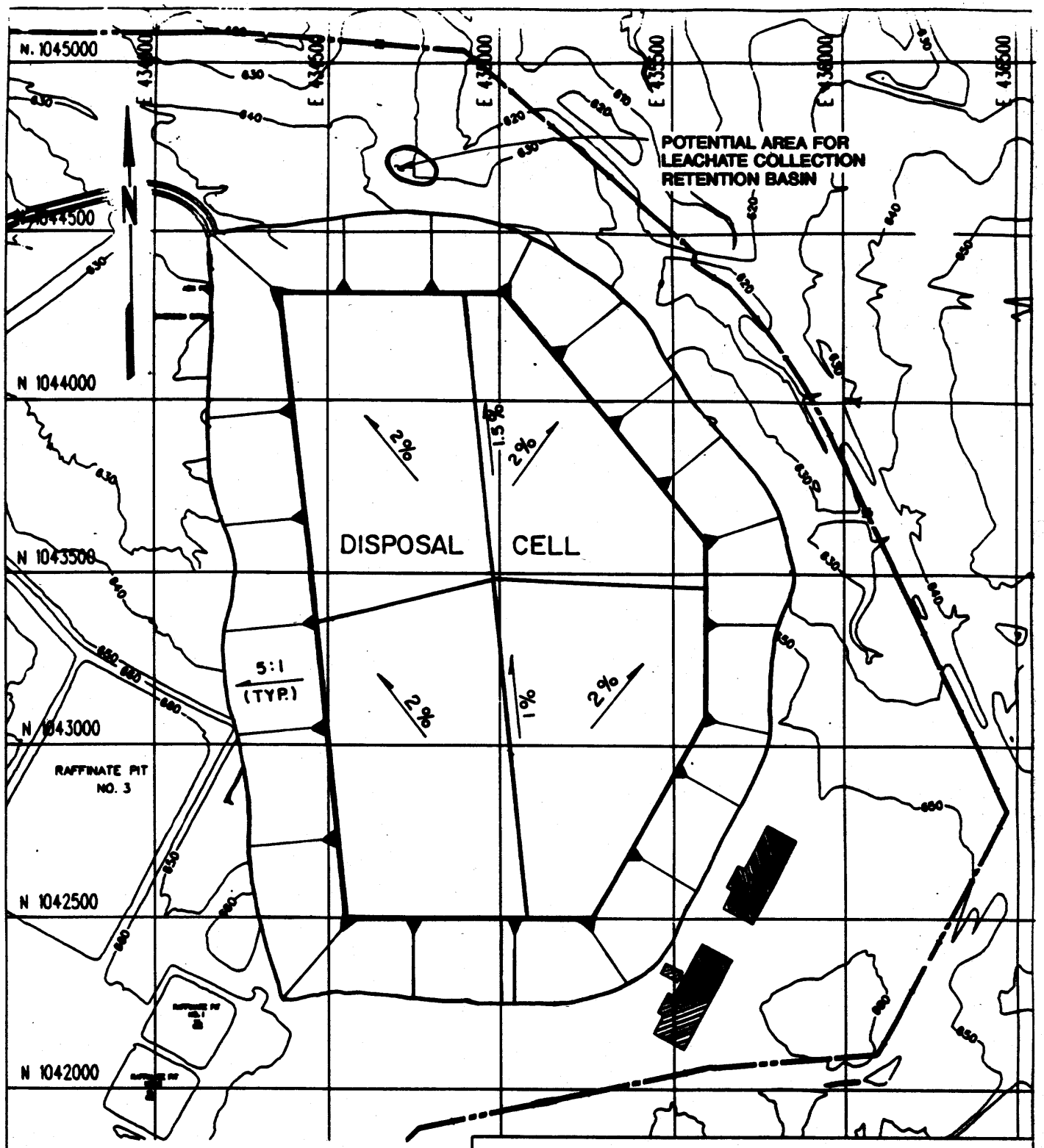
NOTE: CLEAN-FILL DIKE (CFD) TOE LINE SHOWN HERE IS BASED ON EXISTING TOPOGRAPHY.

PLAN VIEW OF CSS DISPOSAL CELL MINIMUM EXCAVATION CONFIGURATION

FIGURE 5.2.3-15

REPORT NO.: DOE/OR/21548-411	DRAWING NO.:	
ORIGINATOR: KWL	DRAWN BY: AMA	DATE:

D-3840CELL/3040C4.DGN



400 0 400 FEET

121.9 0 121.9 METERS

SCALE

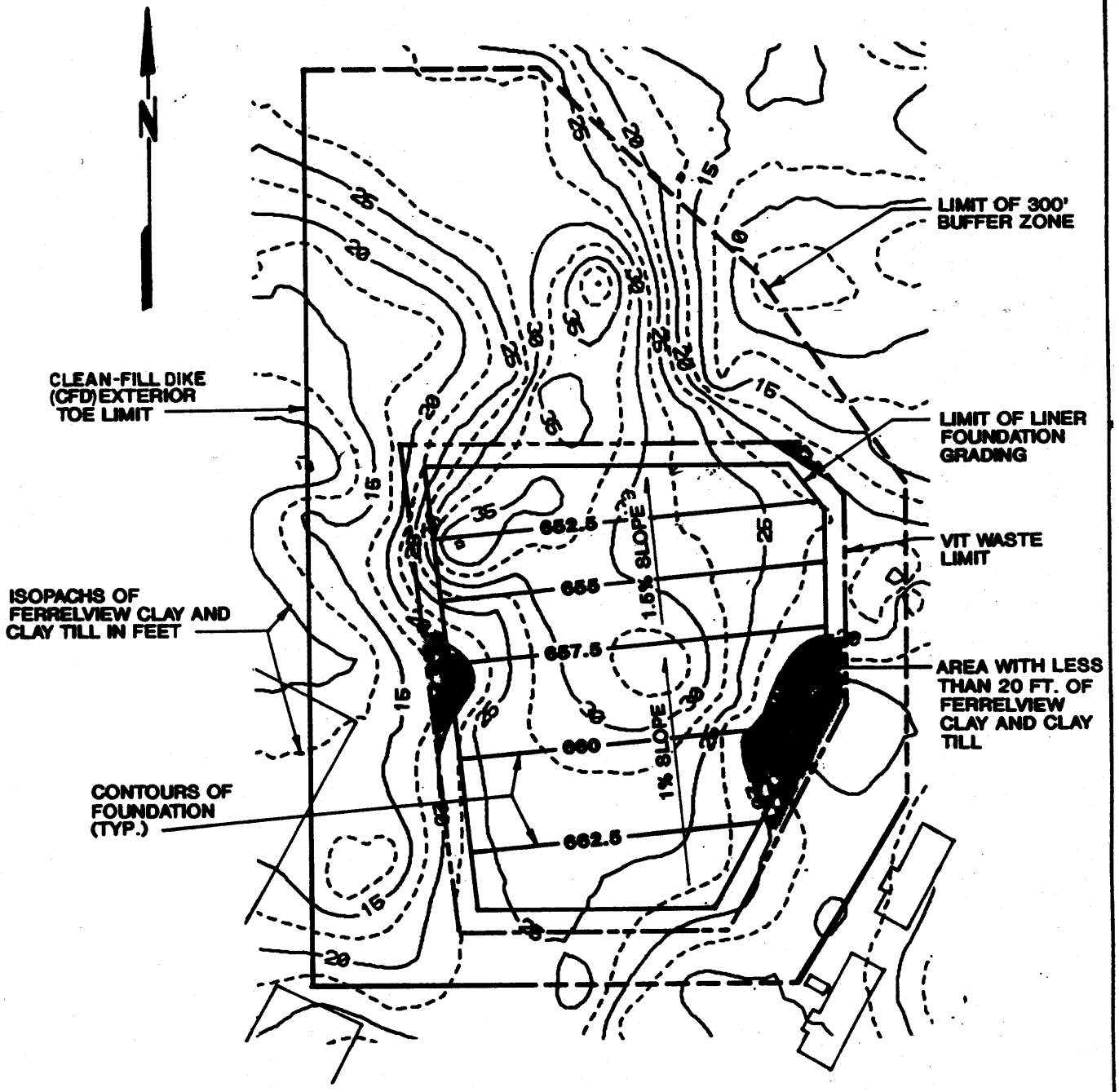
NOTE: CLEAN-FILL DIKE (CFD) TOE LINE SHOWN HERE IS BASED ON EXISTING TOPOGRAPHY.

PLAN VIEW OF CSS DISPOSAL CELL PARTIALLY BELOW GRADE CONFIGURATION

FIGURE 5.2.3-16

REPORT NO.: DOE/OR/21548-411	DRAWING NO.:	
ORIGINATOR: KWL	DRAWN BY: AMA	DATE:

D-3840CELL/3040C4.DGN



400 0 400 FEET

121.9 0 121.9 METERS

SCALE

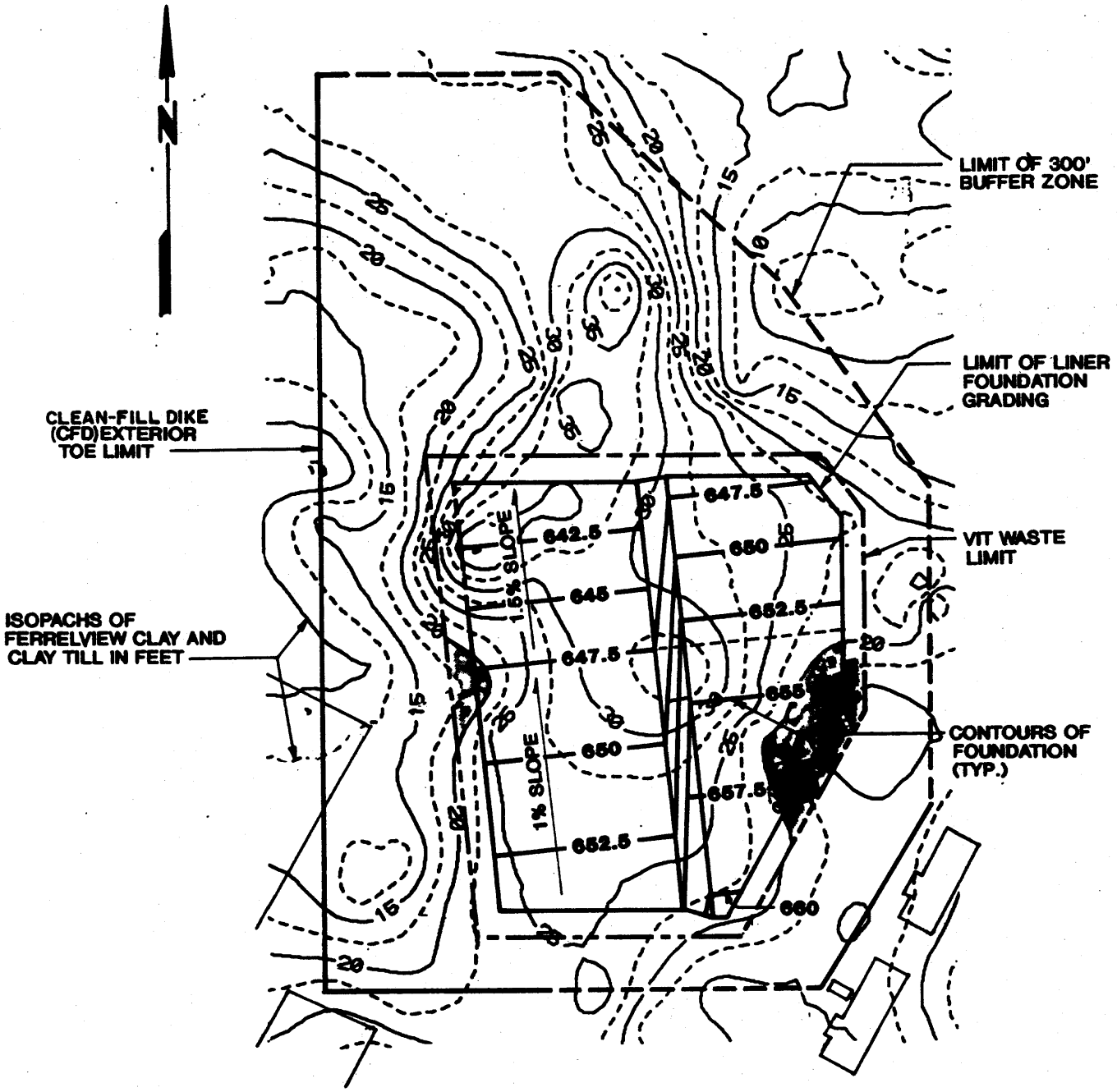
LEGEND

= AREA WITH LESS THAN 20 FEET OF FERRELL VIEW CLAY AND CLAY TILL

VIT DISPOSAL CELL FOUNDATION PLAN MINIMUM EXCAVATION CONFIGURATION

FIGURE 5.2.3-17

REPORT NO: DOE/OR/21548-411	DRAWING NO:	
ORIGINATOR: KWL	DRAWN BY: AMA	DATE:



400 0 400 FEET
121.9 0 121.9 METERS
. SCALE

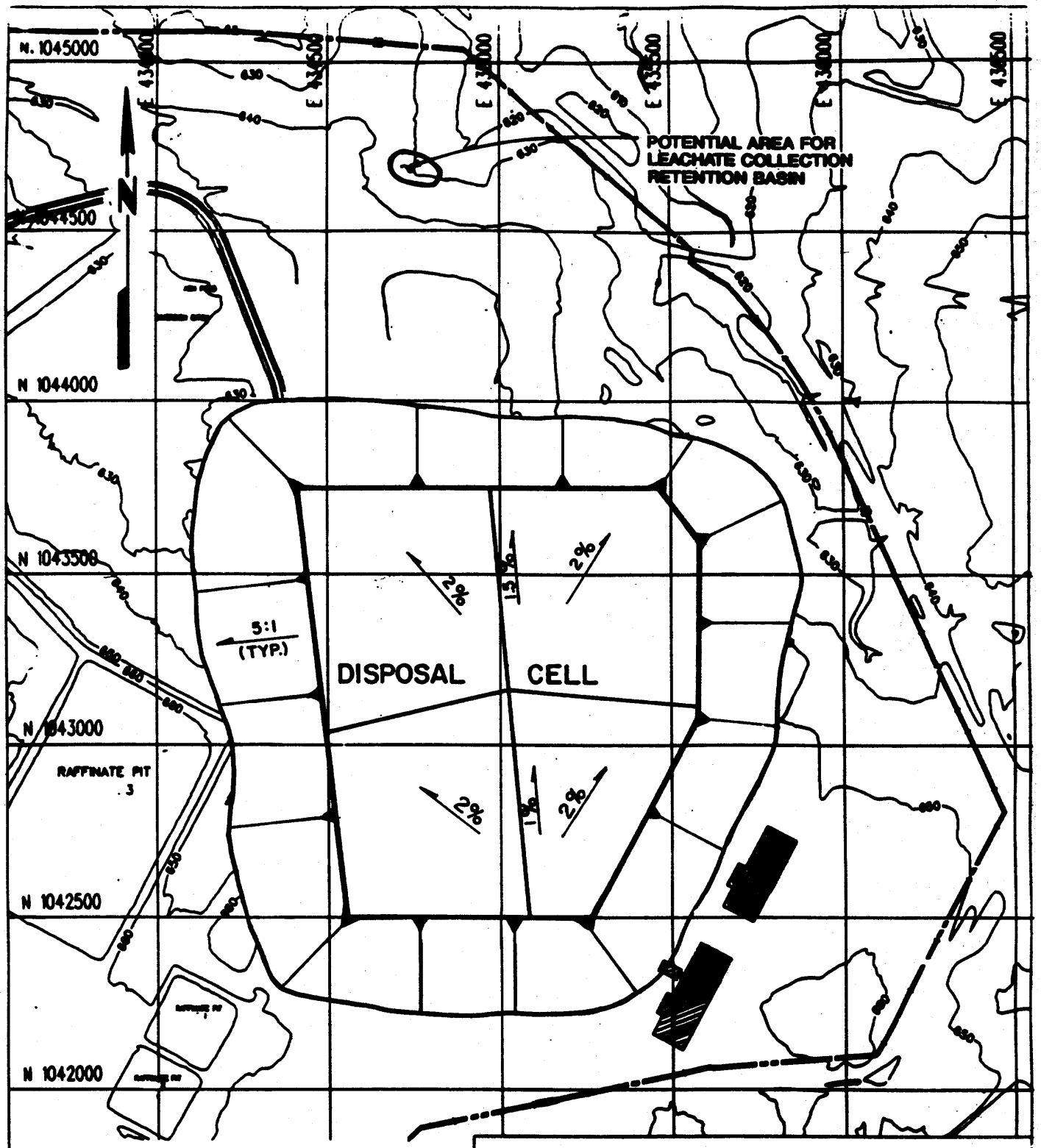
LEGEND

=AREA WITH LESS THAN 20 FEET OF FERRELVIEW CLAY AND CLAY TILL

VIT DISPOSAL CELL FOUNDATION PLAN PARTIALLY BELOW GRADE CONFIGURATION

FIGURE 5.2.3-18

REPORT NO: DOE/OR/21548-411	DRAWING NO:	
ORIGINATOR: KWL	DRAWN BY: AMA	DATE:



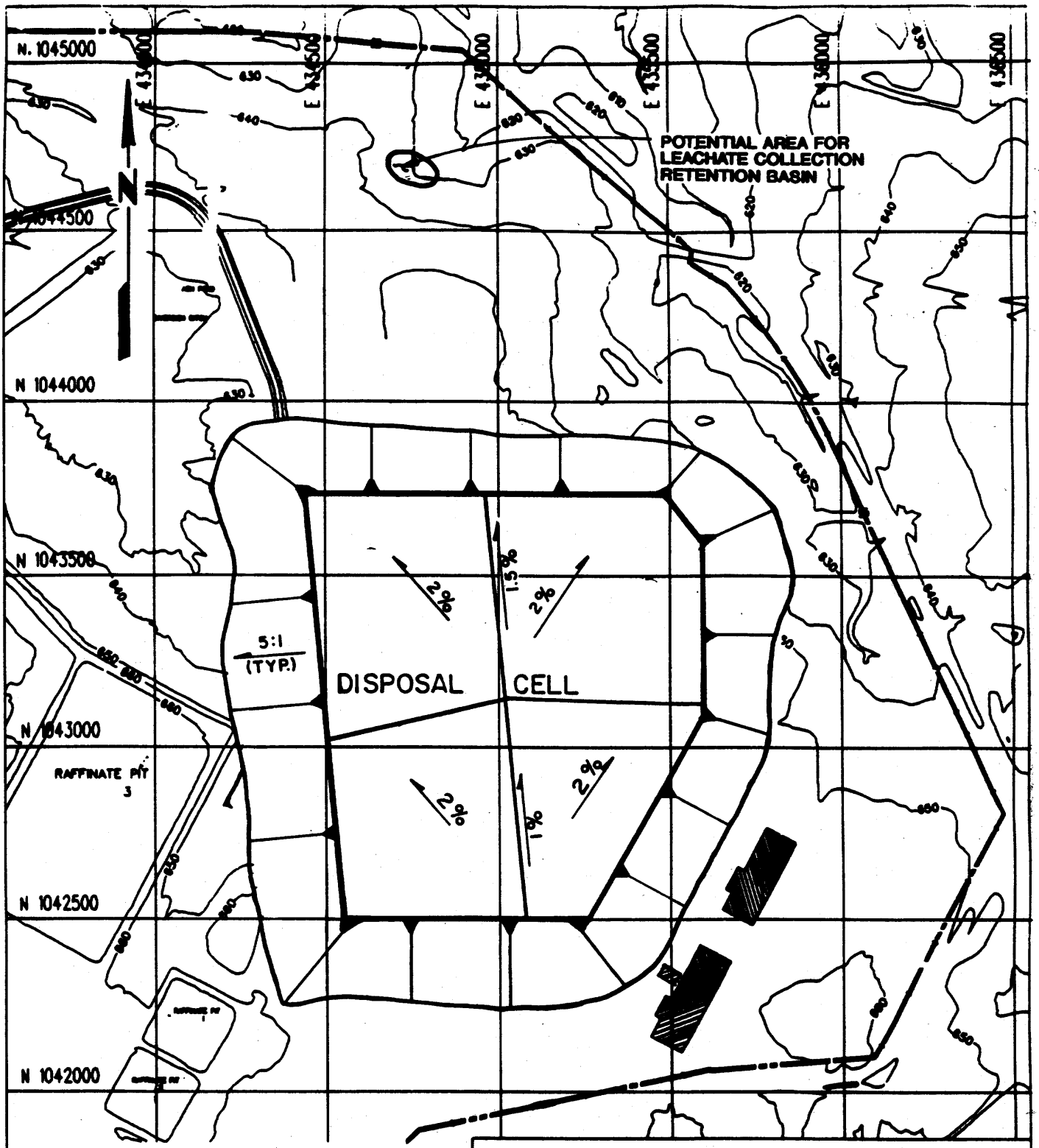
NOTE: CLEAN-FILL DIKE (CFD) TOE LINE SHOWN HERE IS BASED ON EXISTING TOPOGRAPHY.

PLAN VIEW OF VIT DISPOSAL CELL MINIMUM EXCAVATION CONFIGURATION

FIGURE 5.2.3-19

REPORT NO.: DOE/OR/21548-411		DRAWING NO.:	
ORIGINATOR: KWL	DRAWN BY: AMA	DATE:	

D-3840CELL/3040C4.DWN



400 0 400 FEET
121.9 0 121.9 METERS
SCALE

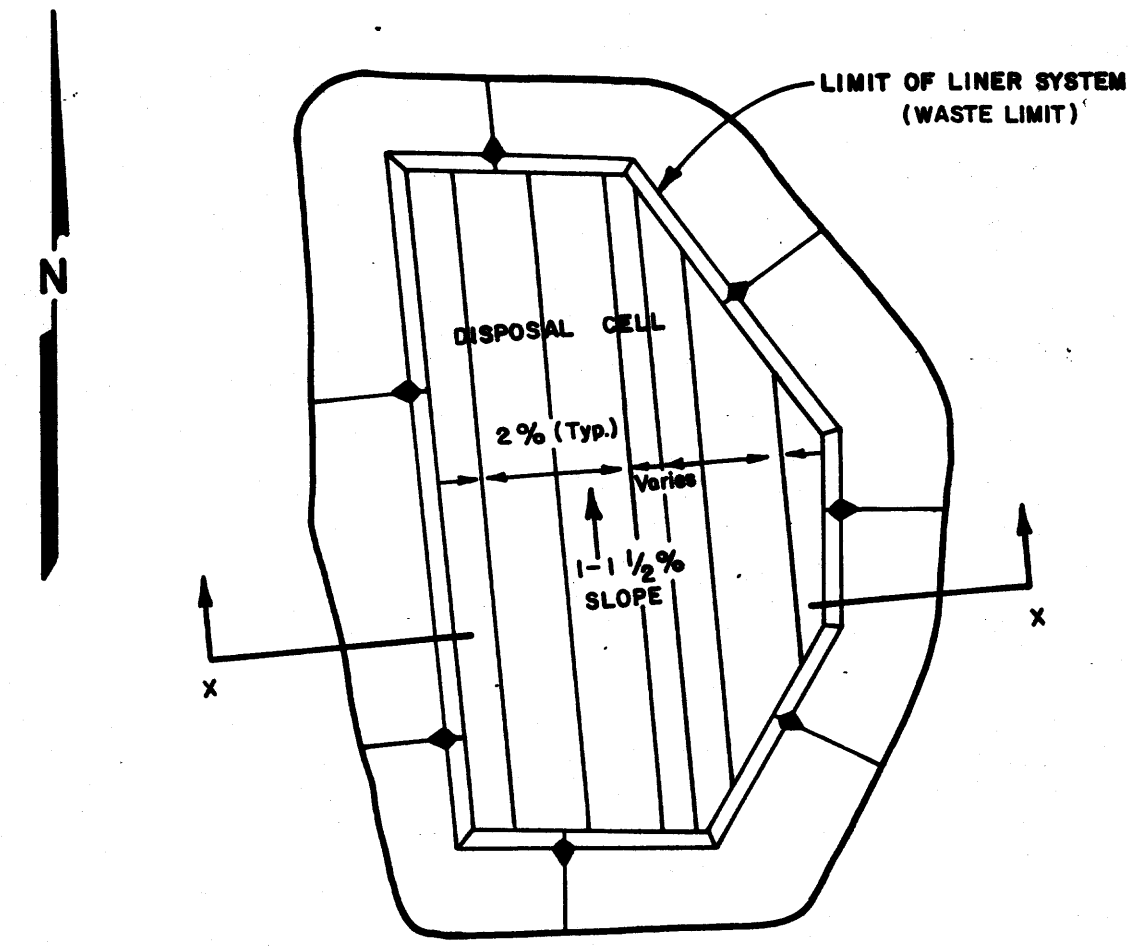
NOTE: CLEAN-FILL DIKE (CFD) TOE LINE SHOWN HERE IS BASED ON EXISTING TOPOGRAPHY.

PLAN VIEW OF VIT DISPOSAL CELL PARTIALLY BELOW GRADE CONFIGURATION

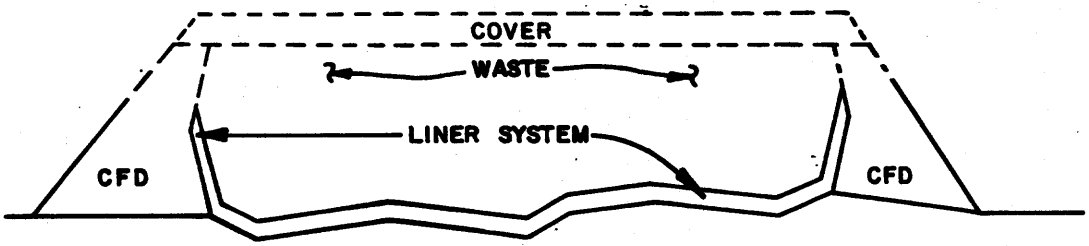
FIGURE 5.2.3-20

REPORT NO.: DOE/OR/21548-411		DRAWING NO.:
ORIGINATOR: KWL	DRAWN BY: AMA	DATE:

D:3840CELL/3040C4.DGN



PLAN
NOT TO SCALE



SECTION
NOT TO SCALE

LEGEND

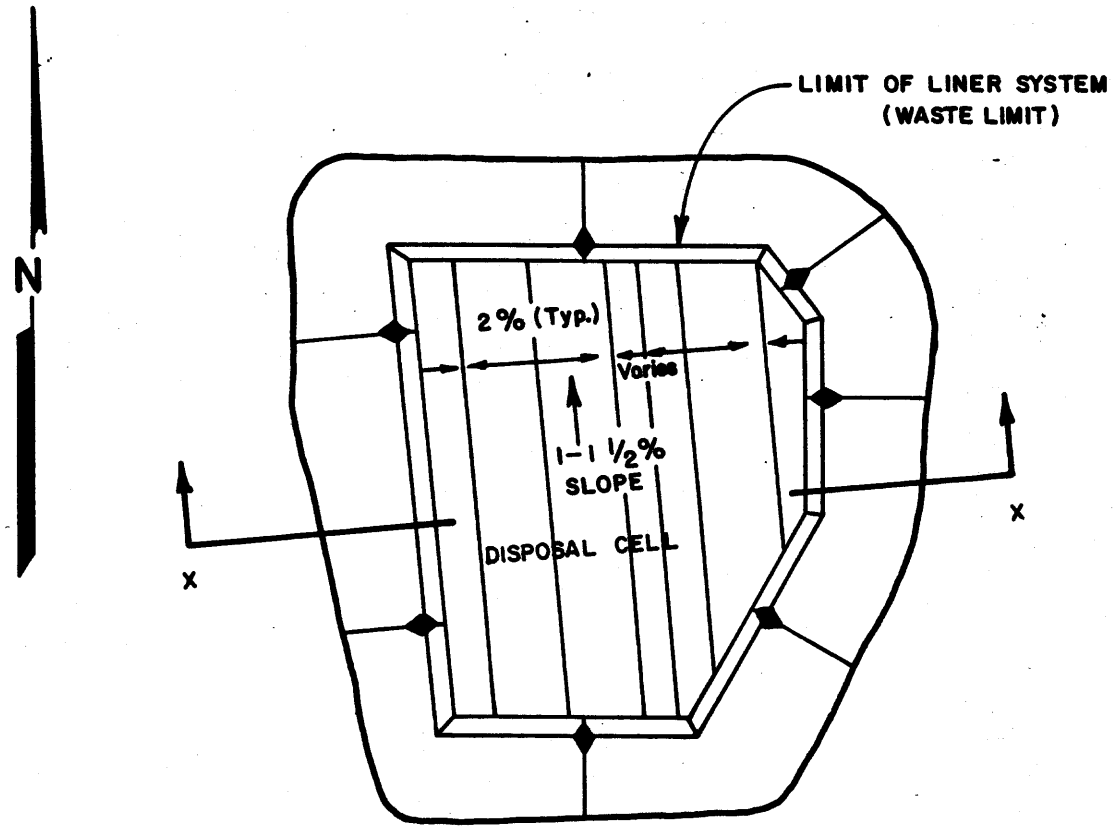
CFD = CLEAN FILL DIKE

X X = CROSS SECTION

LINER SYSTEM SCHEMATIC PLAN and SECTION CSS CELL

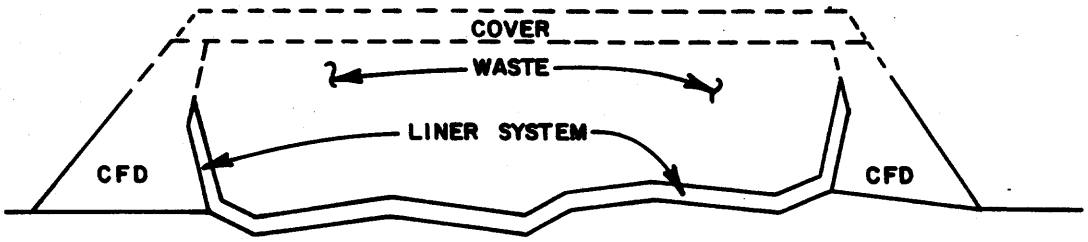
FIGURE 5.2.5-1

REPORT NO.: DOE/OR/21548-411	DRAWING NO.:	
ORIGINATOR: K.O.	DRAWN BY: ray	DATE: AUG., 1992



PLAN

NOT TO SCALE



SECTION

NOT TO SCALE

LEGEND

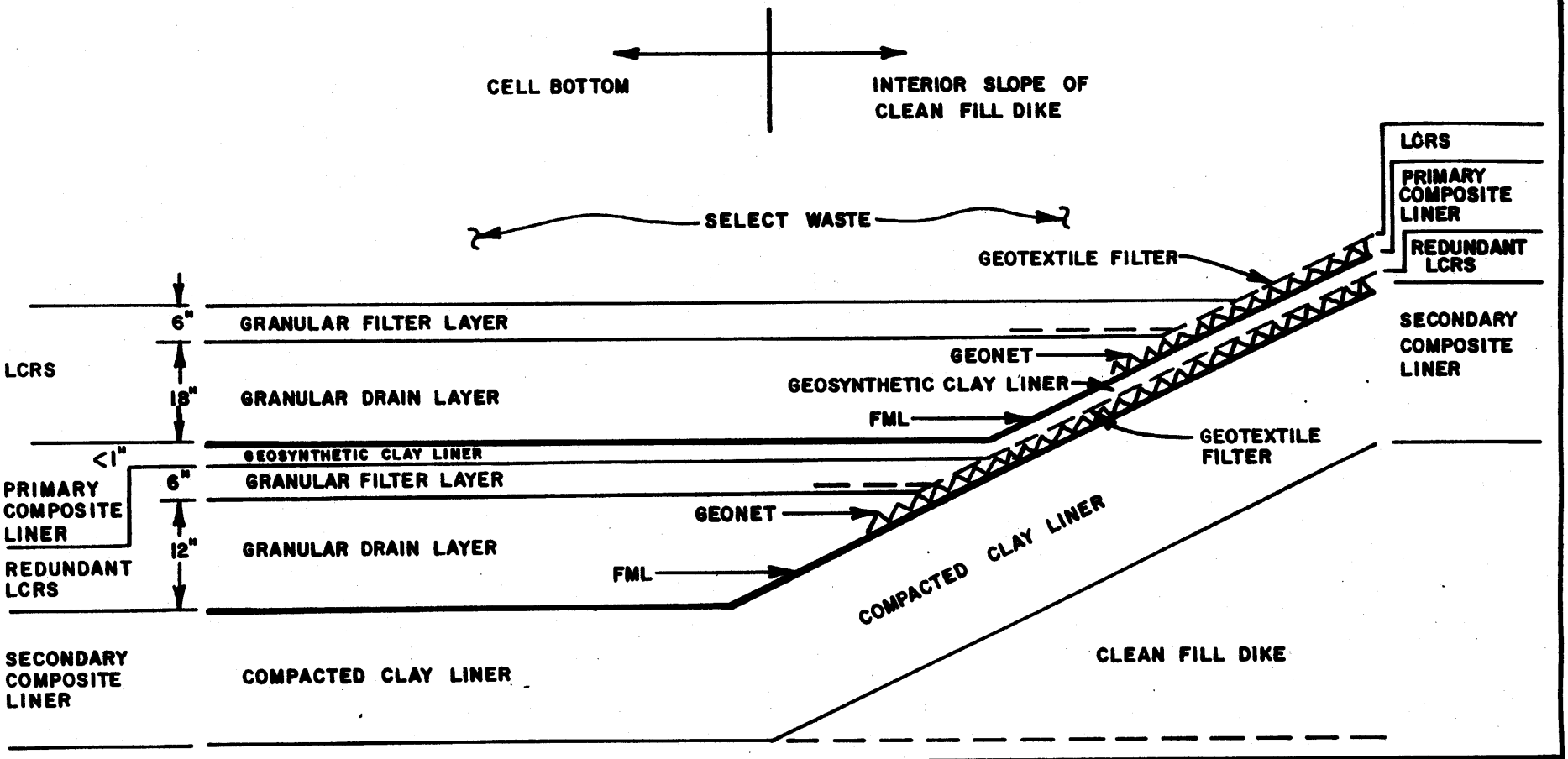
CFD = CLEAN FILL DIKE

X X = CROSS SECTION

LINER SYSTEM SCHEMATIC PLAN and SECTION VIT CELL

FIGURE 5.2.5-2

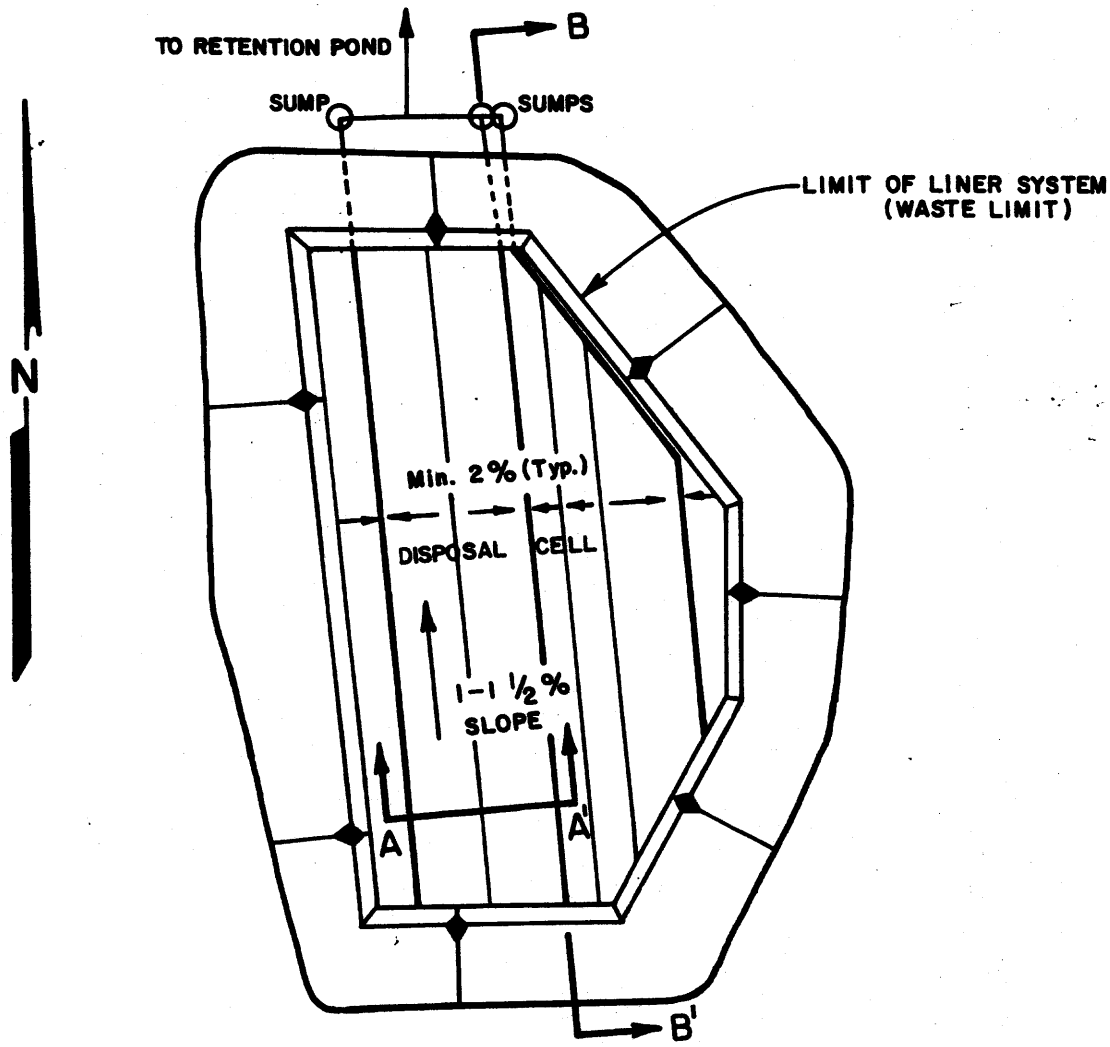
REPORT NO.: DOE/OR/21548-411	DRAWING NO.:	
ORIGINATOR: K.O.	DRAWN BY: ray	DATE: DEC., 1992



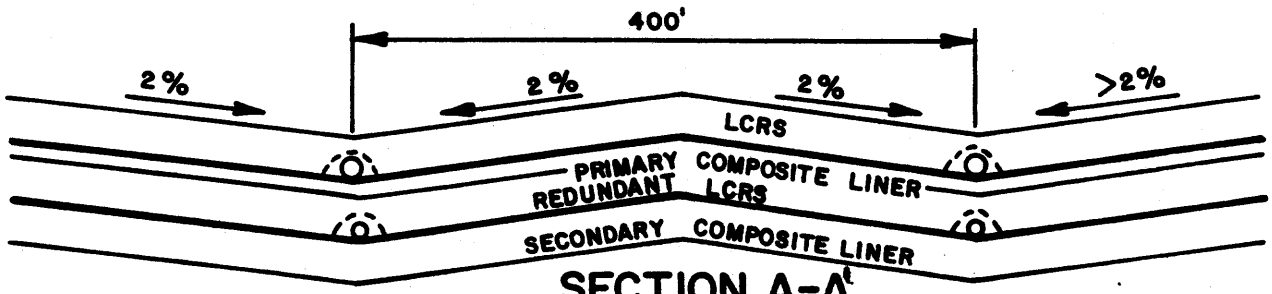
LINER SYSTEM SECTION and DETAILS

FIGURE 5.2.5-3

REPORT NO.: DOE/OR/21548-411	DRAWING NO.:	
ORIGINATOR: K.O.	DRAWN BY: ray	DATE: AUG., 1992



PLAN
NOT TO SCALE



SECTION A-A'
NOT TO SCALE

LEGEND

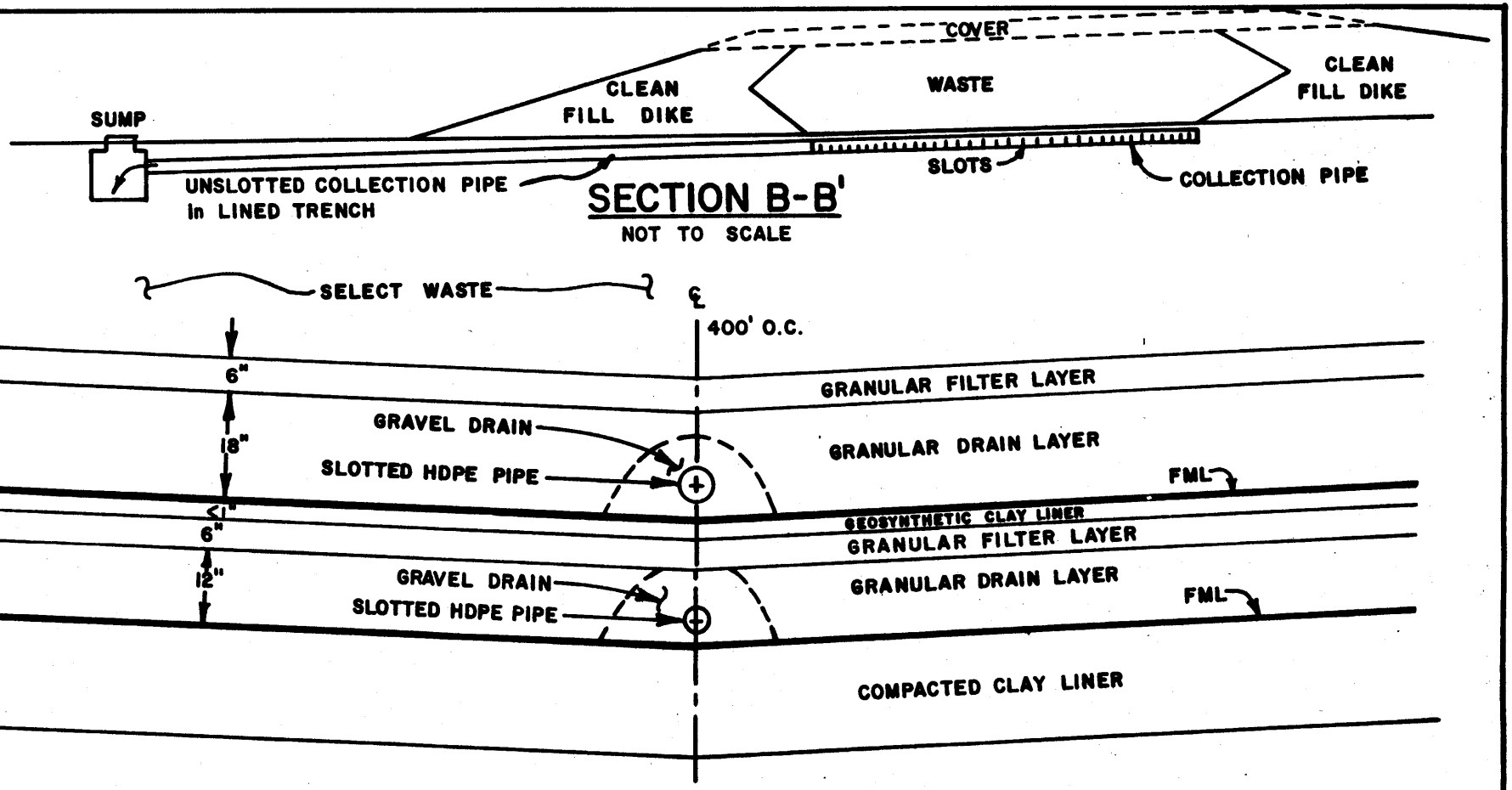
NOTE: REFER TO FIGURE 5.8.5-5
LCRS DETAILS FOR SECTION B-B'

A A' = CROSS SECTION

LINER SYSTEM SCHEMATIC PLAN and SECTION CSS CELL

FIGURE 5.2.5-4

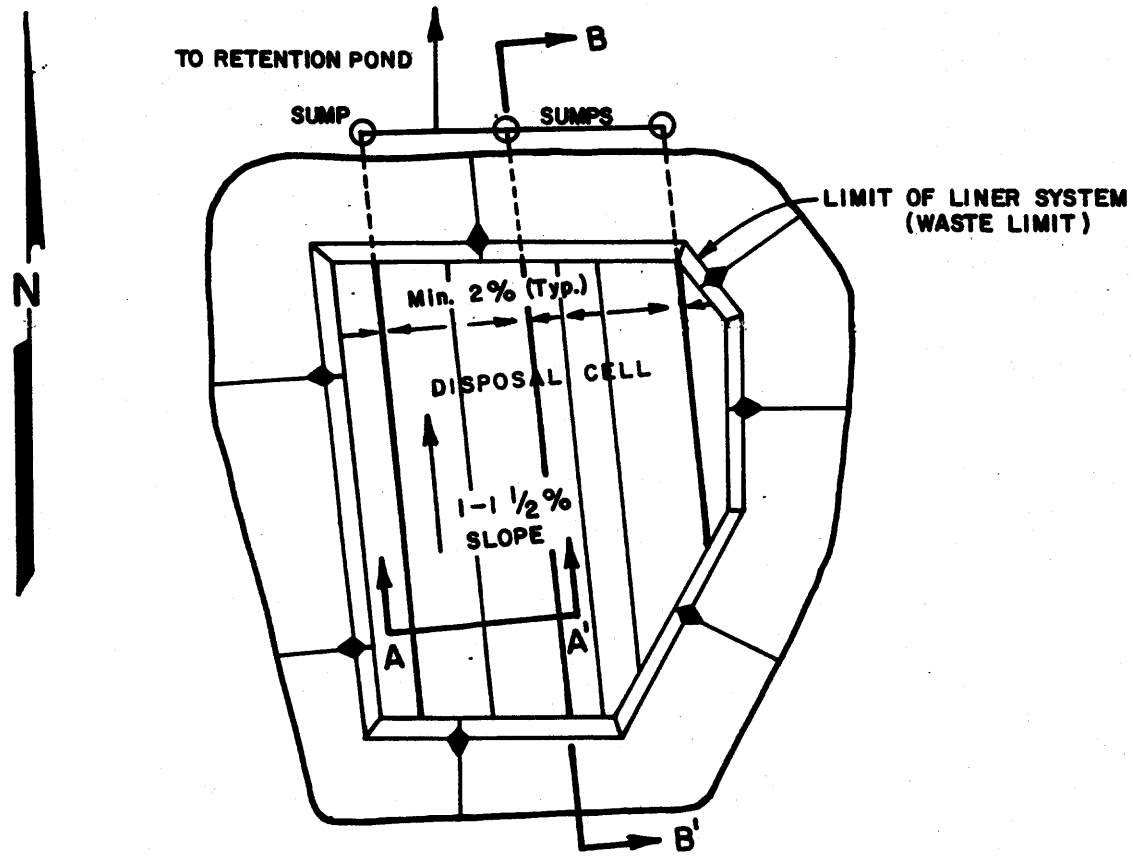
REPORT NO.: DOE/OR/21548-411	DRAWING NO.:	
ORIGINATOR: K.O.	DRAWN BY: ray	DATE: AUG., 1992



LCRS DETAILS

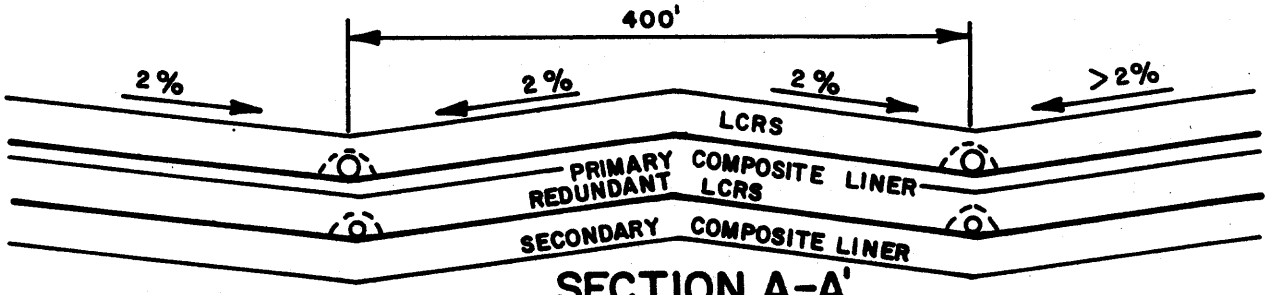
FIGURE 5.2.5-5

REPORT NO.: DOE/OR/21548-411	DRAWING NO.:	
ORIGINATOR: K.O.	DRAWN BY: ray	DATE: AUG., 1992



PLAN

NOT TO SCALE



SECTION A-A'

NOT TO SCALE

LEGEND

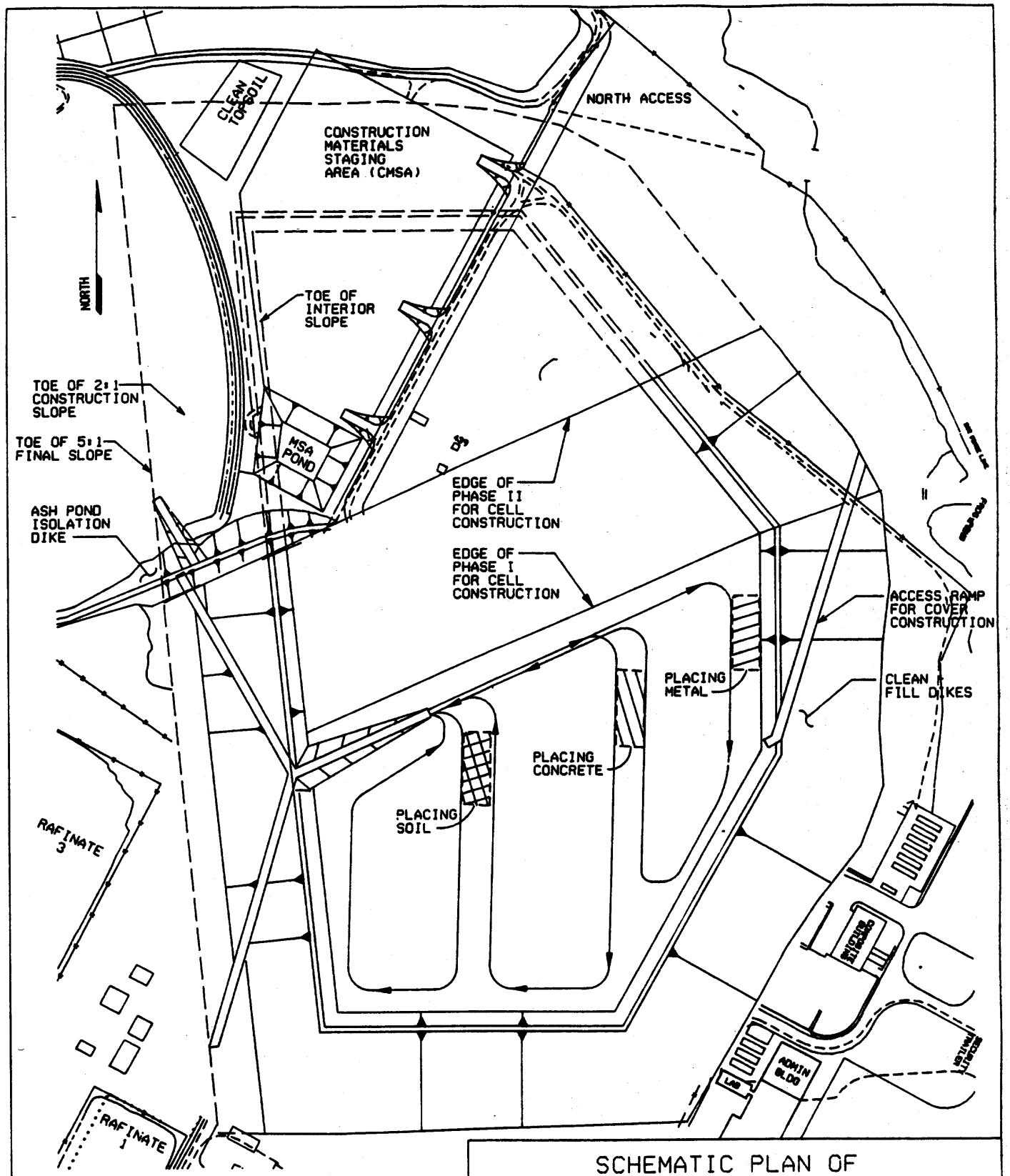
NOTE: REFER TO FIGURE 5.8.5-5
LCRS DETAILS FOR SECTION B-B'

A A' = CROSS SECTION

LINER SYSTEM SCHEMATIC PLAN and SECTION VIT CELL

FIGURE 5.2.5-6

REPORT NO.: DOE/OR/21548-411	DRAWING NO.:	
ORIGINATOR: K.O.	DRAWN BY: ray	DATE: DEC., 1992



LEGEND

- METAL DEBRIS
- CONCRETE DEBRIS
- CONTAMINATED SOIL
- CSS GROUT OVER METAL OR CONCRETE DEBRIS
- DOTTED OUTLINE INDICATES AREA OF ACTIVE WASTE PLACEMENT

0FT 50 100 200 300 400FT
0FT 15.2 30.5 61.0 91.4 121.9M
SCALE

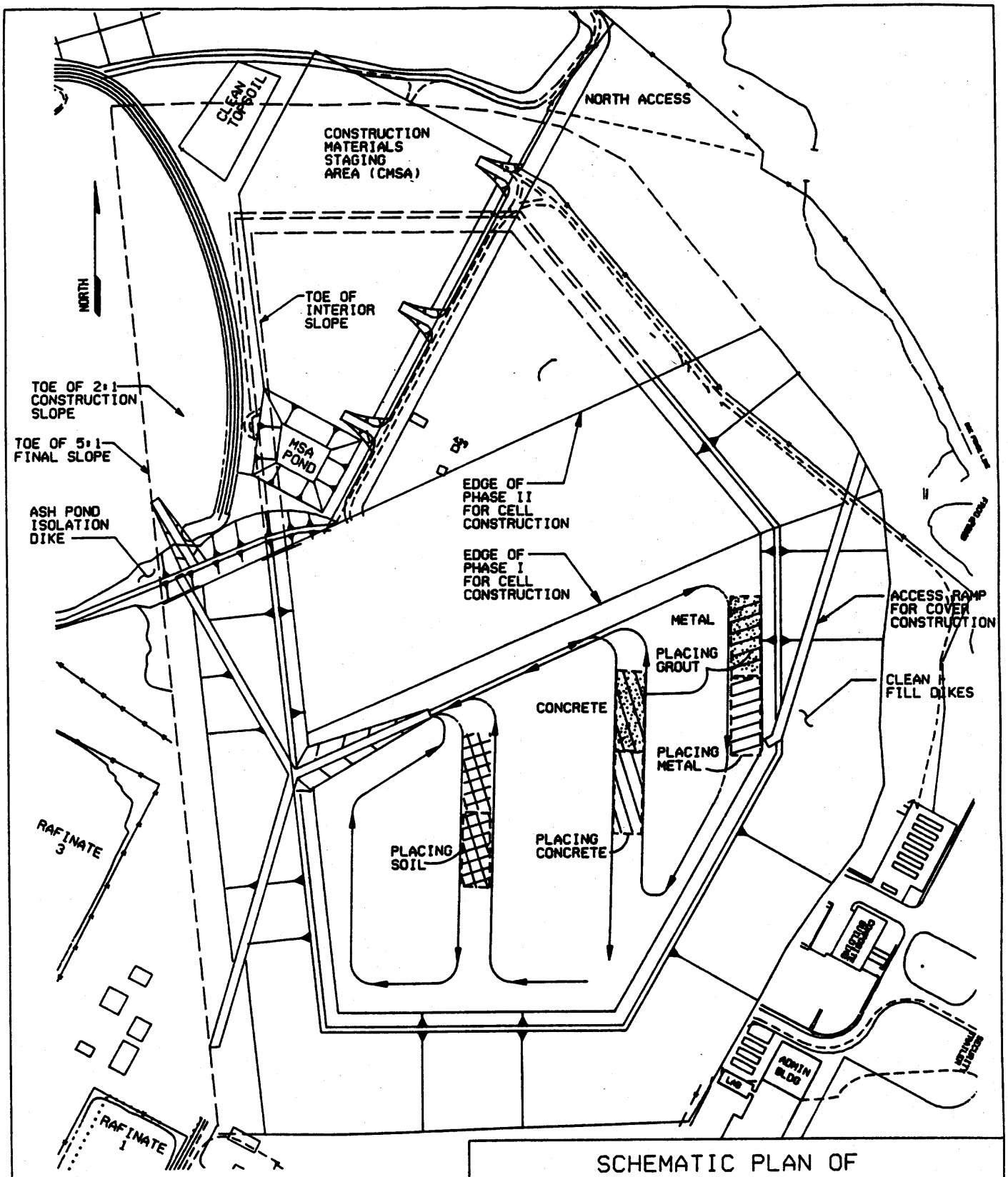
SCHEMATIC PLAN OF WASTE PLACEMENT

WEEK 1/DAY 1

FIGURE 5.2.6-1

REPORT NO: DOE/OR/21548-411		DRAWING NO:
ORIGINATOR: JBF	DRAWING BY: MIZ	DATE: DECEMBER 1992

/USR/384001/38400707.DGN



LEGEND

- METAL DEBRIS
- CONCRETE DEBRIS
- CONTAMINATED SOIL
- CSS GROUT OVER METAL OR CONCRETE DEBRIS
- DOTTED OUTLINE INDICATES AREA OF ACTIVE WASTE PLACEMENT

0FT 50 100 200 300 400FT
0FT 15.2 30.5 61.0 91.4 121.9M
SCALE

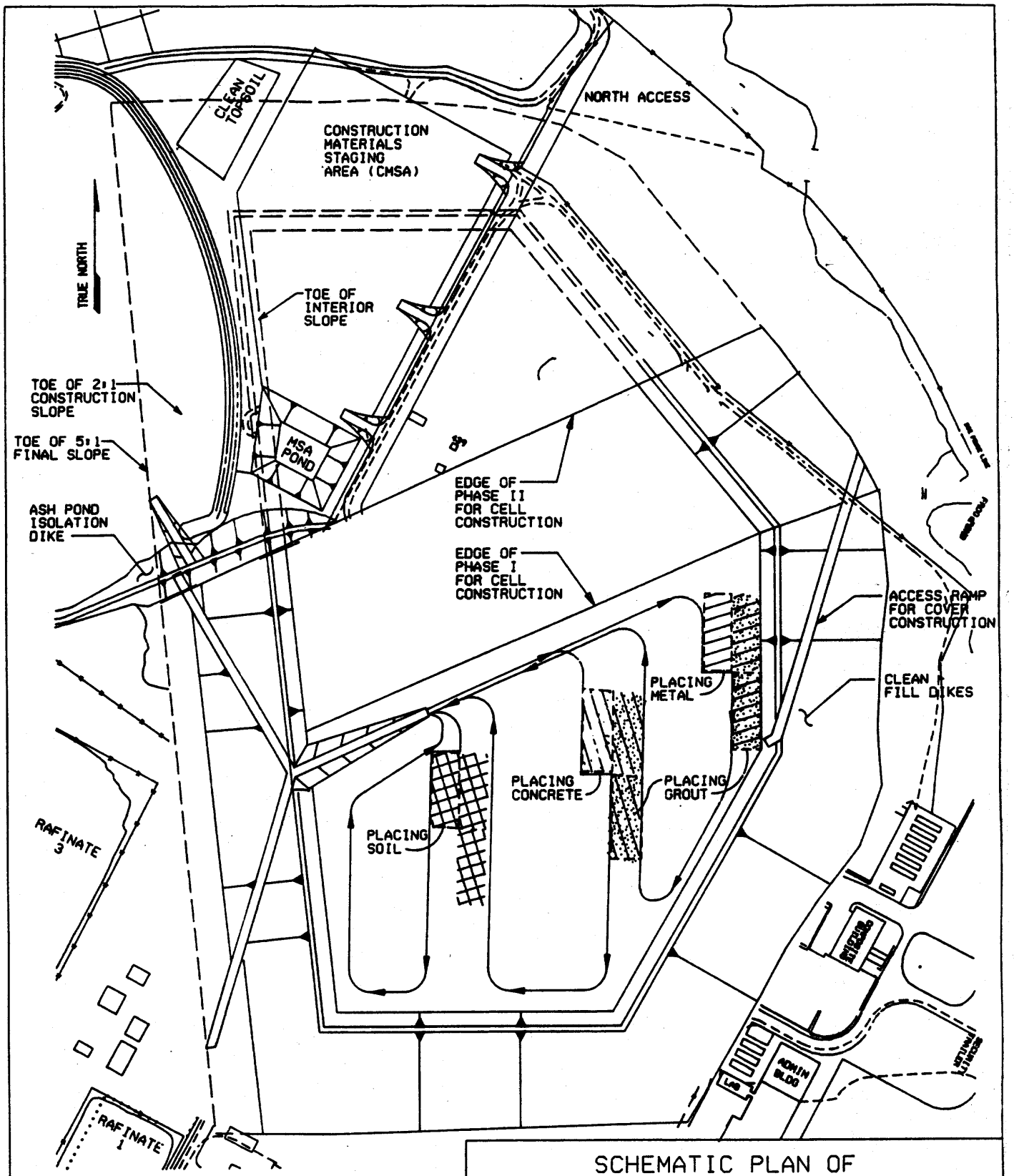
SCHEMATIC PLAN OF WASTE PLACEMENT

WEEK 1/DAY 2

FIGURE 5.2.6-2

REPORT NO: DOE/OR/21548-411	DRAWING NO:	
ORIGINATOR: JBF	DRAWING BY: MIZ	DATE: DECEMBER 1992

/USR/384001/38400707.DGN



LEGEND

- METAL DEBRIS
- CONCRETE DEBRIS
- CONTAMINATED SOIL
- CSS GROUT OVER METAL OR CONCRETE DEBRIS
- DOTTED OUTLINE INDICATES AREA OF ACTIVE WASTE PLACEMENT

0FT 50 100 200 300 400FT
0FT 15.2 30.5 61.0 91.4 121.9M
SCALE

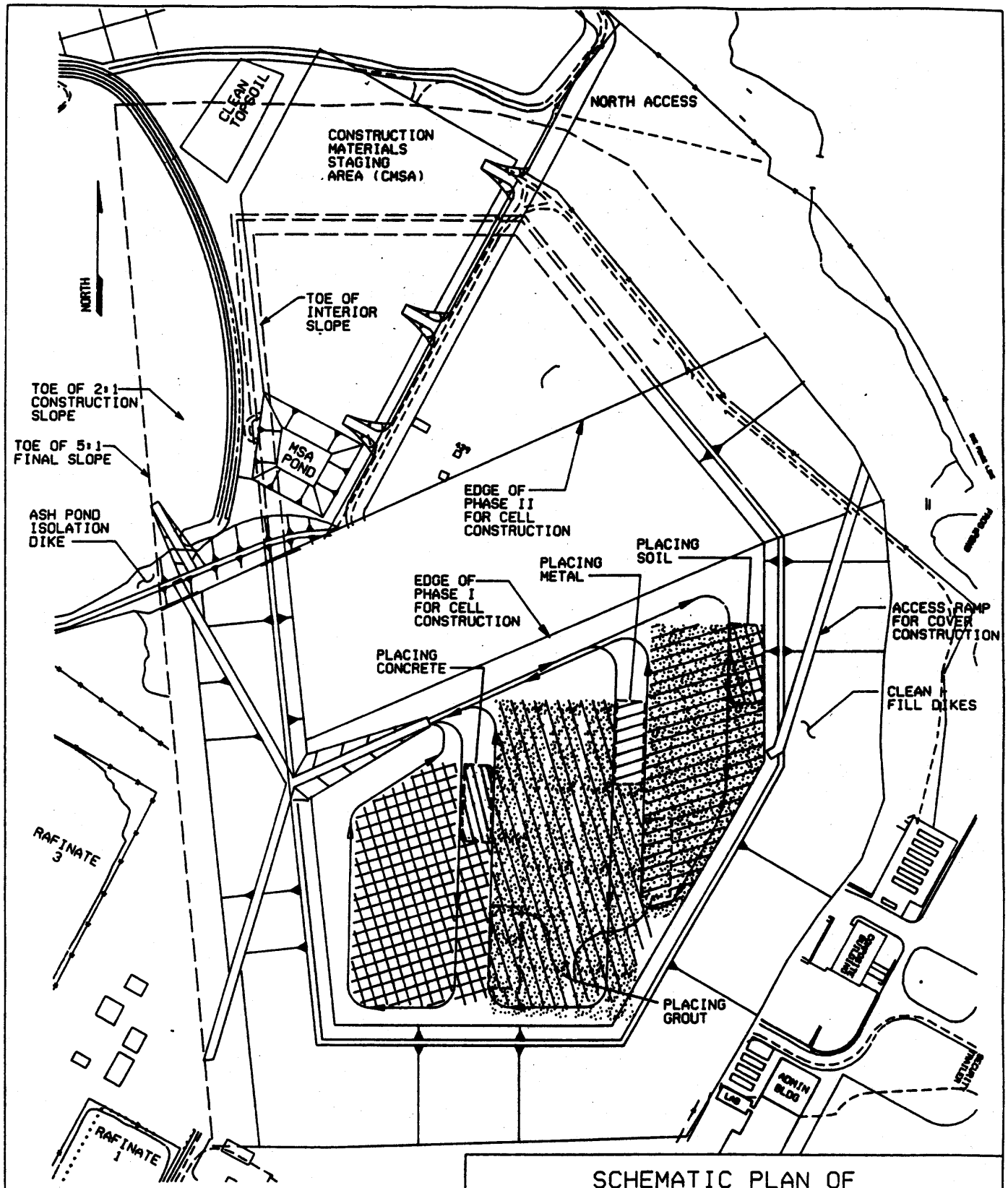
SCHEMATIC PLAN OF WASTE PLACEMENT

WEEK 1/DAY 3

FIGURE 5.2.6-3

REPORT NO: DOE/OR/21548-411		DRAWING NO:
ORIGINATOR: JBF	DRAWING BY: MIZ	DATE: DECEMBER 1992

/USR/384001/384007B7.DGN



LEGEND

- METAL DEBRIS
- CONCRETE DEBRIS
- CONTAMINATED SOIL
- CSS GROUT OVER METAL OR CONCRETE DEBRIS
- DOTTED OUTLINE INDICATES AREA OF ACTIVE WASTE PLACEMENT

0FT 50 100 200 300 400FT
0FT 15.2 30.5 61.0 91.4 121.9M
SCALE

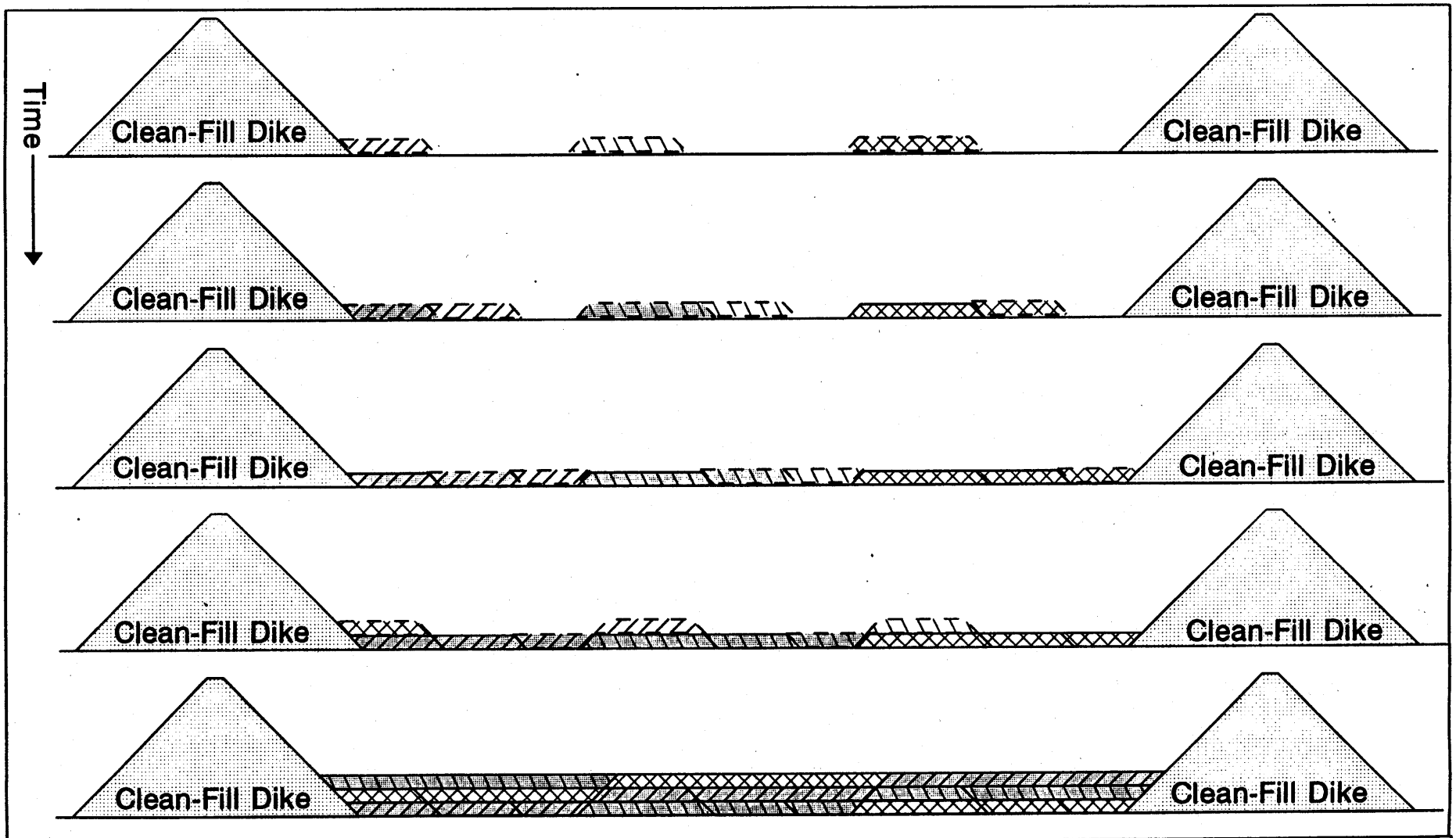
SCHEMATIC PLAN OF WASTE PLACEMENT

WEEK 1/DAY 4

FIGURE 5.2.6-4

REPORT NO: DOE/OR/21548-411		DRAWING NO:
ORIGINATOR: JBF	DRAWING BY: MIZ	DATE: DECEMBER 1992

/USR/384881/38488787.DGN



Legend

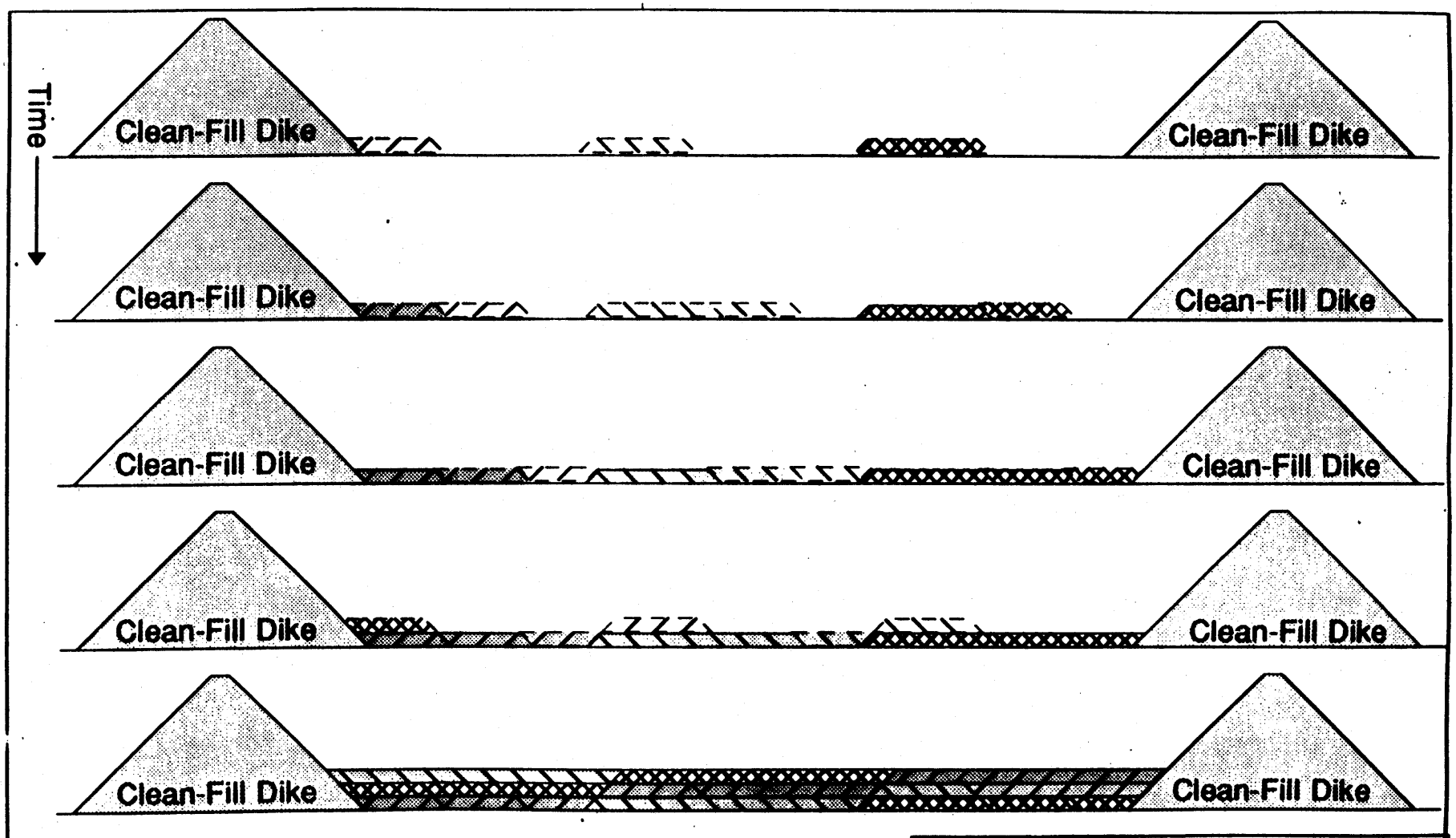
- Metal Waste
- Metal Entombed w/ CSS Grout
- Concrete Rubble
- Concrete Entombed w/ CSS Grout
- Contaminated Soil
- Dashed Line = Active Placement Zone

SCHEMATIC SECTION OF CSS WASTE PLACEMENT SEQUENCE

FIGURE 5.2.6-5

Doc.No. DOE/OR/21548-411		
Originator: JBF	Drawn by: JBF	Date: December 1992

f:\wsrap\tid\t737\FigZone3



Legend

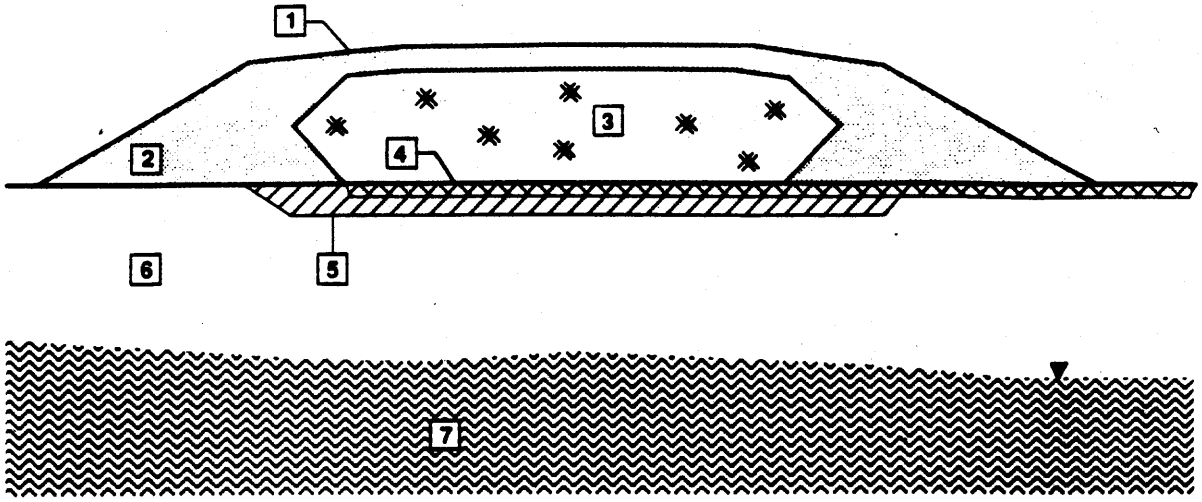
- Metal Waste
- Metal Entombed w/ Clean Grout
- Concrete Rubble
- Concrete filled w/ VIT, Soil, or Gravel
- Contaminated Soil
- Dashed Line = Active Placement Zone

SCHEMATIC SECTION OF VIT WASTE PLACEMENT SEQUENCE

FIGURE 5.2.6-6

Doc. No DOE/OR/21548-411		
Originator JBF	Drawn by JBF	Date December 1992

f:\wssrap\tid\737\FigZone4



LEGEND: CELL COMPONENTS

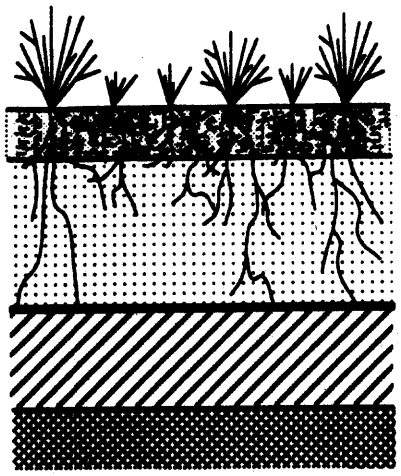
1. TOP COVER
2. PERIMETER ENCAPSULATION SYSTEM (CLEAN-FILL DIKES)
3. WASTE
4. BASAL LINERS AND LEACHATE COLLECTION AND REMOVAL SYSTEM
5. FOUNDATION
6. VADOSE ZONE
7. GROUNDWATER

WASTE ENCAPSULATION SYSTEM COMPONENTS

The essential parts of a waste encapsulation system which isolate waste and its emanation products from the environment are the cover, dikes, basal liners, drains, foundation soils and rocks.

FIGURE 5.2.7-1

REPORT NO.		
DOE/OR/21548-411		
ORIGINATOR	DRAWN BY	DATE
JC	MD	05-04-93



	VEGETATION
1.0'	SOIL (1)
3.0'	FROST PROTECTION AND ROOTING ZONE (2)
	INFILTRATION BARRIER: GEOMEMBRANE (3)
1.5 - 2.0'	INFILTRATION/RADON BARRIER (4)
	WASTE

(1) MATERIALS: ALTERNATIVE TOP COMPONENTS
- *0.5' EROSION RESISTANT ROCK
- *1.0' EROSION ROCK WITH SOIL IN VOIDS
- *1.0' GRAVEL MULCH (SOIL ROCK MIX)

(2) MIXED CLAY SILT. AND SAND

(3) A GEOSYNTHETIC SUCH AS PVC OR HDPE

(4) LOW-PERMEABILITY CLAY OR SILTY CLAY

NOTE: THIS COVER HAS BEEN USED ON SANITARY LANDFILLS

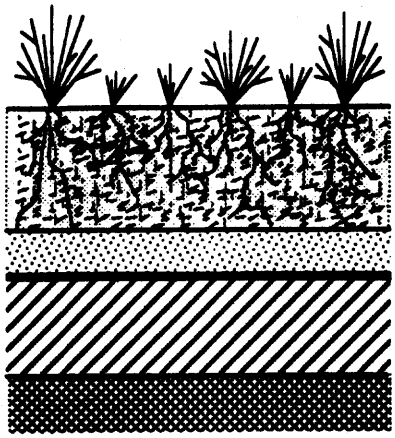
ALTERNATIVE COVER 1:
THE SIMPLE VEGETATED/ROCK COVER

FIGURE 5.2.7-2

REPORT NO DOE/OR/21548-411

ORIGINATOR	DRAWN BY	DATE
JC	MD	05-04-93

5 2 7-2 ALT COV 1 - SIMP VEG/ROCK



VEGETATION

2.5' SOIL: Random or selected*

1.0' FILTER/DRAIN/BEDDING: Sand
INFILTRATION BARRIER: Geomembrane

2.0' RADON/INFILTRATION BARRIER: Silt & clay

WASTE

*THESE MAY BE COVERED WITH ROCK MULCH.
ALTERNATIVELY, THE UPPER 0.5' MAY BE COARSER GRAINED GRAVEL.

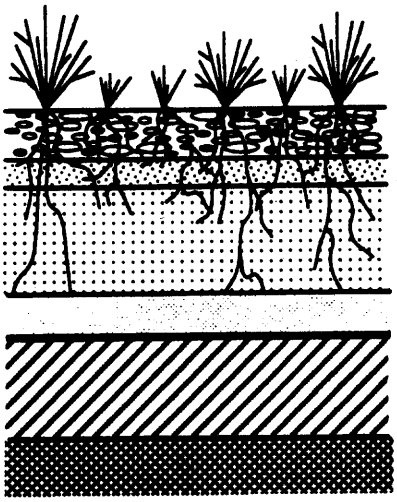
NOTE: THIS COVER COMPLIES WITH EPA REGULATIONS FOR A COVER FOR A HAZARDOUS WASTE FACILITY

ALTERNATIVE COVER 2: THE RCRA COVER

FIGURE 5.2.7-3

REPORT NO		
DOE/OR/21548-411		
ORIGINATOR	DRAWN BY	DATE
JC	MD	05-04-93

5.2.7-3 ALT COV 2 - RCRA COV



1.0'	EROSION BARRIER: Coarse gravel*
0.5'	FILTER/DRAIN/BEDDING: Sand
2.0'	FROST PROTECTION: Random soil
1.0'	FILTER/DRAIN/BEDDING: Fine-to-medium sand INFILTRATION BARRIER (OPTIONAL): Geomembrane
1.5 - 2.0'	RADON/INFILTRATION BARRIER: Silt and clay
	WASTE

***NOTE: ALTERNATIVE TOP COMPONENTS**

*1.0' SOIL FOR VEGETATION
*1.0' COARSE GRAVEL WITH SOIL IN VOIDS
*1.0' GRAVEL MULCH

NOTE: THIS COVER HAS BEEN USED ON THE SIDE SLOPE OF A URANIUM MILL TAILINGS PILE. THE UPPER COMPONENT WAS ROCK.

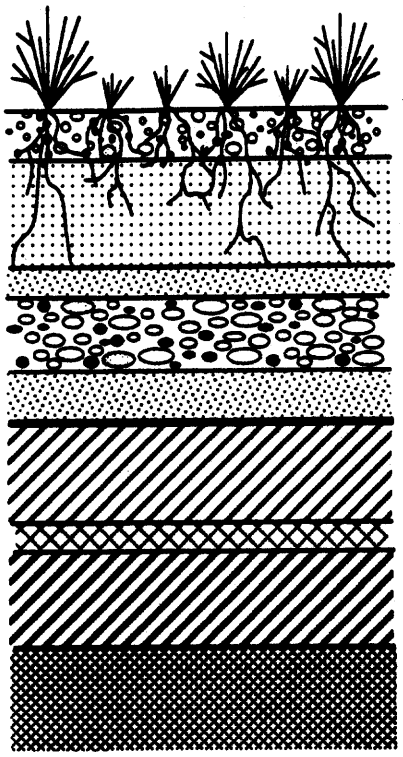
ALTERNATIVE COVER 3:
THE DOUBLE DRAIN COVER

FIGURE 5.2.7-4

REPORT NO DOE/OR/21548-411

ORIGINATOR	DRAWN BY	DATE
JC	MD	05-04-93

5.2.7-4 ALT COV 3 - DOUBLE DR COV



	VEGETATION
1.0'	EROSION BARRIER: Gravelly silty sand *
2.0'	FROST PROTECTION: Random soil
0.5'	FILTER/DRAIN/BEDDING: Sand **
1.0'	DRAIN/BIOBARRIER: Gravel
0.5'	FILTER/DRAIN/BEDDING: Sand INFILTRATION BARRIER: Geomembrane and Geomat
1.5	INFILTRATION BARRIER: Silt and clay
	LEAK DETECTION SYSTEM: Geogrid (Optional Design Component)
1.5	RADON BARRIER: Silt and clay
	WASTE

NOTE: ALTERNATE EROSION BARRIERS

*1.0' ROCK OVER BEDDING
*1.0' ROCK WITH SOIL IN VOIDS
*1.0' SOIL

** OPTIONAL: NOT NEEDED IF ROCK IS CHOKED.

NOTE: THIS IS THE MOST COMPLEX COVER CONSIDERED IN THIS REPORT. IT IS THE SELECTED COVER. VARIANTS HAVE BEEN USED TO COVER URANIUM MILL TAILINGS PILES.

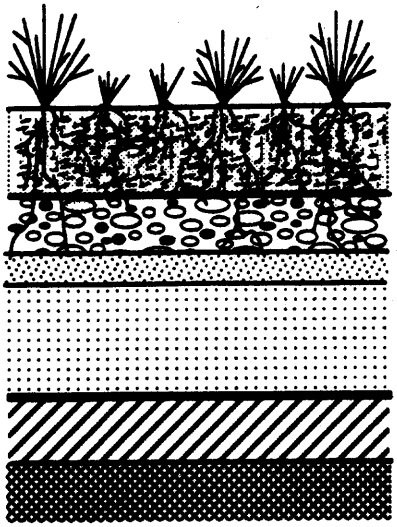
ALTERNATIVE COVER 4:
THE MULTI-COMPONENT COVER

FIGURE 5.2.7-5

REPORT NO: DOE/OR/21548-411

ORIGINATOR	DRAWN BY	DATE
JC	MD/BM	05-19-93

5.2.7-5 ALT COV 3 - MULTI-COM COV



	VEGETATION
0.5' - 1.5	SOIL*
1.0' - 2.0'	EROSION BARRIER: Coarse gravel
0.5' - 1.0'	FILTER/DRAIN/BEDDING: Sand
2.0'	FROST PROTECTION: Selected soil
	INFILTRATION BARRIER: Geomembrane
0.5 - 1.0'	RADON/INFILTRATION BARRIER: Silt and clay
	WASTE

*THIS SOIL MAY BE ENHANCED WITH GRAVEL TO INCREASE EROSION RESISTANCE. ALTERNATIVELY, THIS COULD BE A LAYER OF ROCK WITH SOIL IN THE VOIDS.

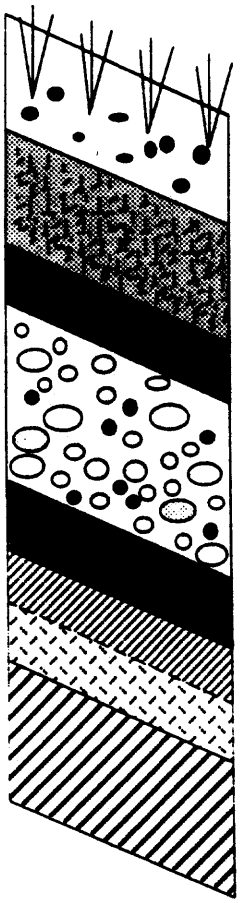
ALTERNATIVE COVER 5:
THE EROSION RESISTER

FIGURE 5.2.7-6

REPORT NO. DOE/OR/21548-411

ORIGINATOR	DRAWN BY	DATE
JC	MD/BM	05-05-93

5.2.7-6 ALT COV 3 - EROSION RES



COVER COMPONENT	FUNCTION	MATERIAL
VEGETATION	• Aesthetics • Evapotranspiration • Erosion Control	Prairie Grass
TOP SOIL	• Support Vegetation • Control Erosion	Gravelly Soil
SOIL	• Frost Protection • Root Zone	Mixed Clay, Silt and Sand
FILTER	• Control Piping	Clean Sand
BIOINTRUSION	• Inhibit Roots • Control Burrowing Animals	Cobbles and Boulders
BEDDING	• Protect Geomembrane • Shed Water	Clean Sand
INFILTRATION BARRIER	• Reduce and Control Infiltration	(a) FML: Geomembrane (b) GLC: Bentonite Mat (c) Soil: Clay/Silt
*LEAK DETECTION	• Monitor Infiltration	Geogrid
RADON BARRIER	• Control Radon Flux	Silty/Clay

*Design Option

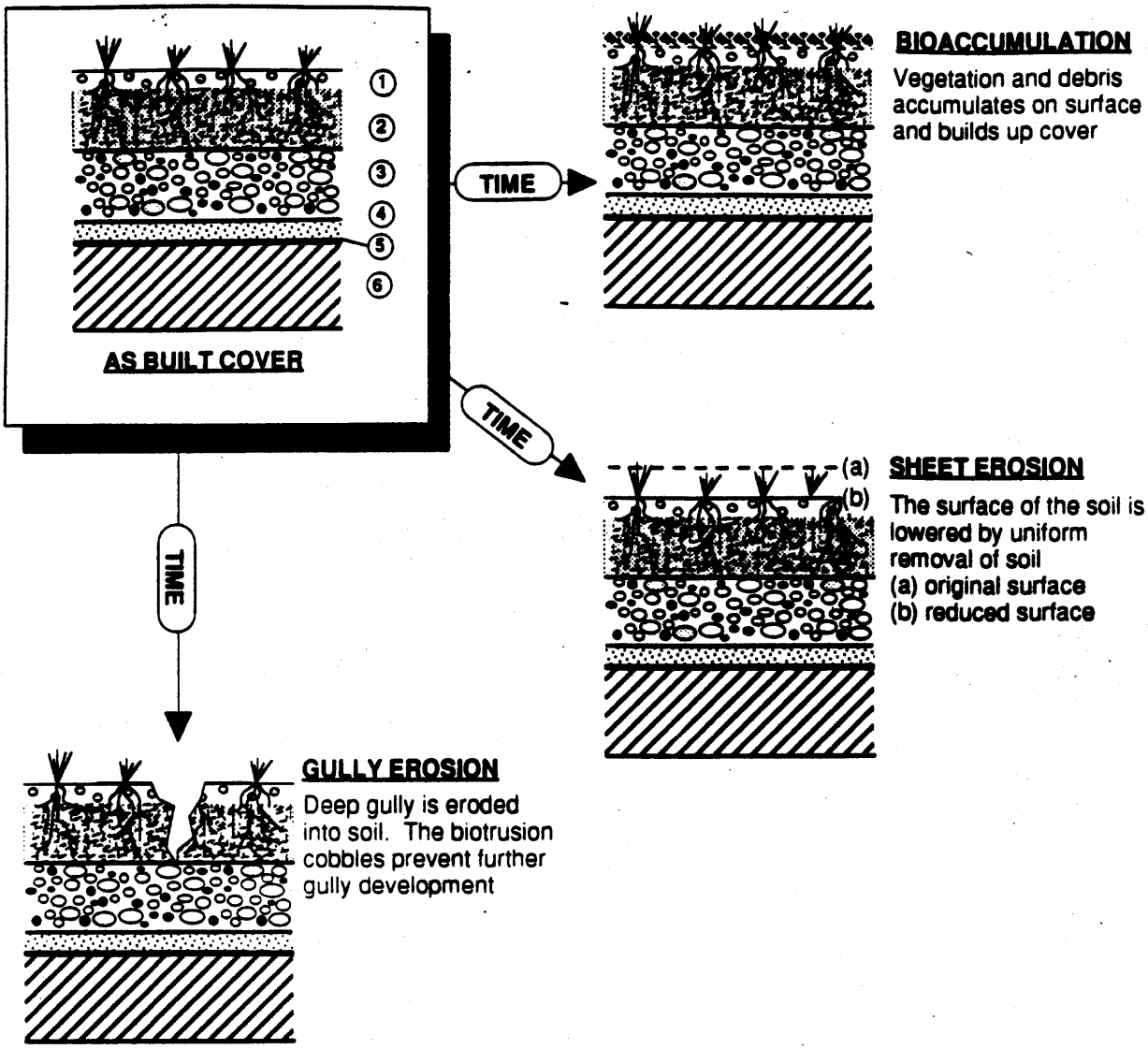
TOP SLOPE COVER:

A typical disposal cell multi-component cover provides multiple protection of the waste

FIGURE 5.2.7-7

REPORT NO: DOE/OR/21548-411

ORIGINATOR	DRAWN BY	DATE
JC	BR/MD/BM	05-05-93



LEGEND

1. GRAVELLY SOIL
2. RANDOM SOIL
3. BIOTRUSION COBBLES
4. SAND DRAIN
5. INFILTRATION BARRIER
6. RADON BARRIER

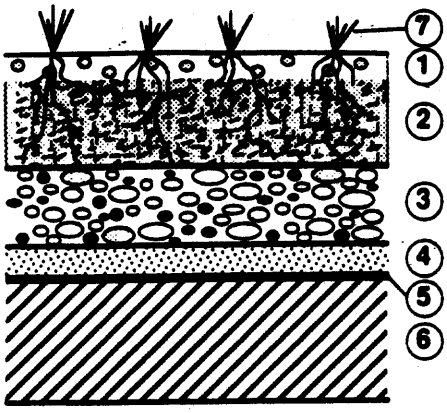
TOP COVER EROSION - ALTERNATIVE PERFORMANCE SCENARIOS

With time the upper surface of the cover may be affected by bioaccumulation, sheet erosion, or gully erosion

FIGURE 5.2.7-8

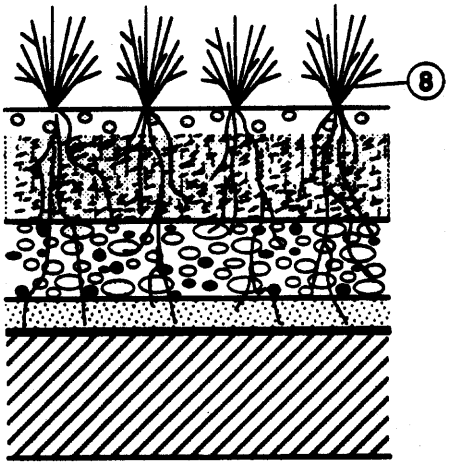
REPORT NO		
DOE/OR/21548-411		
ORIGINATOR	DRAWN BY	DATE
JC	DJK/BM	05-05-93

5 2 7-8 TOP COV ALT PERFL



NORMAL SITUATION:

Roots grow in upper random soil. Downward advance impeded by biointrusion rock, lack of moisture in voids, grass type.

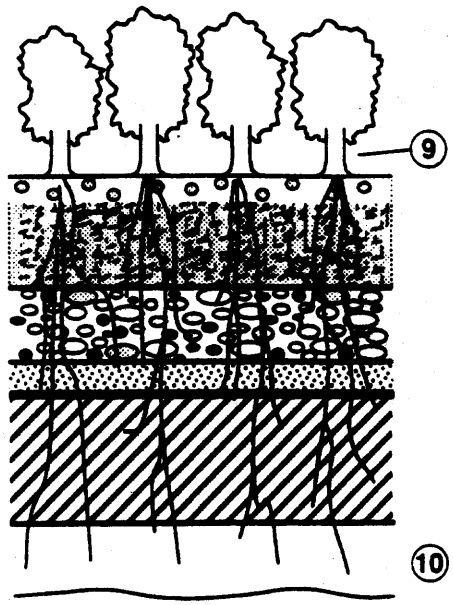


FAILURE SCENARIO I:

Roots penetrate biointrusion and drain. Shedding of water in drains is impeded and infiltration increased. Further root advance impeded by geomembrane, bentonite, and compacted clay.

COVER FEATURES TO PRECLUDE FAILURE

- Thick soils for root growth
- Biointrusion barrier cobbles
- Low moisture content of cobbles and sand
- Geomembrane and bentonite
- Compacted clay
- Grass mowing and burning



FAILURE SCENARIO II:

Roots penetrate waste. Increased infiltration and radon flux. Physical degradation of cover components.

LEGEND

1. GRAVELLY SOIL
2. RANDOM SOIL
3. COBBLES
4. SAND
5. GEOMEMBRANE AND GEOMAT
6. SILT AND CLAY
7. GRASS
8. GRASS AND BUSHES
9. BUSHES AND TREES
10. WASTE

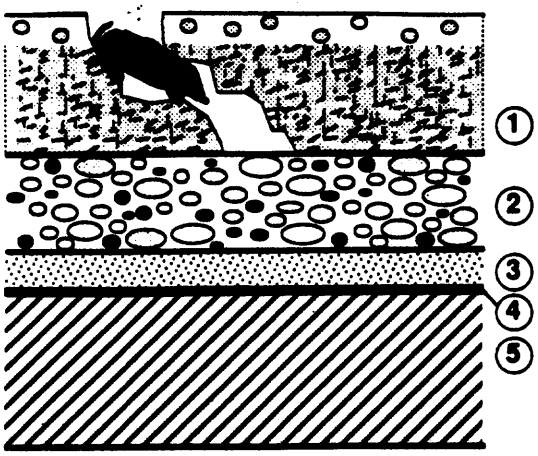
VEGETATION PENETRATION FAILURE SCENARIOS

Root penetration is impeded by the multicomponents of the cover

FIGURE 5.2.7-9

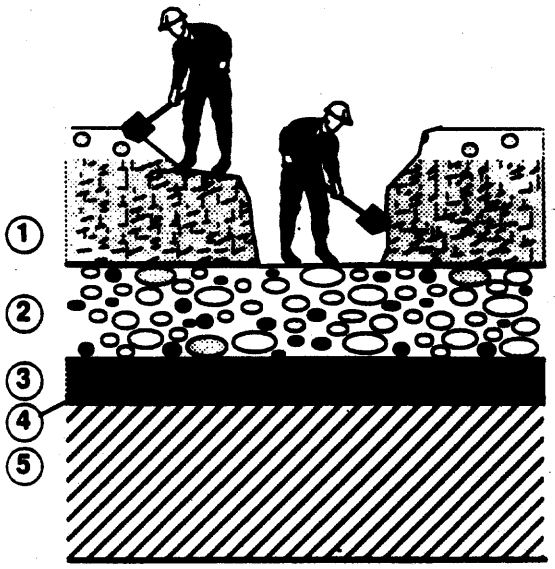
REPORT NO		
DOE/OR/21548-411		
ORIGINATOR	DRAWN BY	DATE
JC	MD	05-05-93

5 2 7-9 VEG PENETRATION FAIL SC



ANIMAL INTRUSION

A burrowing animal's progress is impeded by the cobbles of the biointrusion barrier.



HUMAN INTRUSION

Inadvertent human intrusion may be impeded or slowed by the cobbles of the biointrusion barrier.

LEGEND

1. RANDOM SOIL
2. BIOINTRUSION COBBLES
3. DRAIN SAND
4. INFILTRATION BARRIER
5. RADON BARRIER

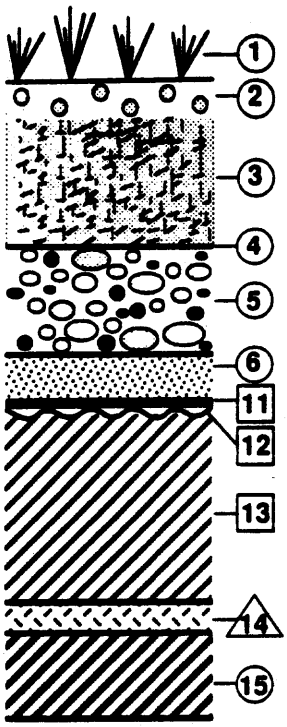
ANIMAL AND HUMAN INTRUSION FAILURE SCENARIOS

The large cobbles of the biointrusion barrier may intercept and impede animals and humans and hence protect the remainder of the cover and the wastes.

FIGURE 5.2.7-10

REPORT NO: DOE/OR/21548-411		
ORIGINATOR: JC	DRAWN BY: DJK	DATE: 05-05-93

5 2 7-10 AN HUM INTRU



COVER PROTECTION LAYERS ABOVE INFILTRATION BARRIER

(1) VEGETATION:	Control erosion and increase evapotranspiration
(2) GRAVELLY SOIL:	Control erosion
(3) RANDOM SOIL:	Freeze/Thaw protection; rooting medium
(4) FILTER	Contol particle migration into biointrusion layer
(5) BIOINTRUSION COBBLES:	Animal, human, and root intrusion control
(6) DRAIN SAND:	Bedding to preclude cobble punching and deformation

INFILTRATION BARRIER COMPONENTS

[11] GEOMEMBRANE:	Very low permeability; may deteriorate with time
[12] BENTONITE LAYER (IN GEOMAT):	Very low permeability; long-term durable natural material; also seals geomembrane pinhole leaks.
[13] RADON BARRIER CLAY/SILT:	Low permeability. Seepage not sensitive to water ponding. Long-term functioning and effectiveness may be affected by deformation, freeze/thaw, or dessication.

INFILTRATION BARRIER MONITORING

(14)* GEOGRID:	Intercepts and directs infiltration barrier seepage to monitoring stations. *(Design Option)

BACK-UP INFILTRATION BARRIER

(15) RADON BARRIER:	Low-permeability soil may function as a back-up or secondary infiltration barrier

INFILTRATION BARRIER COMPONENTS: THEIR NATURE AND FUNCTION

Each component of the cover plays a part in protecting the infiltration barrier and limiting infiltration

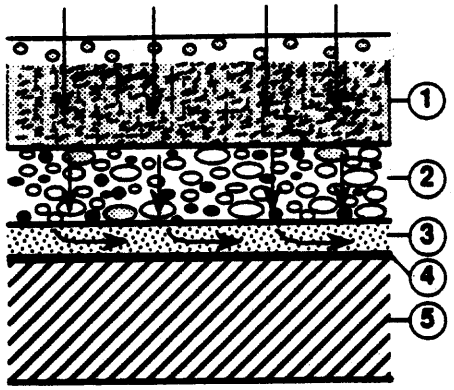
FIGURE 5.2.7-11

REPORT NO. DOE/OR/21548-411

ORIGINATOR.	DRAWN BY	DATE
JC	DJK/BM	05-19-93

FEATURES THAT PRECLUDE MALPERFORMANCE

The very high-permeability biointrusion cobbles are not susceptible to clogging. loss of flow capacity in the drain can be augmented by cobble layer flow capacity.

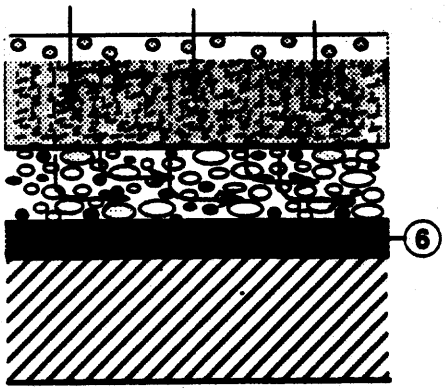


1. RANDOM SOIL
2. BIOINTRUSION COBBLES
3. DRAIN SAND
4. INFILTRATION BARRIER
5. RADON BARRIER

NORMAL PERFORMANCE

Seepage through soil and cobbles flows into drain sand and flows laterally in drain layer above infiltration barrier.

6. BLOCKED OR CLOGGED DRAIN



FAILURE SCENARIO: BLOCKED OR CLOGGED DRAIN

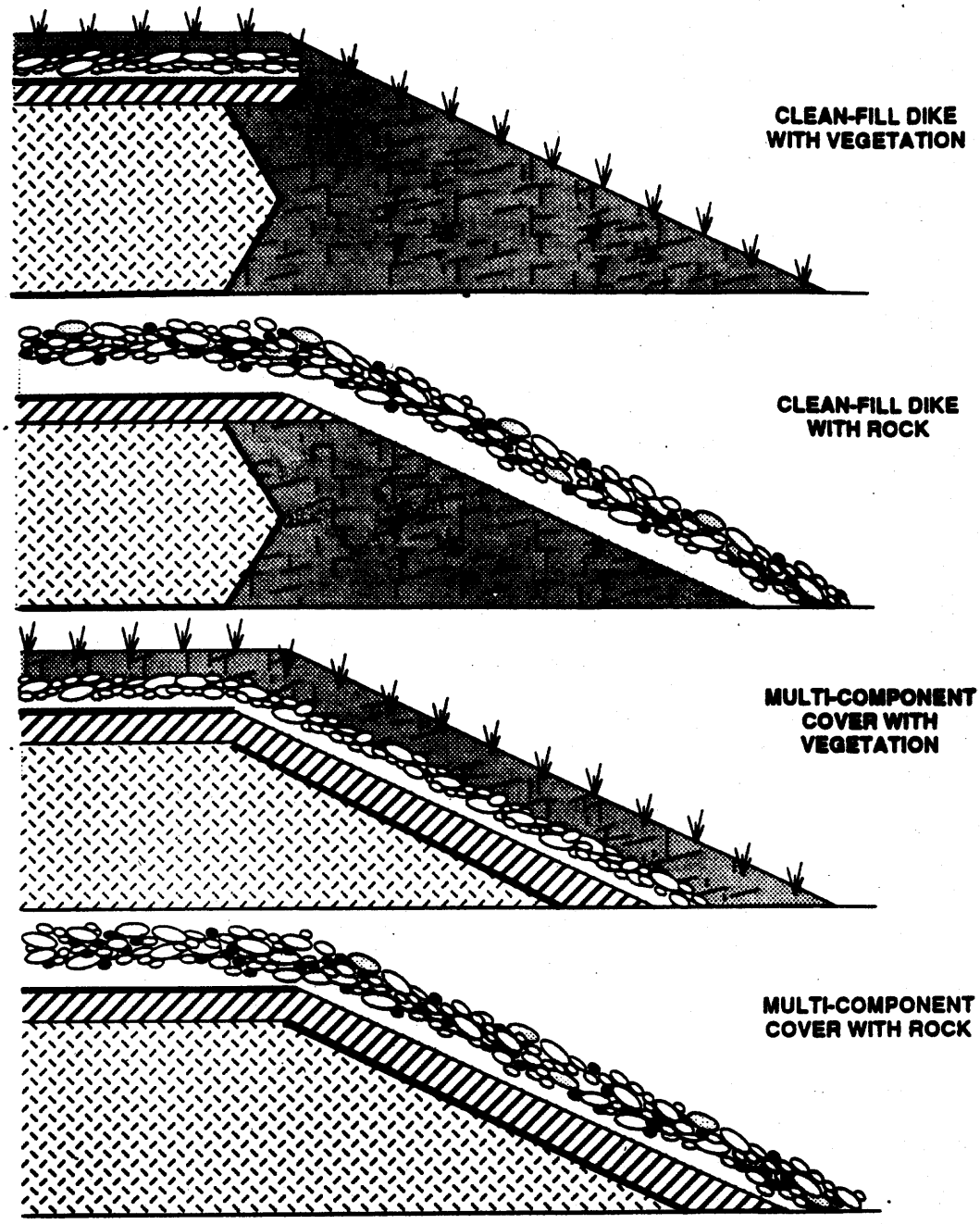
Seepage through soil and cobbles flows laterally in cobble layer above clogged drain.

COVER DRAIN CLOGGING SCENARIO ANALYSIS

Blocking or clogging of the cover drain by physical or chemical processes will not impair the cover's ability to shed water

FIGURE 5.2.7-12

REPORT NO: DOE/OR/21548-411		
ORIGINATOR: JC	DRAWN BY: DJK	DATE 05-18-93



LEGEND

- SOIL
- VEGETATION
- SAND
- ROCK
- GRAVEL
- CLAY AND SOIL
- WASTE
- GEOMEMBRANE

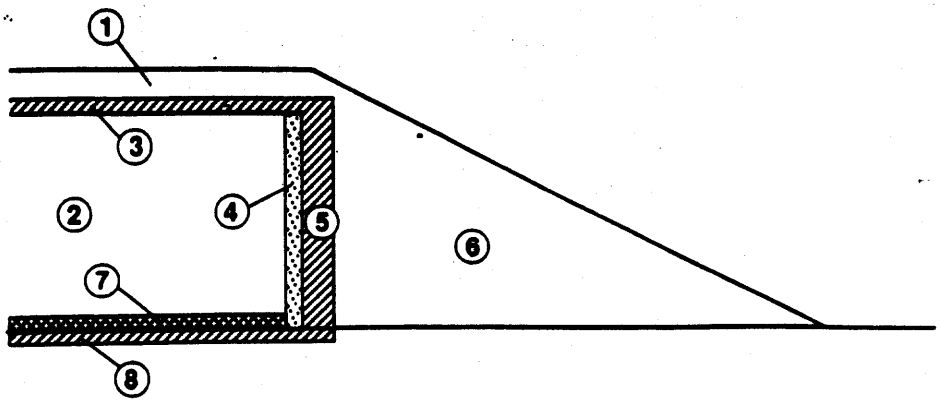
PERIMETER ENCAPSULATION:

Four perimeter encapsulation systems were evaluated and compared

FIGURE 5.2.7-13

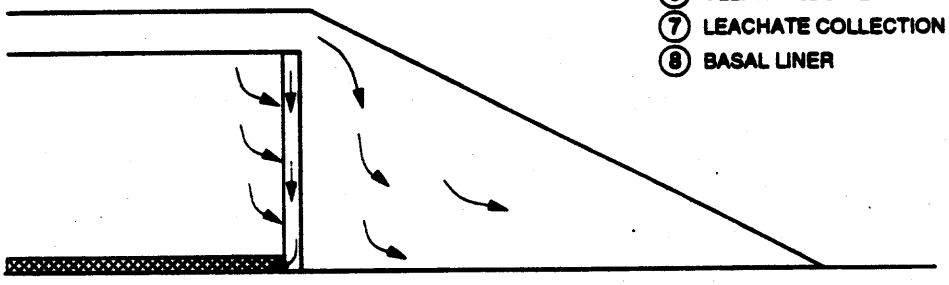
REPORT NO		
DOE/OR/21548-411		
ORIGINATOR: JC	DRAWN BY: BR/MD/BM	DATE: 05-17-93

5 2 7-13 PERIM ENCAP



SECTION OF VERTICAL INNER FACE CLEAN-FILL DIKE

1. COVER
2. WASTE
3. INFILTRATION BARRIER
4. VERTICAL DRAIN
5. LOW-PERMEABILITY CLAY ZONE
6. CLEAN-FILL DIKE
7. LEACHATE COLLECTION SYSTEM
8. BASAL LINER



FUNCTION OF VERTICAL DRAIN

SEEPAGE FROM THE WASTE INTO THE VERTICAL DRAIN WILL FLOW DOWN TO THE BASAL LEACHATE COLLECTION SYSTEM. DIKE INFILTRATION WILL BE IMPEDED FROM ENTERING THE DRAIN BY THE LOW PERMEABILITY CLAY ZONE.

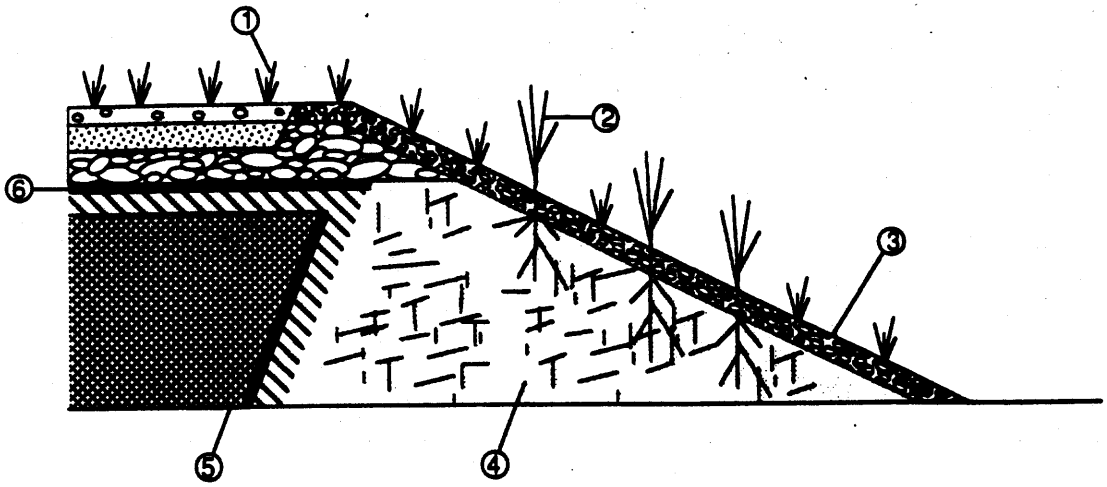
VERTICAL FACE CLEAN-FILL DIKE

To achieve all the advantages of a clean-fill dike, and increase cell capacity, the inner face of the dike may be vertical

FIGURE 5.2.7-14

REPORT NO: DOE/OR/21548-411

ORIGINATOR:	DRAWN BY:	DATE:
JC	MD	05-17-93



LEGEND

1. SHALLOW-ROOTING VEGETATION
2. OCCASIONAL DEEP-ROOTING VEGETATION
3. EROSION BARRIER
4. CLEAN-FILL DIKE
5. DRAINS AND LINER
6. BIOINTRUSION LAYER
7. WASTE

VEGETATION GROWTH & ROOTING PATTERNS

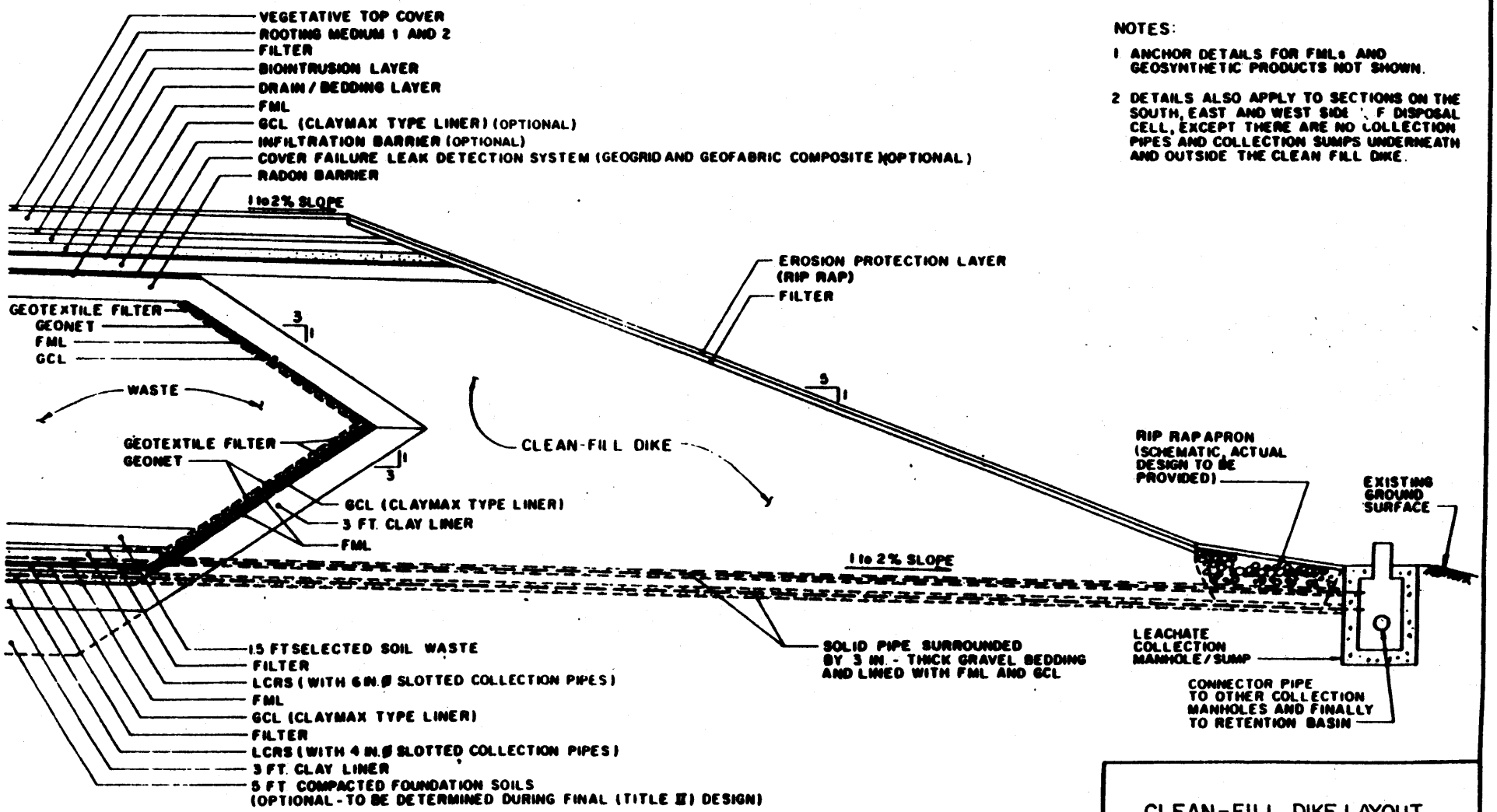
To inhibit root penetration, the top cover includes a biointrusion barrier, and the side slope clean-fill dikes provide volume for root growth

FIGURE 5.2.7-15

REPORT NO: DOE/OR/21548-411

ORIGINATOR:	DRAWN BY:	DATE
JC	EBR	05-17-93

5 2 7-15 VEG GROWTH & ROOT PAT



NOTES:

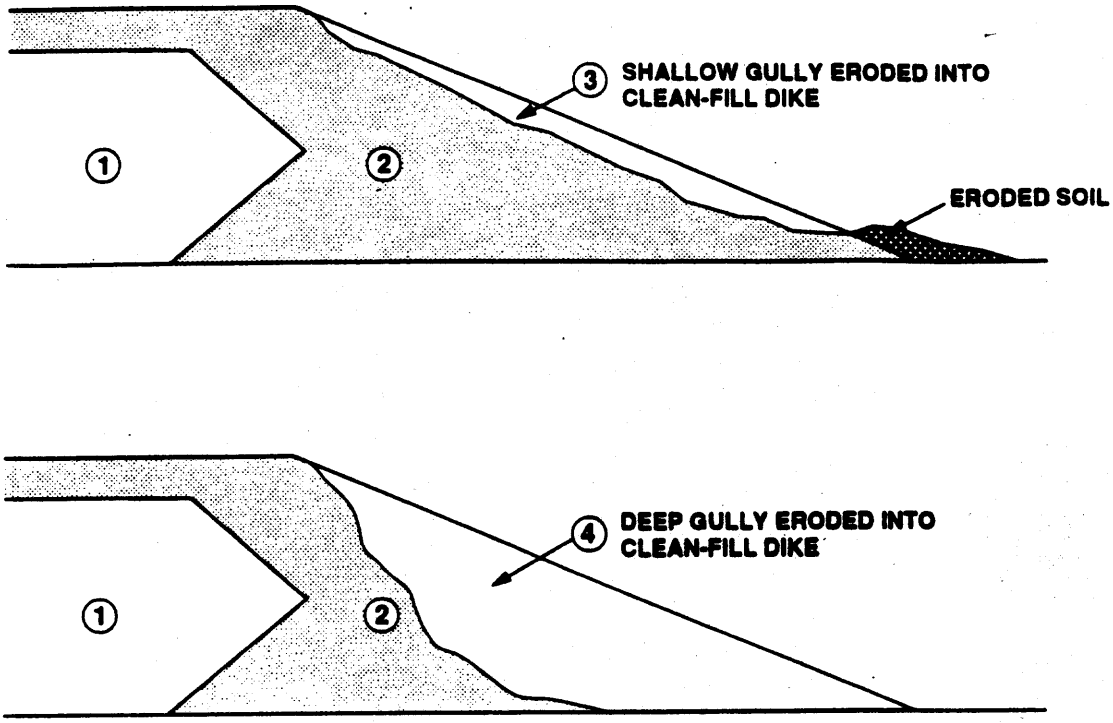
1 ANCHOR DETAILS FOR FMLs AND GEOSYNTHETIC PRODUCTS NOT SHOWN.

2 DETAILS ALSO APPLY TO SECTIONS ON THE SOUTH, EAST AND WEST SIDE OF DISPOSAL CELL, EXCEPT THERE ARE NO COLLECTION PIPES AND COLLECTION SUMPS UNDERNEATH AND OUTSIDE THE CLEAN FILL DIKE.

CLEAN-FILL DIKE LAYOUT

FIGURE 5.2.7-16

REPORT NO DOE/OR/21548-411	DRAWING NO	
ORIGINATOR KWL	DRAWN BY AMA	DATE



LEGEND

① WASTE
② CLEAN-FILL DIKE
③ SHALLOW GULLY
④ DEEP GULLY

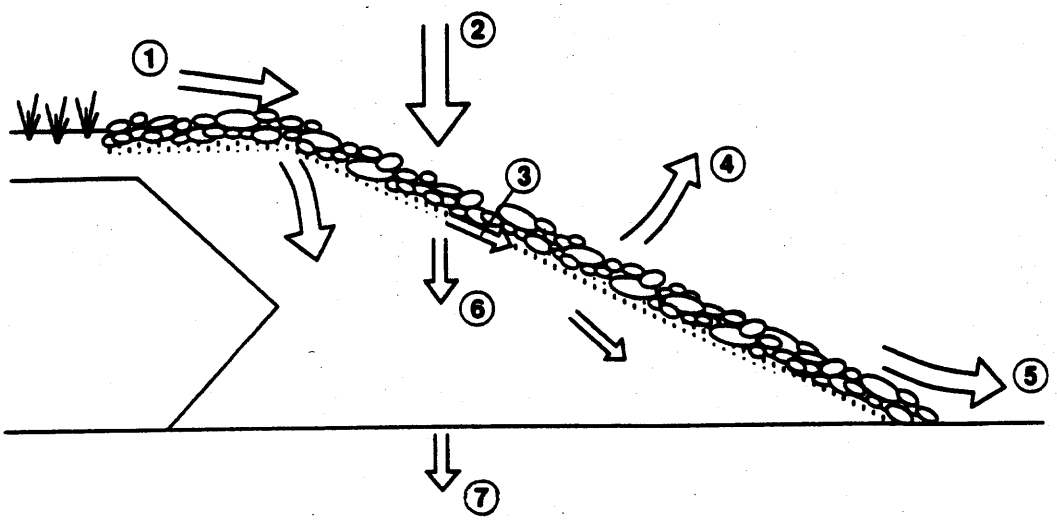
CLEAN-FILL DIKE EROSION GULLY GEOMETRY

Even significant gully formation by erosion of the clean-fill dike will not expose the encapsulated wastes

FIGURE 5.2.7-17

REPORT NO: DOE/OR/21548-411		
ORIGINATOR: JC	DRAWN BY: MD	DATE 05-17-93

5 2 7-17 CLN FL DIKE EROSION GULLY



CLEAN-FILL DIKE SECTION WITH FLOW COMPONENTS

FLOW COMPONENTS
1 TOP COVER RUNOFF
2 SIDE SLOPE INCIDENT PRECIPITATION
3 SIDE SLOPE RUNOFF
4 SIDE SLOPE EVAPOTRANSPIRATION
5 TOTAL CELL RUNOFF
6 DIKE INFILTRATION
7 SEEPAGE TO VADOSE ZONE

CLEAN-FILL DIKE WATER BALANCE MODEL FOR ROCK COVER

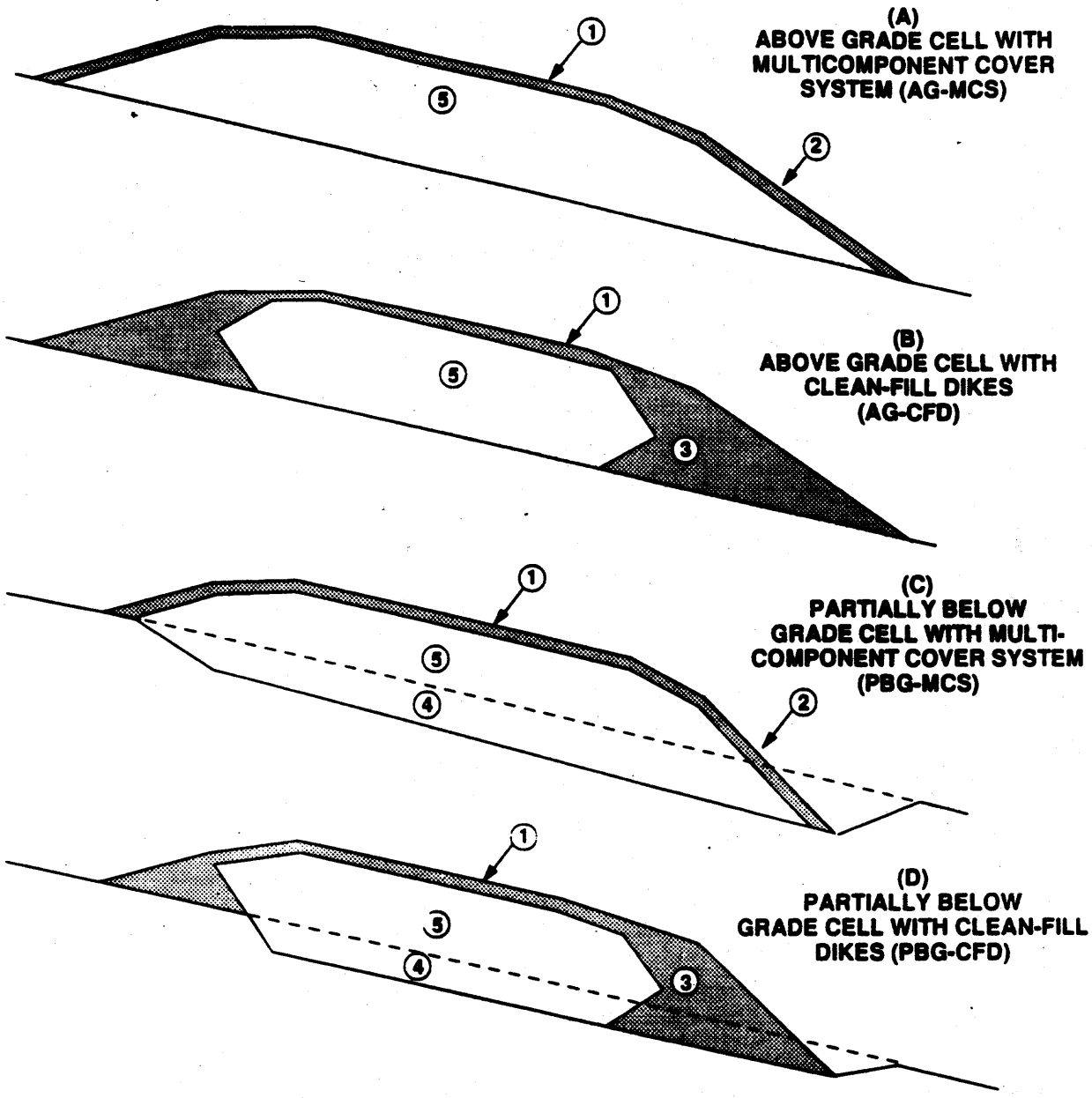
Some incident precipitation on the dike runs off and some infiltrates to seep to the groundwater

FIGURE 5.2.7-18

REPORT NO: DOE/OR/21548-411

ORIGINATOR	DRAWN BY	DATE
JC	MD/BM	05-17-93

5 2 7-18 CLEAN FL DK WTR BAL MOD



LEGEND

1. TOP SLOPE COVER
2. SIDE SLOPE COVER
3. CLEAN-FILL DIKE
4. EXCAVATION ZONE
5. ENCAPSULATED WASTE

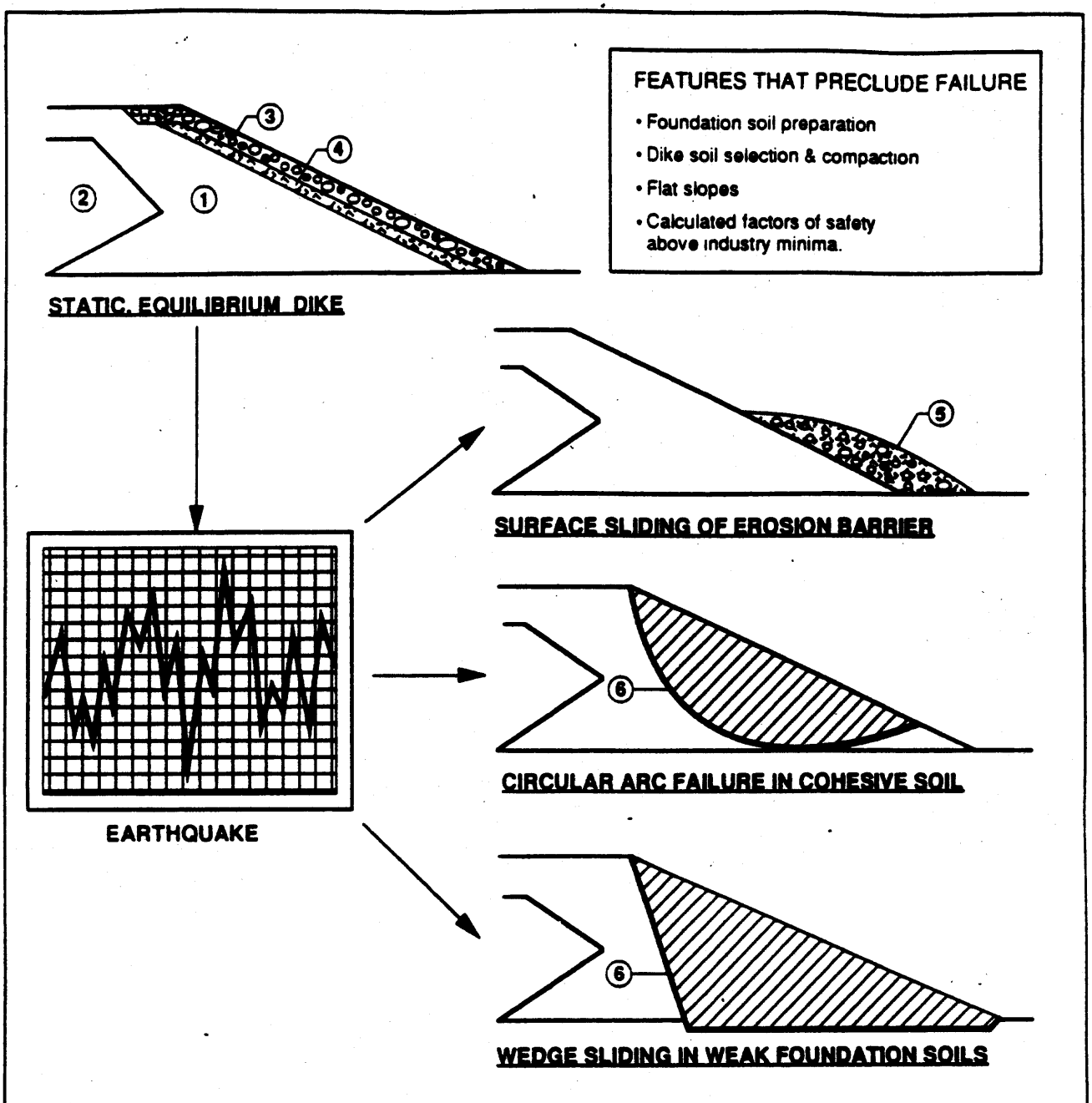
CELL TYPES:
These are the four basic cell types discussed and evaluated in this report

FIGURE 5.2.7-19

REPORT NO: DOE/OR/21548-411

ORIGINATOR	DRAWN BY	DATE
JC	BR	05-17-93

5 2 7-19 CELL TYPES



LEGEND

1. CLEAN-FILL DIKE
2. WASTE
3. EROSION ROCK
4. DRAIN SAND
5. DISPLACED ROCK & SAND
6. POTENTIAL FAILURE PLAIN

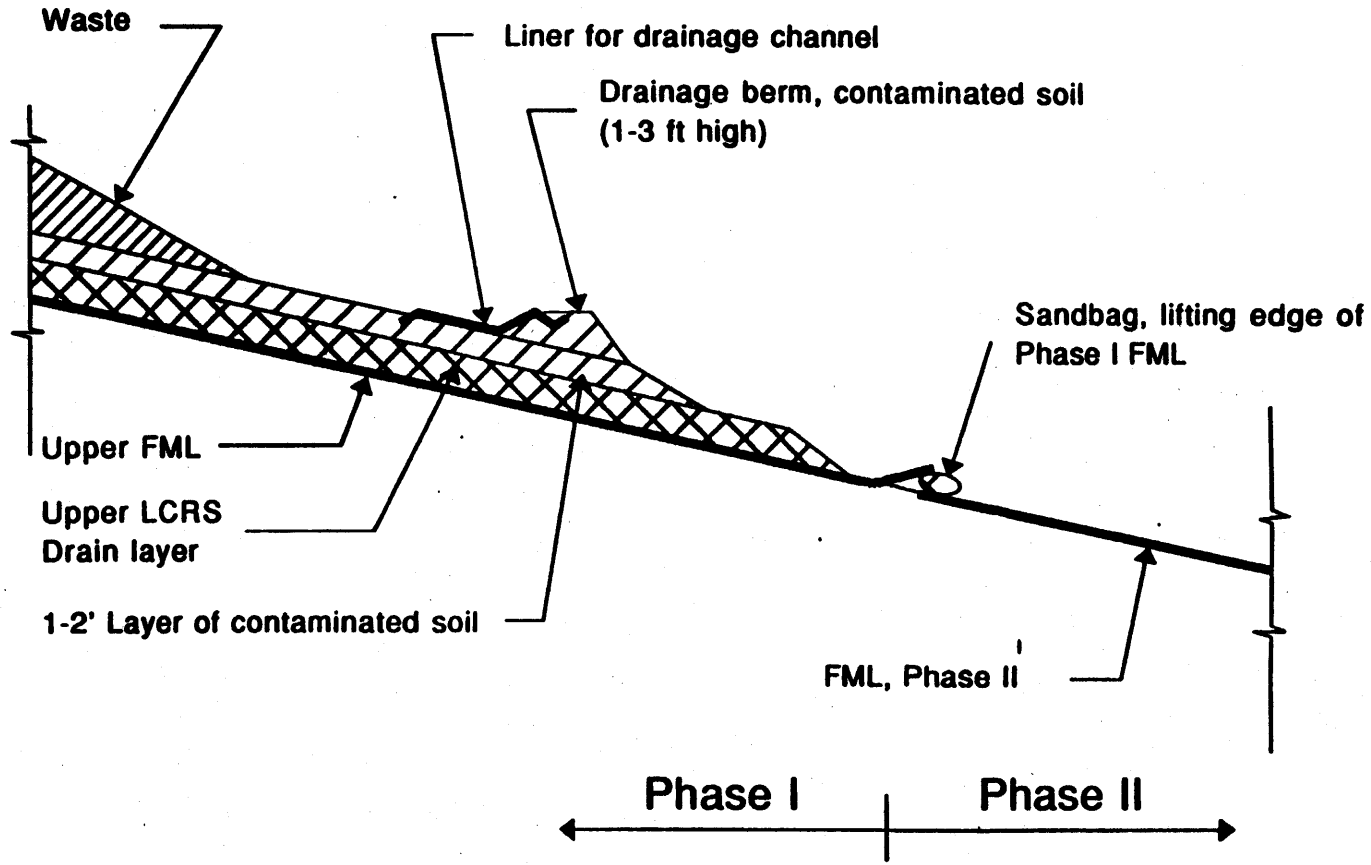
DIKE POTENTIAL SLOPE FAILURE MODES

An earthquake could induce slope instability and potentially cause dike soils to displace

FIGURE 5.2.7-20

REPORT NO: DOE/OR/21548-411

ORIGINATOR:	DRAWN BY	DATE
JC	EBR	05-17-93



Legend

FML Flexible Membrane Liner
LCRS Leachate Collection and Removal System

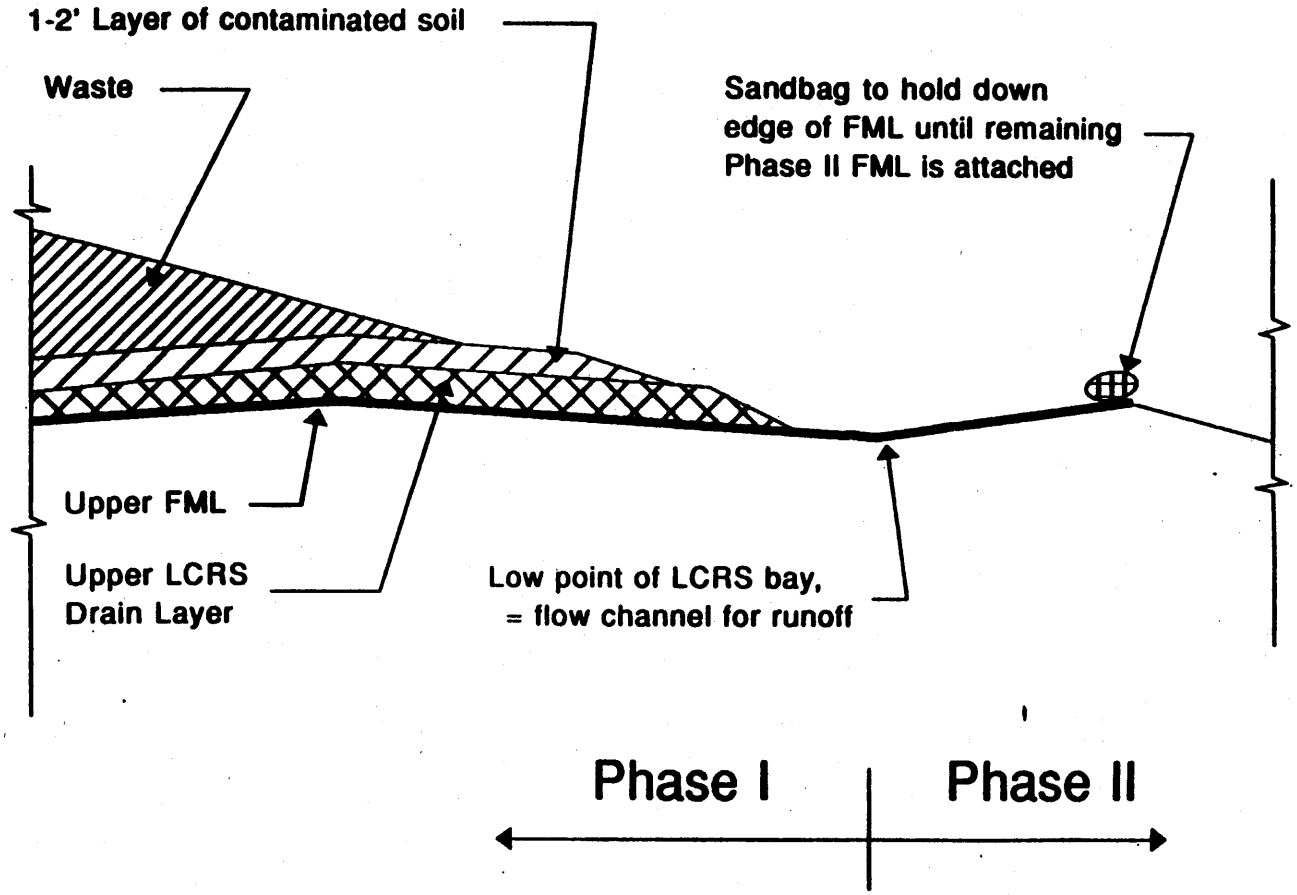
Note: Figure is schematic and not drawn to scale.

Drainage Collection at Edge of Phases I & II (Alternatives A-A, B-B, C-C)

Figure 5.2.8-1

Report No. DOE/OR/21548-411	Drawing No.	
Originator: JBF	Drawn by: JBF	Date: December 1992

I:\wssrap\tid\1738\Fig-1.ch3



Legend

FML	Flexible Membrane Liner
LCRS	Leachate Collection and Removal System

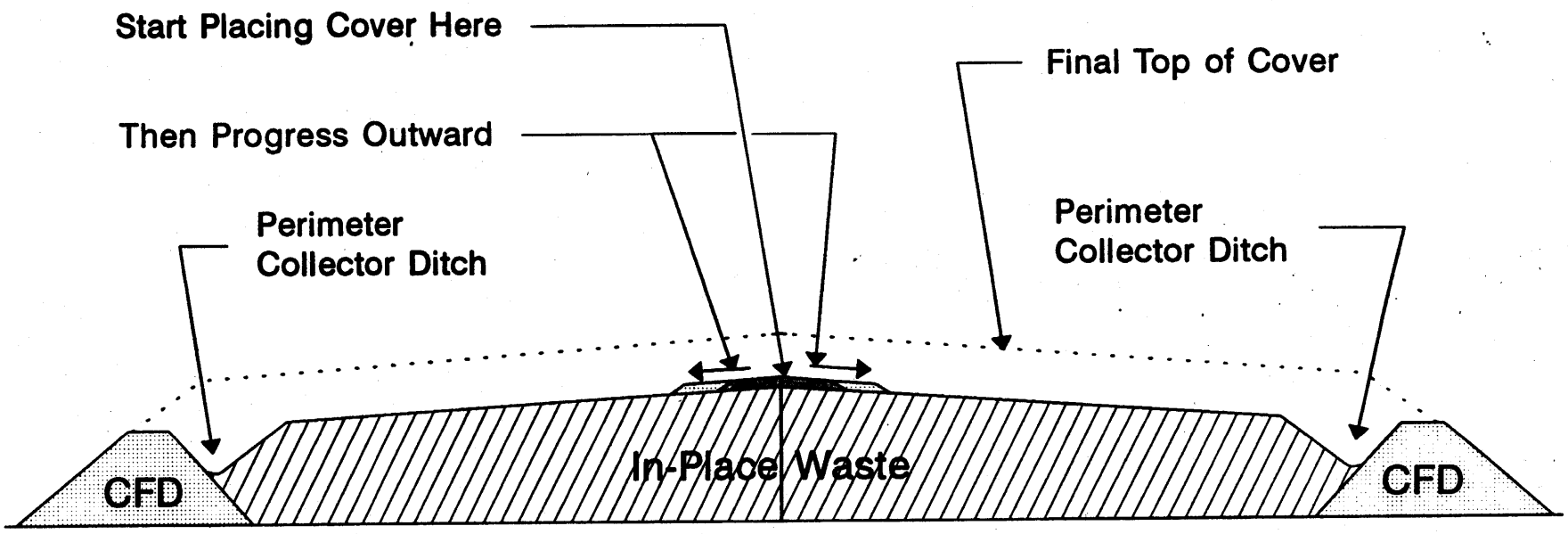
Note: Figure is schematic and not drawn to scale.

Drainage Collection Edges of Phases I & II (Alternative D-D)

Figure 5.2.8-2

Report No. DOE/OR/21548-411	Drawing No.	
Originator: JBF	Drawn by: JBF	Date: December 1992

I:\wssrap\tid\t738\Fig-2.ch3



Legend

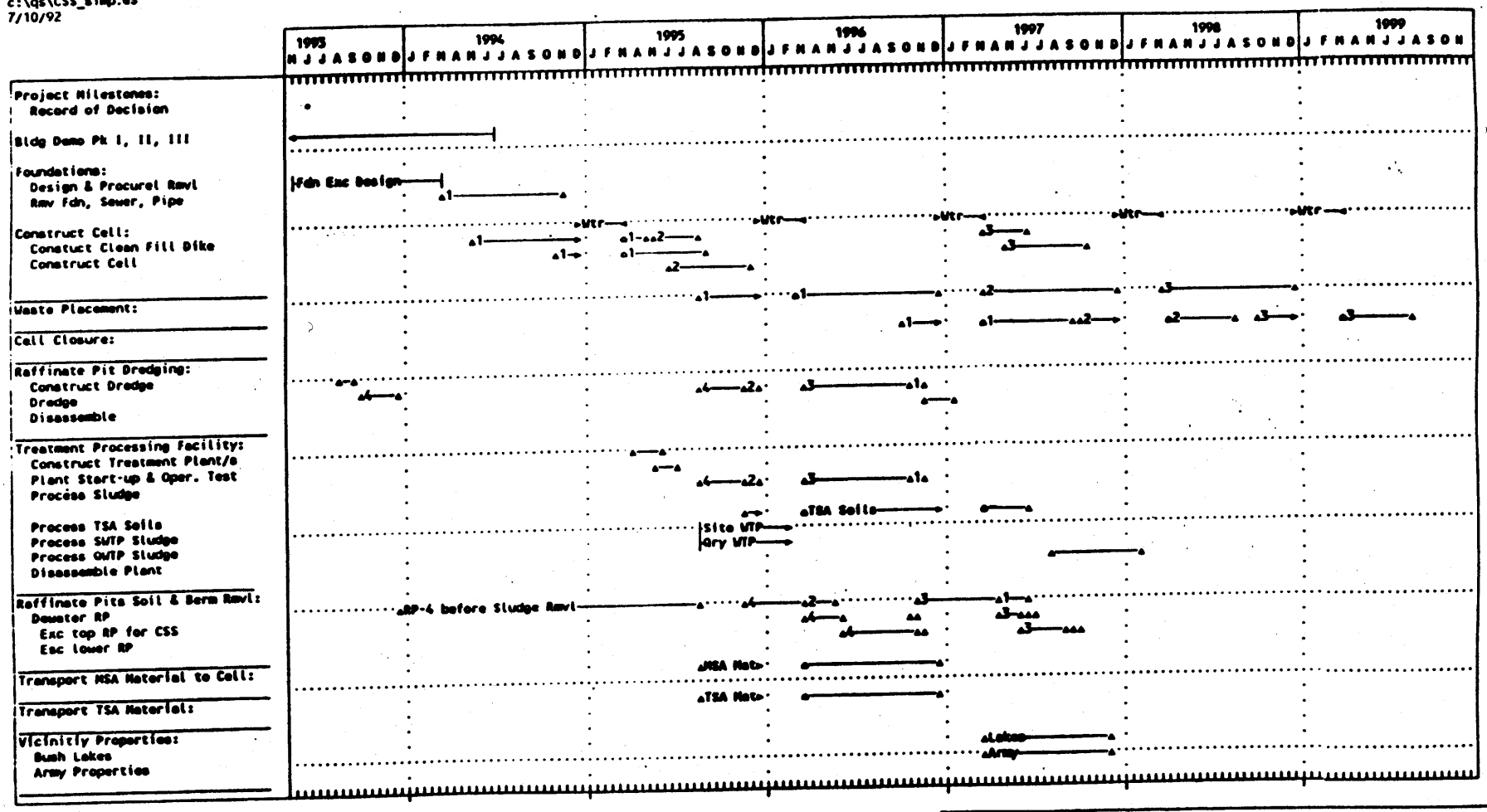
- CFD — Clean-Fill Dike
- Area of Clean Cover Placement
- Area of In-Place Clean Cover

Note: Figure is schematic and not drawn to scale.

Placement of Initial Lifts of Disposal Cell Cover		
FIGURE 5.2.8–3		
Report No: DOE/OR/21548-411	Drawing No.	
Originator: JBF	Drawn by: JBF	Date: November 1992

f:\weeran\tid\1728\Fig-3.cb3

WSSRAP CDR Schedule
Disposal Cell Operation
c:\qs\CSS_simp.QS
7/10/92



NOTE: FOR MORE DETAILED SCHEDULE, MVE SESSION: INTEGRATED SCHEDULE FOR EXCAVATION, TREATMENT, PLACEMENT AND CELL CONSTRUCTION

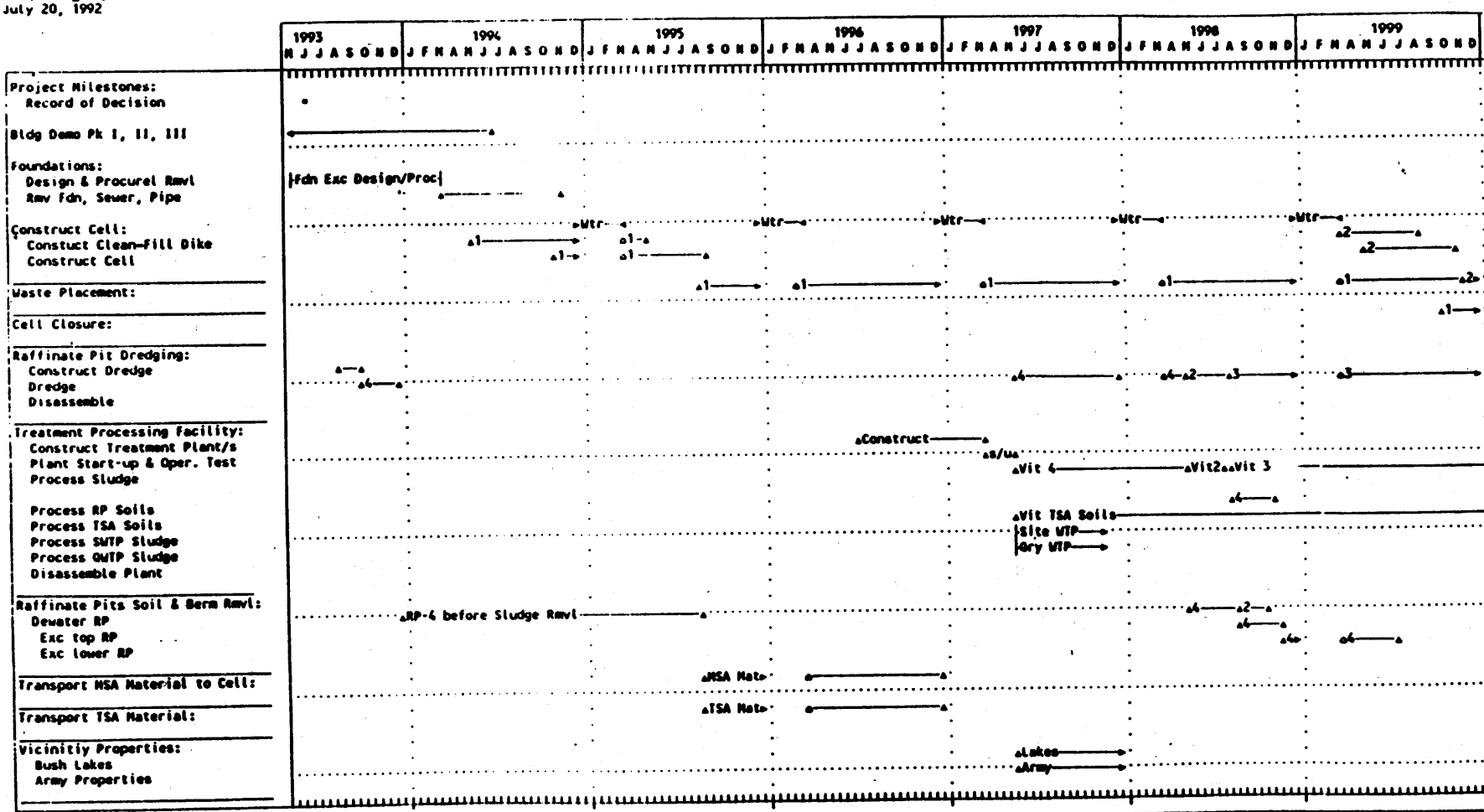
CSS Simplified Schedule

FIGURE 5.2.9-1

Report No: DOE/OR/21548-411		Drawing No.
Originator: JBF	Drawn by: JBF	Date: December 1992

f:\wssrap\tid\t738\cssSched.ch3

WSSRAP CDR Schedule
Disposal Cell Operation
c:\qs\VIT_simp.QS
July 20, 1992



VIT Simplified Schedule

(Page 1 of 2: 1993-1999)

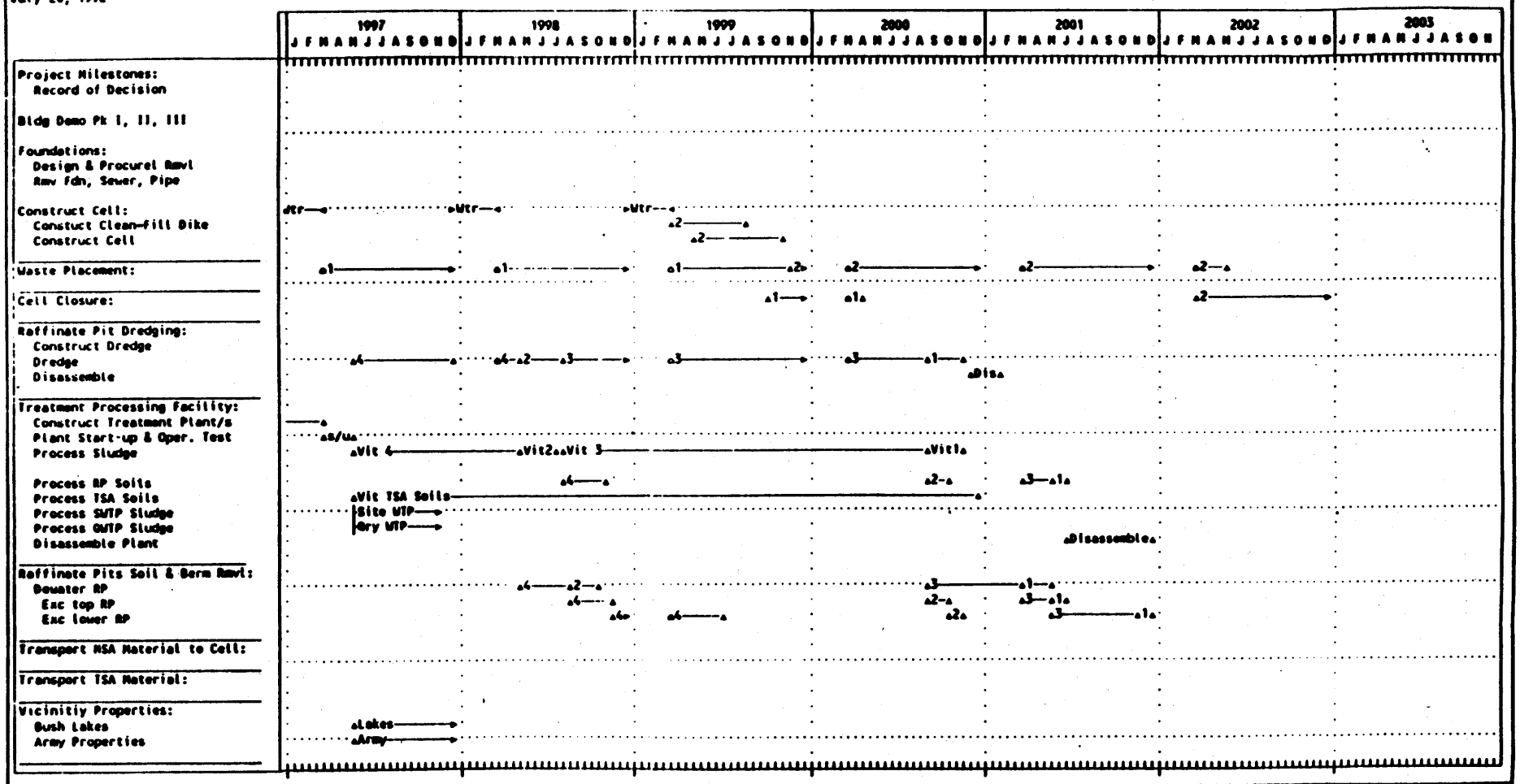
FIGURE 5.2.9-2

Report No: DOE/OR/21548-411	Drawing No.	
Originator: JBF	Drawn by: JBF	Date: December 1992

NOTE: FOR MORE DETAILED SCHEDULE, MVE SESSION: INTEGRATED SCHEDULE FOR EXCAVATION, TREATMENT, PLACEMENT AND CELL CONSTRUCTION

f:\wsrap\tid\t738\vitSche1.ch3

WSSRAP CDR Schedule
Disposal Cell Operation
c:\qs\VIT_simp.QS
July 20, 1992



VIT Simplified Schedule

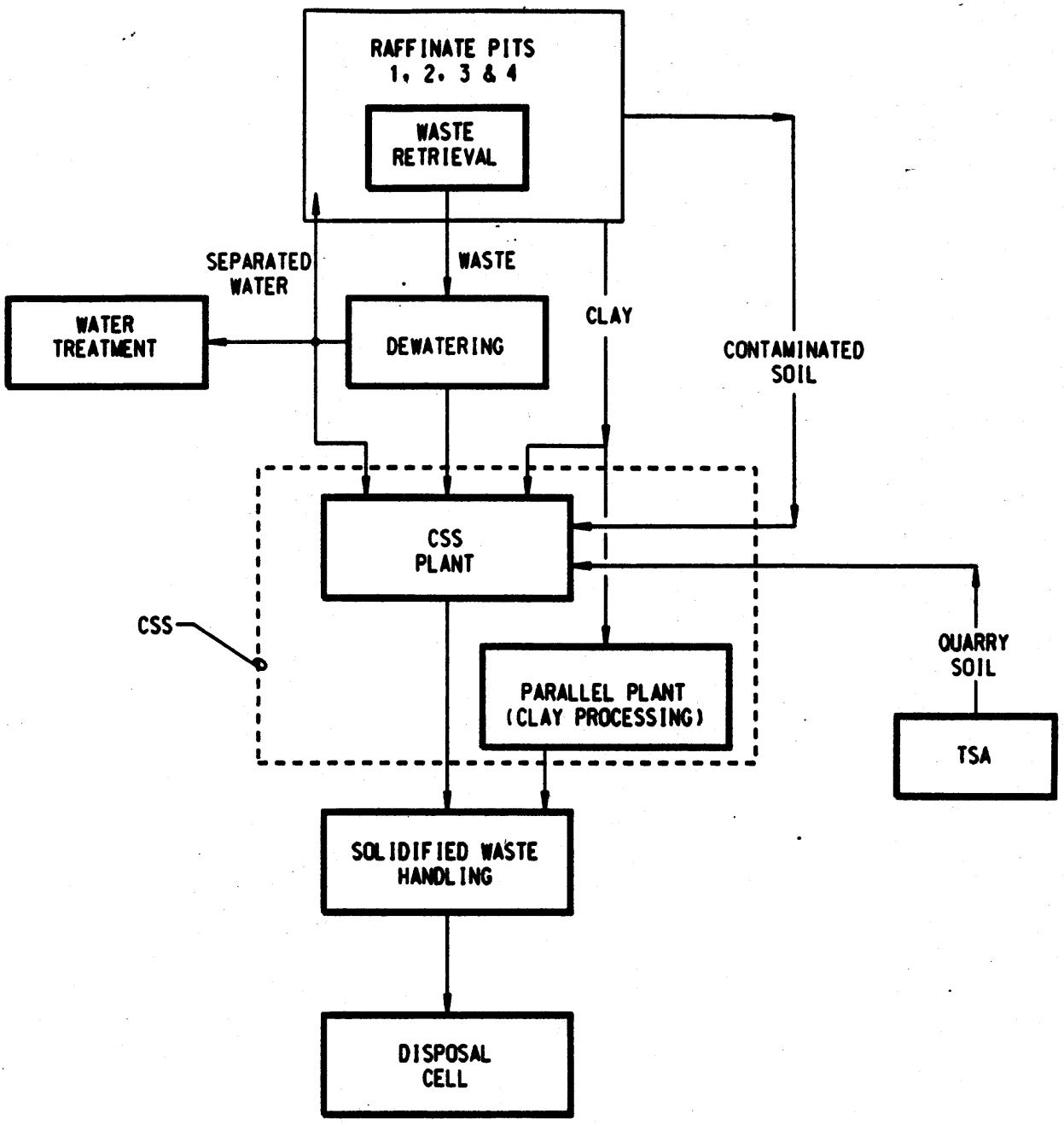
(Page 2 of 2: 1997-2003)

FIGURE 5.2.9-3

NOTE: FOR MORE DETAILED SCHEDULE, MVE SESSION: INTEGRATED SCHEDULE FOR EXCAVATION, TREATMENT, PLACEMENT AND CELL CONSTRUCTION

Report No: DOE/OR/21548-411	Drawing No.	
Originator: JBF	Drawn by: JBF	Date: December 1992

f \wssrap\tid\l :Sche2.ch3

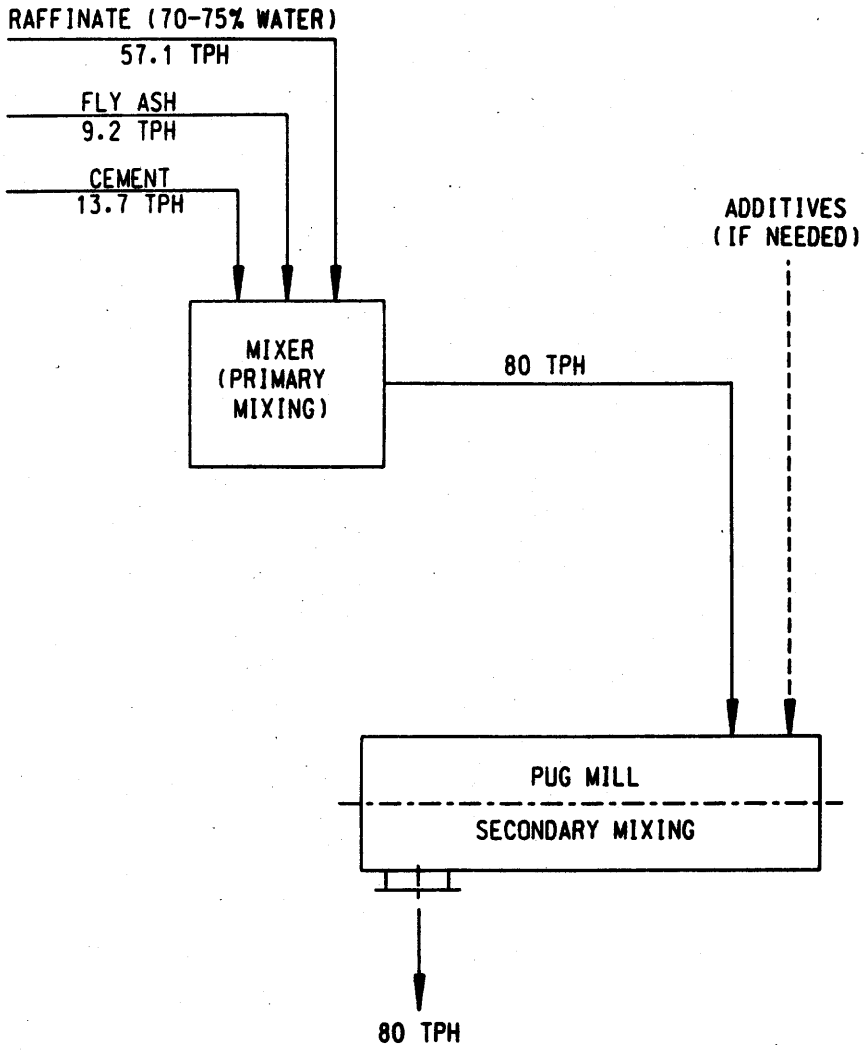


MAJOR COMPONENTS OF THE
WSS
WASTE TREATMENT PROCESS

FIGURE 5.3.1-1

REPORT NO.	DRAWING NO.	
DOE/OR/21548-411		
ORIGINATOR	DRAWN BY	DATE

CAD FILE: WSS040/JOEFLOW.DGN PLOT DATE: 11/30/92



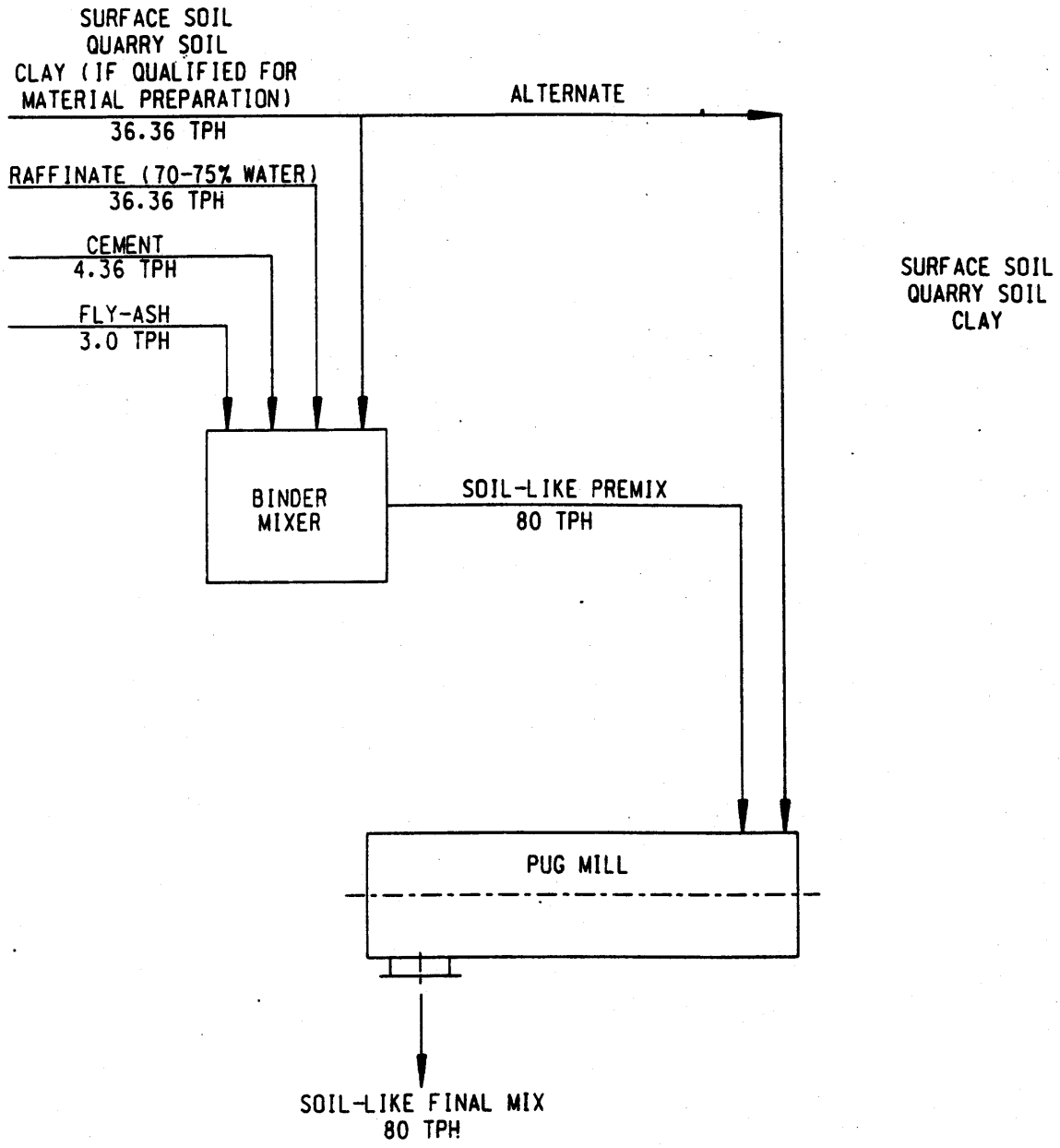
THIS DIAGRAM DEPICTS THE PRODUCTION OF A GROUT-LIKE PRODUCT BASED ON THE RAFFINATE + BINDER MIX. TWO-STEP MIXING IS RECOMMENDED. NO ADDITIONAL WATER IS REQUIRED.

NOTE: BASED ON WTG MATERIAL BALANCE

MATERIAL BALANCE
RAFFINATE PITS 1, 2, 3 & 4
GROUT-LIKE PRODUCT
(RAFFINATE SLUDGE AND BINDER)

FIGURE 5.3.2-1

REPORT NO: DOE/OR/21548-411	DRAWING NO:	
ORIGINATOR:	DRAWING BY:	DATE: 05/28/93



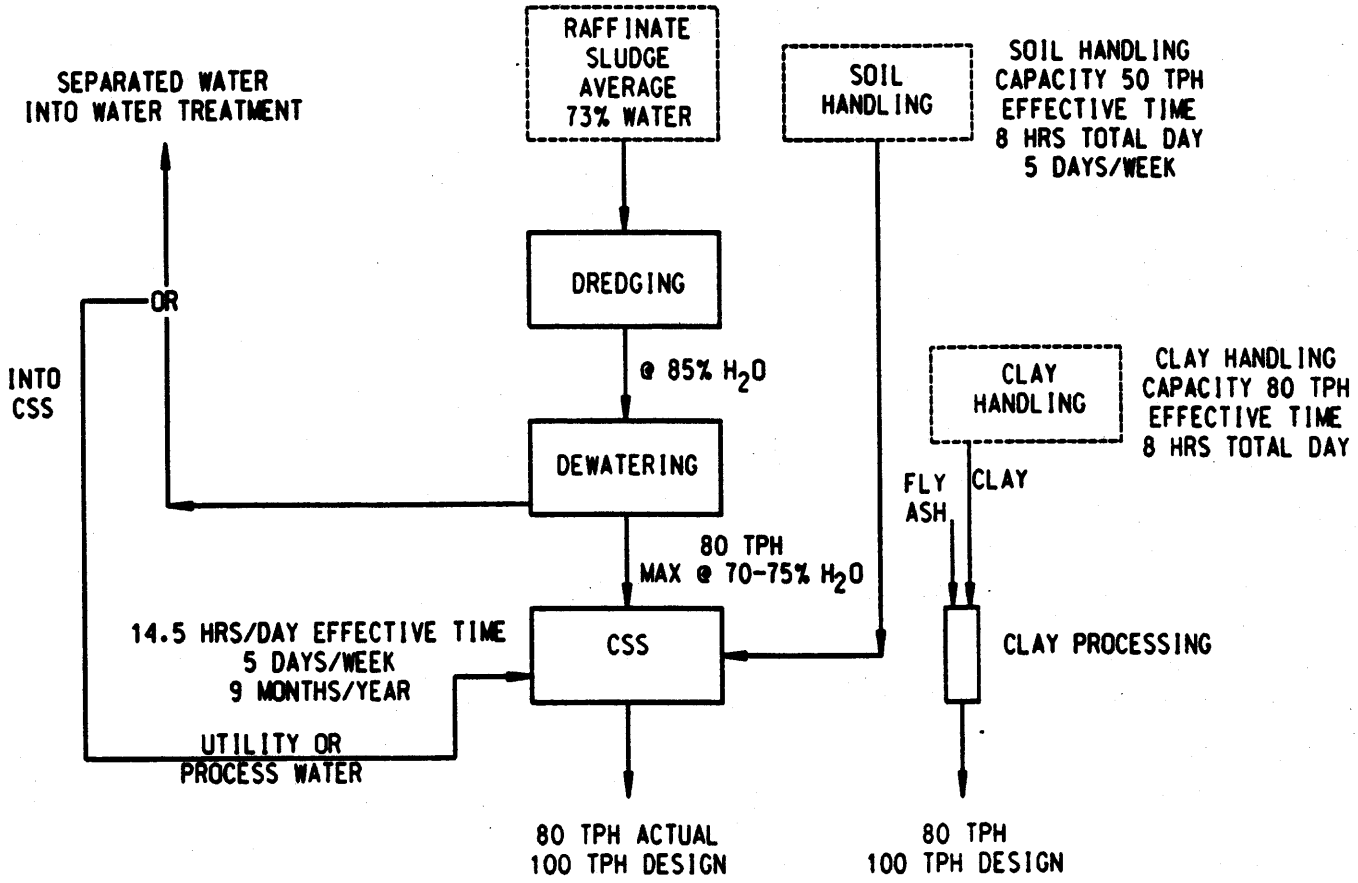
THIS DIAGRAM DEPICTS THE PRODUCTION OF A SOIL-LIKE PRODUCT BASED ON THE RAFFINATE + SOIL + BINDER MIX. TWO-STEP MIXING IS RECOMMENDED. NO ADDITIONAL WATER REQUIRED.

NOTE: BASED ON WTG MATERIAL BALANCE

MATERIAL BALANCE
SOIL-LIKE PRODUCT

FIGURE 5.3.2-2

REPORT NO: DOE/OR/21548-411		DRAWING NO:
ORIGINATOR:	DRAWING BY:	DATE: 05/28/93

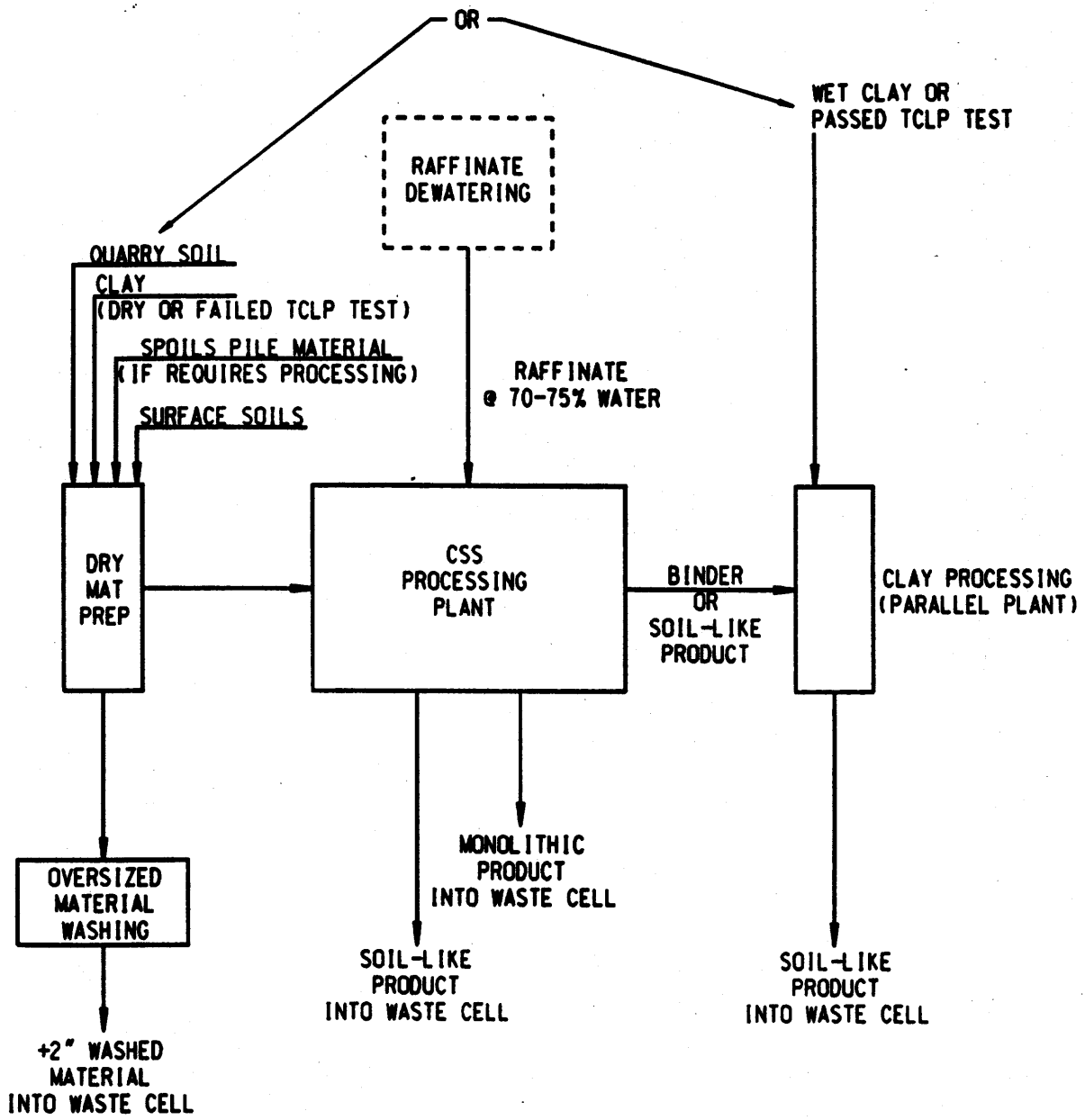


CSS - RELATED PROCESS CAPACITIES AND TIMING

FIGURE 5.3.2-3

REPORT NO. DOE/OR/21548-411	DRAWING NO.	
ORIGINATOR	DRAWN BY	DATE

CAD FILE: W03840/JOEF...DGN PLOT DATE: ...



PROPOSED OVERALL CSS PROCESS

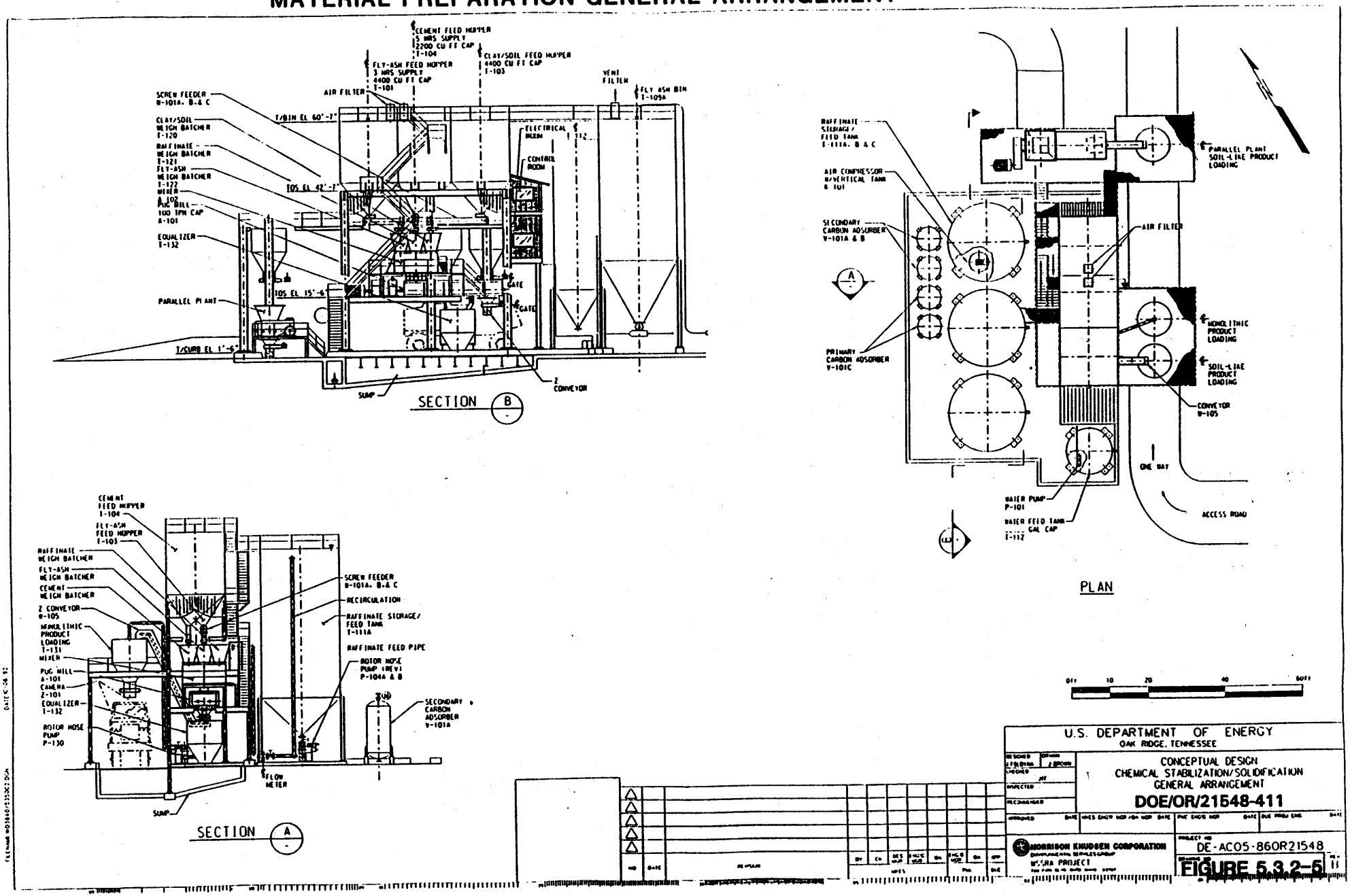
FIGURE 5.3.2-4

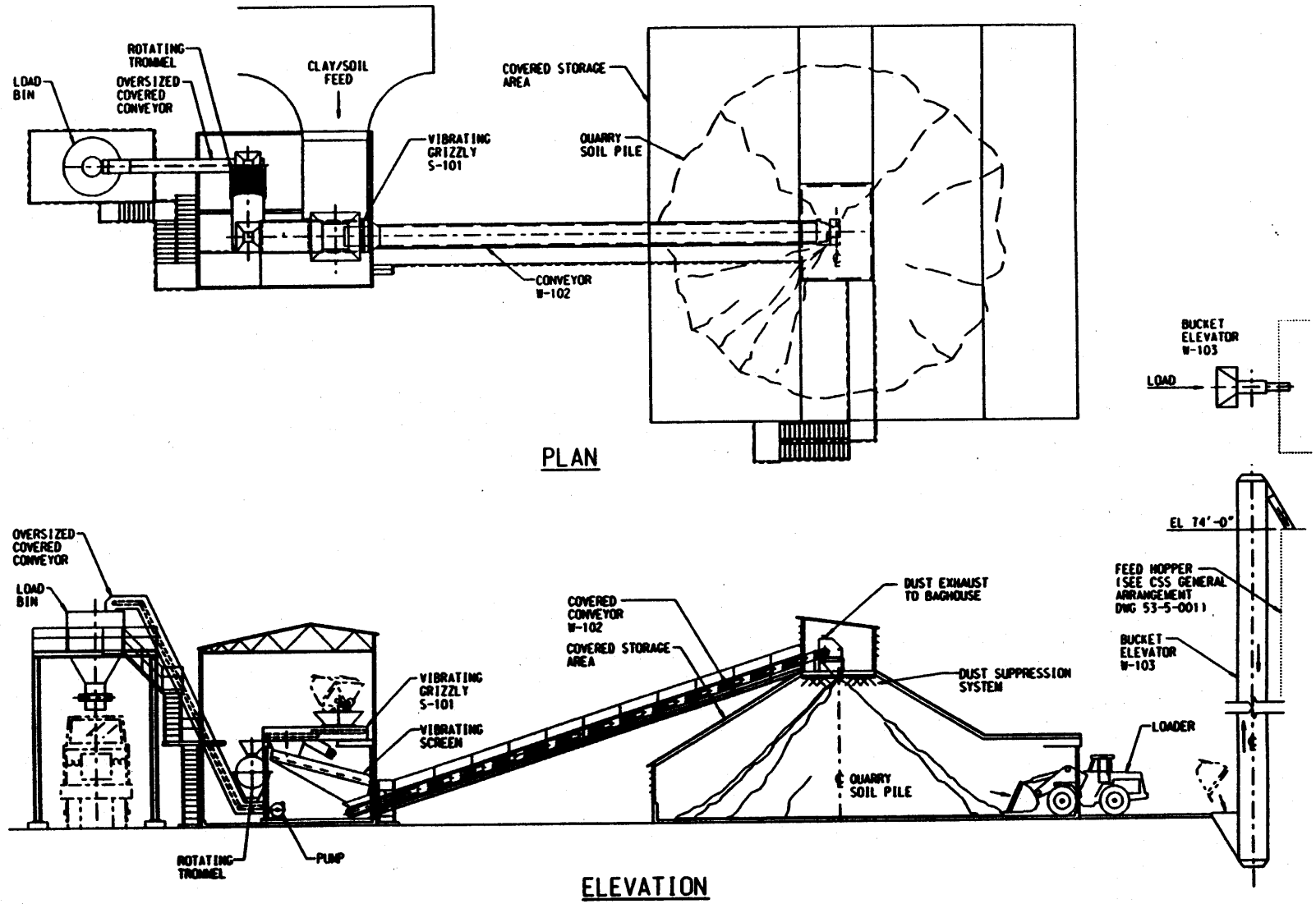
REPORT NO.	DRAWING NO
DOE/OR/21548-411	

ORIGINATOR	DRAWN BY	DATE

CAD FILE: W03640/JOEFLOW.DGN PLOT DATE: 11/30/92

CONCEPTUAL DESIGN CHEMICAL STABILIZATION/SOLIDIFICATION
MATERIAL PREPARATION GENERAL ARRANGEMENT

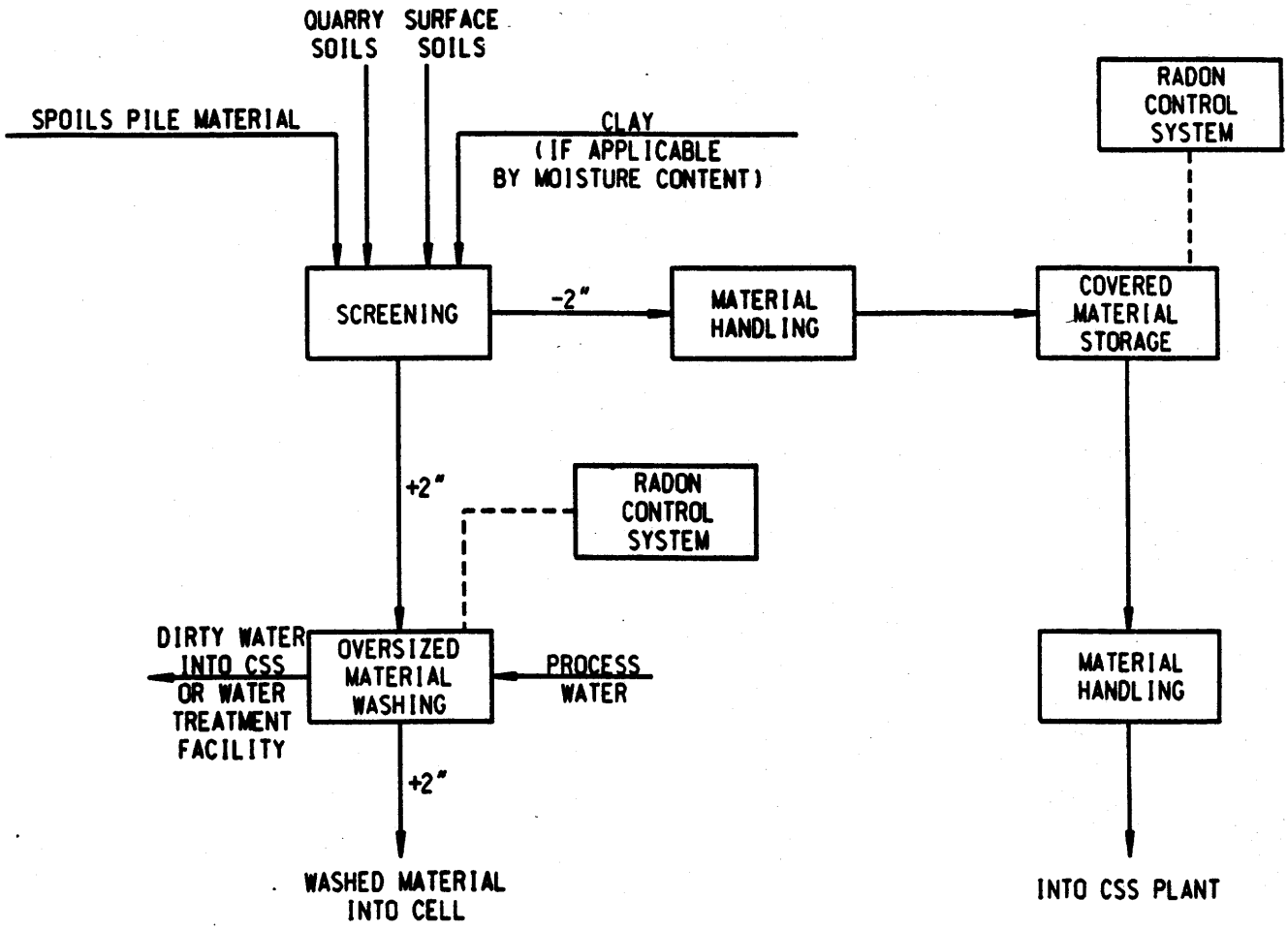




CONCEPTUAL DESIGN
CHEMICAL STABILIZATION/SOLIDIFICATION
MATERIAL PREPARATION
GENERAL ARRANGEMENT

FIGURE 5.3.2-6

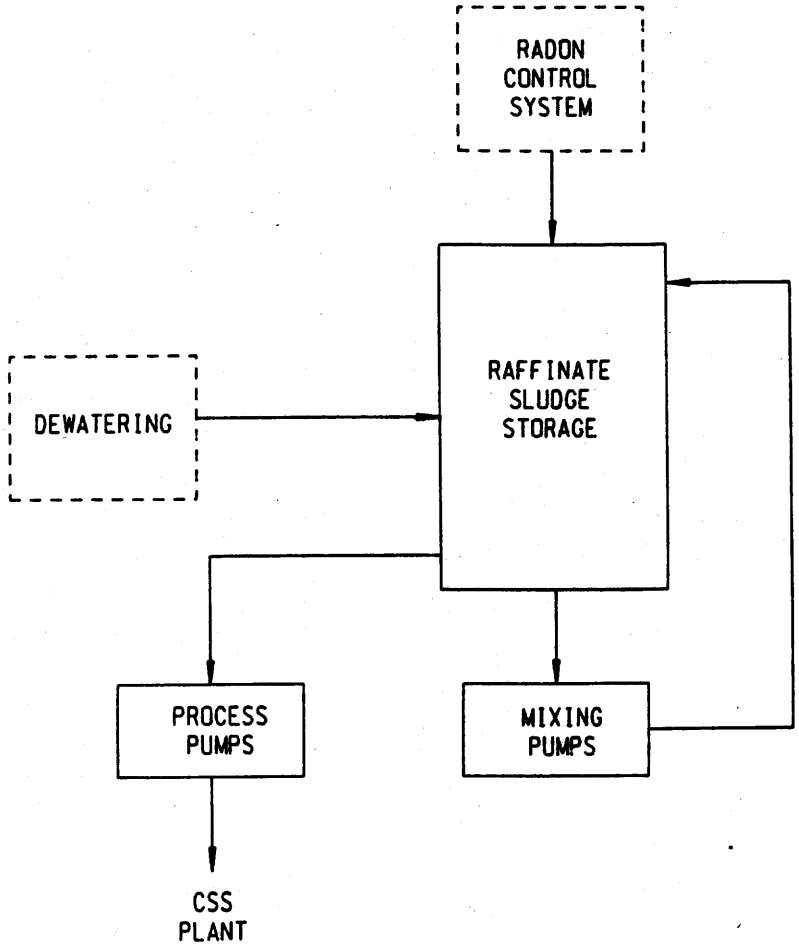
REPORT NO. DOE/OR/21548-411	DRAWING NO.	
ORIGINATOR	DRAWN BY	DATE



SOLID MATERIAL PREPARATION
(SOIL-LIKE PRODUCT)

FIGURE 5.3.2-7

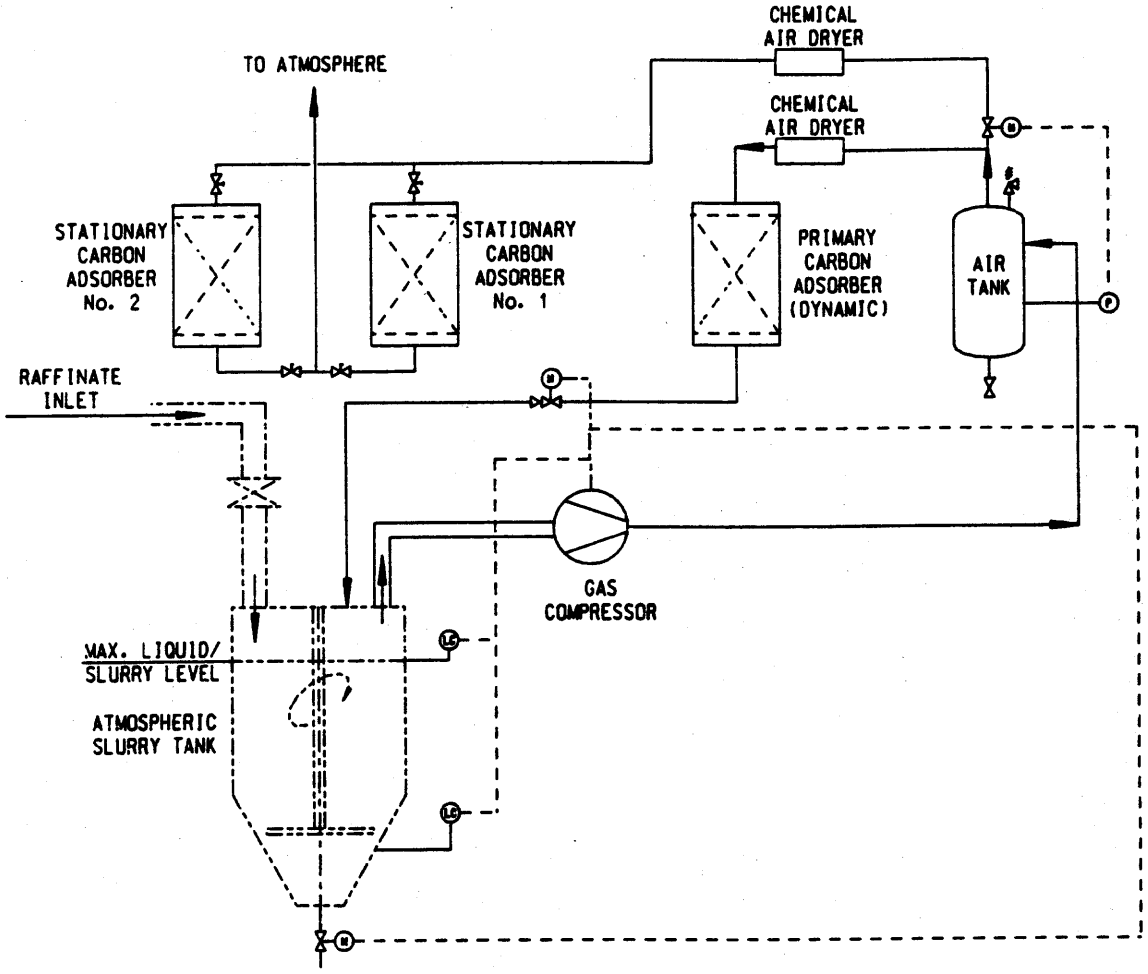
REPORT NO. DOE/OR/21548-411	DRAWING NO.	
ORIGINATOR	DRAWN BY	DATE



LIQUID MATERIAL PREPARATION
(GROUT-LIKE PRODUCT)

FIGURE 5.3.2-8

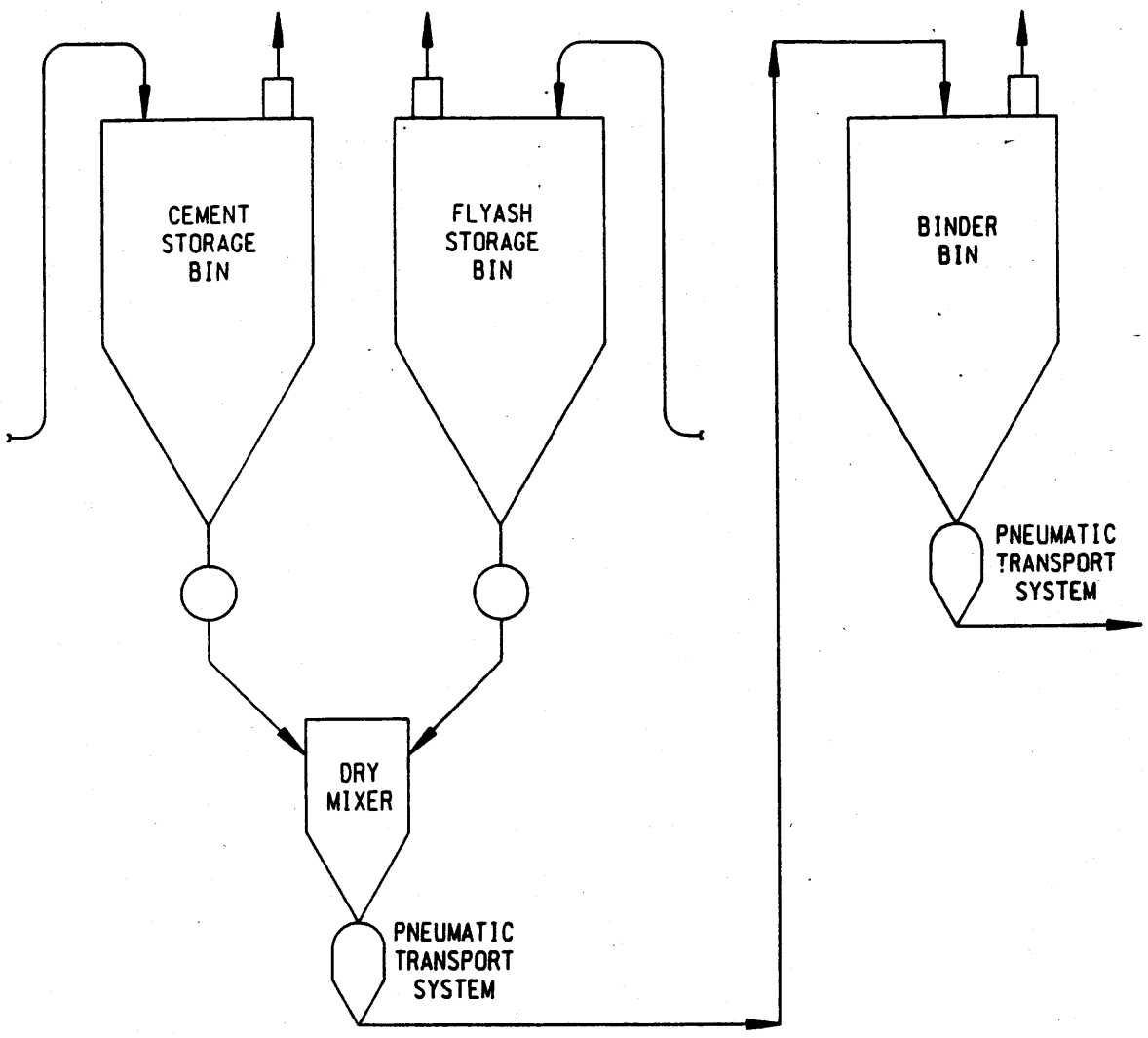
REPORT NO: DOE/OR/21548-411		DRAWING NO:
ORIGINATOR:	DRAWING BY:	DATE: 05/28/93



RADON EMISSION CONTROL
(FUNCTIONAL DIAGRAM)

FIGURE 5.3.2-9

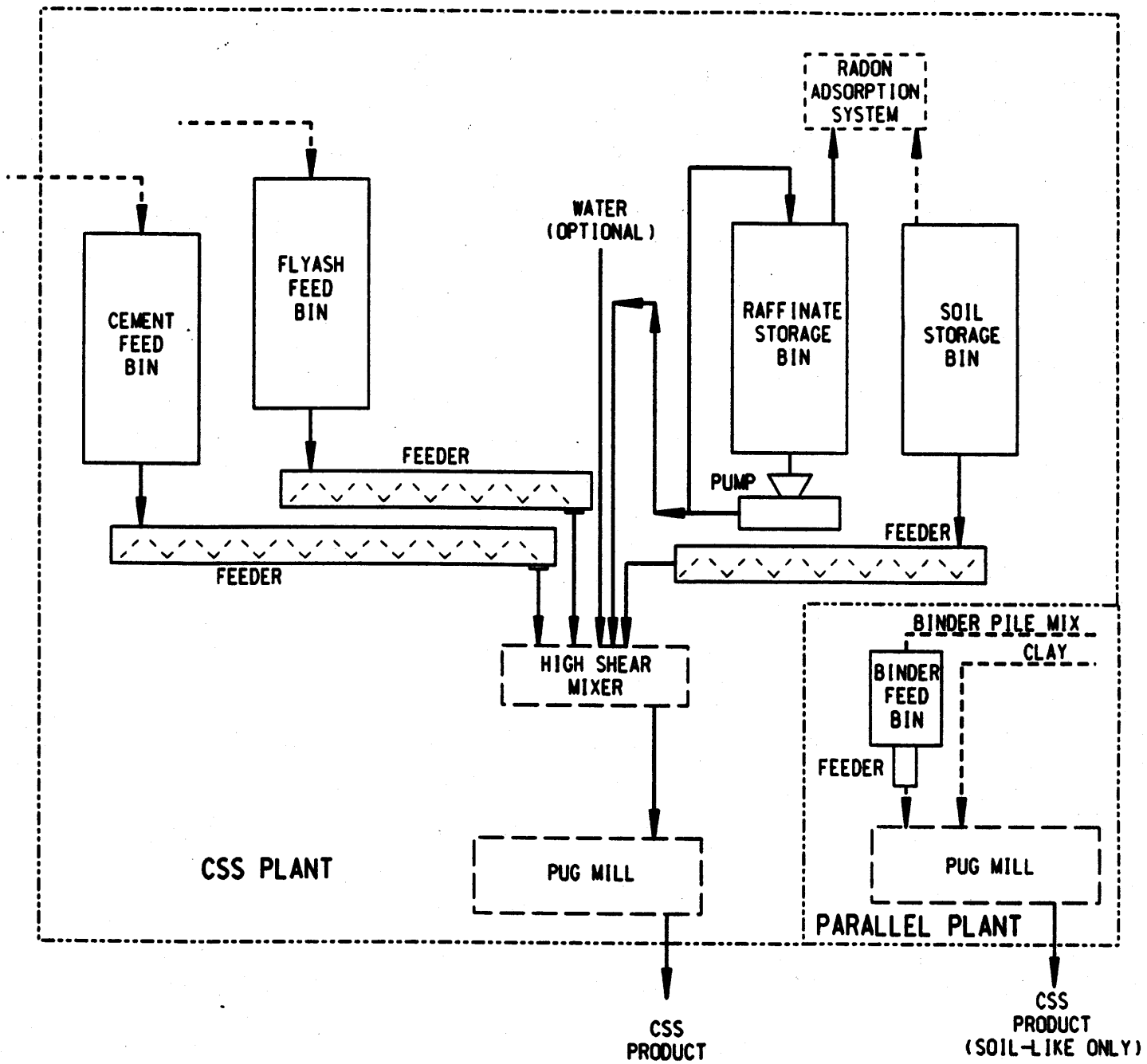
REPORT NO: DOE/OR/21548-411		DRAWING NO:
ORIGINATOR:	DRAWING BY:	DATE: 05/28/93



PRODUCT STORAGE SYSTEM
(FUNCTIONAL DIAGRAM)

FIGURE 5.3.2-10

REPORT NO: DOE/OR/21548-411		DRAWING NO:
ORIGINATOR:	DRAWING BY:	DATE: 05/28/93

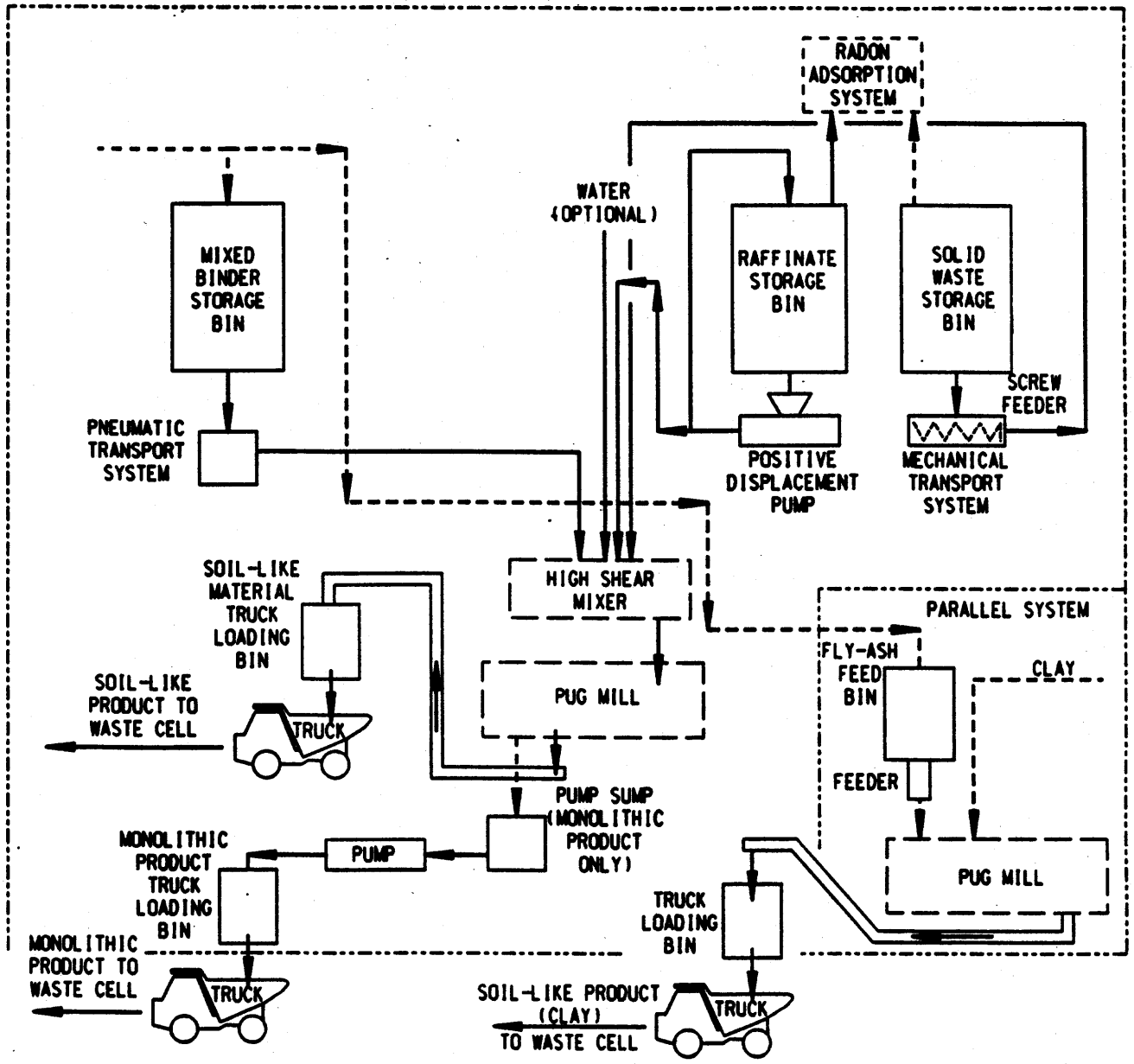


MECHANICAL FEED SYSTEM
(FUNCTIONAL DIAGRAM)

FIGURE 5.3.2-11

REPORT NO.	DRAWING NO.	
DOE/OR/21548-411		
ORIGINATOR	DRAWN BY	DATE

CAD FILE: W03840/JOEFLOW.DGN PLOT DATE: 11/30/9



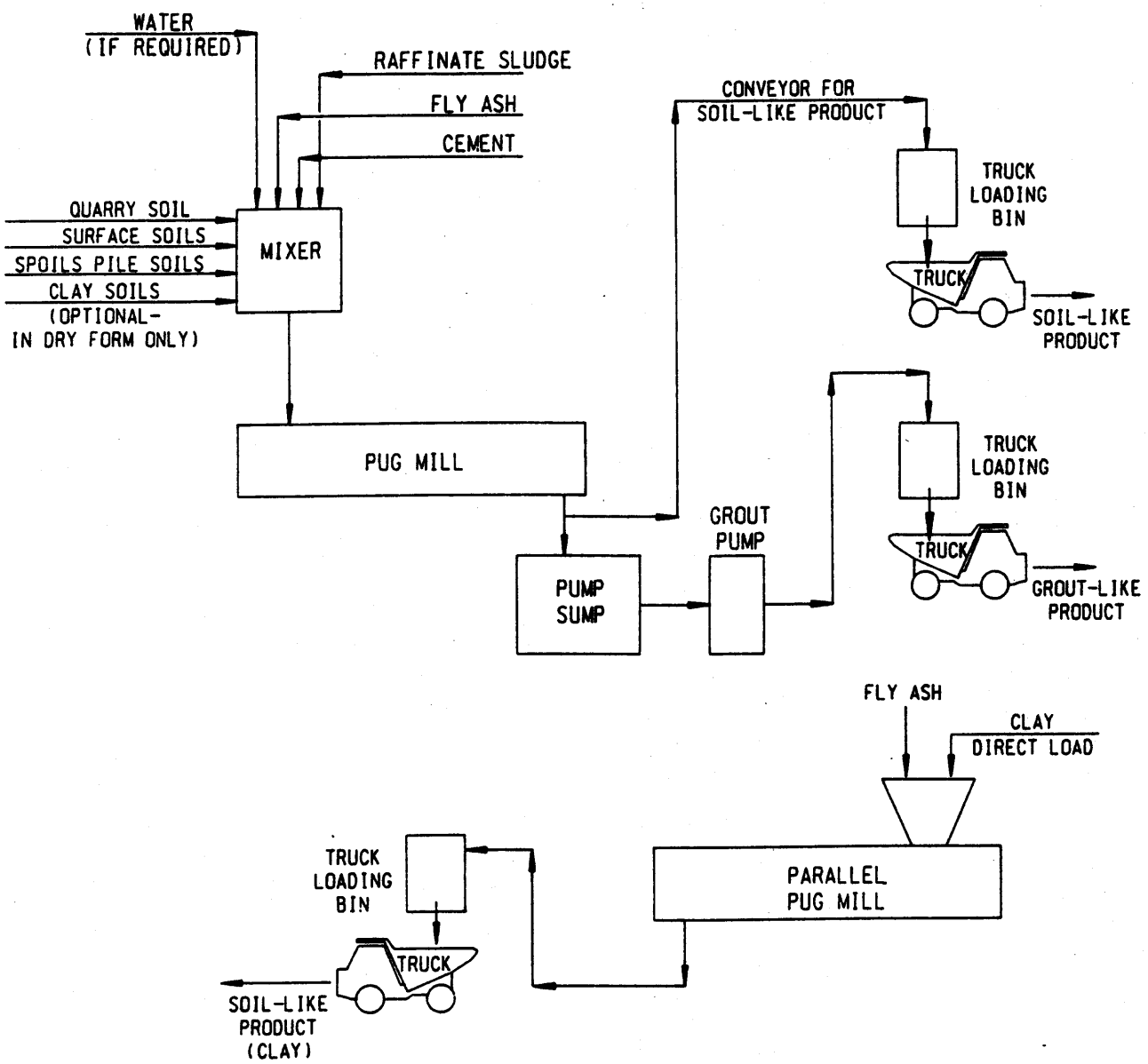
PNEUMATIC BINDER FEED SYSTEM COMBINATION W/MECHANICAL SYSTEM (FUNCTIONAL DIAGRAM)

FIGURE 5.3.2-12

REPORT NO.	DRAWING NO.
DOE/OR/21548-411	

ORIGINATOR	DRAWN BY	DATE

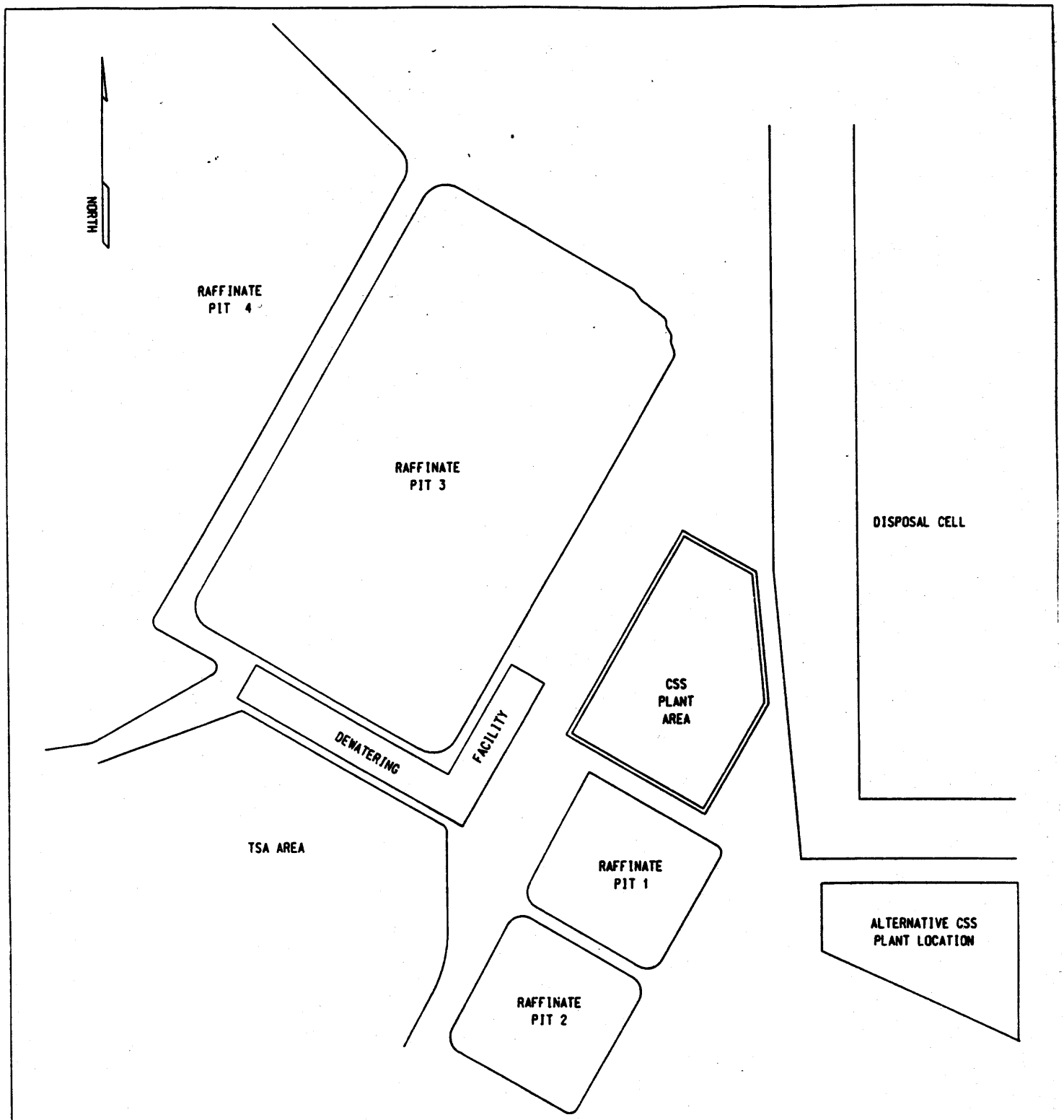
CAD FILE: W03840/JOEFLOW.DGN PLOT DATE: 11/30/



MIXING SYSTEM
(FUNCTIONAL DIAGRAM)

FIGURE 5.3.2-13

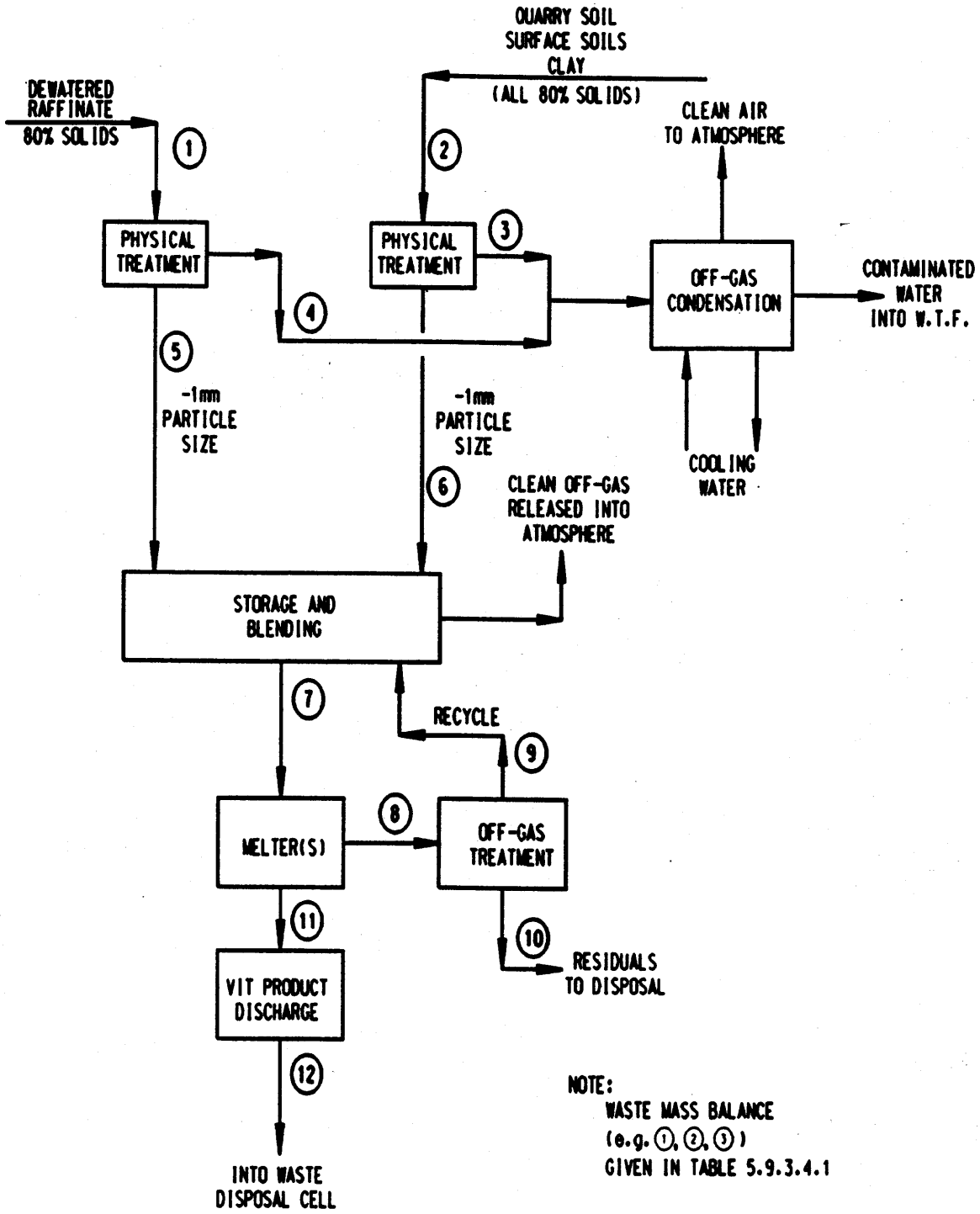
REPORT NO: DOE/OR/21548-411		DRAWING NO:
ORIGINATOR:	DRAWING BY:	DATE: 05/28/93



LOCATION OF CSS PLANT AND DEWATERING FACILITY

FIGURE 5.3.2-14

REPORT NO: DOE/OR/21548-411		DRAWING NO:
ORIGINATOR:	DRAWING BY:	DATE: 05/28/93

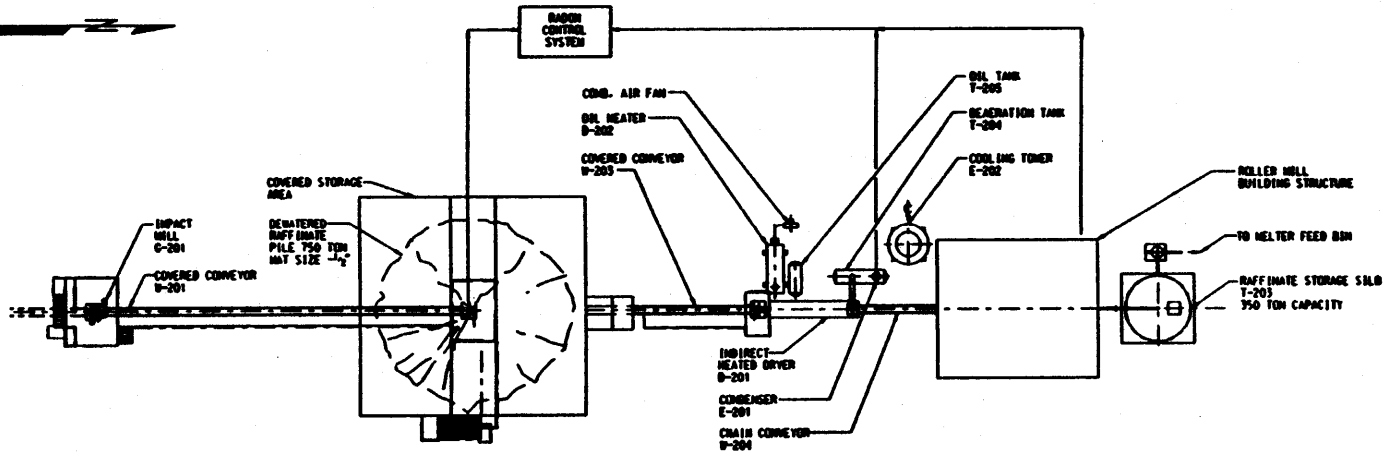


NOTE:
WASTE MASS BALANCE
(e.g. 1, 2, 3)
GIVEN IN TABLE 5.9.3.4.1

CONCEPTUAL FLOW CHART
FOR VITRIFICATION
TREATMENT SYSTEM

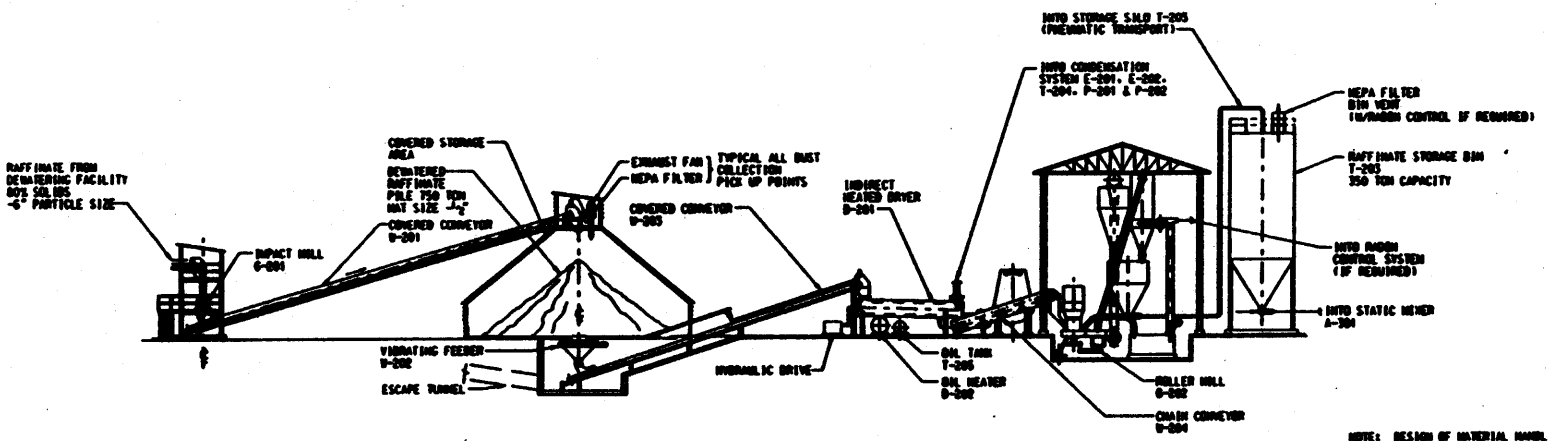
FIGURE 5.3.3-1

REPORT NO.	DRAWING NO.	
DOE/OR/21548-411		
ORIGINATOR	DRAWN BY	DATE



PLAN - RAFFINATE MATERIAL PREPARATION

SCALE: 1/8" = 1'-0"



ELEVATION - RAFFINATE MATERIAL PREPARATION

SCALE: 1/8" = 1'-0"

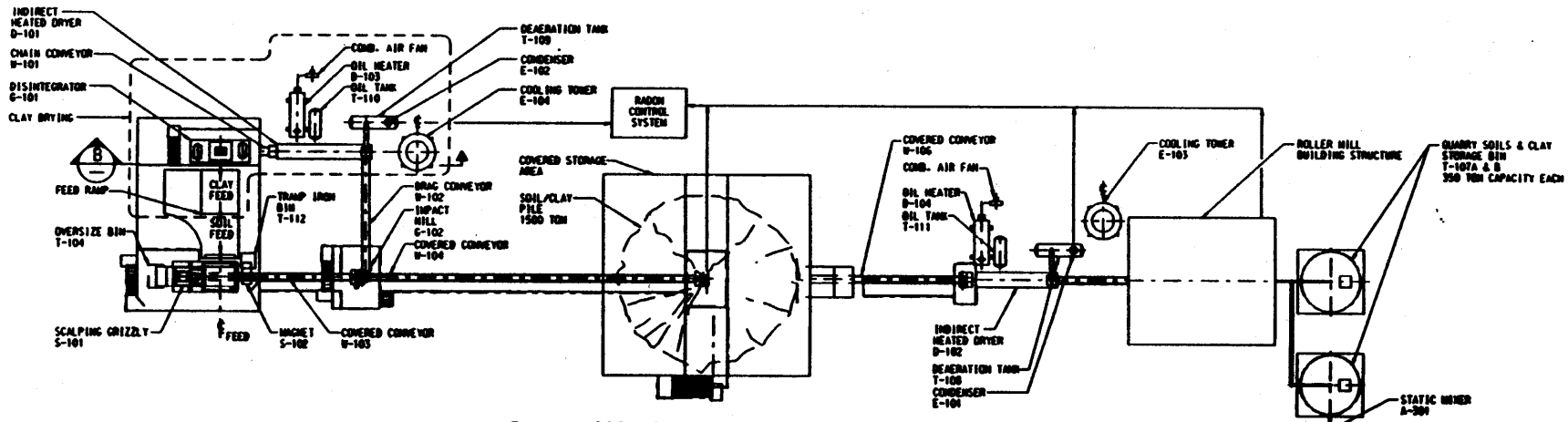
NOTE: DESIGN OF MATERIAL HANDLING SYSTEM IS SHOWN IN ONE LINE FOR CLARITY

GENERAL ARRANGEMENT OF RAFFINATE PRETREATMENT CIRCUITS (PREFERRED DESIGN)

FIGURE 5.3.3-2

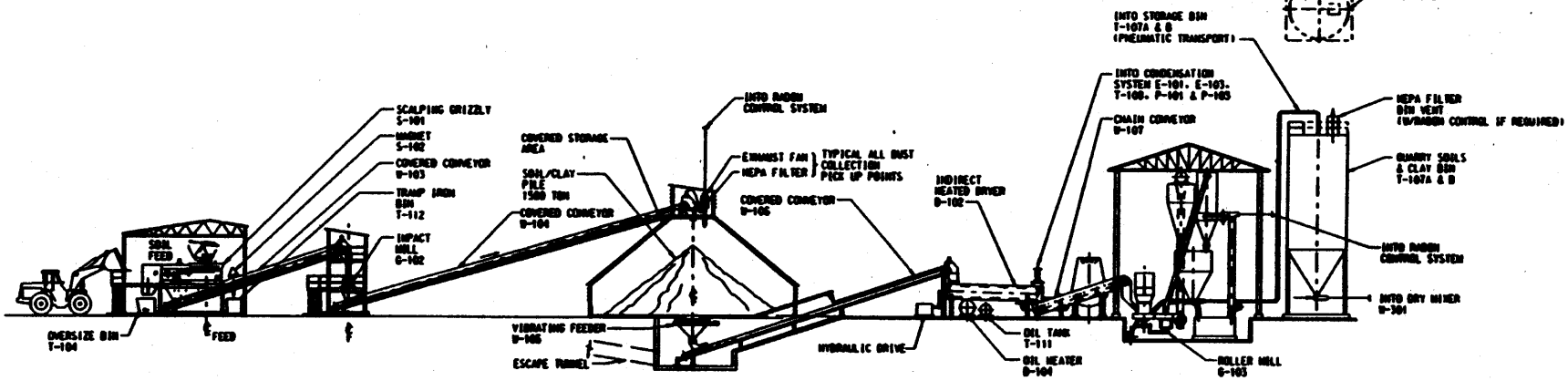
REPORT NO. DOE/OR/21548-411	DRAWING NO.	
ORIGINATOR	DRAWN BY	DATE

CAD FILE: [illegible] PLOT DATE: 08/12/95



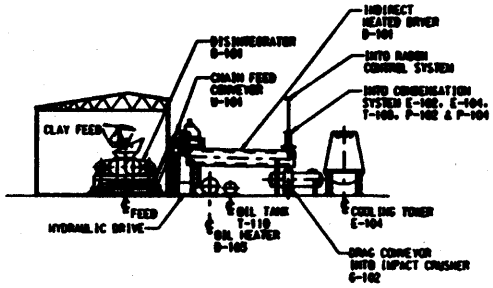
PLAN - SOIL/CLAY SIZING & HANDLING

SCALE: 1/16" = 1'-0"



ELEVATION - SOIL/CLAY SIZING & HANDLING

SCALE: 1/16" = 1'-0"



SECTION B CLAY DRYING

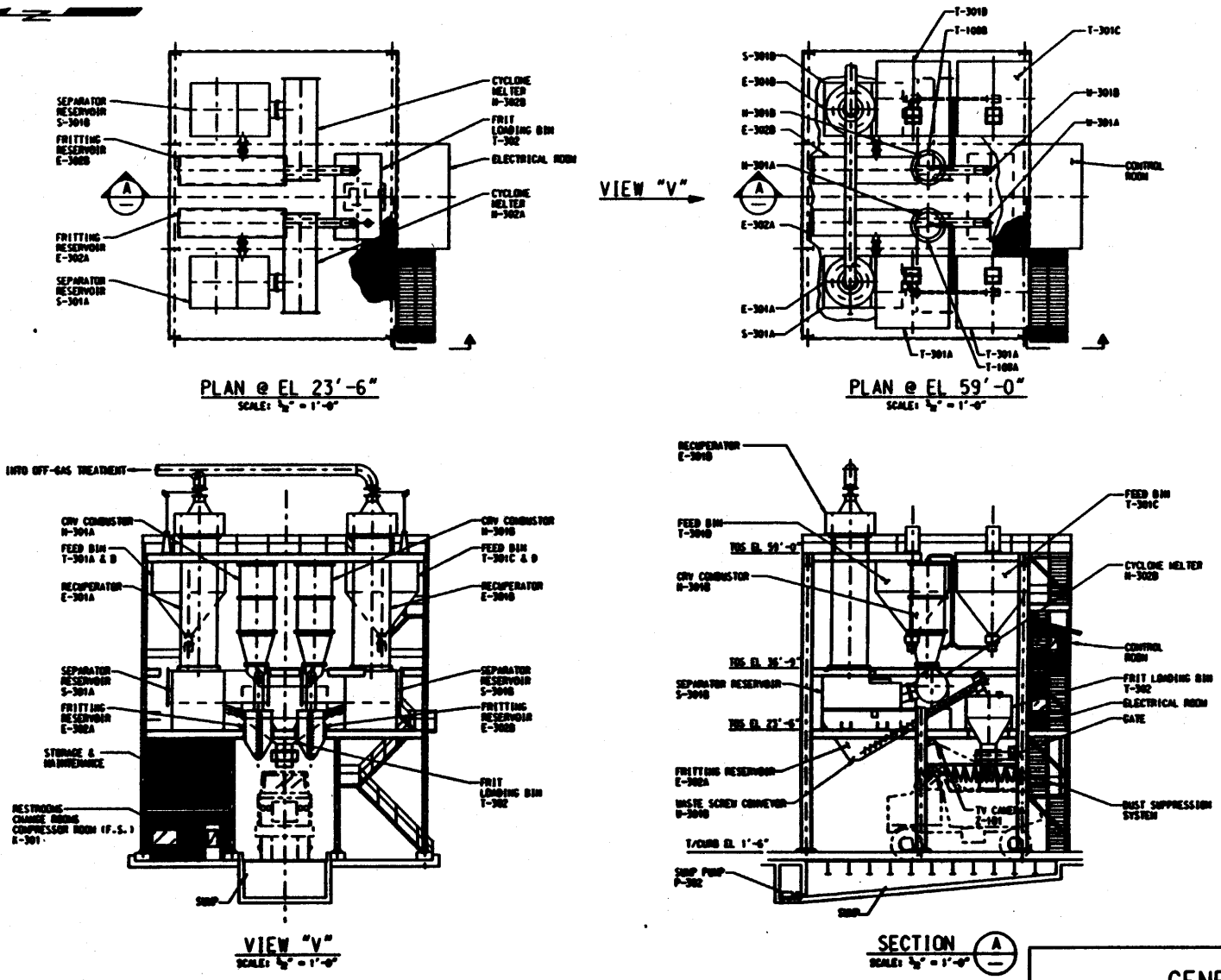
SCALE: 1/16" = 1'-0"

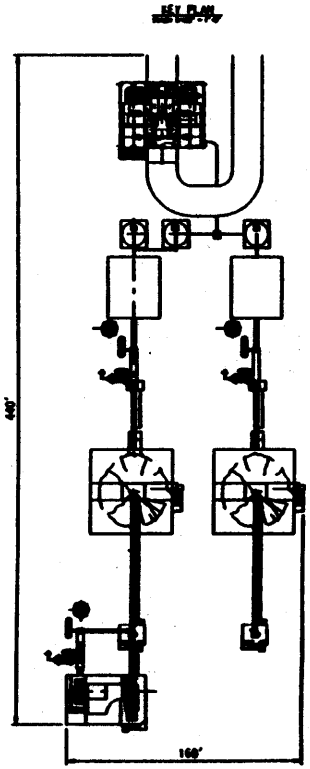
GENERAL ARRANGEMENT OF SOIL/CLAY PRETREATMENT CIRCUITS (PREFERRED DESIGN)

FIGURE 5.3.3-3

REPORT NO.	DRAWING NO.	
DOE/OR/21548-411		
ORIGINATOR	DRAWN BY	DATE

CAD FILE: [illegible] PLOT DATE: 08/11/93



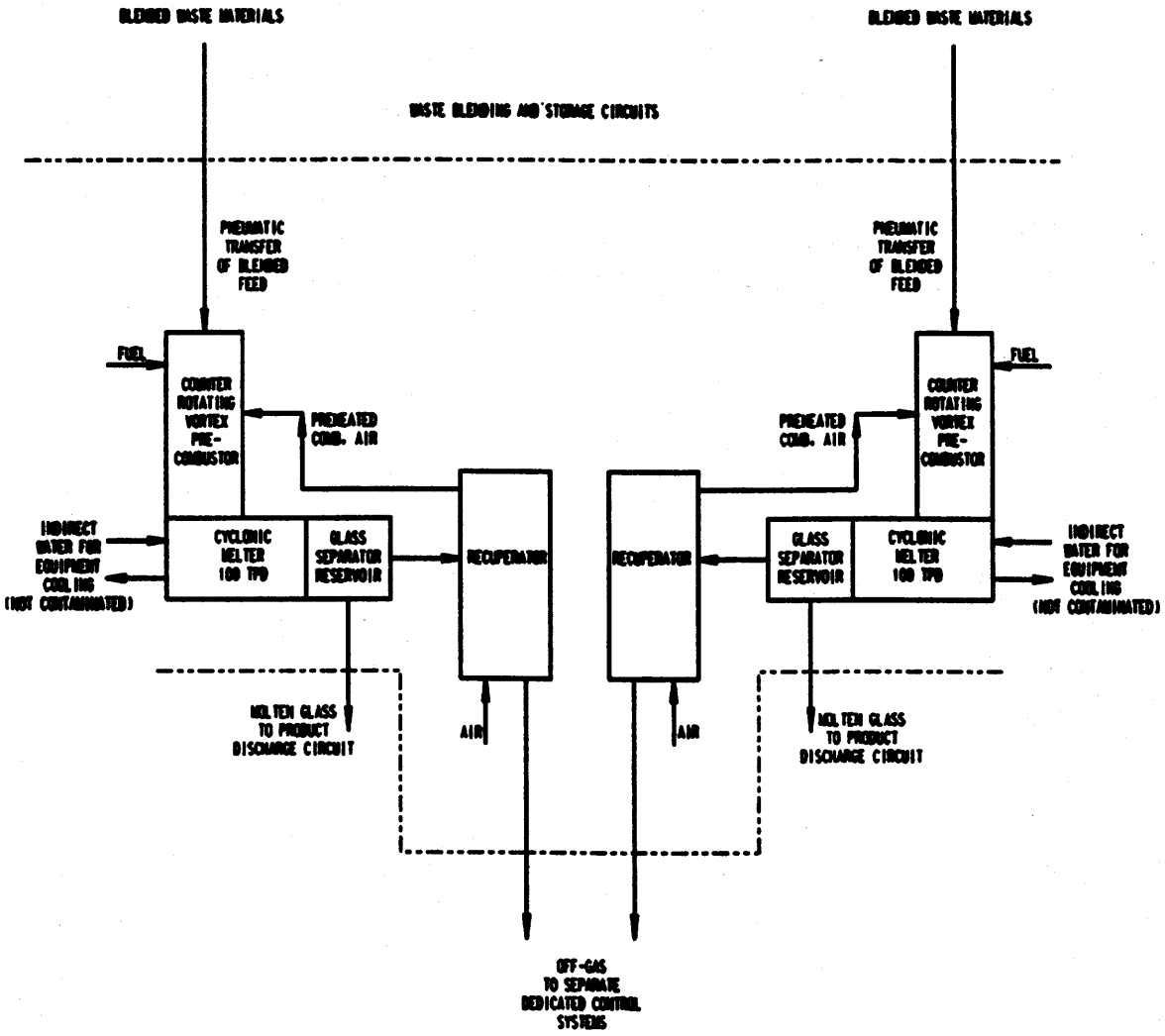


GENERAL ARRANGEMENT OF WASTE STORAGE, MIXING, FEEDING, MELTING AND PRODUCT DISCHARGE CIRCUITS (PREFERRED DESIGN)

FIGURE 5.3.3-4

REPORT NO. DOE/OR/21548-411	DRAWING NO.	
ORIGINATOR	DRAWN BY	DATE

CAD FILE: WE040/530000.DGN PLOT DATE: 09/11/93



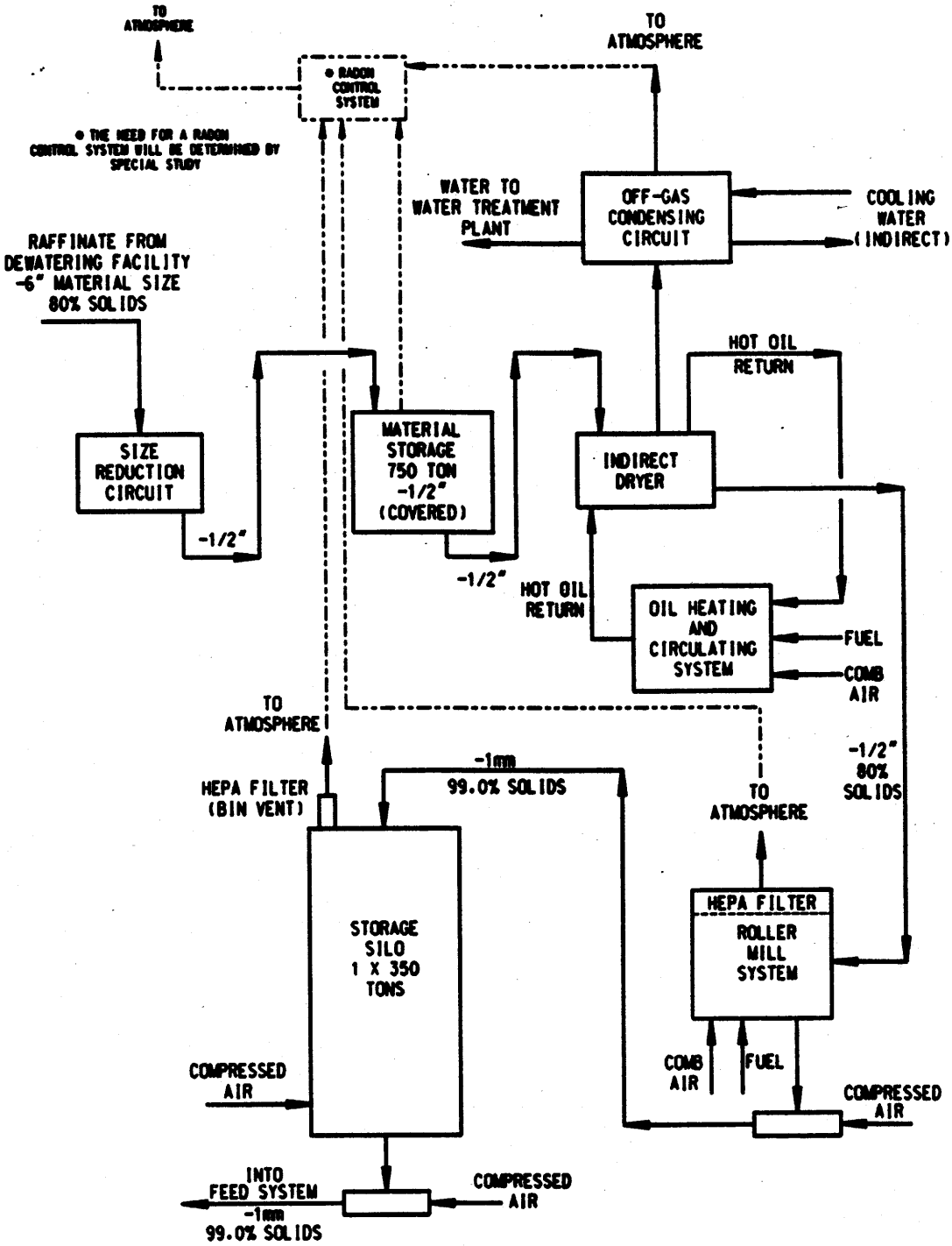
GENERAL FLOW DIAGRAM OF MELTER CIRCUITS

FIGURE 5.3.3-5

REPORT NO.	DRAWING NO
DOE/OR/21548-411	

ORIGINATOR	DRAWN BY	DATE

CAD FILE: W03840/JUEFLOW.DGN PLOT DATE: 11/30/9



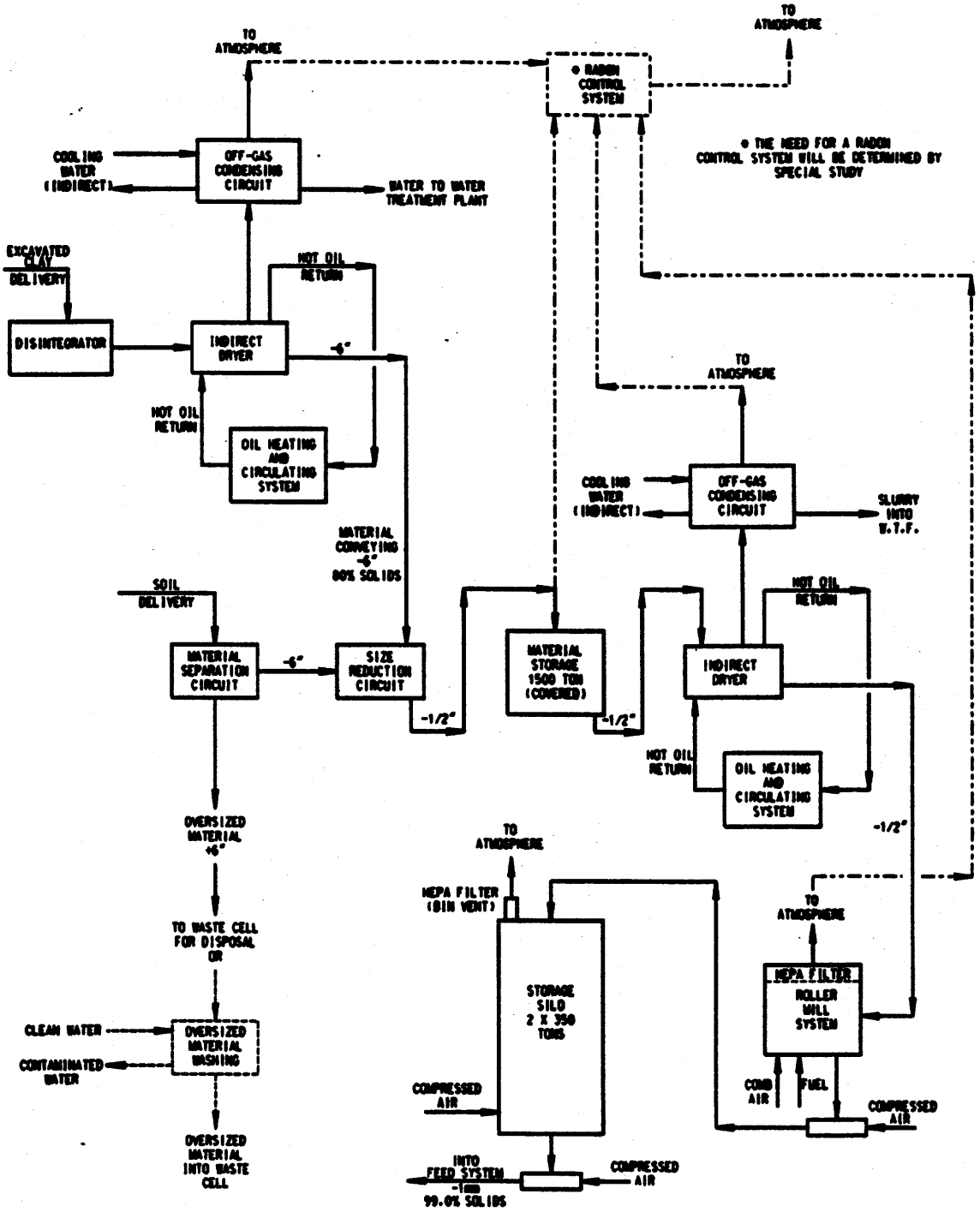
GENERAL FLOW DIAGRAM OF RAFFINATE PRETREATMENT CIRCUITS

FIGURE 5.3.3-6

REPORT NO.	DRAWING NO.
DOE/OR/21548-411	

ORIGINATOR	DRAWN BY	DATE

CAD FILE: W05040/JOEFLOW.DGN PLOT DATE: 11/30/

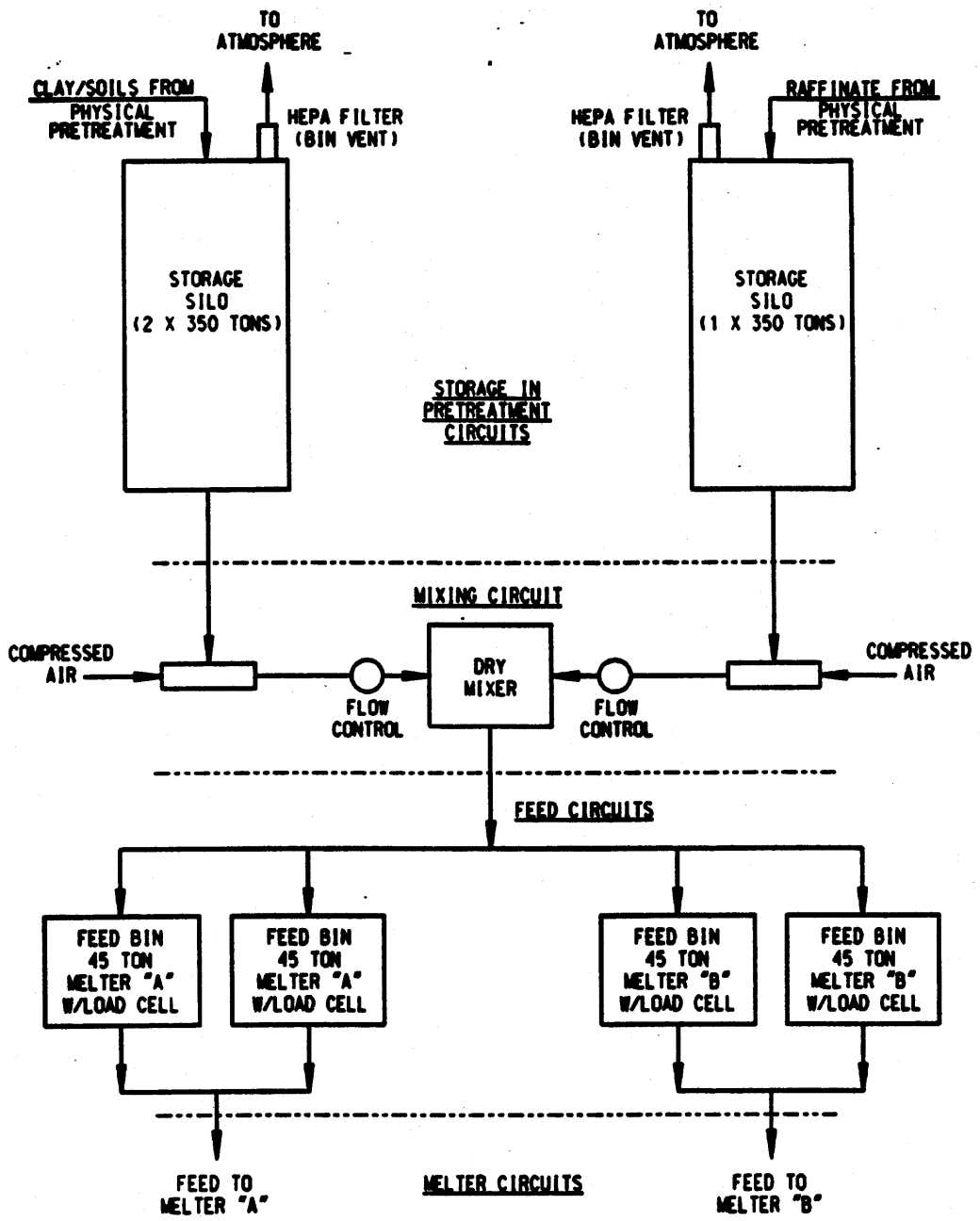


GENERAL FLOW DIAGRAM OF SOIL/CLAY PRETREATMENT CIRCUIT

FIGURE 5.3.3-7

REPORT NO.	DRAWING NO.	
DOE/OR/21548-411		
ORIGINATOR	DRAWN BY	DATE

CAD FILE: W03040/JOEFLOW.DGN PLOT DATE: 11/30



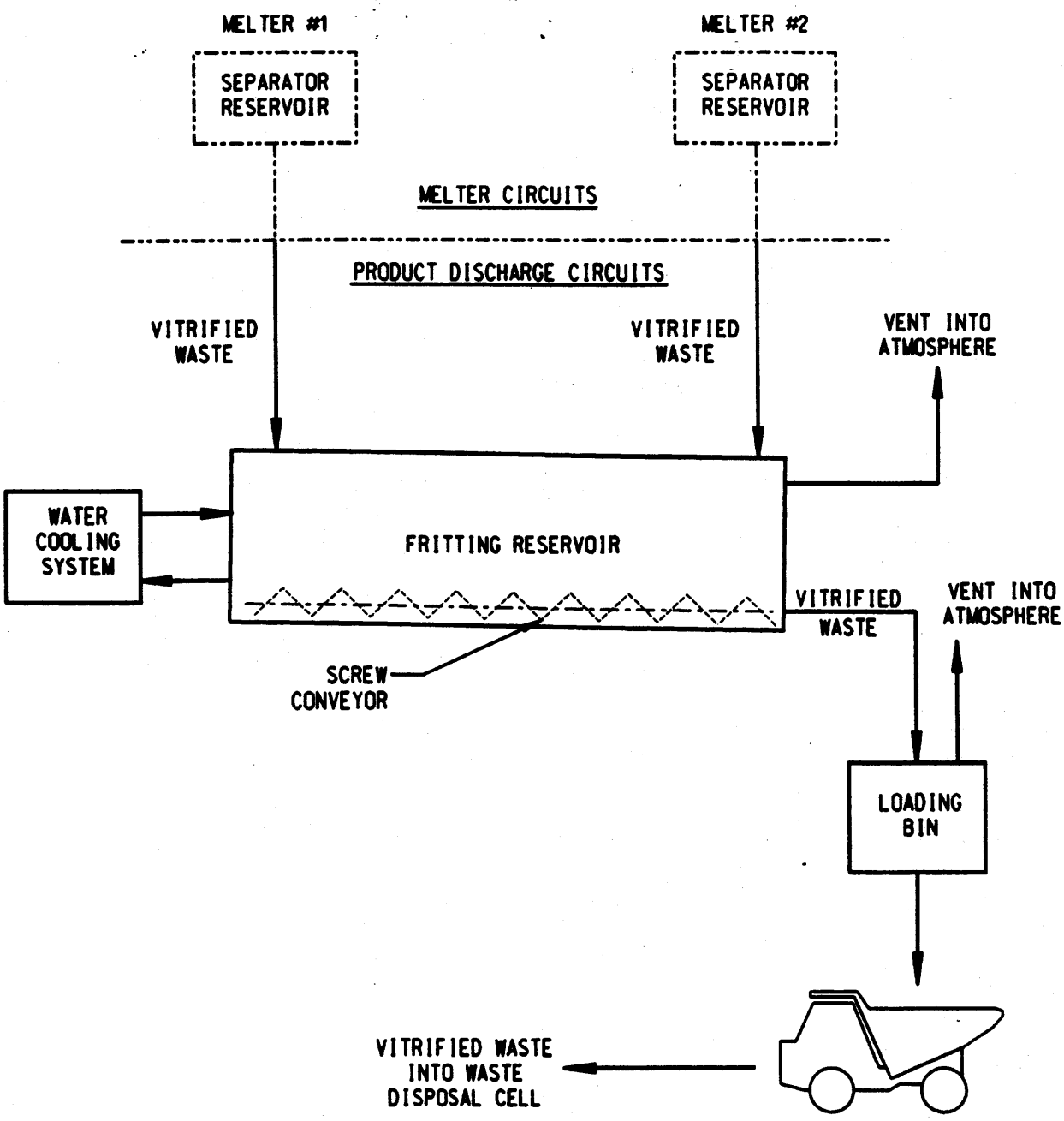
GENERAL FLOW DIAGRAM OF WASTE STORAGE, MIXING AND FEEDING CIRCUITS

FIGURE 5.3.3-8

REPORT NO.	DRAWING NO.
DOE/OR/21548-411	

ORIGINATOR	DRAWN BY	DATE

CAD FILE: W03640/JCEFLOW.DGN PLOT DATE: 11/30/92

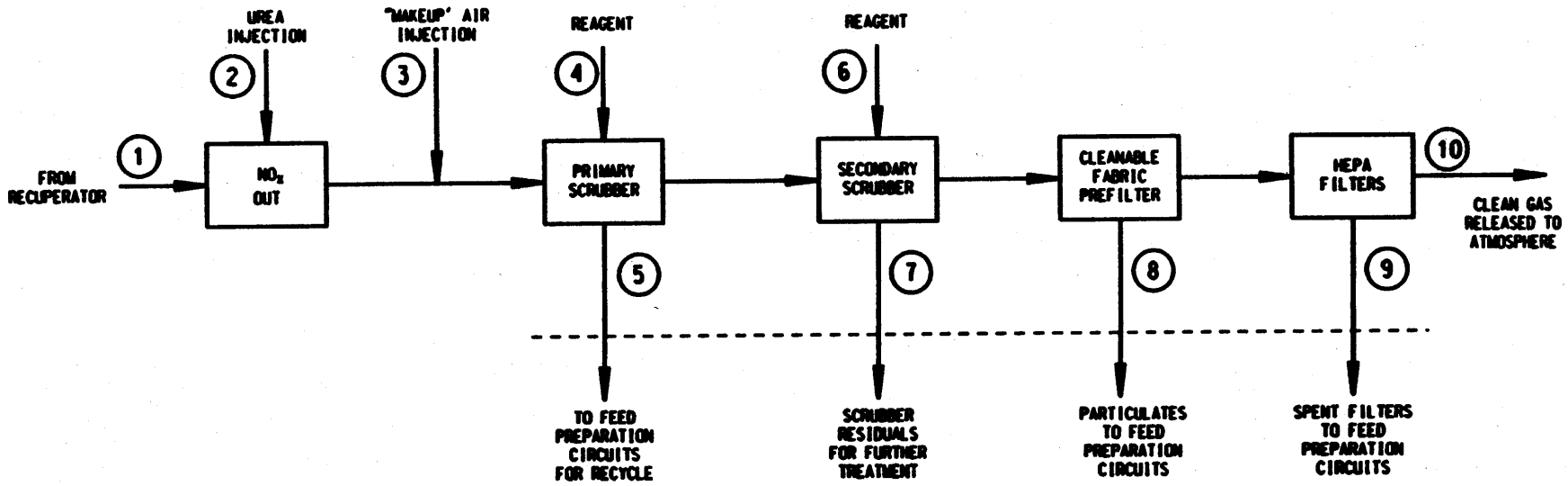


GENERAL FLOW DIAGRAM
OF
PRODUCT DISCHARGE CIRCUIT

FIGURE 5.3.3-9

REPORT NO.	DRAWING NO.	
DOE/OR/21548-411		
ORIGINATOR	DRAWN BY	DATE

CAD FILE: 103640/JOEFLOW.DGN PLOT DATE: 11/30/92

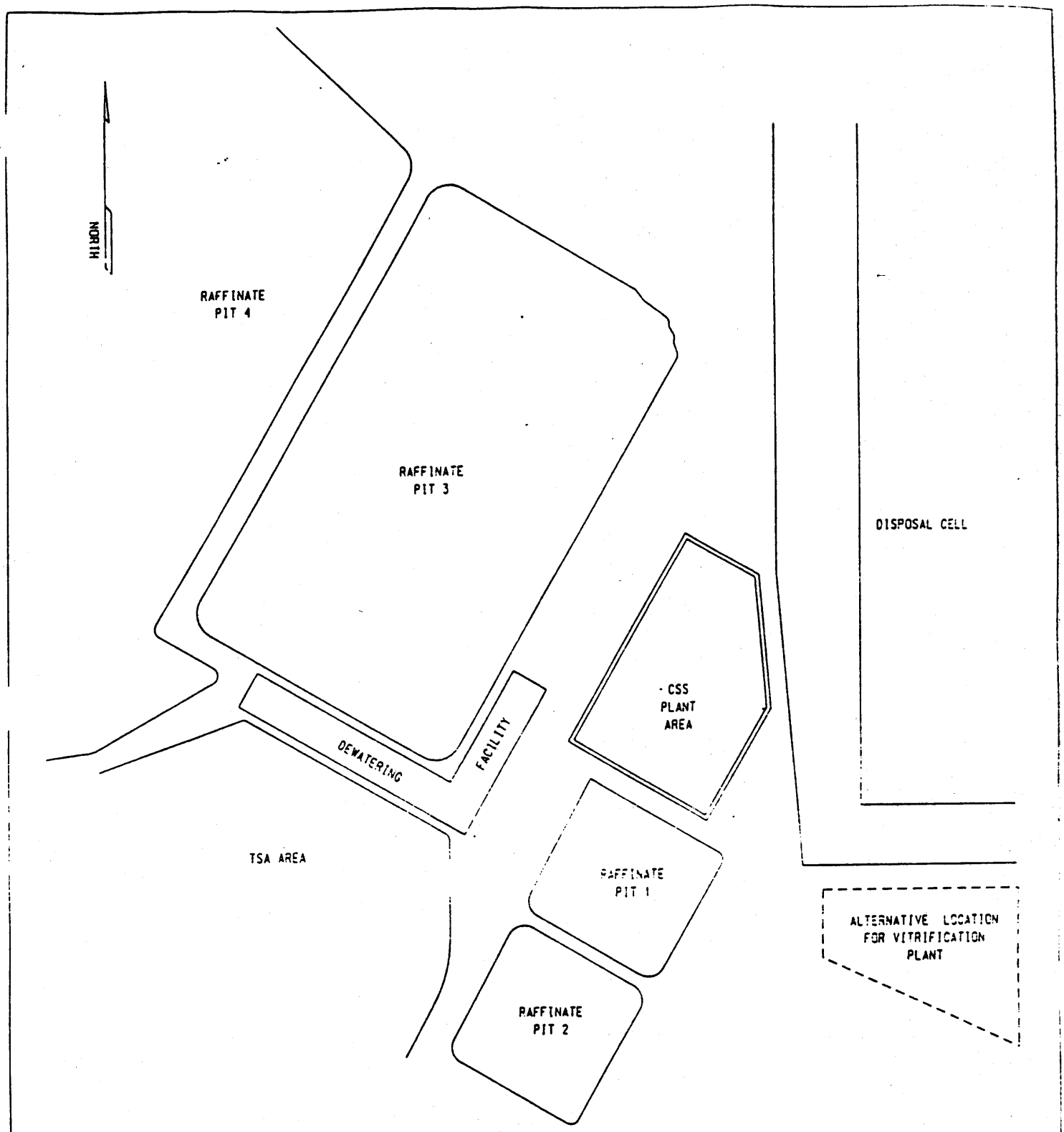


GENERAL FLOW DIAGRAM FOR OFF-GAS TREATMENT CIRCUITS

FIGURE 5.3.3-10

REPORT NO. DOE/OR/21548-411 | DRAWING NO.

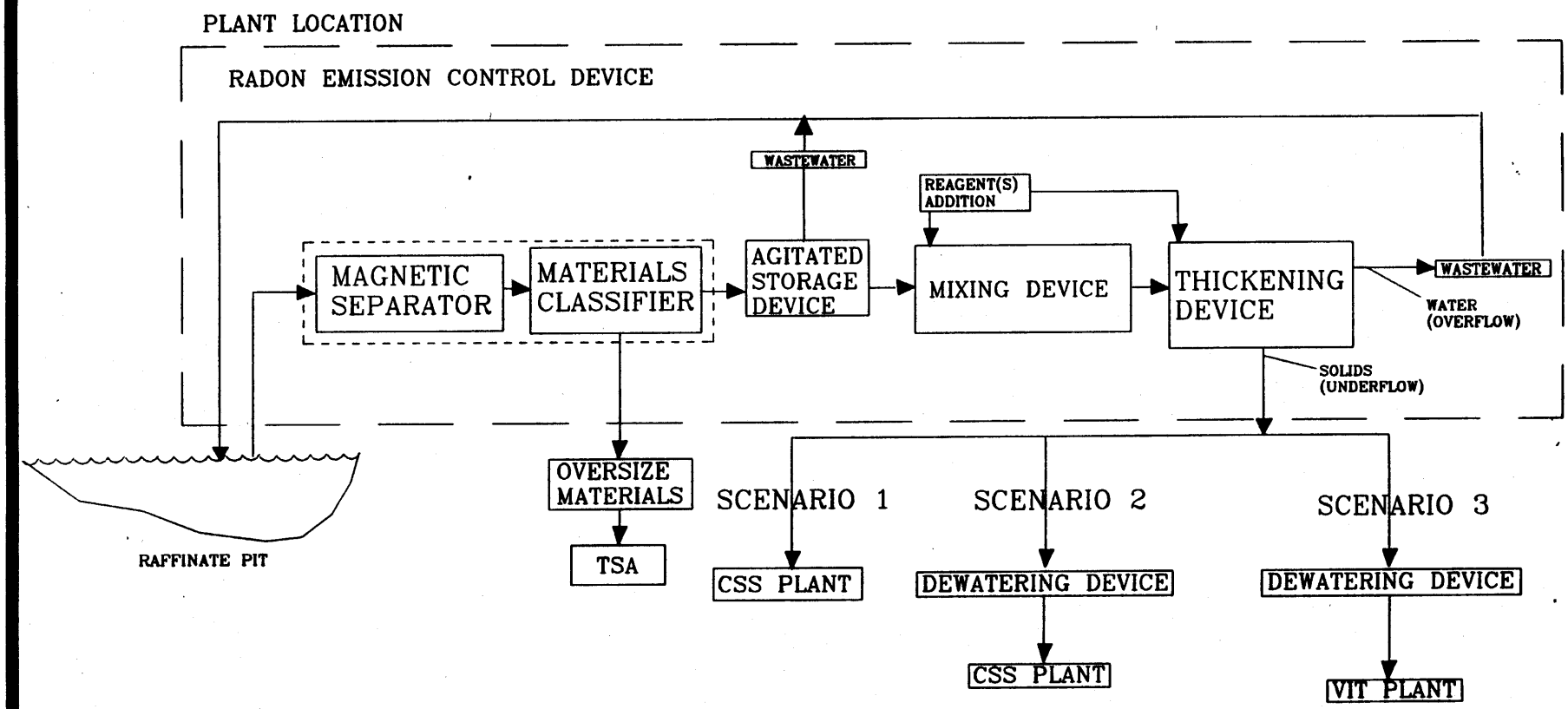
ORIGINATOR | DRAWN BY | DATE



LOCATION OF VITRIFICATION FACILITY

FIGURE 5.3.3-11

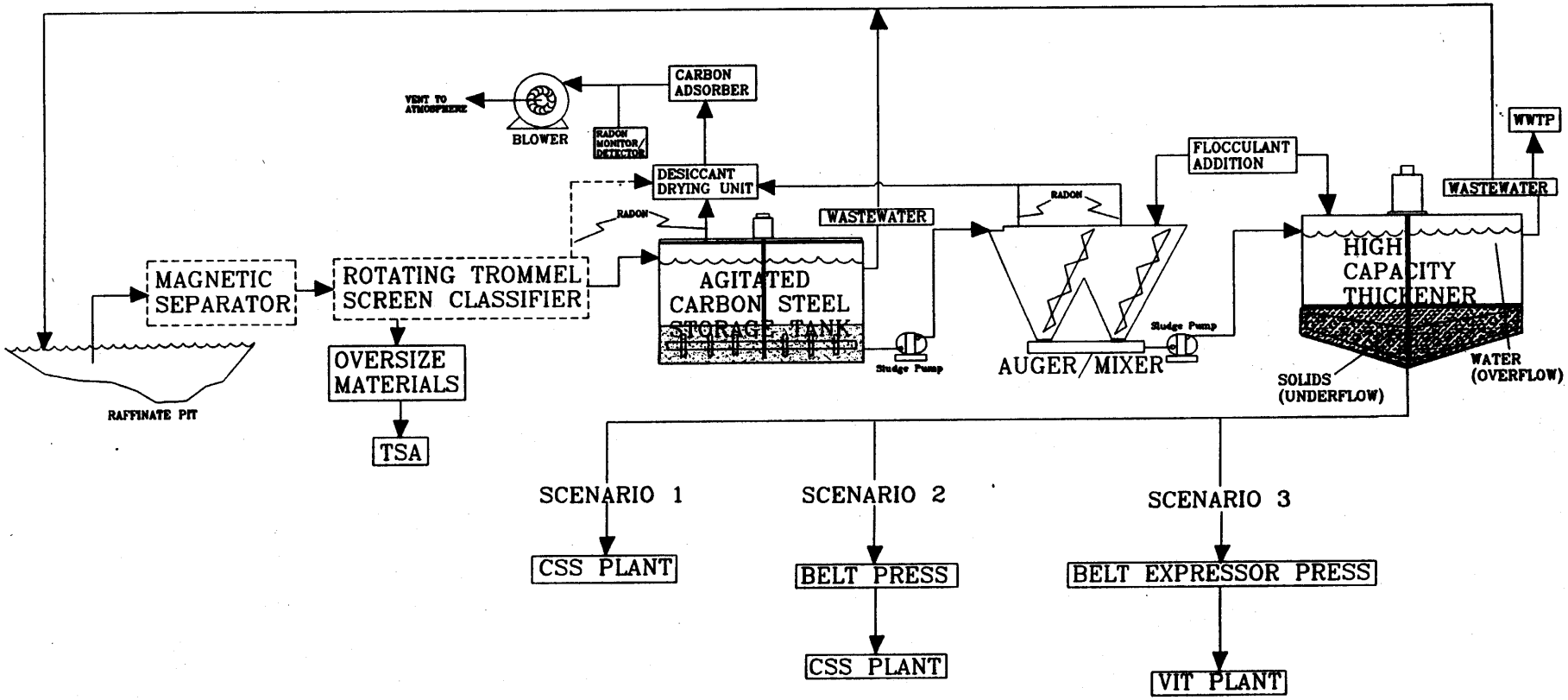
REPORT NO: DOE/OR/21548-411		DRAWING NO:
ORIGINATOR:	DRAWING BY:	DATE: 05/29/93



CONCEPTUAL DEWATERING PROCESS FOR THE RAFFINATE SLUDGES

FIGURE 5.3.5 – 1

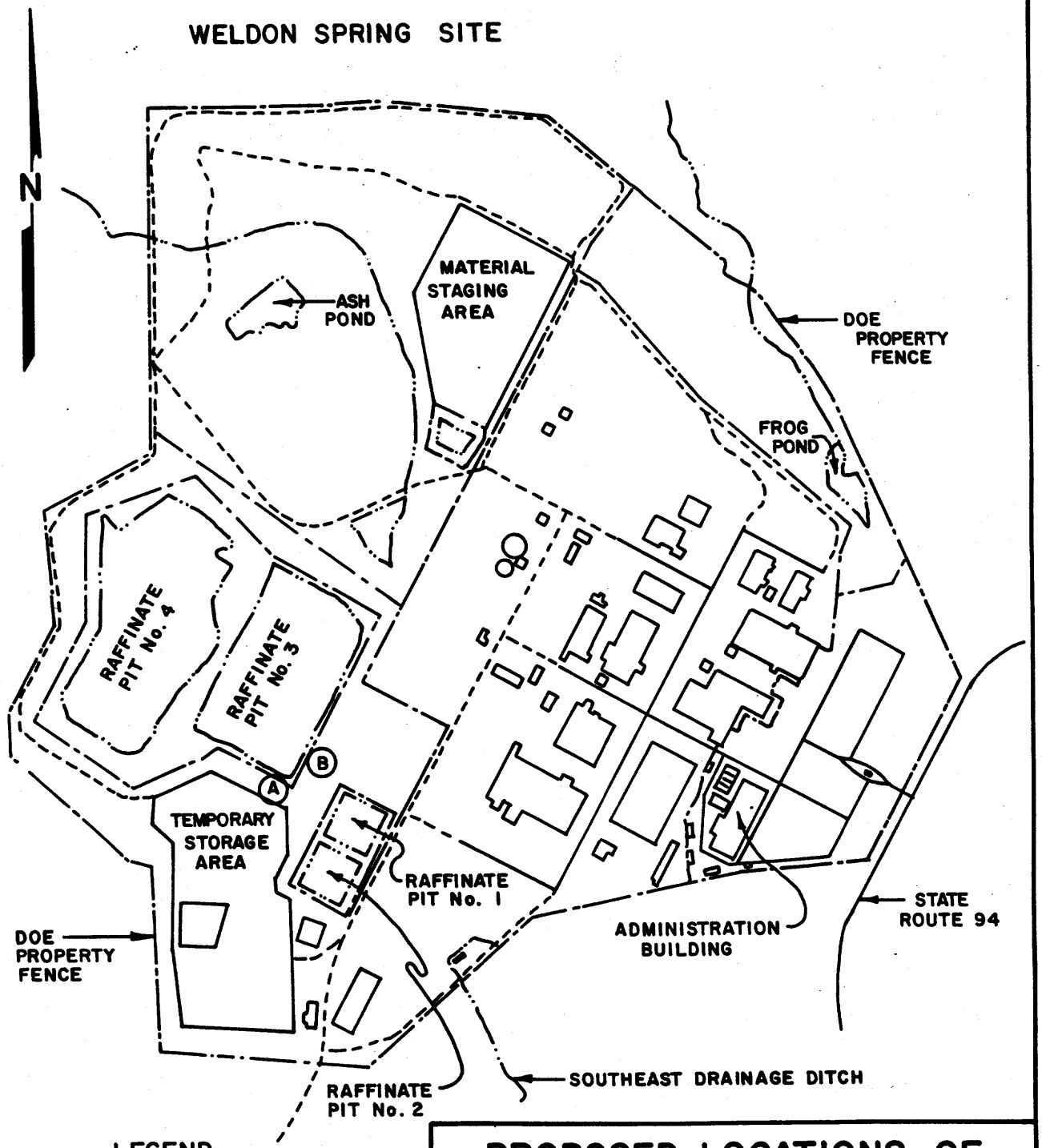
REPORT NO: DOE/OR/21548-411	DRAWING NO: Rev. 0	
ORIGINATOR:	DRAWN BY: OLL	DATE: 9/8/93



CONCEPTUAL SELECTION OF DEWATERING PROCESSING EQUIPMENT FOR RAFFINATE SLUDGES

FIGURE 5.3.5 – 2

REPORT NO: DOE/OR/21548-411	DRAWING NO: Rev. 0	
ORIGINATOR:	DRAWN BY: OLL	DATE: 9/8/93



LEGEND

(A) (B) PROPOSED LOCATIONS RAFFINATE SLUDGE DEWATERING PLANTS

0 500 1000 Ft.

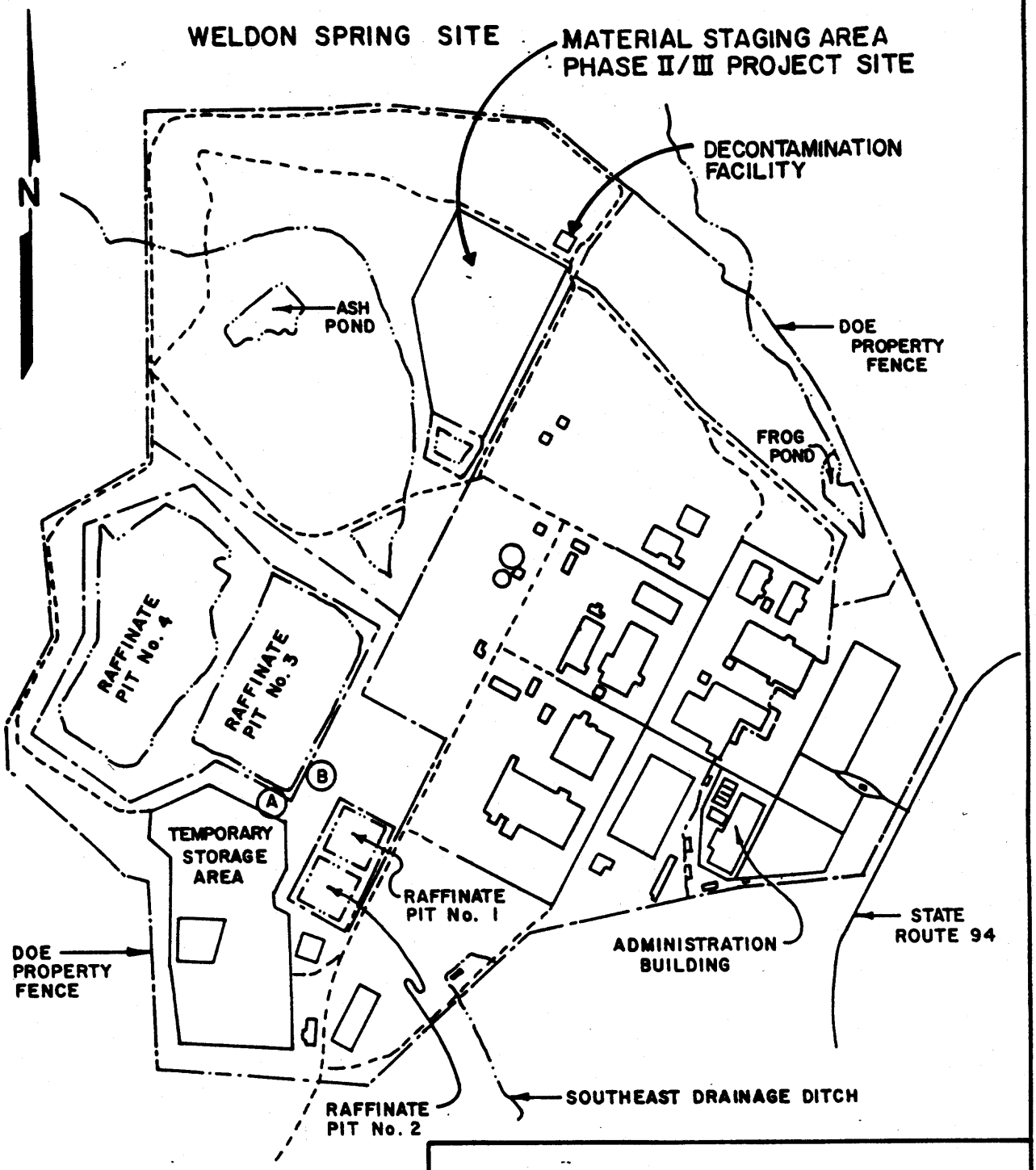
0 152.4 304.8 M

SCALE

PROPOSED LOCATIONS OF RAFFINATE SLUDGE DEWATERING PLANT

FIGURE 5.3.5-3

REPORT NO.: DOE/OR/21548-411	DRAWING NO.:	
ORIGINATOR: L.L.	DRAWN BY: ray	DATE: DEC., 1992



0 500 1000 Ft.

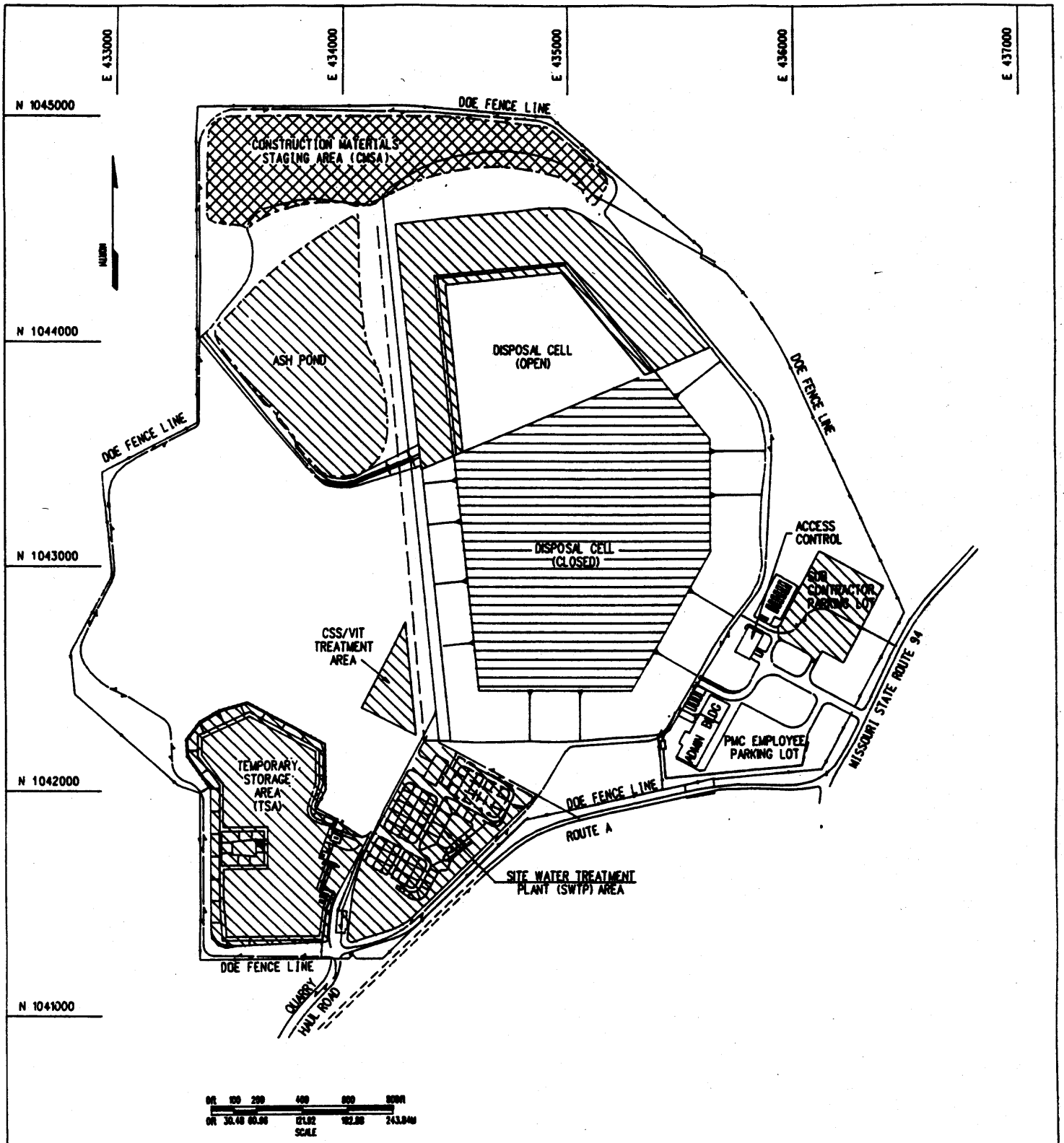
0 152.4 304.8 M

SCALE

DECONTAMINATION FACILITY LOCATION

FIGURE 5.3.6-1

REPORT NO.: DOE/OR/21548-411	DRAWING NO.:	
ORIGINATOR: L.L.	DRAWN BY: ray	DATE: DEC., 1992



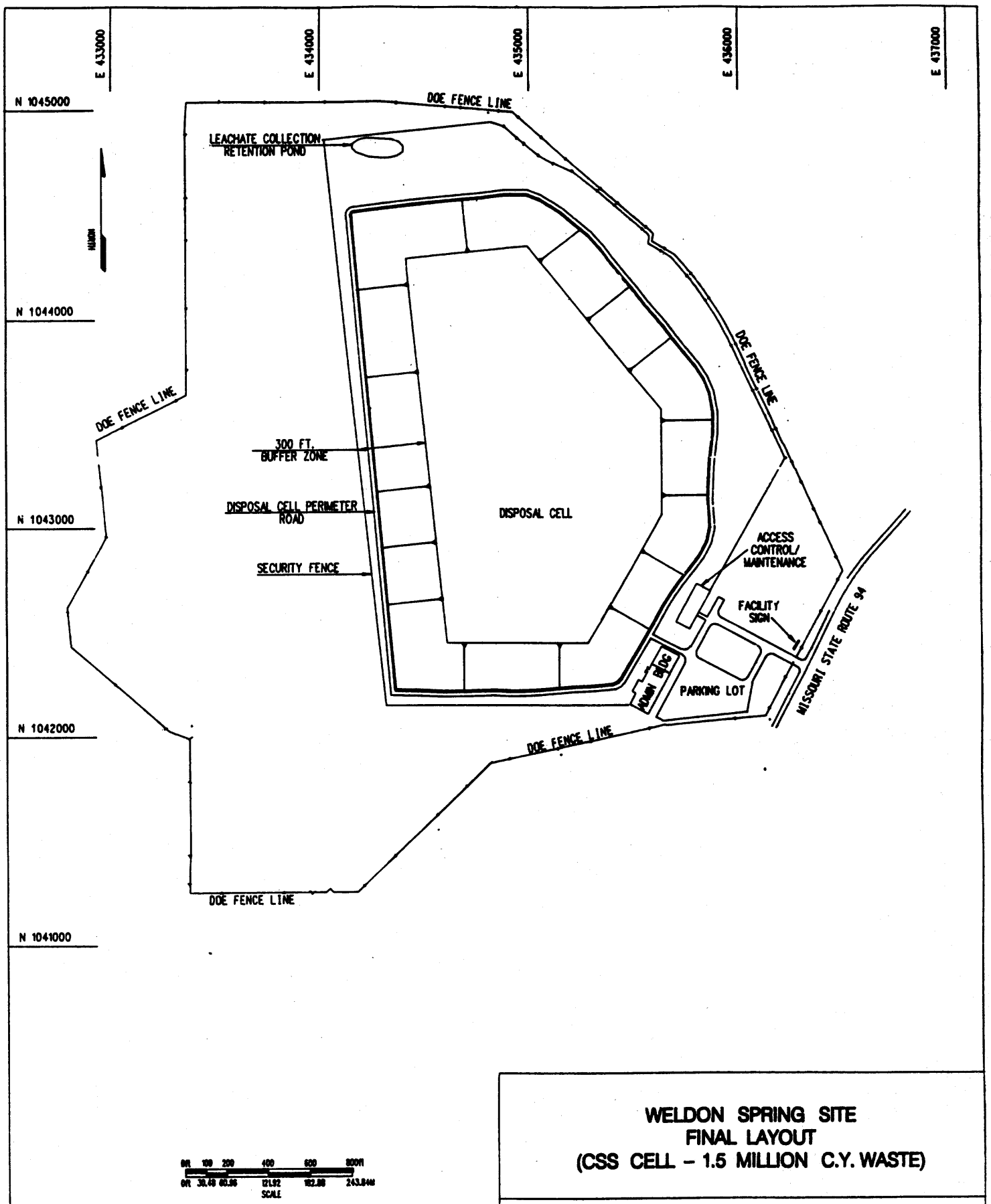
LEGEND

- ROADS
- CLEAN MATERIAL (MAY BE USED AS SITE RESTORATION MATERIAL)
- CONTAMINATED MATERIAL THAT MUST BE REMOVED PRIOR TO SITE CLOSURE
- COVER OF DISPOSAL FACILITY (CELL)

WELDON SPRING SITE
(PRIOR TO SITE CLOSURE ACTIVITIES)

FIGURE 5.4-1

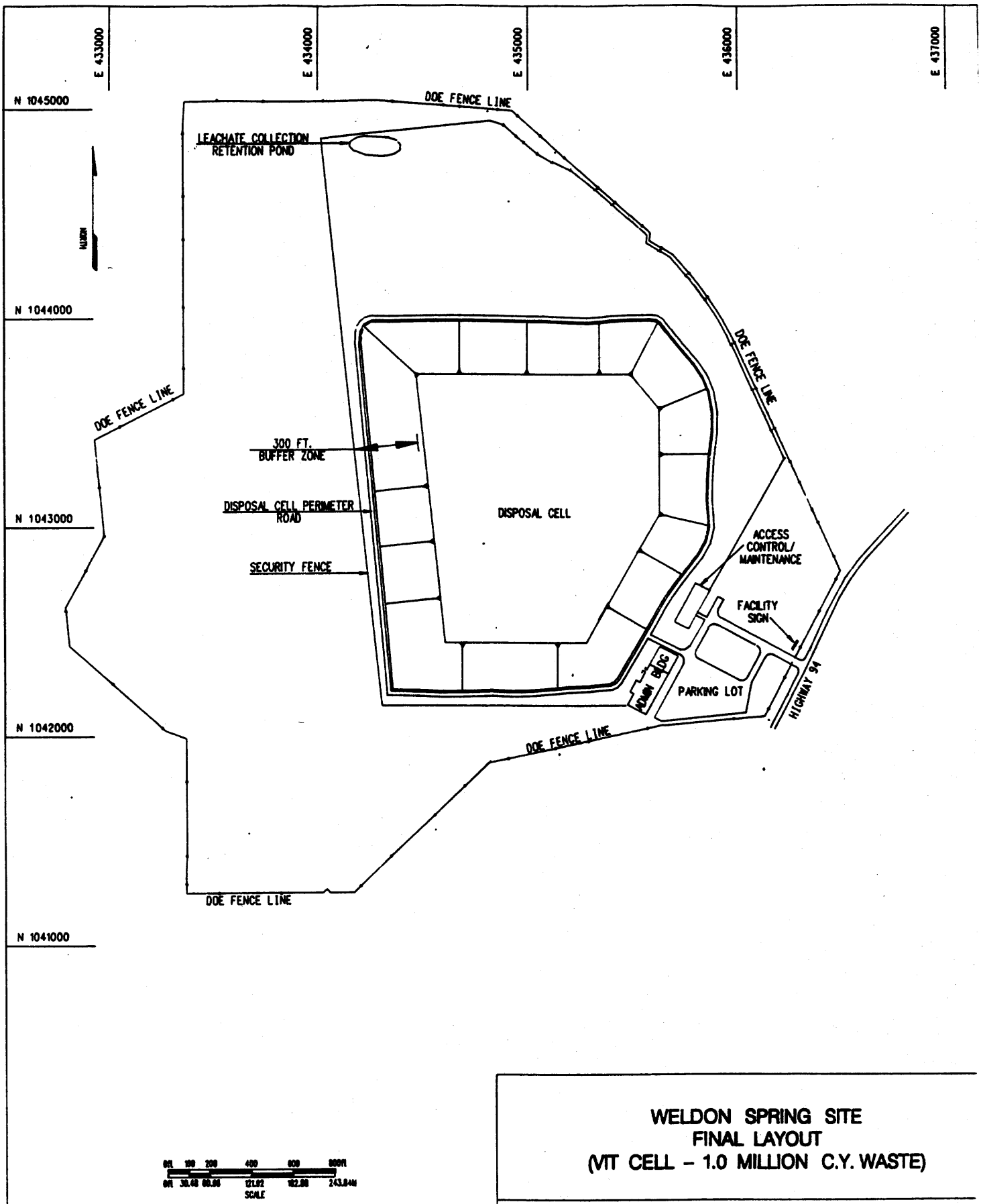
REPORT NO: DOE/OR/21548-411		DRAWING NO: 384001/ULRICH.DGN	
ORIGINATOR: UC	DRAWING BY: CWF	DATE: 11/24/92	



WELDON SPRING SITE
FINAL LAYOUT
(CSS CELL – 1.5 MILLION C.Y. WASTE)

FIGURE 5.4–2

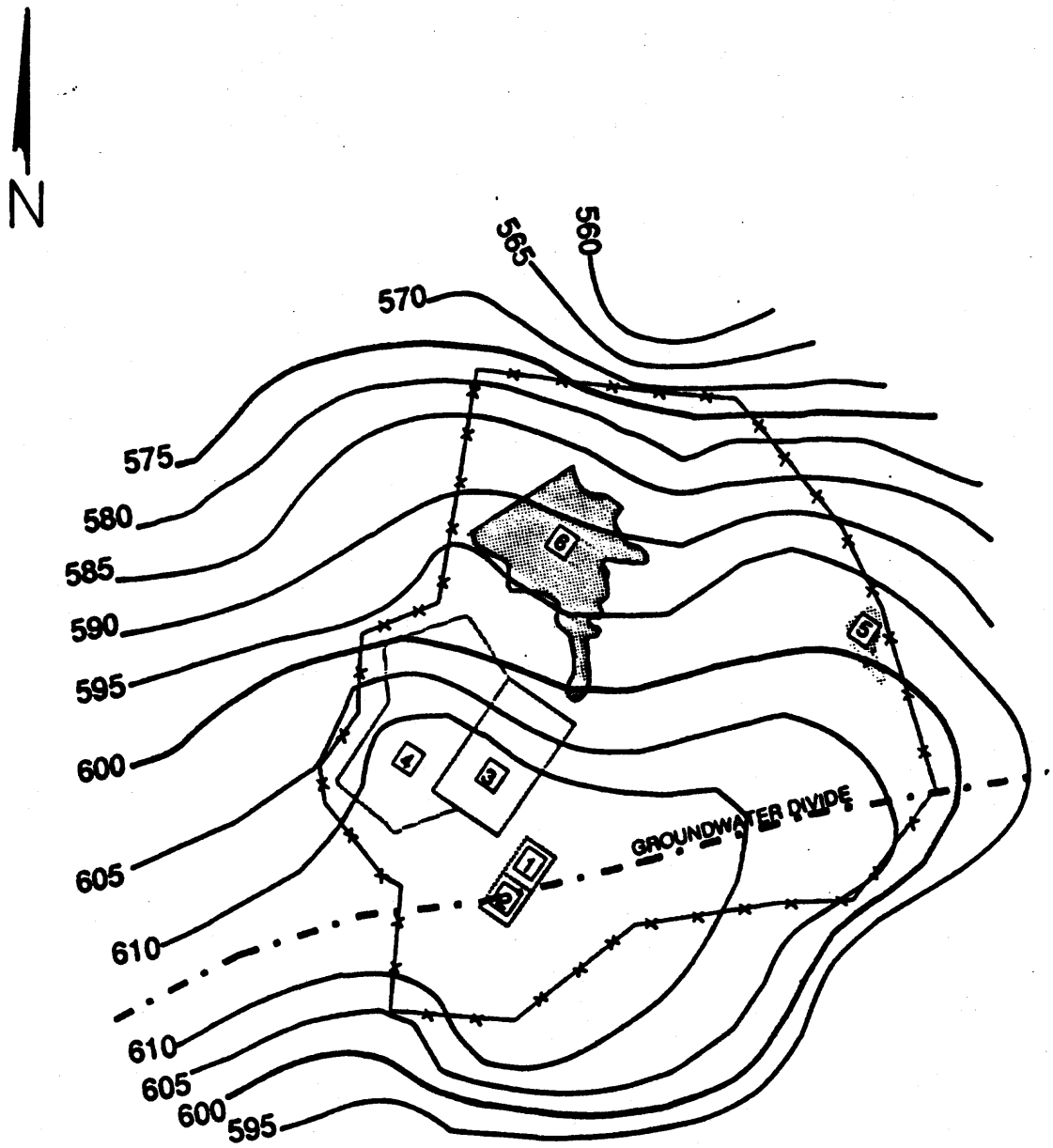
REPORT NO: DOE/OR/21548-411	DRAWING NO:	
ORIGINATOR: UC	DRAWING BY: CWF	DATE: 11/24/92



WELDON SPRING SITE
FINAL LAYOUT
(VIT CELL – 1.0 MILLION C.Y. WASTE)

FIGURE 5.4–3

REPORT NO: DOE/OR/21548-411		DRAWING NO:	
ORIGINATOR: UC	DRAWING BY: CWF		DATE: 11/30/92



NOT TO SCALE

LEGEND

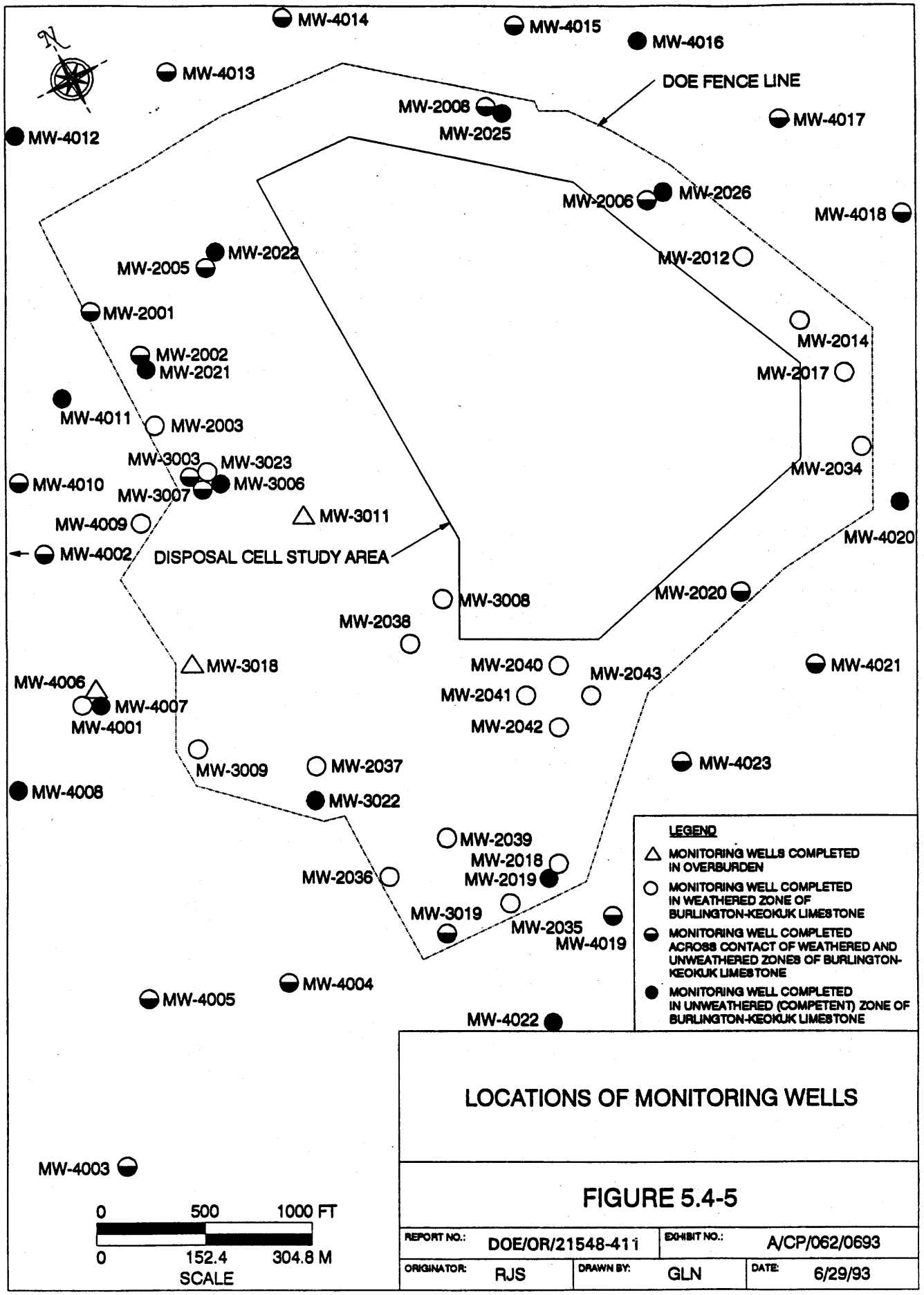
- 1 RAFFINATE PIT 1
- 2 RAFFINATE PIT 2
- 3 RAFFINATE PIT 3
- 4 RAFFINATE PIT 4
- 5 FROG POND
- 6 ASH POND
- GROUNDWATER DIVIDE
- FENCE

(from Supporting Study 4B)

SURFACE OF THE SHALLOW GROUNDWATER TABLE

FIGURE 5.4-4

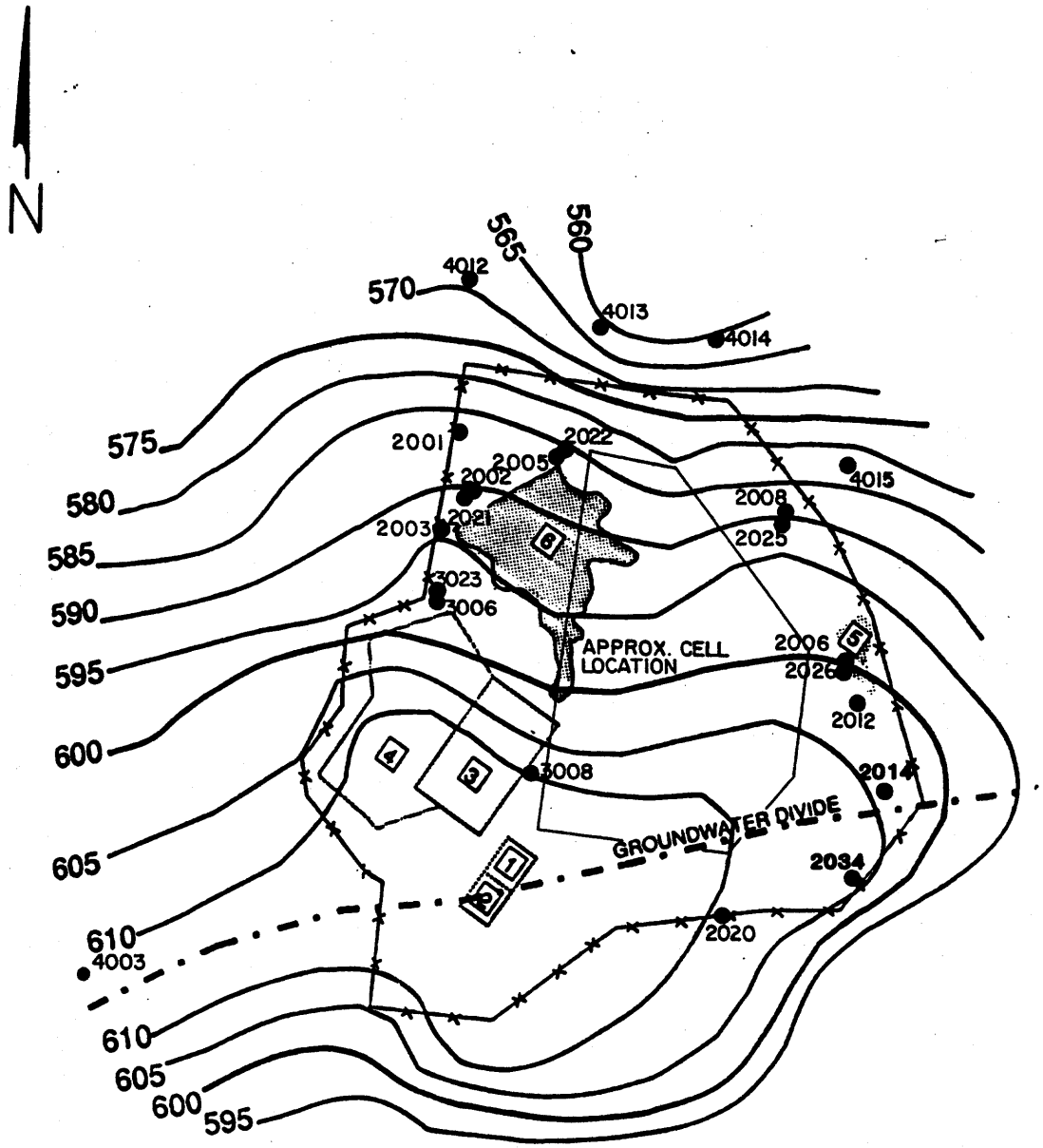
REPORT NO.: DOE/OR/21548-411	DRAWING NO.:	
ORIGINATOR: U.C.	DRAWN BY: K.W.	DATE: NOV., 1992



LOCATIONS OF MONITORING WELLS

FIGURE 5.4-5

REPORT NO.: DOE/OR/21548-411		EXHIBIT NO.: A/CP/062/0693	
ORIGINATOR: RJS	DRAWN BY: GLN	DATE: 6/29/93	



NOT TO SCALE

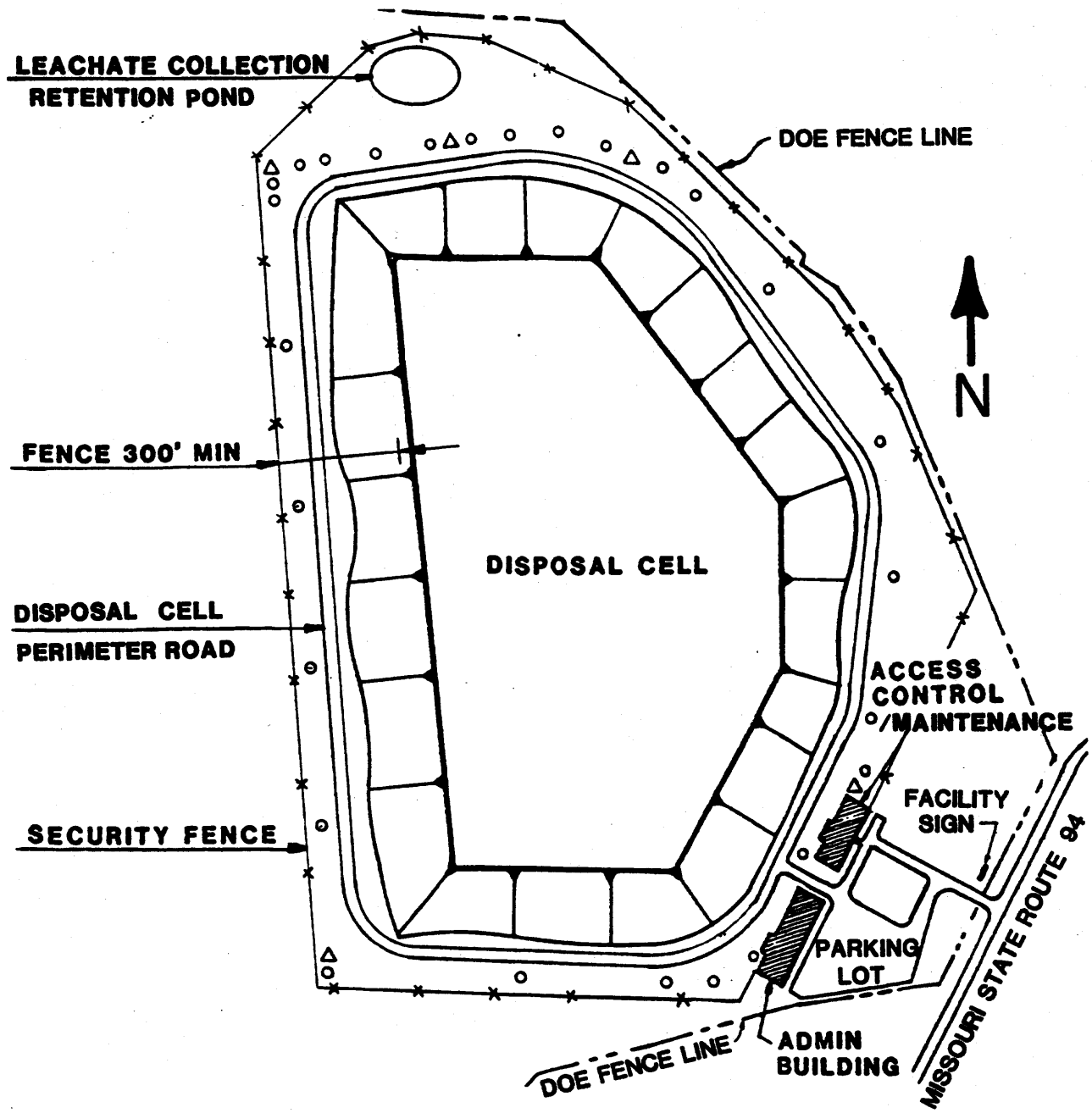
LEGEND

- 1 RAFFINATE PIT 1
- 2 RAFFINATE PIT 2
- 3 RAFFINATE PIT 3
- 4 RAFFINATE PIT 4
- 5 FROG POND
- 6 ASH POND
- ● MONITORING WELL
- 605 POTENTIOMETRIC SURFACE
- GROUNDWATER DIVIDE
- DOE FENCE LINE

LOCATION OF MONITORING WELLS TO REMAIN FOR POST-CLOSURE MONITORING

FIGURE 5.4-6

REPORT NO.: DOE/OR/21548-411	DRAWING NO.:	
ORIGINATOR: U.C.	DRAWN BY: K.W.	DATE: NOV., 1992



0 500 1000 FT

0 152.4 304.8 M

SCALE

LEGEND

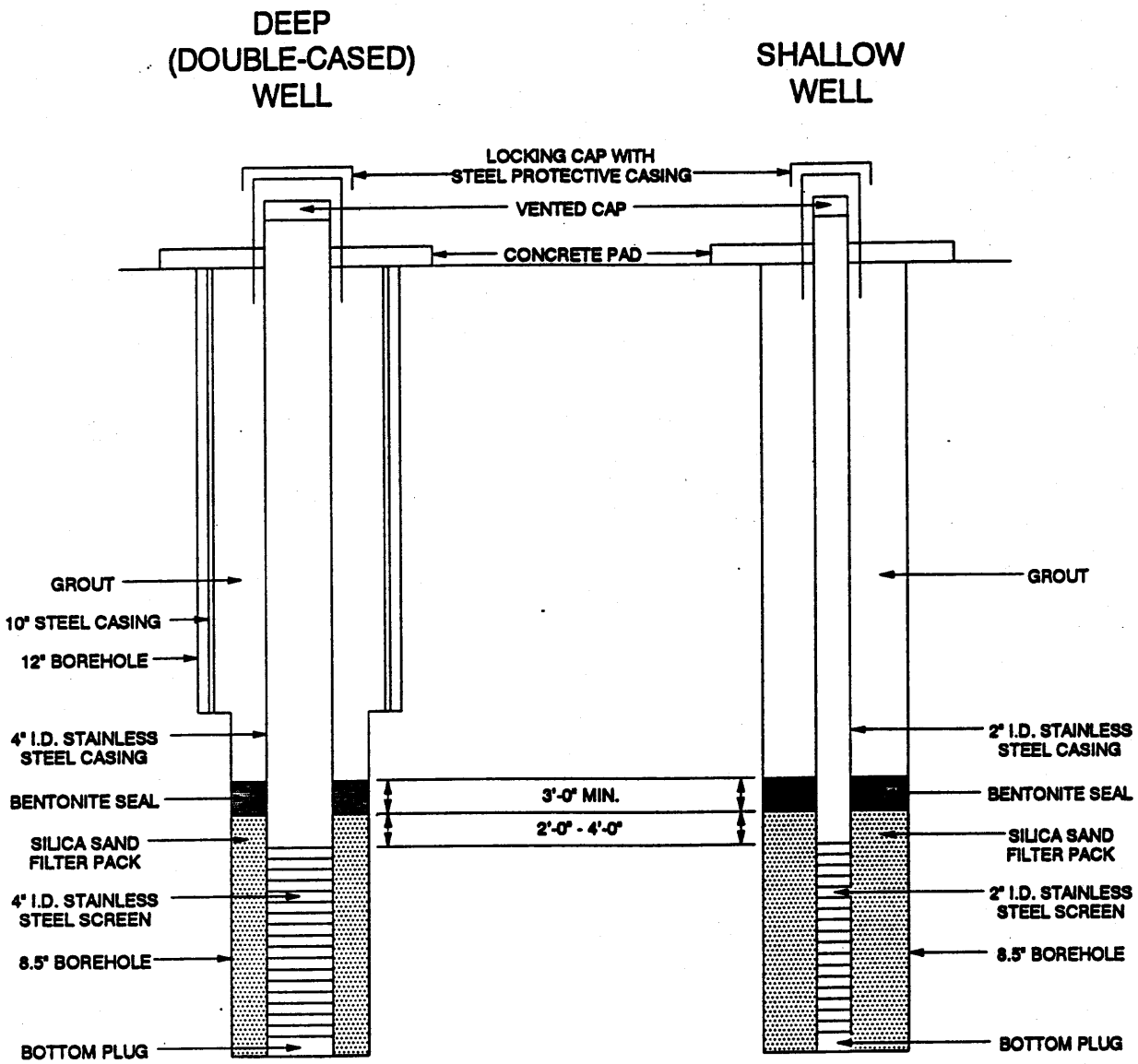
o MONITORING WELL IN WEATHERED ZONE OF SHALLOW BEDROCK AQUIFER

△ MONITORING WELL IN WEATHERED ZONE OF SHALLOW BEDROCK AQUIFER

LOCATIONS OF ADDITIONAL POST-CLOSURE MONITORING WELLS

FIGURE 5.4-7

REPORT NO.: DOE/OR/21548-411	DRAWING NO.:	
ORIGINATOR: U.C.	DRAWN BY: K.W.	DATE: NOV., 1992



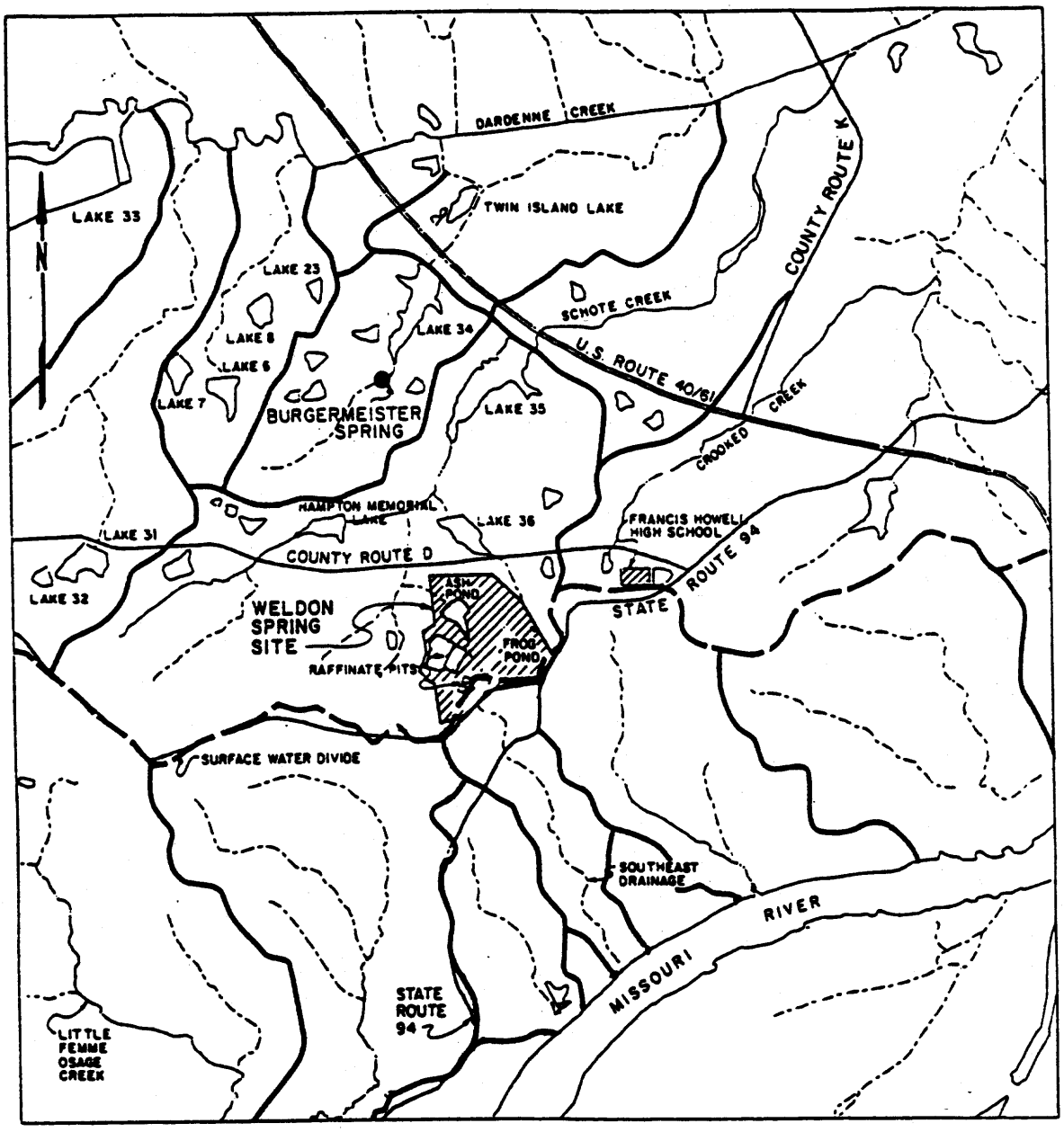
NOT TO SCALE

SOURCE : (MKF AND JEG, 1988)

TYPICAL MONITORING WELL CONSTRUCTION

FIGURE 5.4- 8

REPORT NO.: DOE/OR/21548-411		EXHIBIT NO.: A/PI/094/0693	
ORIGINATOR: RJS	DRAWN BY: GLN	DATE: 6/28/93	



0 3200 6400 Feet

0 975.4 1950.7 Meters

SCALE

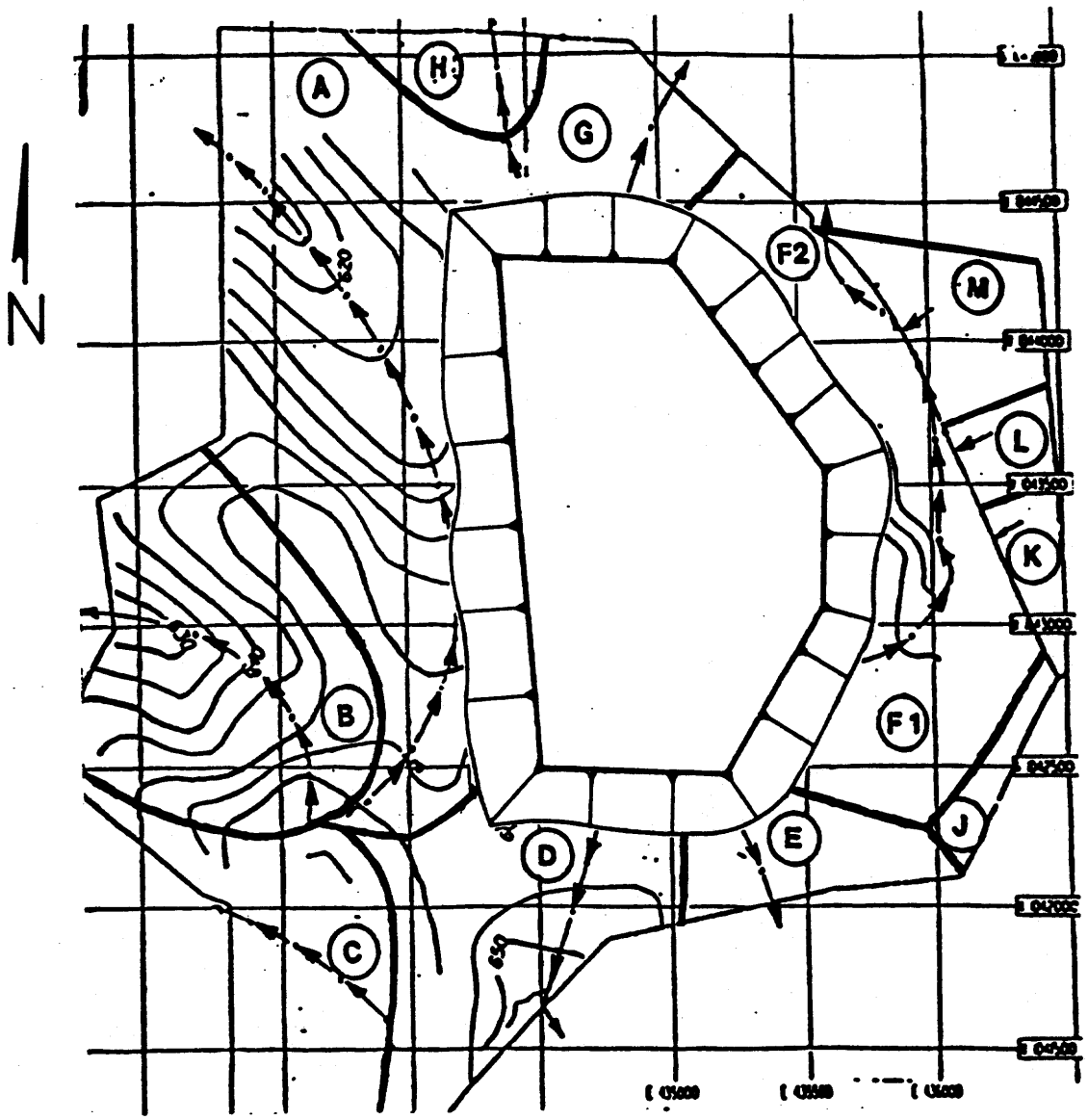
LEGEND:

- — — SURFACE WATER DIVIDE BETWEEN MISSISSIPPI RIVER AND MISSOURI RIVER
- —— DRAINAGE BOUNDARY
- —·—·— CREEK OR SURFACE DRAINAGE
- POND OR LAKE

SURFACE WATER FEATURES AND DRAINAGES NEAR THE WSS

FIGURE 5.4-9

REPORT NO.: DOE/OR/21548-411	DRAWING NO.:	
ORIGINATOR: U.C.	DRAWN BY: K.W.	DATE: NOV., 1992



500 0 500 Feet

152.4 0 152.4 Meters

SCALE

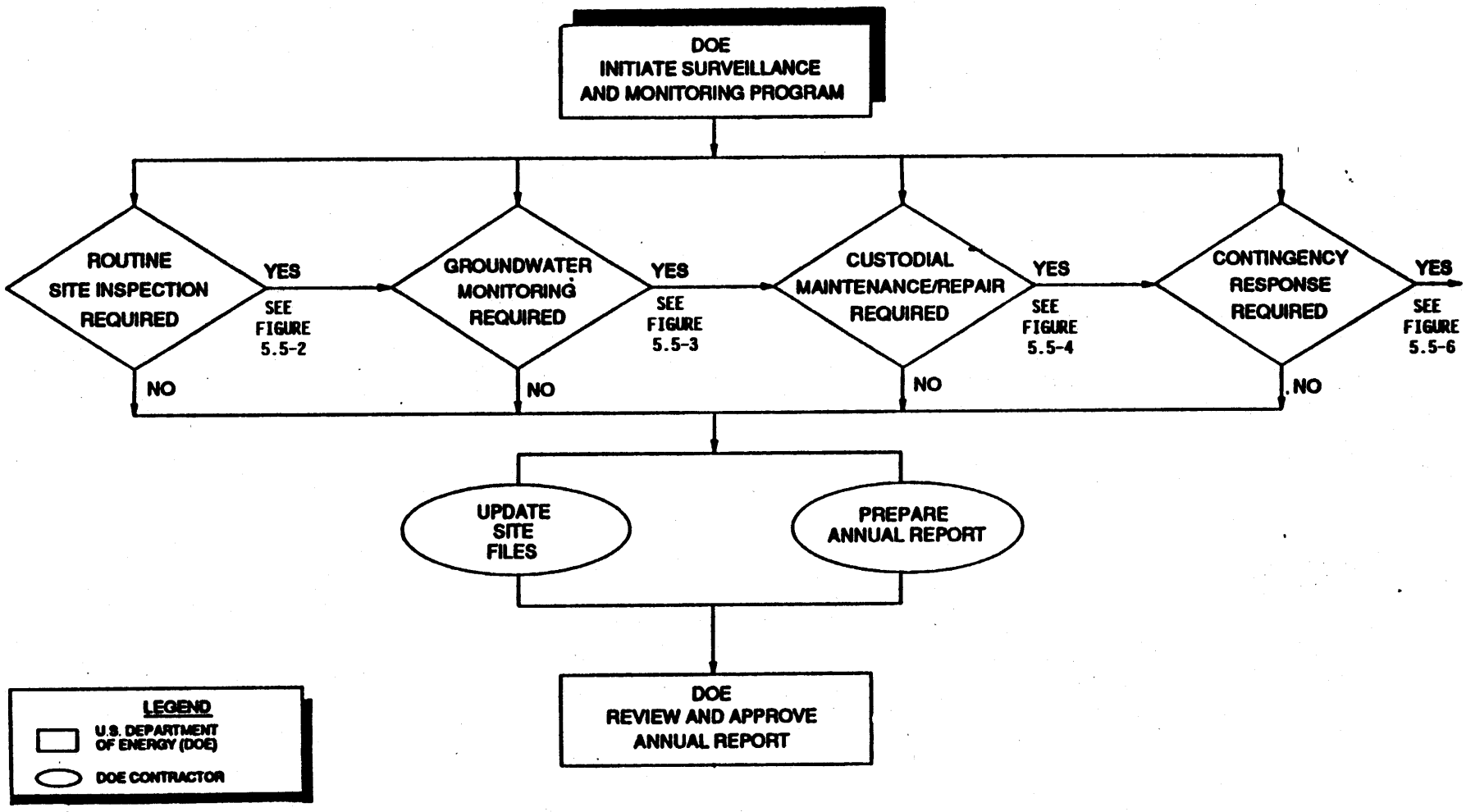
LEGEND

- DRAINAGE BOUNDARY
- LONGEST FLOW PATH
- (A) DRAINAGE AREA

SURFACE RUNOFF DRAINAGE PLAN

FIGURE 5.4- 10

REPORT NO.: DOE/OR/21548-411	DRAWING NO.:	
ORIGINATOR: U.C.	DRAWN BY: K.W.	DATE: NOV., 1992



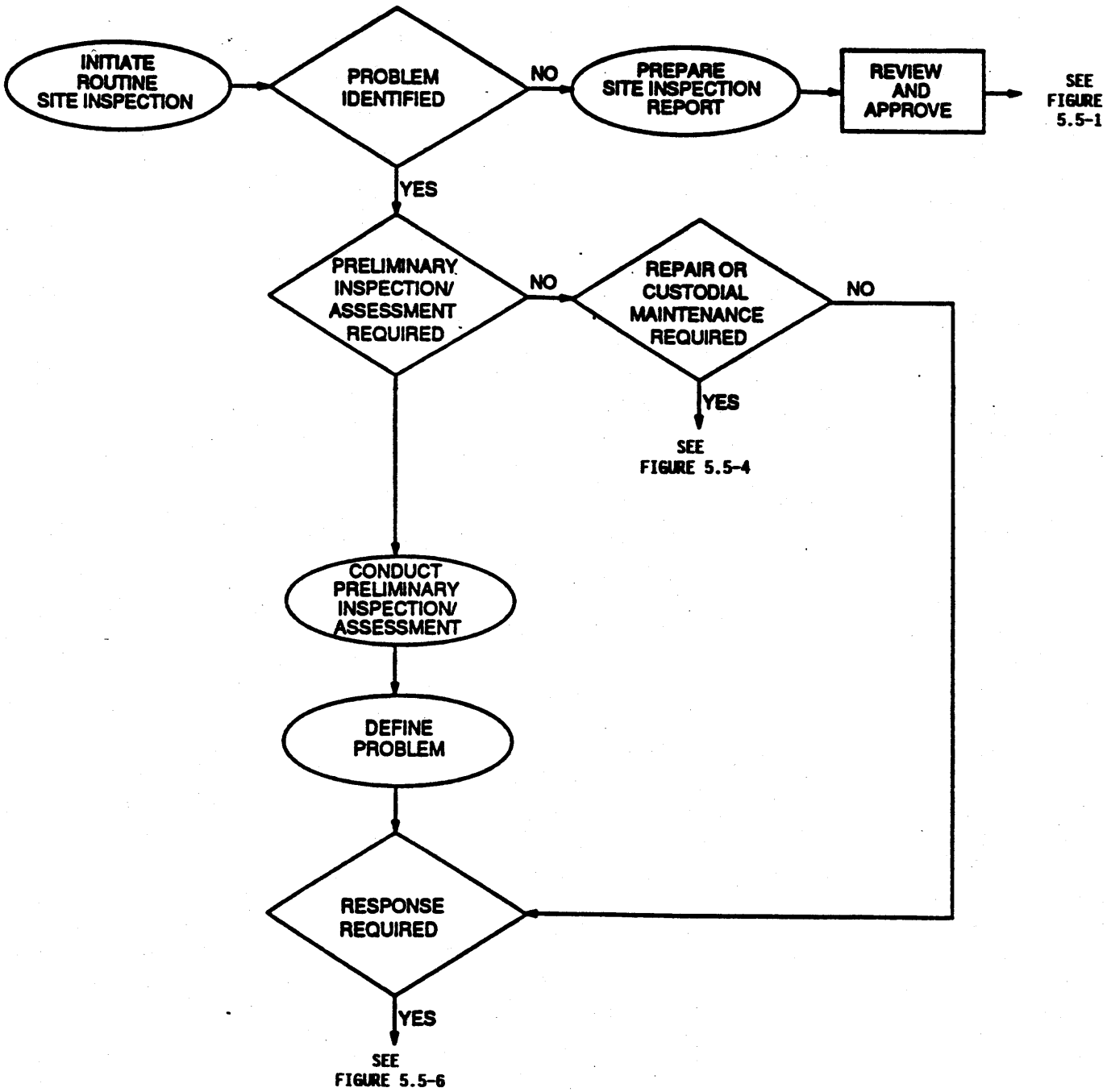
PROJECT SURVEILLANCE

AND MONITORING PROGRAM

FIGURE 5.5-1

REPORT NO.	DRAWING NO.
DOE/OR/21548-411	

ORIGINATOR	DRAWN BY	DATE



LEGEND

U. S. DEPARTMENT OF ENERGY (DOE)

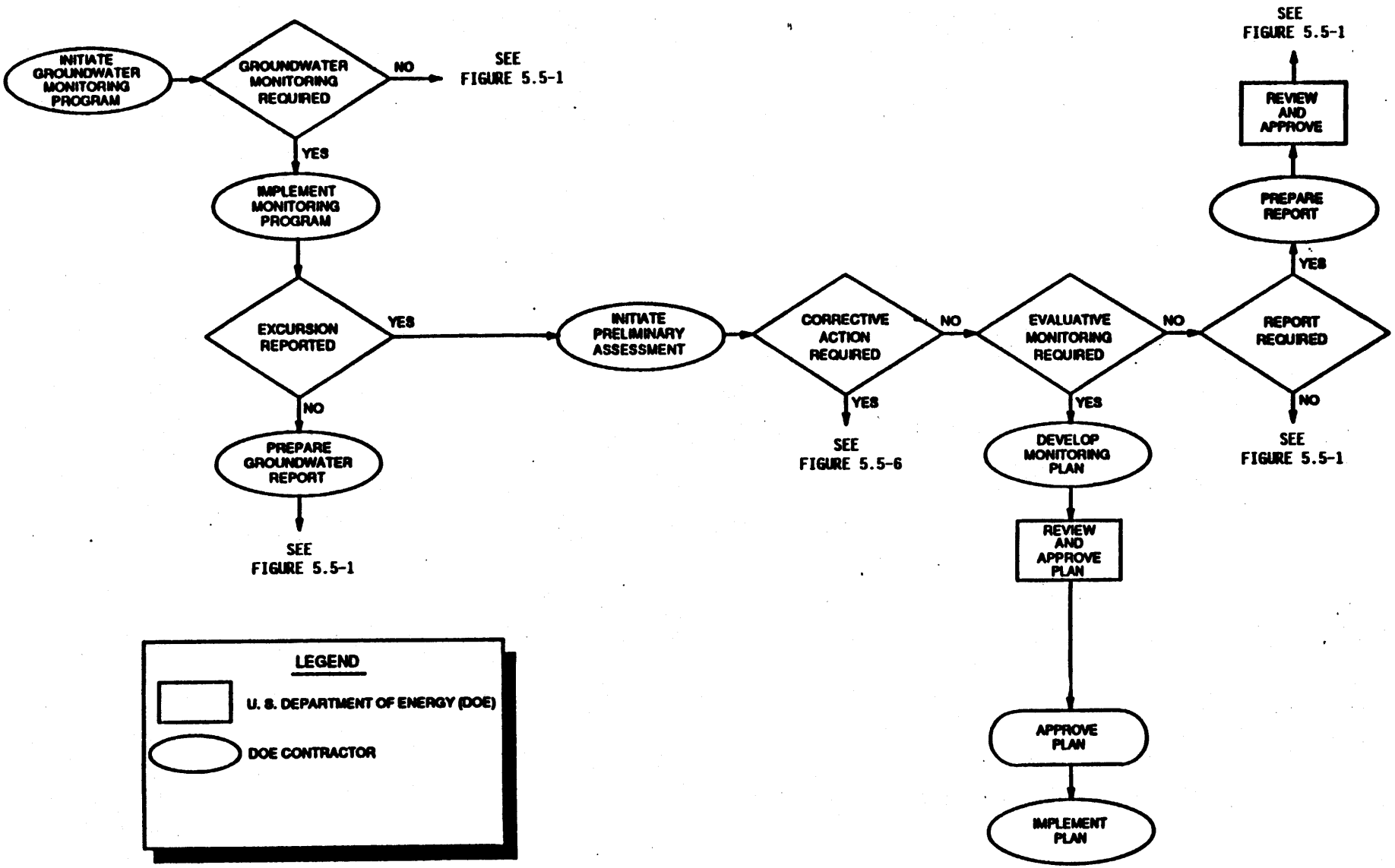
DOE CONTRACTOR

SURVEILLANCE AND MONITORING:

ROUTINE SITE INSPECTION

FIGURE 5.5-2

REPORT NO.	DRAWING NO.	
DOE/OR/21548-411		
ORIGINATOR	DRAWN BY	DATE



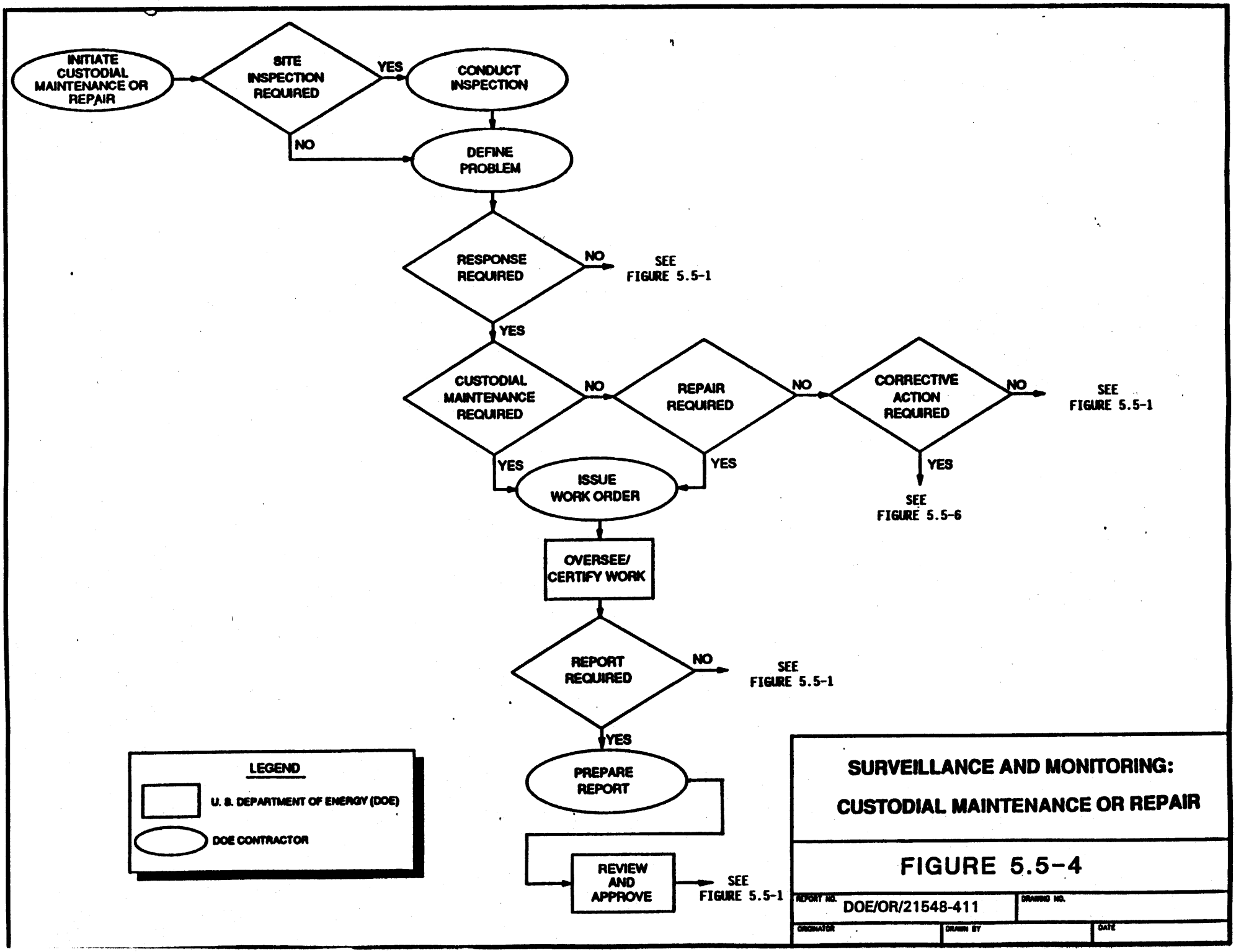
SURVEILLANCE AND MONITORING:

GROUNDWATER MONITORING PROGRAM

FIGURE 5.5-3

REPORT NO.	DRAWING NO.
DOE/OR/21548-411	

ORIGINATOR	DRAWN BY	DATE



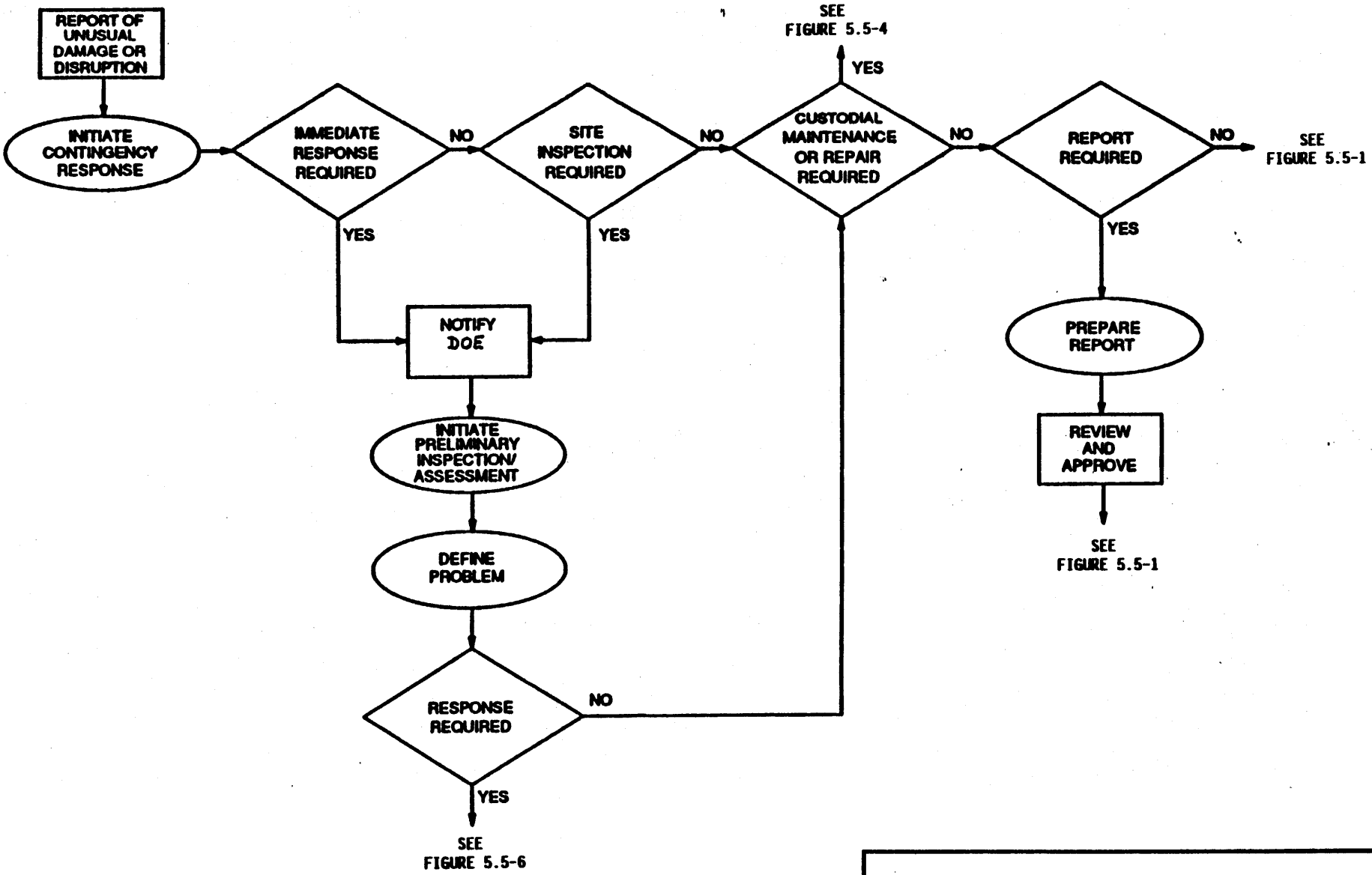
SURVEILLANCE AND MONITORING:

CUSTODIAL MAINTENANCE OR REPAIR

FIGURE 5.5-4

REPORT NO.	DRAWING NO.
DOE/OR/21548-411	

ORIGINATOR	DRAWN BY	DATE



LEGEND

U. S. DEPARTMENT OF ENERGY (DOE)

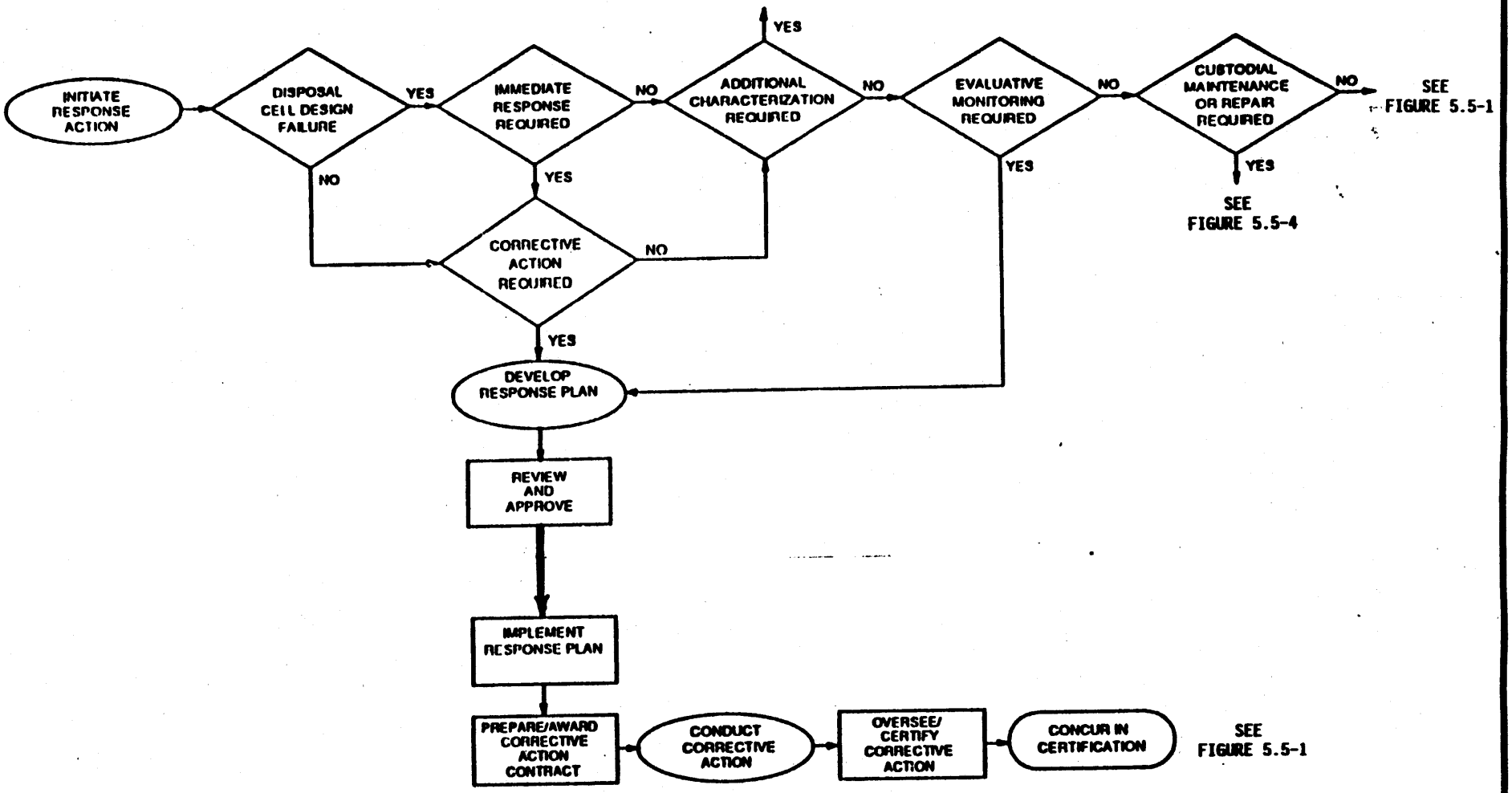
DOE CONTRACTOR

SURVEILLANCE AND MONITORING:

CONTINGENCY RESPONSE

FIGURE 5.5-5

REPORT NO.	DRAWING NO.	
DOE/OR/21548-411		
ORIGINATOR	DRAWN BY	DATE



LEGEND

U. S. DEPARTMENT OF ENERGY (DOE)

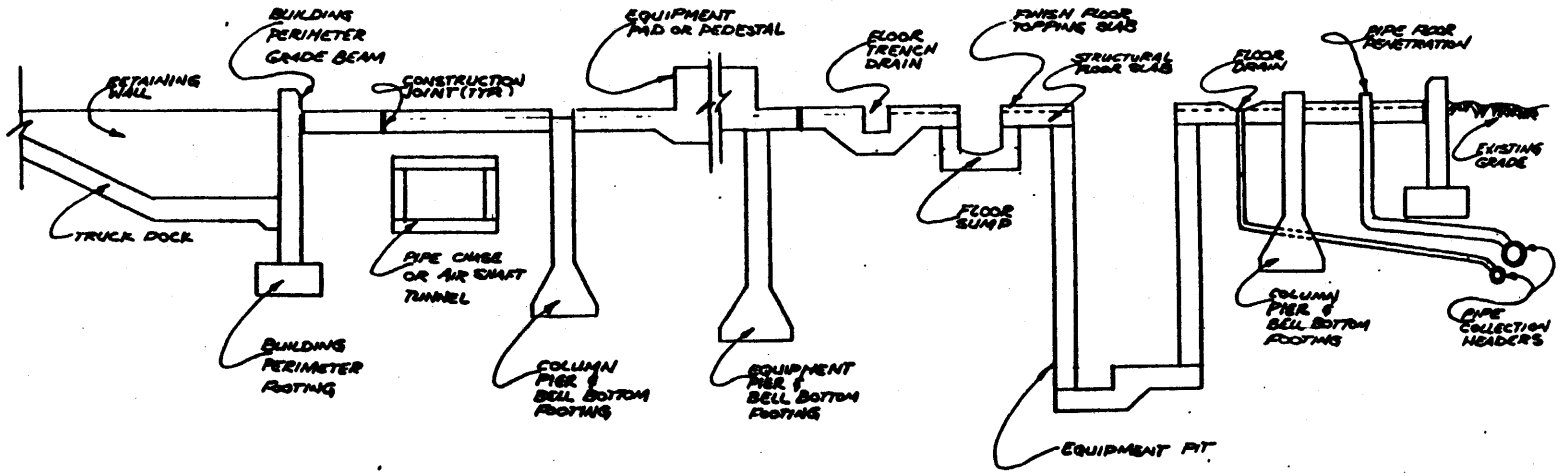
DOE CONTRACTOR

SURVEILLANCE AND MONITORING:

CORRECTIVE ACTION

FIGURE 5.5-6

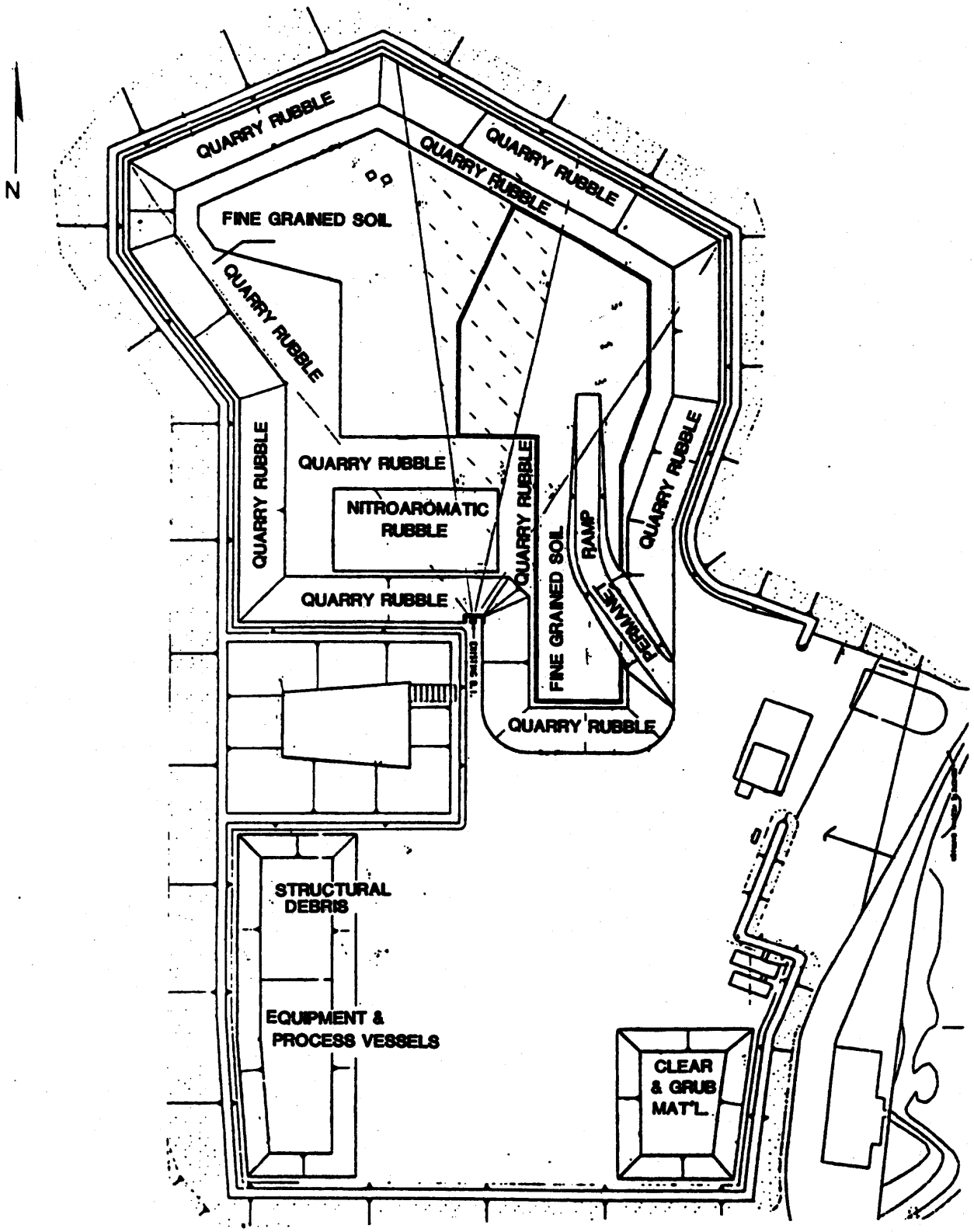
REPORT NO.	DRAWING NO.	
DOE/OR/21548-411		
ORIGINATOR	DRAWN BY	DATE



TYPICAL FOUNDATIONS

FIGURE 6.1.2-1

REPORT NO: DOE/OR/2154B-411		DRAWING NO:
ORIGINATOR:	DRAWING BY:	DATE:

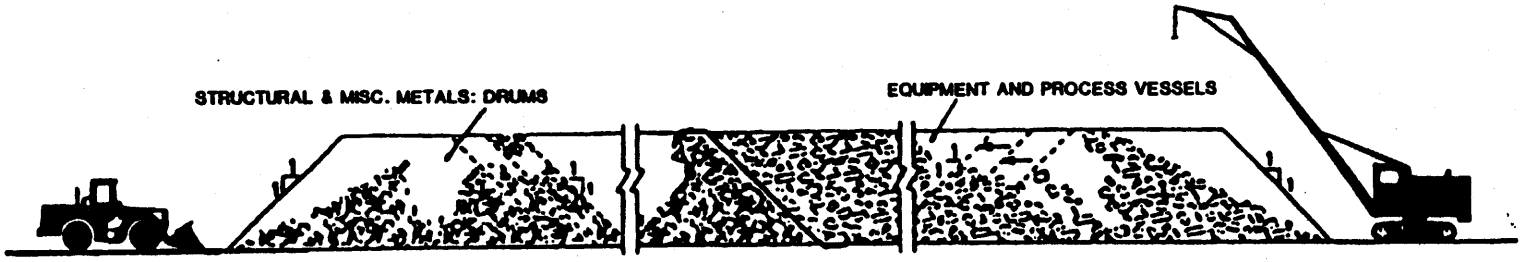


NO SCALE

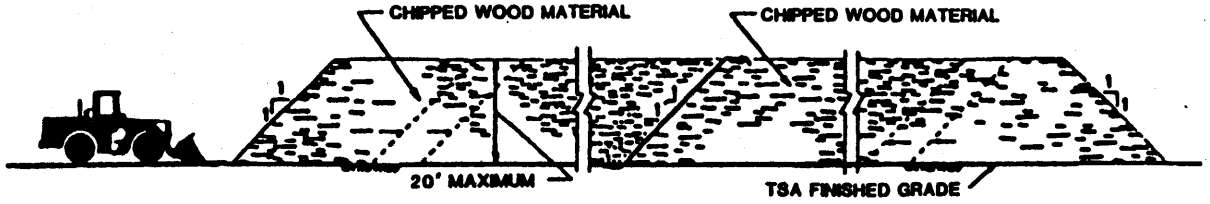
TEMPORARY STORAGE AREA
STOCKPILE PLAN VIEW

FIGURE 6.1.2-2

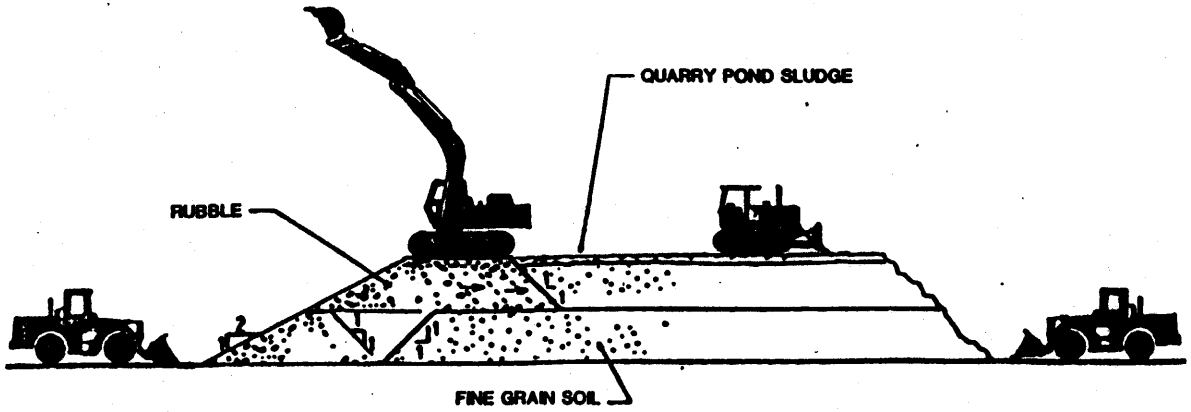
REPORT NO DOE/OR/21548-411		DRAWING NO:
ORIGINATOR:	DRAWING BY:	DATE:



SCENARIO 1



SCENARIO 2

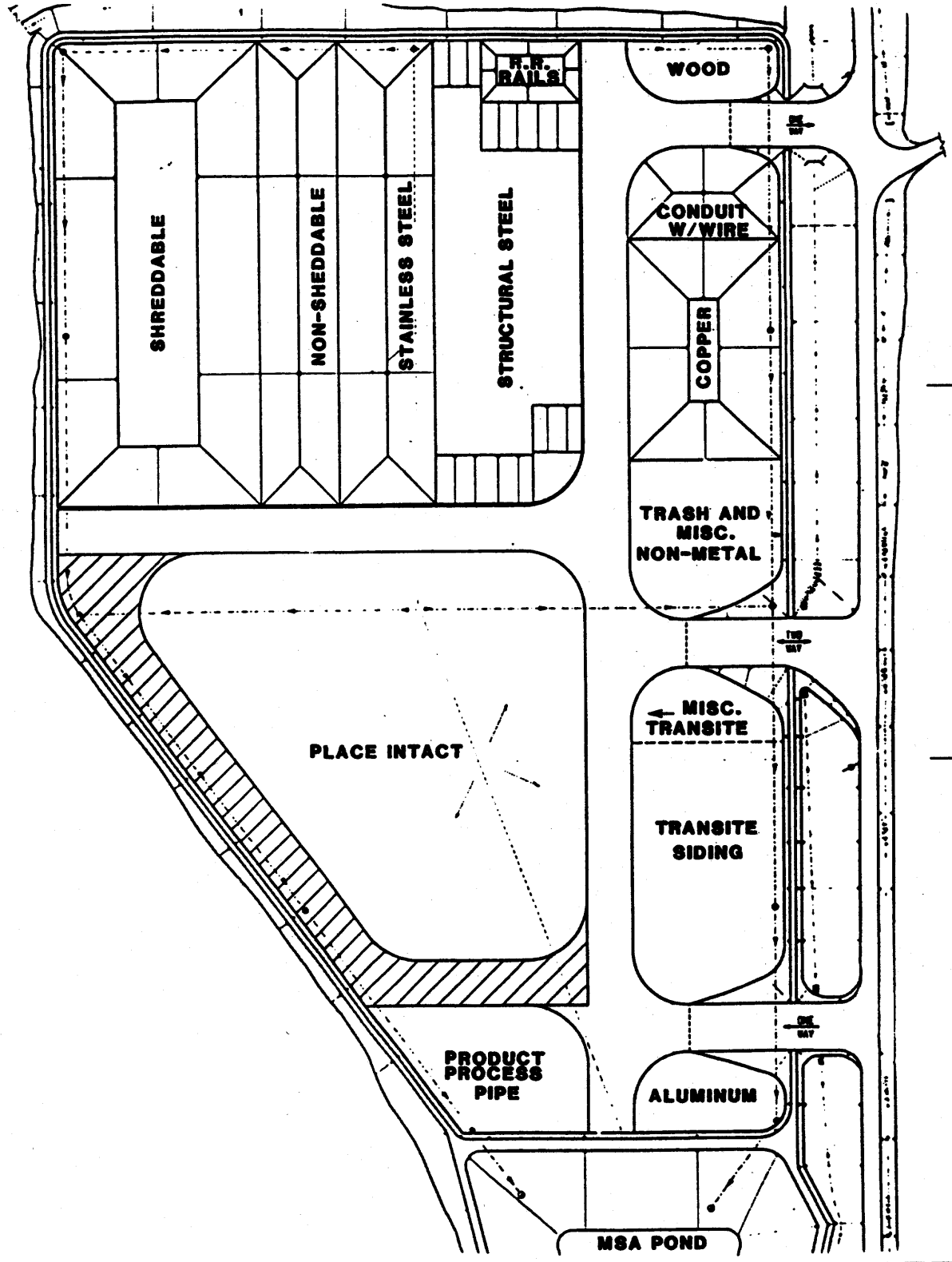


SCENARIO 3

TEMPORARY STORAGE AREA
STOCKPILE REMOVAL SCENARIOS

FIGURE 6.1.2-3

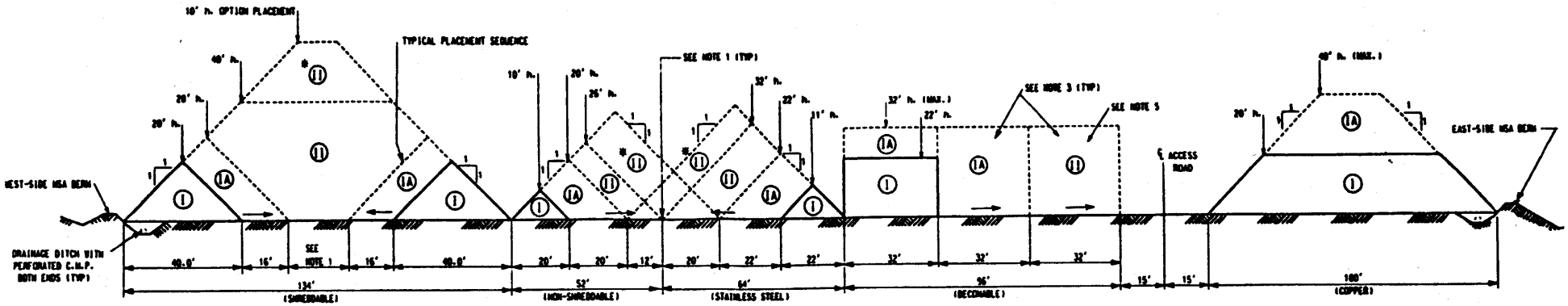
REPORT NO: DOE/OR/21548-411		DRAWING NO:
ORIGINATOR:	DRAWING BY:	DATE:

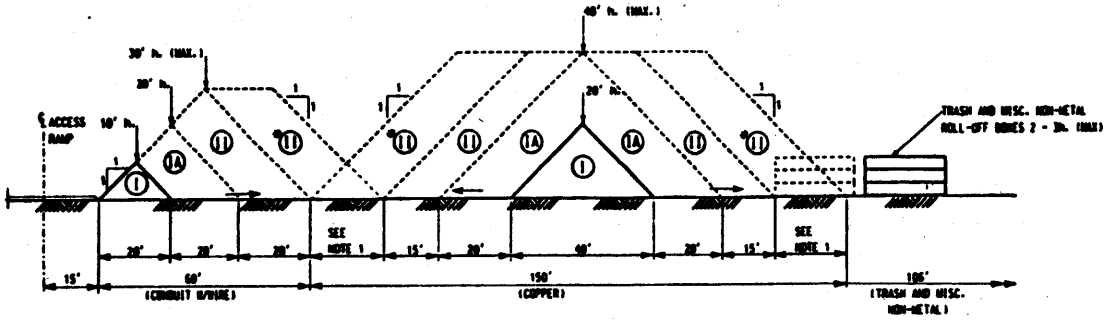


MSA STOCKPILE ARRANGEMENT

FIGURE 6.1.2-4

REPORT NO: DOE/OR/21548-411	DRAWING NO:	
ORIGINATOR:	DRAWING BY:	DATE:





NOTES

1. WHEN THE MATERIAL STORAGE AISLE WIDTH IS REDUCED TO 20 FEET, THE PMC WILL EVALUATE MATERIAL QUANTITIES TO BE PLACED. A DECISION WILL BE MADE WHETHER TO PLACE THE REMAINING MATERIAL USING THE PHASE II OR THE OPTIONAL PHASE II CONFIGURATION AS SHOWN IN SECTION A AND B.

3. PHASE IA AND II CONFIGURATIONS TO BE USED IF REQUIRED AFTER EVALUATION OF MATERIAL QUANTITIES TO BE PLACED.

5. IF PHASE II IS NOT NEEDED FOR PLACING DECONABLE MATERIAL, PMC WILL DETERMINE MATERIAL TYPE TO BE PLACED HERE, IF ANY.

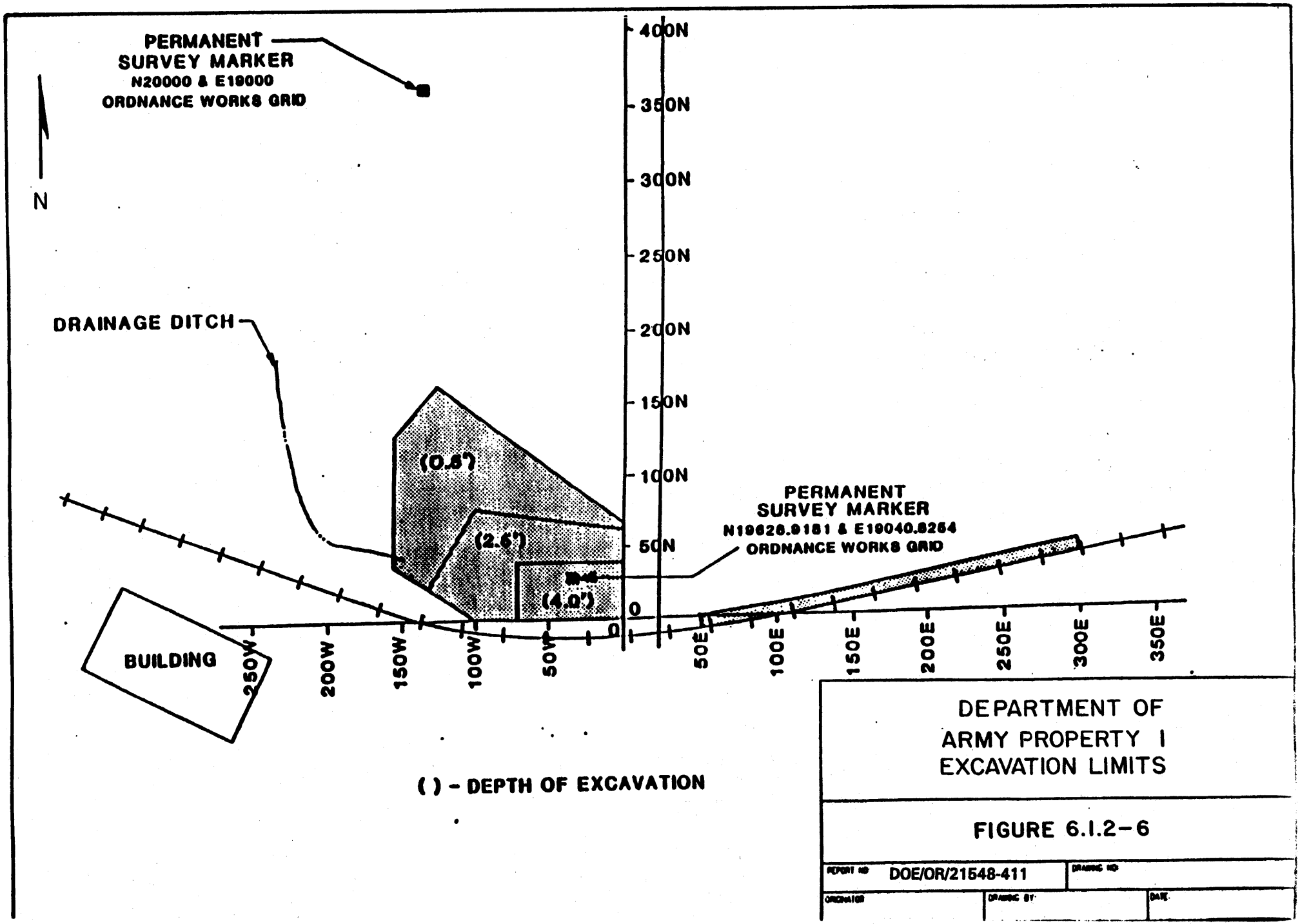
LEGEND

- (I) PHASE I PLACEMENT
- (IA) PHASE IA PLACEMENT
- (II) PHASE II PLACEMENT
- *(II) PHASE II OPTION PLACEMENT

MATERIAL STAGING AREA STOCKPILE CROSS-SECTION VIEW

FIGURE 6.1.2-5

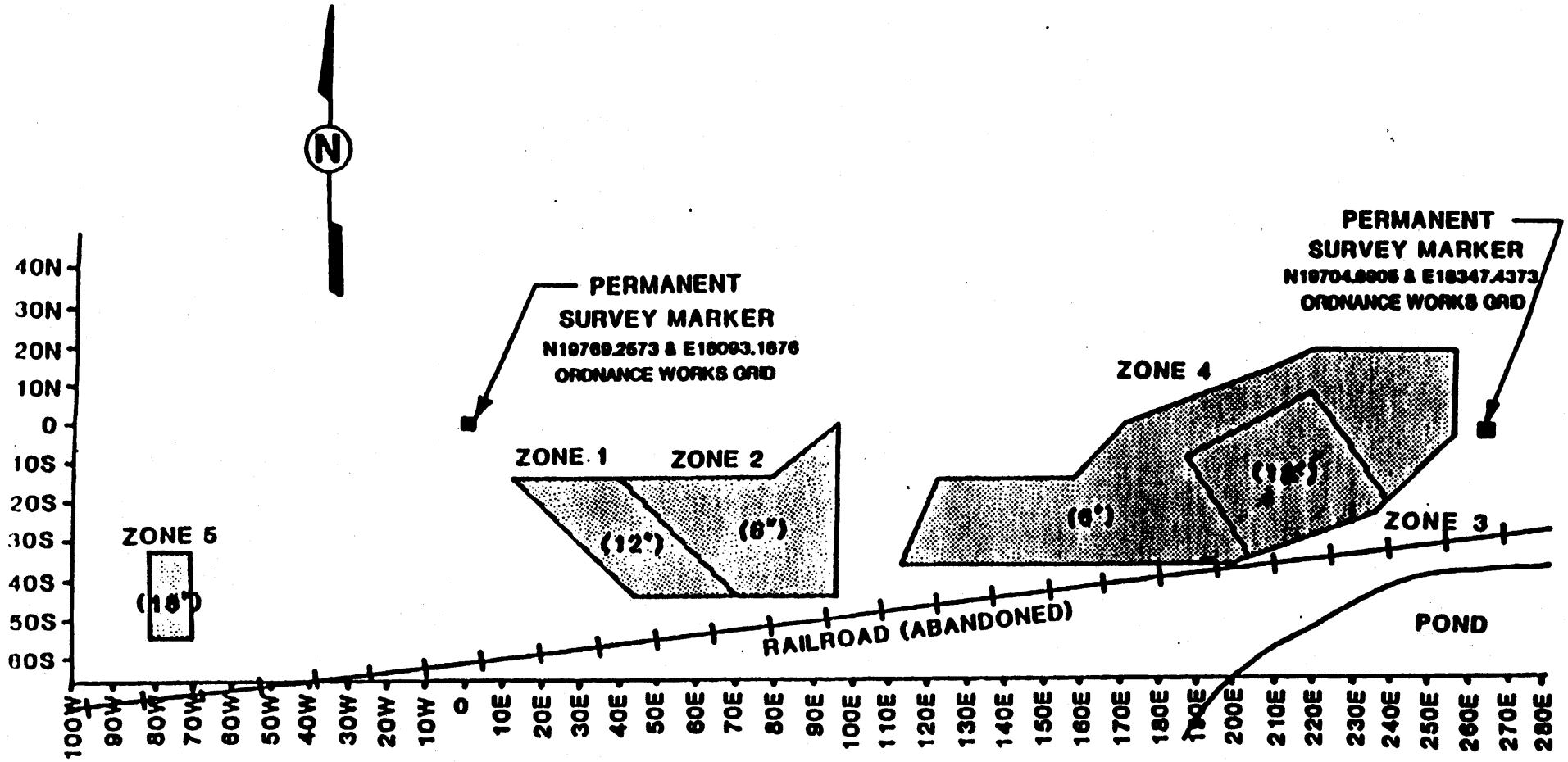
REPORT NO.	DRAWING NO.	
DOE/OR/21548-411		
ORIGINATOR	DRAWN BY	DATE



DEPARTMENT OF ARMY PROPERTY I EXCAVATION LIMITS

FIGURE 6.1.2-6

REPORT NO DOE/OR/21548-411	DRAWING NO	
ORIGINATOR	DRAWING BY	DATE

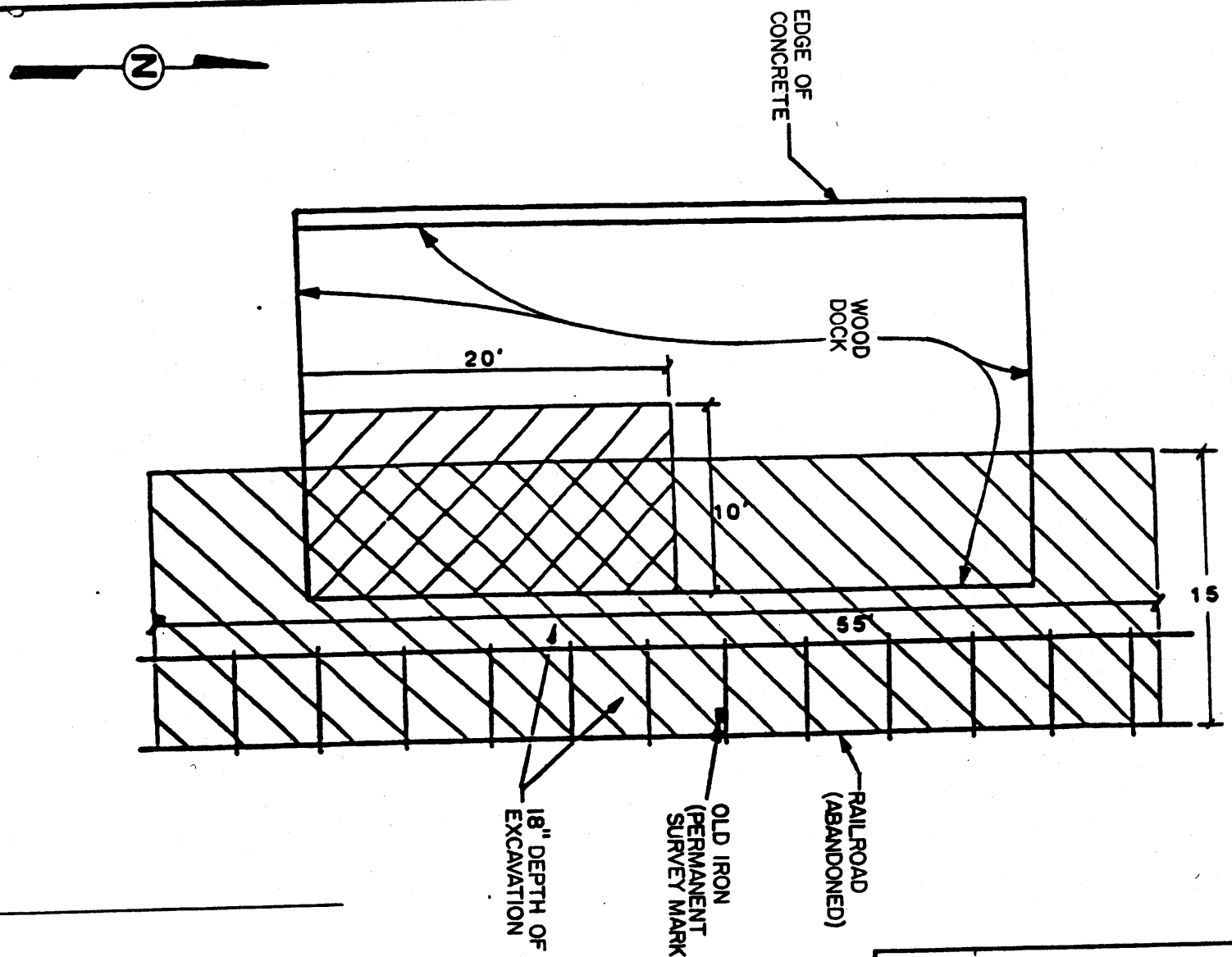


( ) - DEPTH OF EXCAVATION

DEPARTMENT OF ARMY PROPERTY 2
EXCAVATION LIMITS

FIGURE 6.1.2-7

REPORT NO: DOE/OR/21548-411	DRAWING NO:	
ORIGINATOR	DRAWING BY:	DATE



LEGEND

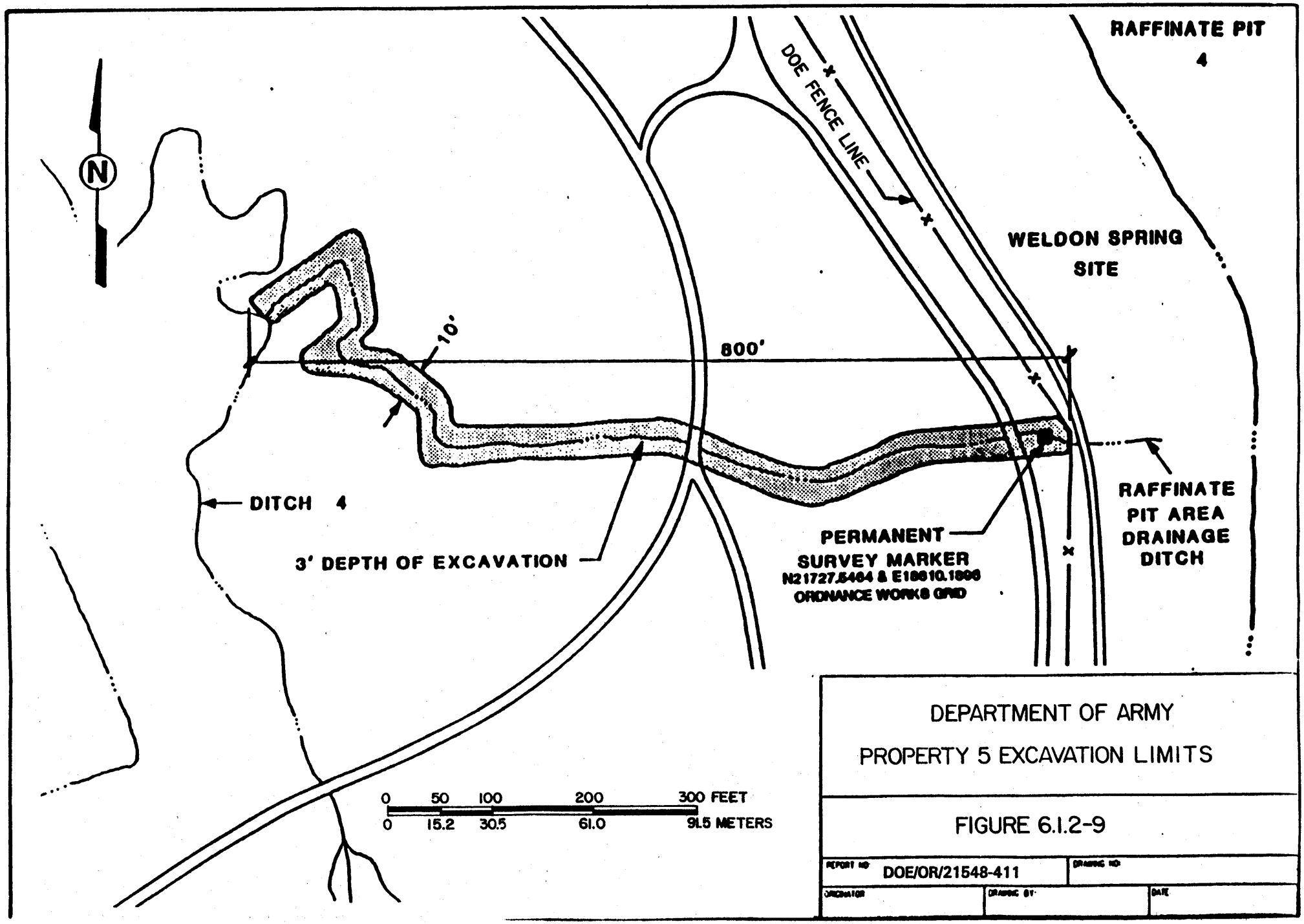
- AREA OF CONTAMINATION BELOW DOCK

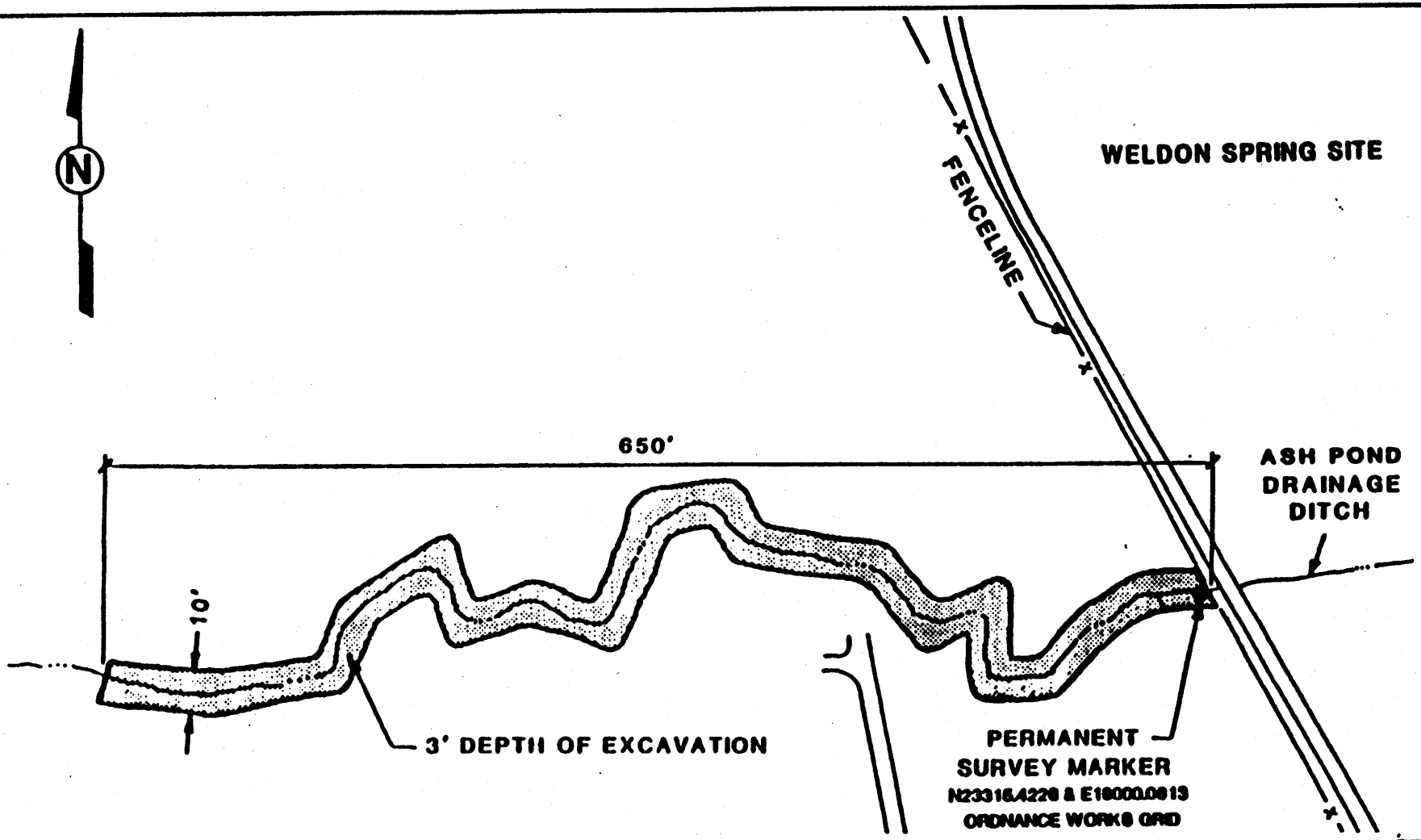
- AREA OF CONTAMINATION ON DOCK FLOOR

DEPARTMENT OF ARMY
PROPERTY 3 EXCAVATION LIMITS

FIGURE 6.1.2-8

REPORT NO.	DRAWING NO.
DOE/OR/21548-411	
DESIGNATED	DRAWN BY / DATE


RAFFINATE PIT
4
DOE FENCE LINE
WELDON SPRING
SITE
10'
800'
DITCH 4
3' DEPTH OF EXCAVATION
PERMANENT
SURVEY MARKER
N21727.5464 & E18610.1806
ORDNANCE WORKS GRID
RAFFINATE
PIT AREA
DRAINAGE
DITCH
N
0 50 100 200 300 FEET
0 15.2 30.5 61.0 91.5 METERS
DEPARTMENT OF ARMY
PROPERTY 5 EXCAVATION LIMITS
FIGURE 6.1.2-9
REPORT NO DOE/OR/21548-411
DRAWING NO
ORIGINATOR
DRAWING BY
DATE

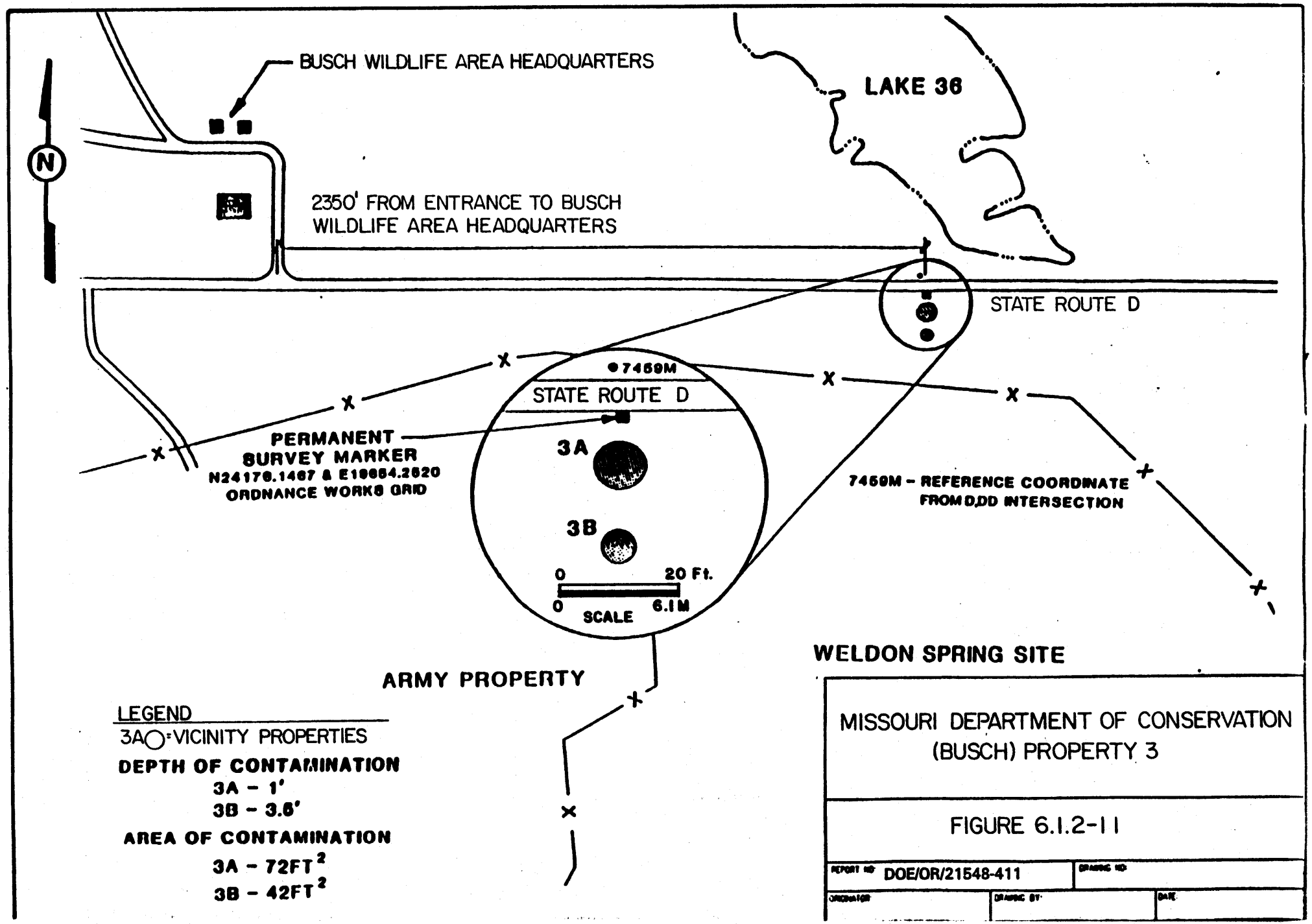


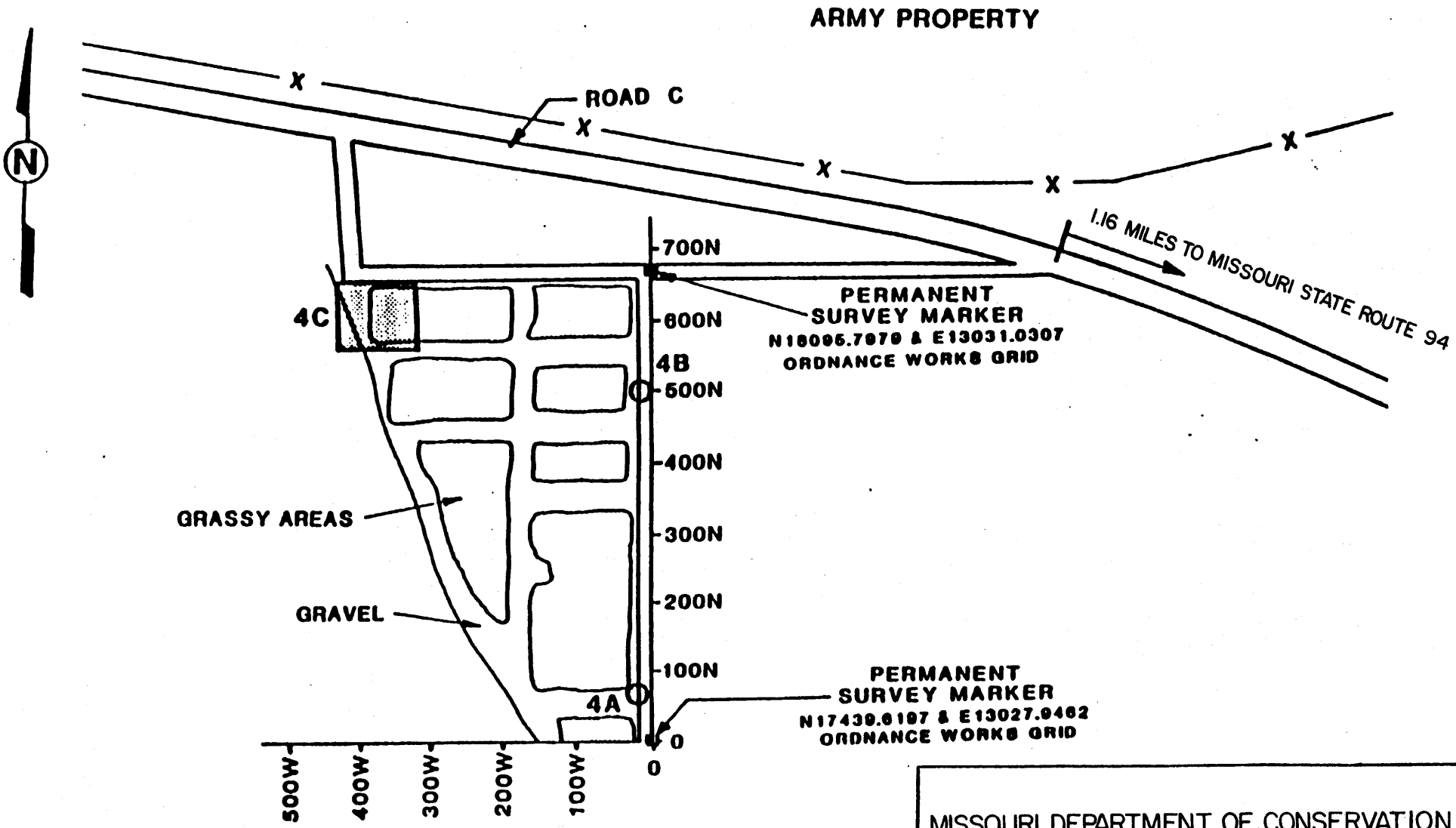
0 50 100 200 FEET
0 15.2 30.5 61.0 METERS

DEPARTMENT OF ARMY
PROPERTY 6 EXCAVATION LIMITS

FIGURE 6.1.2-10

REPORT NO DOE/OR/21548-411	DRAWING NO	
ORIGINATOR	DRAWING BY	DATE


BUSCH WILDLIFE AREA HEADQUARTERS
LAKE 36
N
2350' FROM ENTRANCE TO BUSCH WILDLIFE AREA HEADQUARTERS
STATE ROUTE D
7459M
STATE ROUTE D
PERMANENT SURVEY MARKER
N24176.1467 & E19664.2620
ORDNANCE WORKS GRID
3A
3B
0
20 Ft.
0
6.1M
SCALE
7459M - REFERENCE COORDINATE FROM D,DD INTERSECTION
ARMY PROPERTY
LEGEND
3A ◯ = VICINITY PROPERTIES
DEPTH OF CONTAMINATION
3A - 1'
3B - 3.5'
AREA OF CONTAMINATION
3A - 72FT²
3B - 42FT²
WELDON SPRING SITE
MISSOURI DEPARTMENT OF CONSERVATION
(BUSCH) PROPERTY 3
FIGURE 6.1.2-11
REPORT NO DOE/OR/21548-411
DRAWING NO
ORIGINATOR
DRAWING BY
DATE



LEGEND

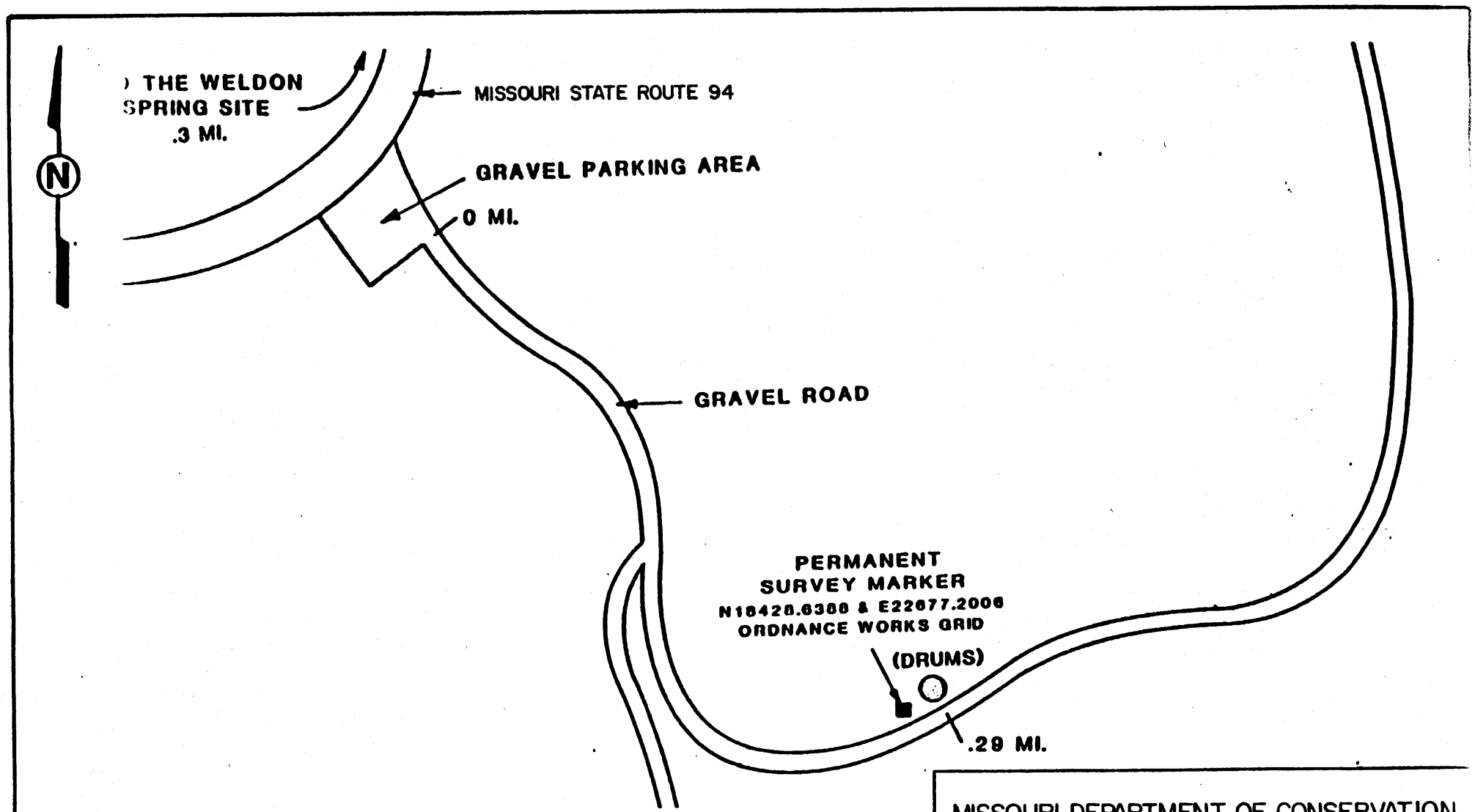
DEPTH OF CONTAMINATION
4A=1.5'
4B=0.5'
4C=1.0'

AREA OF CONTAMINATION
4A = 168 sq. ft.
4B = 130 sq. ft.
4C = 6500 sq. ft.

MISSOURI DEPARTMENT OF CONSERVATION
(BUSCH) PROPERTY 4 EXCAVATION LIMITS

FIGURE 6.1.2-12

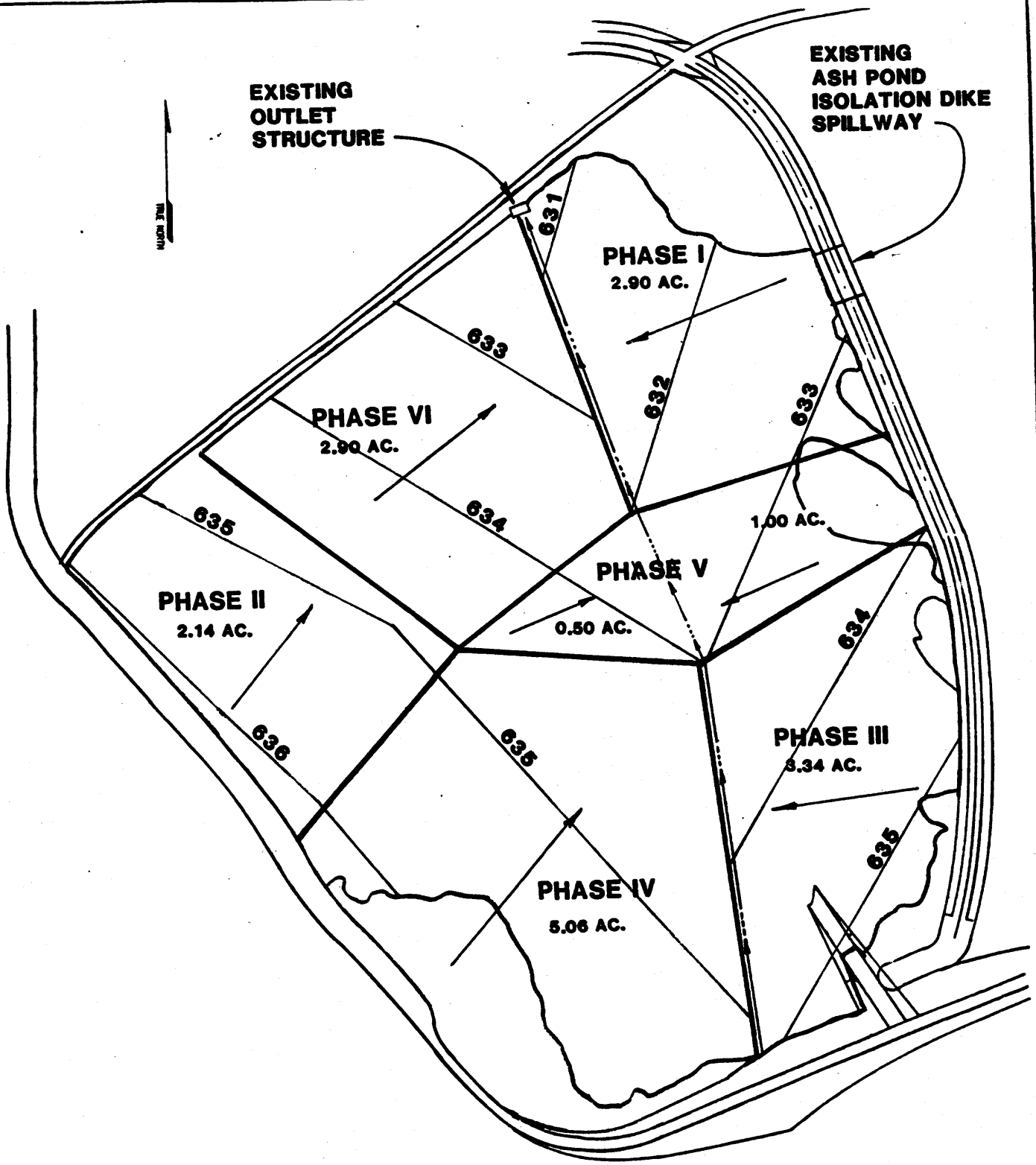
REPORT NO DOE/OR/21548-411	DRAWING NO	
ORIGINATOR	DRAWING BY	DATE



MISSOURI DEPARTMENT OF CONSERVATION
(BUSCH) PROPERTY 5 EXCAVATION LIMITS

FIGURE 6.1.2-13

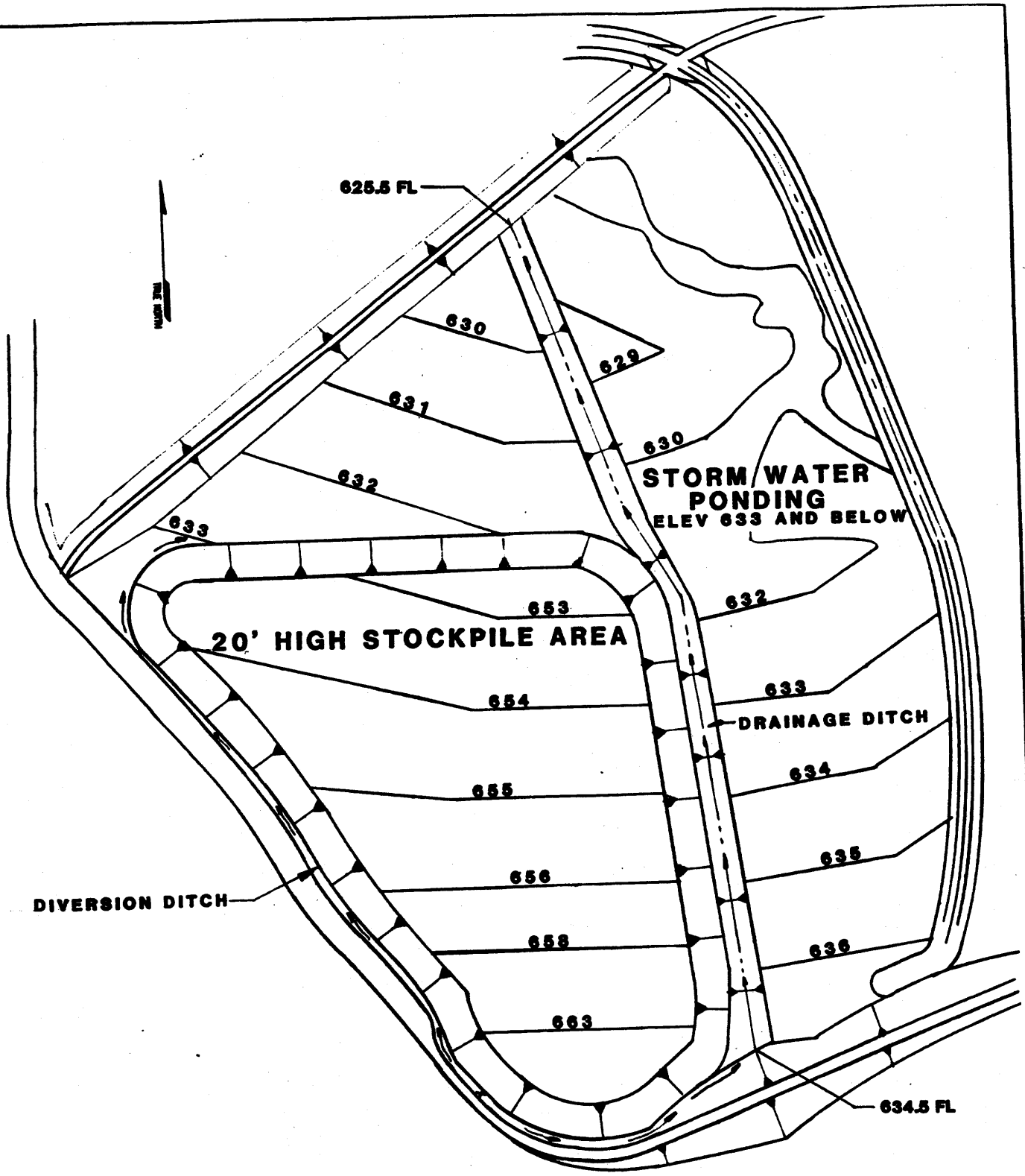
REPORT NO DOE/OR/21548-411		DRAWING NO
ORIGINATOR	DRAWING BY	DATE



ASH POND SPOILS AREA
DEVELOPMENT SEQUENCE

FIGURE 6.1.2-14

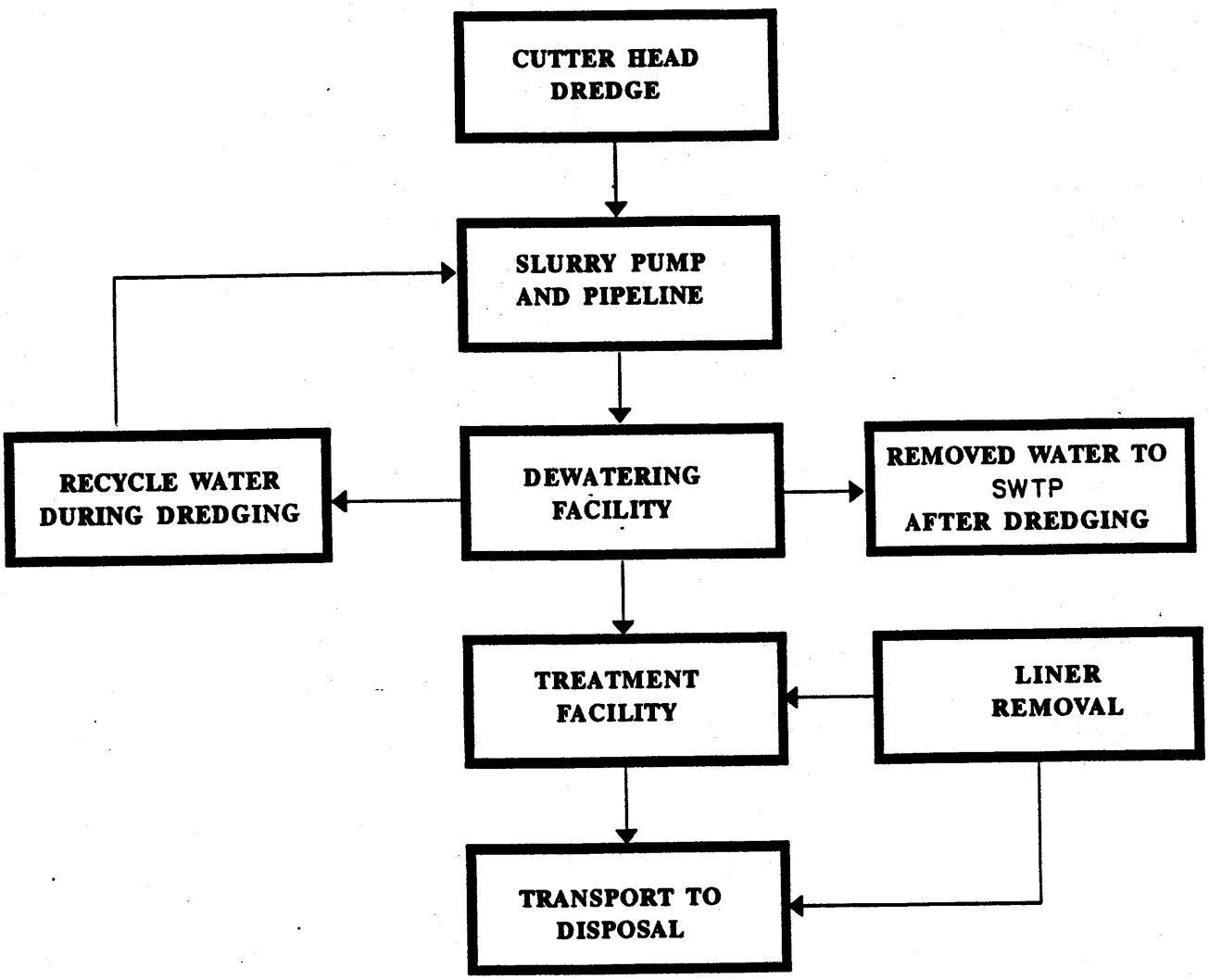
REPORT NO DOE/OR/21548-411	DRAWING NO:	
ORIGINATOR	DRAWING BY:	DATE:



ASH POND SPOILS AREA
ALTERNATE DEVELOPMENT SEQUENCE

FIGURE 6.1.2-15

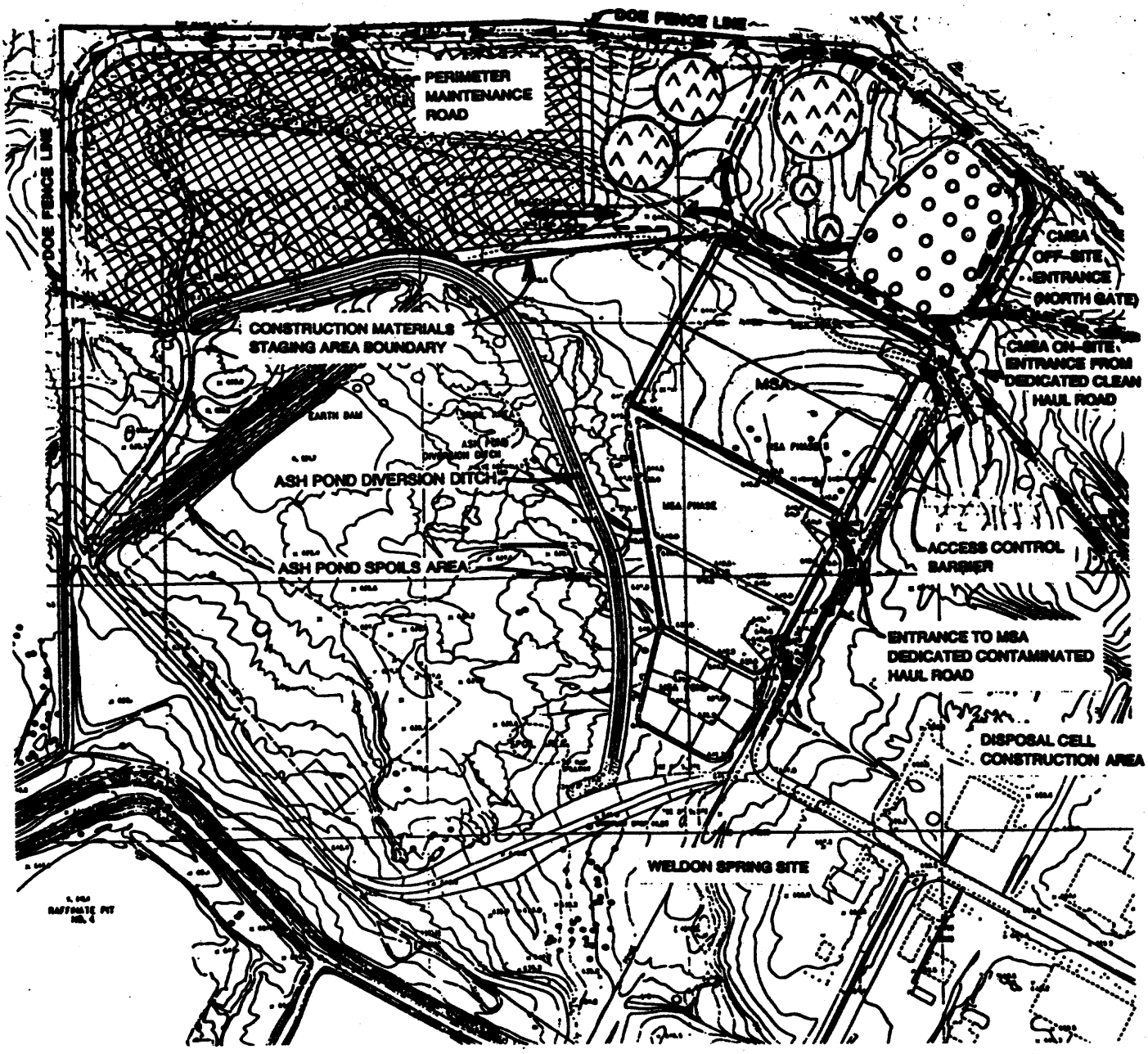
REPORT NO: DOE/OR/21548-411	DRAWING NO:	
ORIGINATOR:	DRAWING BY:	DATE:



RAFFINATE PIT SLUDGE FLOW DIAGRAM

FIGURE 6.1.3-1

REPORT NO: DOE/OR/21548-411		DRAWING NO:
ORIGINATOR:	DRAWING BY:	DATE:



100 0 100 200 300 FEET
30.5 0 30.5 61.0 91.5 METERS
SCALE

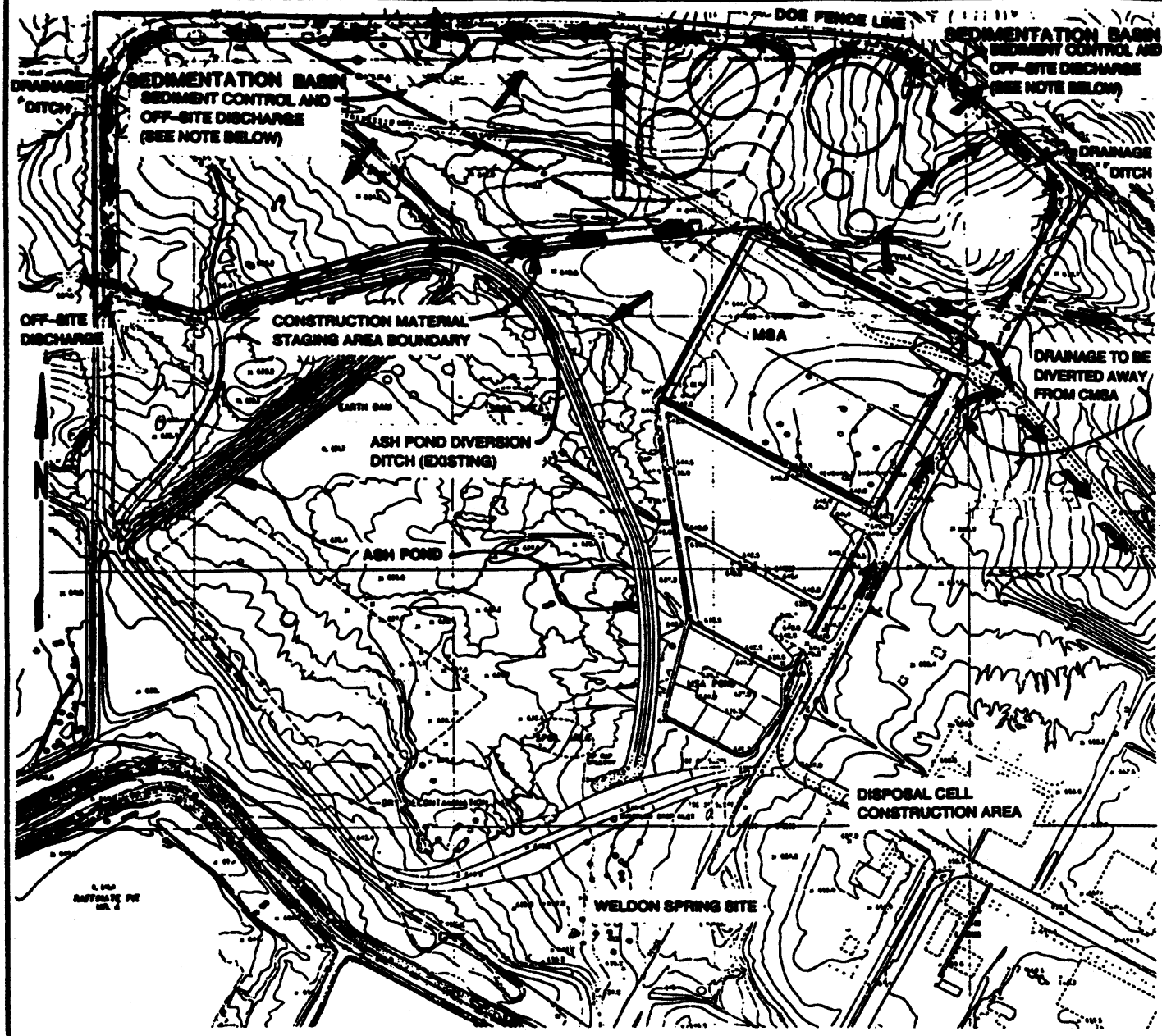
LEGEND

- SYNTHETIC MATERIALS YARD
- NATURAL MATERIALS STOCKPILE
- ON-SITE BORROW STOCKPILE

SKETCH OF
CONSTRUCTION MATERIALS STAGING
AREA TRAFFIC PATTERNS

FIGURE 6.1.4-1

REPORT NO.	DRAWING NO.	
DOE/OR/21548-411		
ORIGINATOR MLB	DRAWN BY HK	DATE NOV. 92



0 200 400 FT

0 61.0 121.9 M

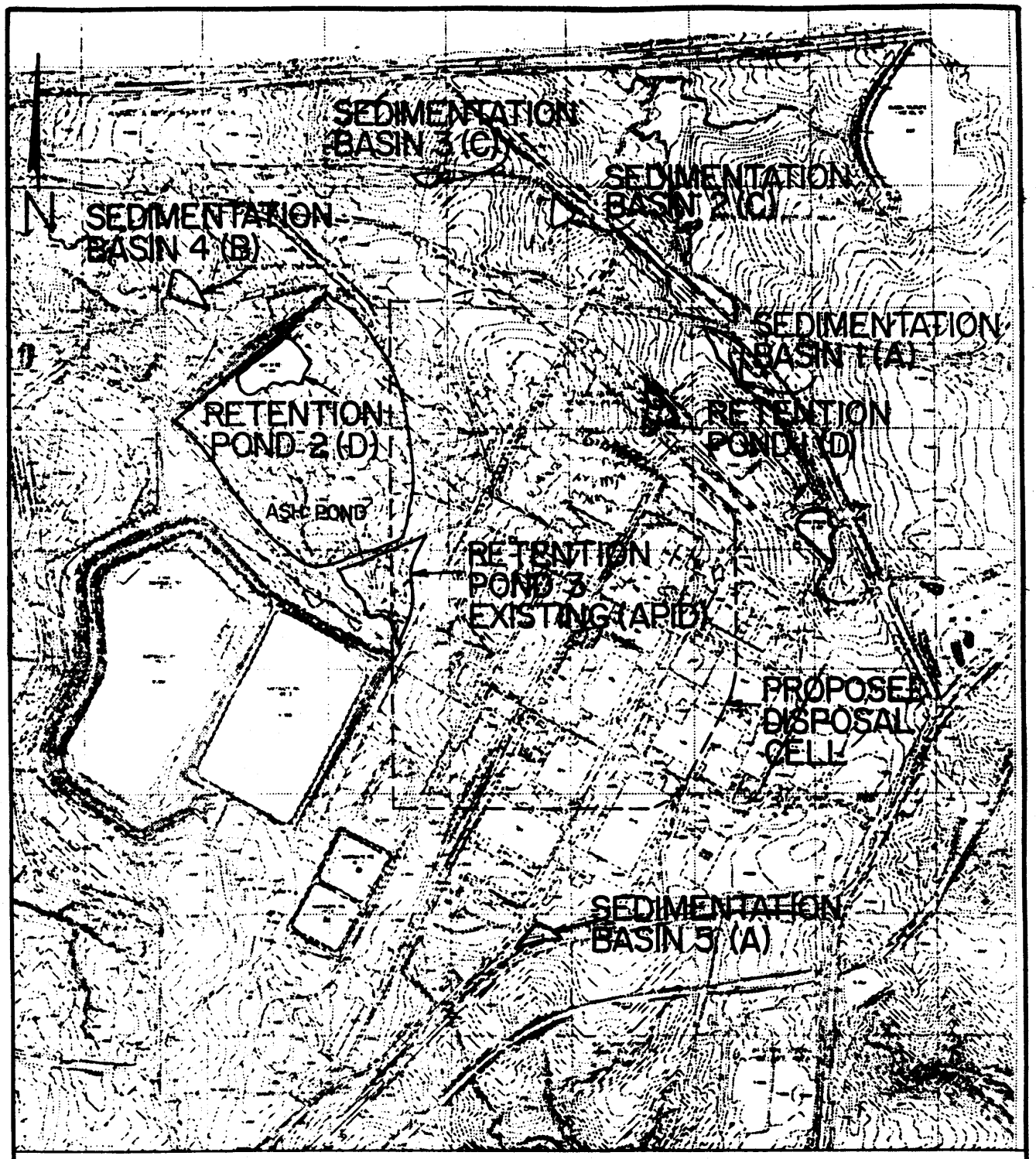
SCALE

NOTE: REMOVE ALL CONTAMINATED SOILS BEFORE CONSTRUCTION OF CMSA. CMSA OFF-SITE DISCHARGE TO THE NORTH WILL BE UNCONTAMINATED

SKETCH OF CONSTRUCTION MATERIALS STAGING AREA (CMSA) SITE LAYOUT RUN-OFF AND DRAINAGE

FIGURE 6.1.4-2

REPORT NO: DOE/OR/21548-411	DRAWING NO:	
ORIGINATOR: MLB	DRAWN BY: HK	DATE: NOV. 92



NOT TO SCALE

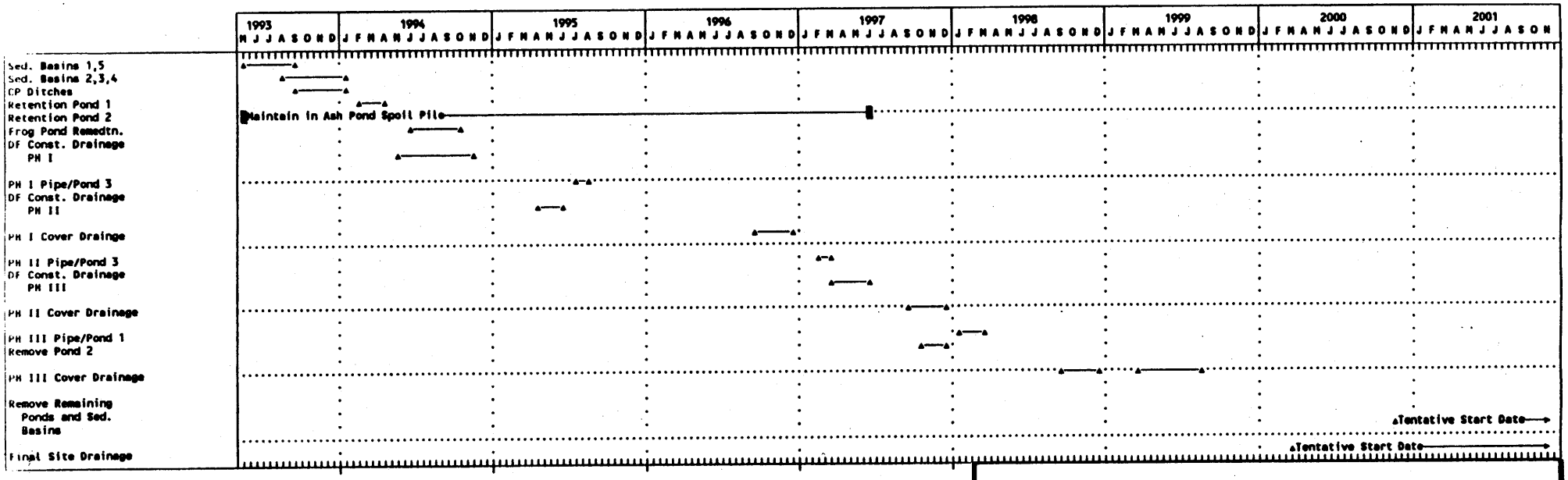
LEGEND

(A)-(D) ORDER OF CONSTRUCTION

ORDER OF CONSTRUCTION OF SEDIMENTATION BASINS AND RETENTION PONDS

FIGURE 6.1.6-1

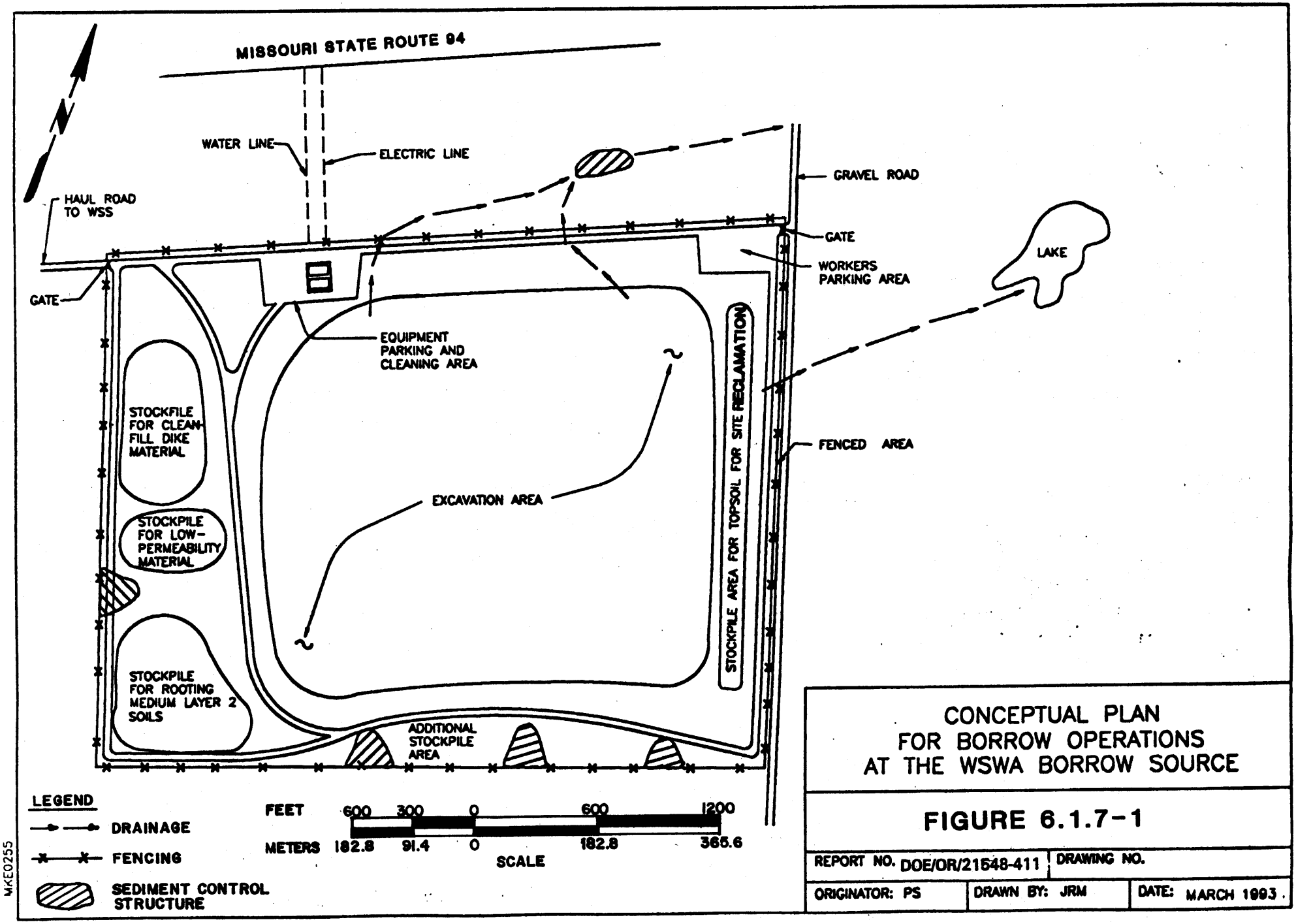
REPORT NO.: DOE/OR/21548-411	DRAWING NO.:	
ORIGINATOR: S.B.	DRAWN BY: K.W.	DATE: NOV., 1992

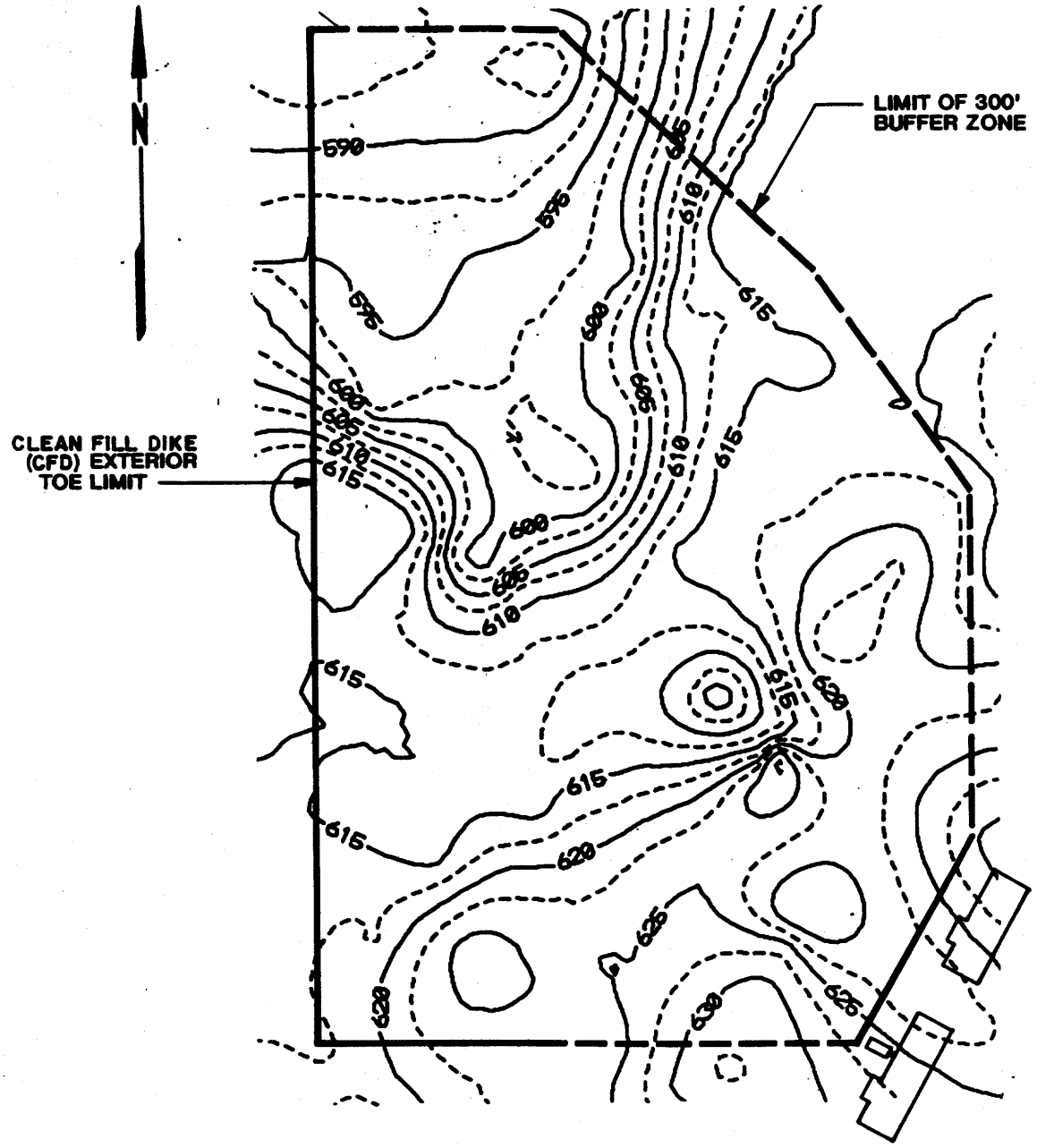


DRAINAGE CONTROLS
CONSTRUCTION SCHEDULE

FIGURE 6.1.6-2

REPORT NO.: DOE/OR/21548-411		DRAWING NO.:	
ORIGINATOR: S.B.	DRAWN BY: S.B.	DATE: DEC., 1992	


MISSOURI STATE ROUTE 94
WATER LINE
ELECTRIC LINE
HAUL ROAD TO WSS
GATE
GRAVEL ROAD
GATE
WORKERS PARKING AREA
LAKE
EQUIPMENT PARKING AND CLEANING AREA
STOCKFILE FOR CLEAN-FILL DIKE MATERIAL
STOCKPILE FOR LOW-PERMEABILITY MATERIAL
STOCKPILE FOR ROOTING MEDIUM LAYER 2 SOILS
EXCAVATION AREA
STOCKPILE AREA FOR TOPSOIL FOR SITE RECLAMATION
FENCED AREA
ADDITIONAL STOCKPILE AREA
LEGEND
DRAINAGE
FENCING
SEDIMENT CONTROL STRUCTURE
FEET 600 300 0 600 1200
METERS 182.8 91.4 0 182.8 365.6
SCALE
CONCEPTUAL PLAN FOR BORROW OPERATIONS AT THE WSWA BORROW SOURCE
FIGURE 6.1.7-1
REPORT NO. DOE/OR/21548-411
DRAWING NO.
ORIGINATOR: PS
DRAWN BY: JRM
DATE: MARCH 1993
MKE0255



400 0 400 FEET

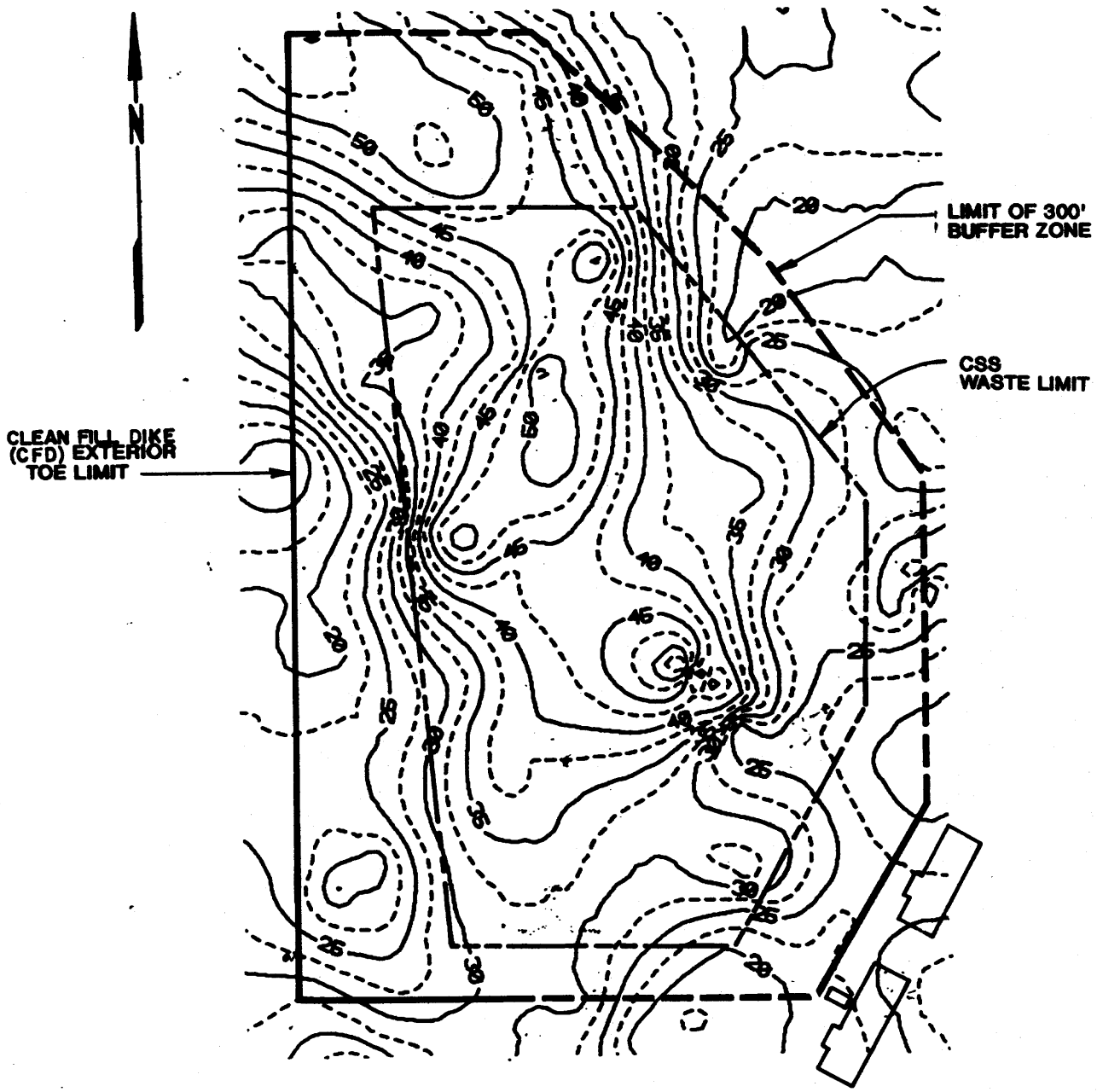
121.9 0 121.9 METERS

SCALE

TOP OF BEDROCK ELEVATION CONTOURS

FIGURE 6.2.3-1

REPORT NO: DOE/OR/21548-411	DRAWING NO:	
ORIGINATOR: KWL	DRAWN BY: AMA	DATE:



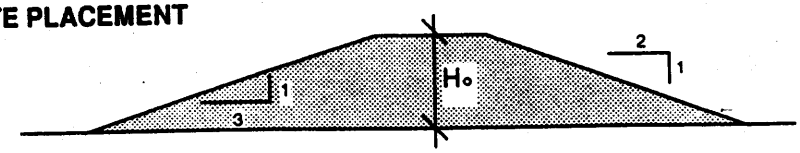
400 0 400 FEET
121.9 0 121.9 METERS
SCALE

ISOPACH MAP OF FERRELVIEW CLAY TO BEDROCK

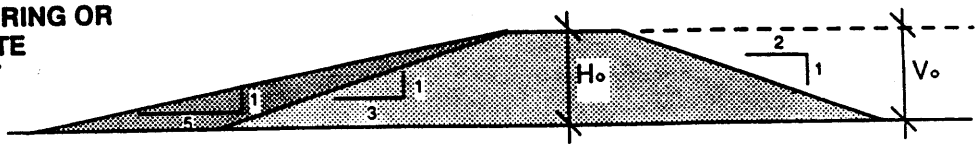
FIGURE 6.2.3-2

REPORT NO: DOE/OR/21548-411	DRAWING NO:	
ORIGINATOR: KWL	DRAWN BY: AMA	DATE:

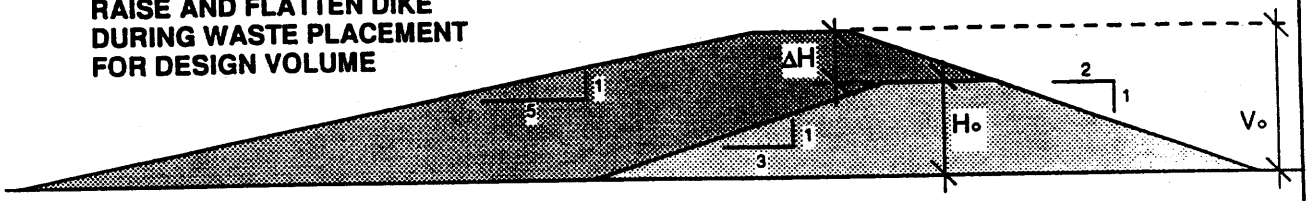
PHASE A DIKE GEOMETRY
PROVIDE EARLY WASTE PLACEMENT VOLUME



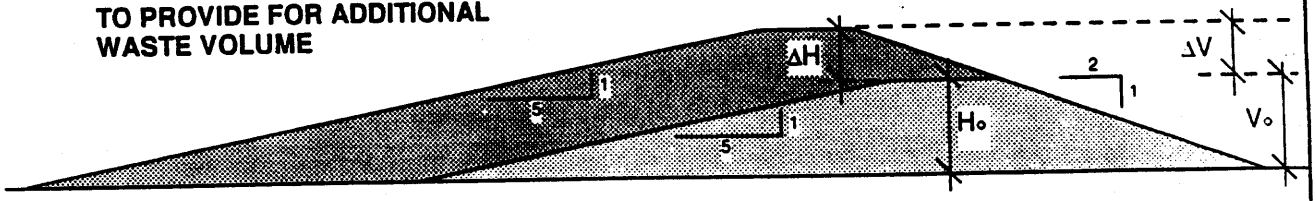
PHASE B DIKE GEOMETRY
FLATTEN DURING OR AFTER WASTE PLACEMENT



PHASE C DIKE GEOMETRY
RAISE AND FLATTEN DIKE DURING WASTE PLACEMENT FOR DESIGN VOLUME



PHASE D DIKE GEOMETRY
RAISE AND EXTEND DIKE TO PROVIDE FOR ADDITIONAL WASTE VOLUME



LEGEND

H_o – INITIAL DIKE HEIGHT

ΔH – INCREASE IN DIKE HEIGHT

V_o – INITIAL CELL VOLUME

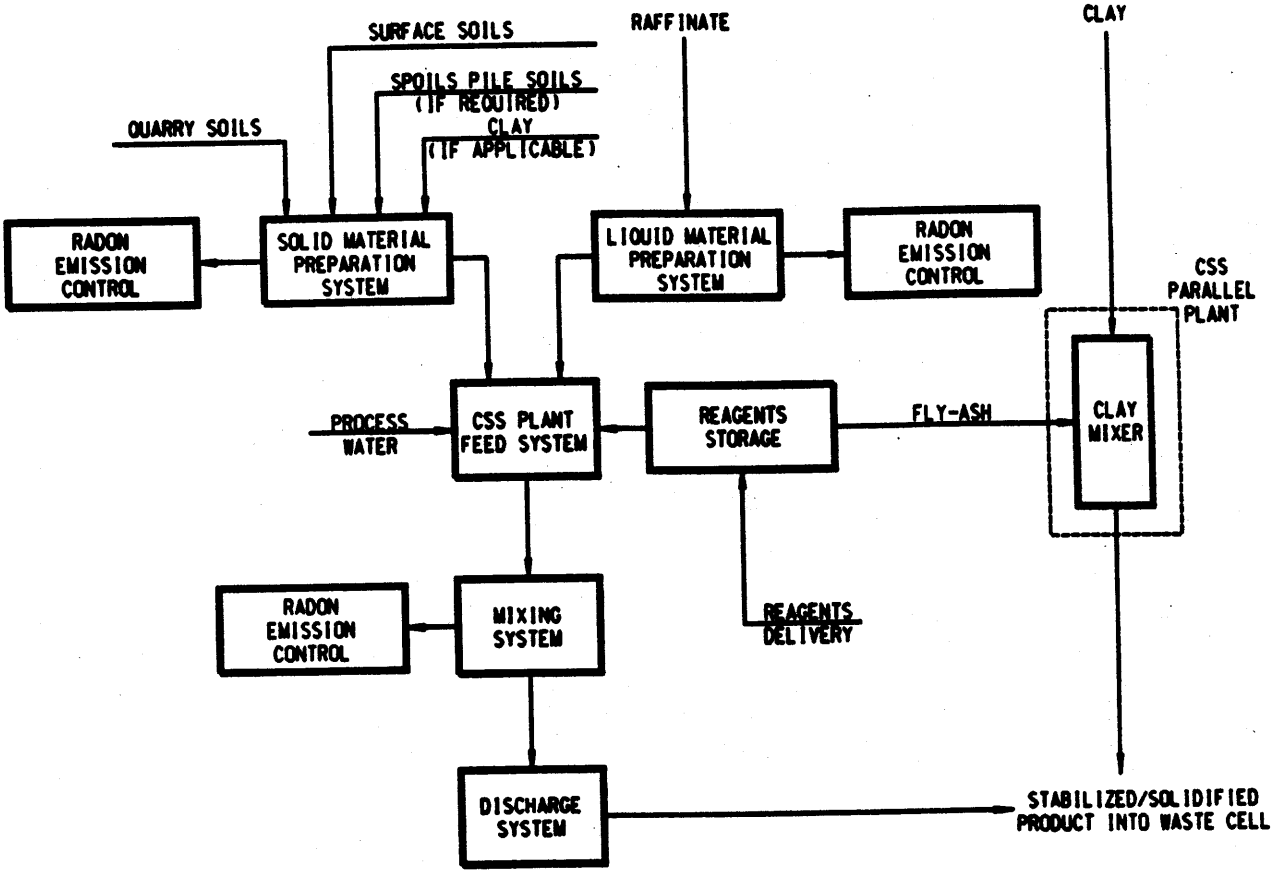
ΔV – INCREASE IN CELL VOLUME

CLEAN-FILL DIKE CONSTRUCTION: ALTERNATIVE PHASES

In order to provide for immediate waste volume, and possible increased waste volumes, the dike construction may be phased.

FIGURE 6.2.6-1

REPORT NO:		
DOE/OR/21548-411		
ORIGINATOR: JC	DRAWN BY: EBR	DATE: 05-17-93



NOTE:
RADON EMISSION CONTROL IS APPLICABLE ONLY AS DEVIATION OF CENTRAL RADON REMOVAL BEFORE DEWATERING PLANT

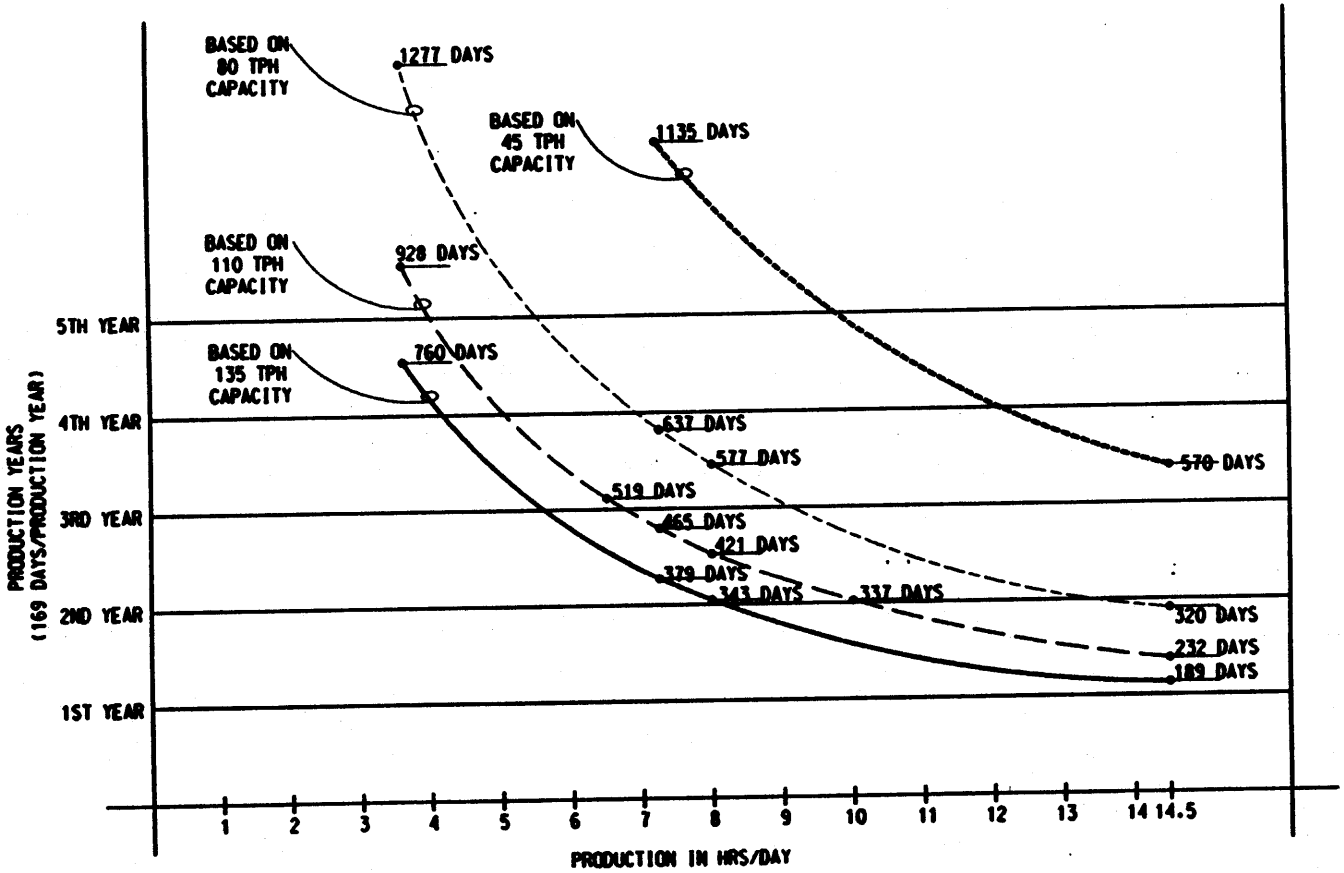
CSS PLANT OPERATIONS

FIGURE 6.3.2-1

REPORT NO.	DRAWING NO.
DOE/OR/21548-411	

ORIGINATOR	DRAWN BY	DATE

CAD FILE: WD3440/JOEFLOW.DGN PLOT DATE: 11-30-



NOTE:

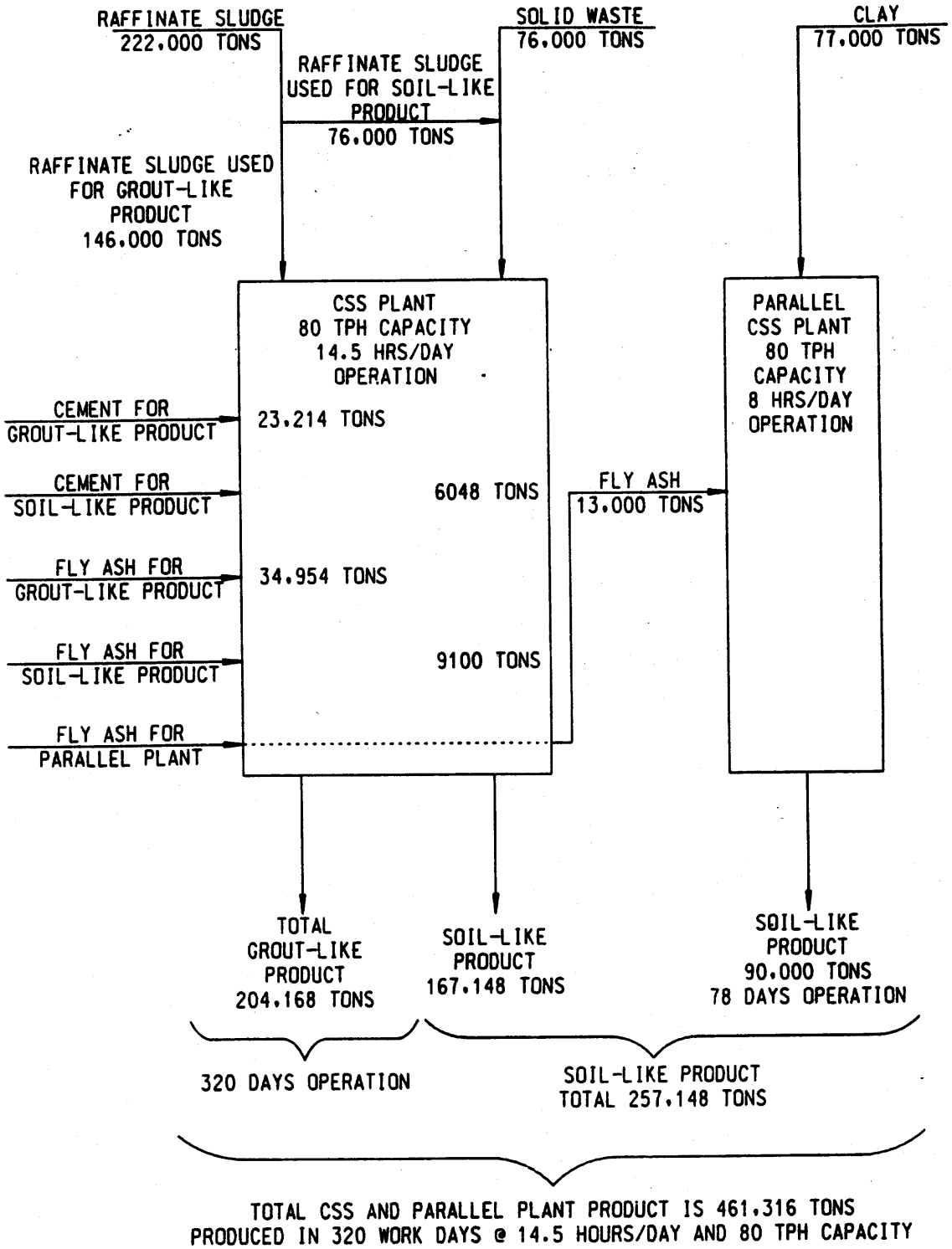
MONOLITHIC PRODUCT	203.000 TONS
SOIL-LIKE PRODUCT	167.000 TONS
TOTAL	370.000 TONS

REF. ONLY PARALLEL PLANT
SOIL-LIKE PRODUCT 90.000 TONS

CSS PLANT CAPACITY CHART
(Parallel plant
not included)

FIGURE 6.3.2-2

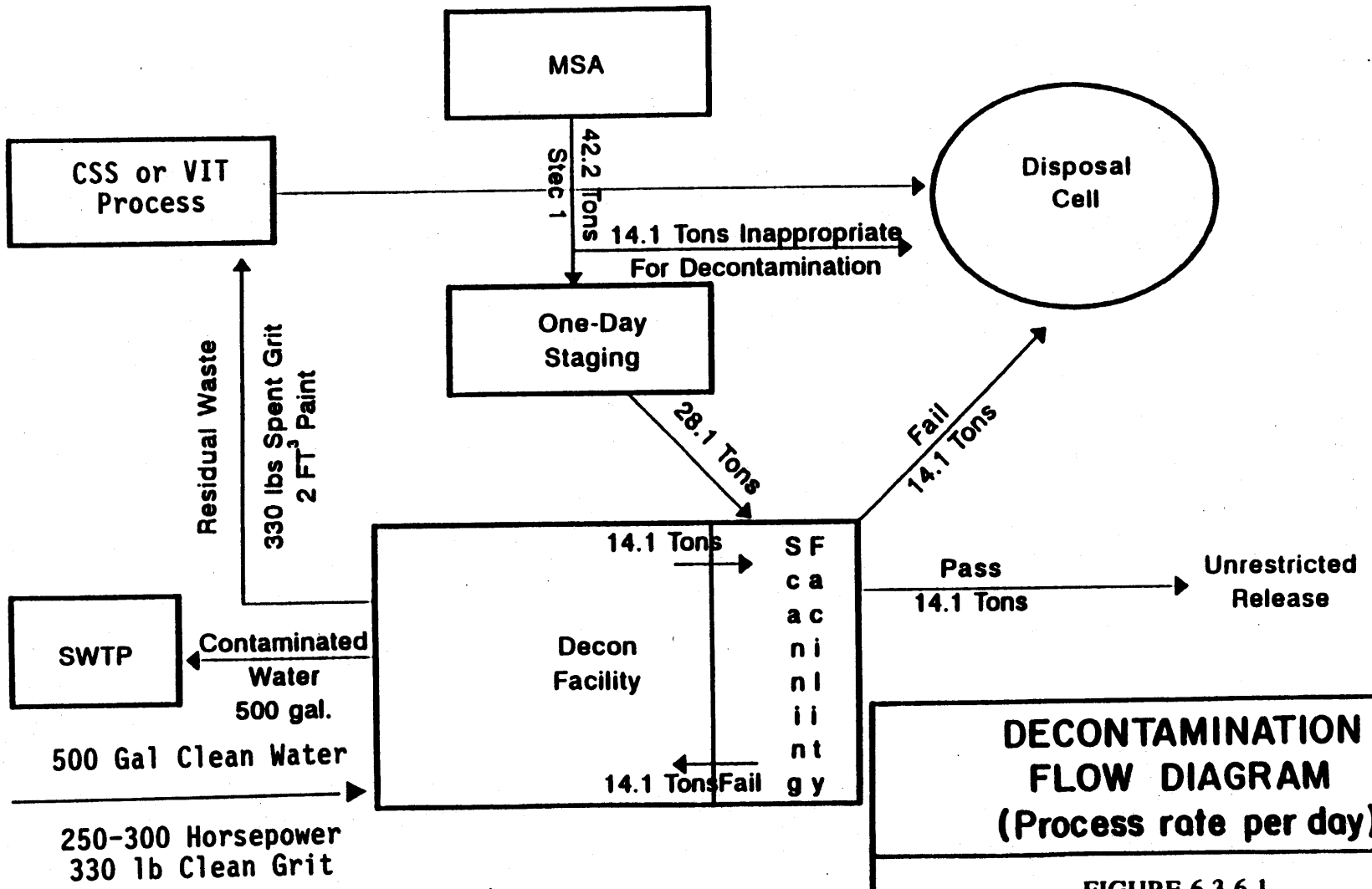
REPORT NO.	DRAWING NO.
DOE/OR/21548-411	
ORIGINATOR	DRAWN BY	DATE



CSS MATERIAL BALANCE

FIGURE 6.3.2-3

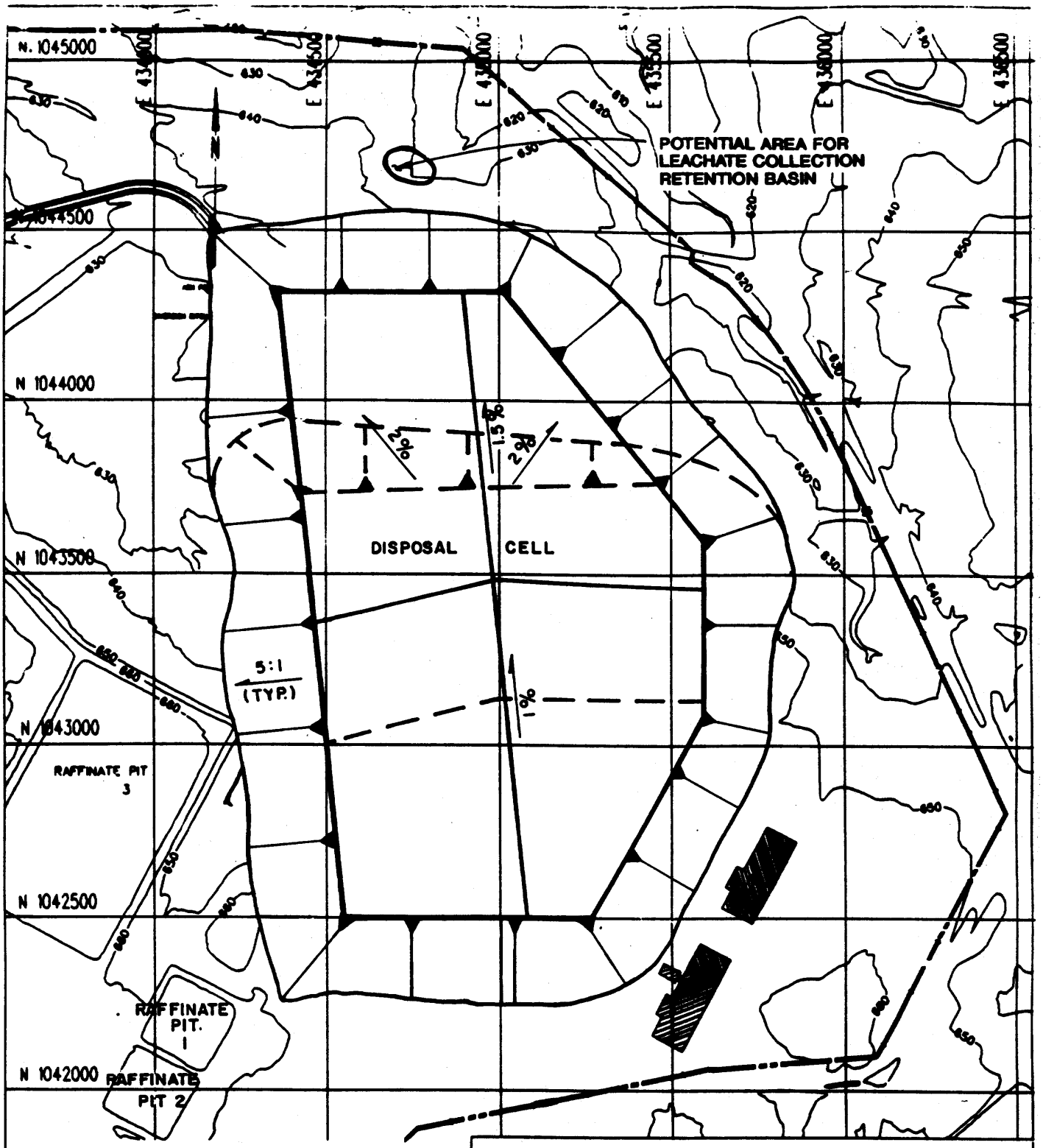
REPORT NO: DOE/OR/21548-411		DRAWING NO:
ORIGINATOR:	DRAWING BY:	DATE: 05/28/93



DECONTAMINATION FLOW DIAGRAM (Process rate per day)

FIGURE 6.3.6-1

REPORT NO.: OF/OR ...048-411	DRAWING NO.:	
ORIGINATOR: J.W.	DRAWN BY: rey	DATE: JAN., 1993



NOTE: CFD TOE LINE SHOWN HERE IS BASED ON EXISTING TOPOGRAPHY.

CELL VOLUME = 1.5 M CY

DASHED LINES SHOW NORTHERN LIMIT AND TOP COVER FOR 1.0 M CY

400 0 400 FEET

121.9 0 121.9 METERS

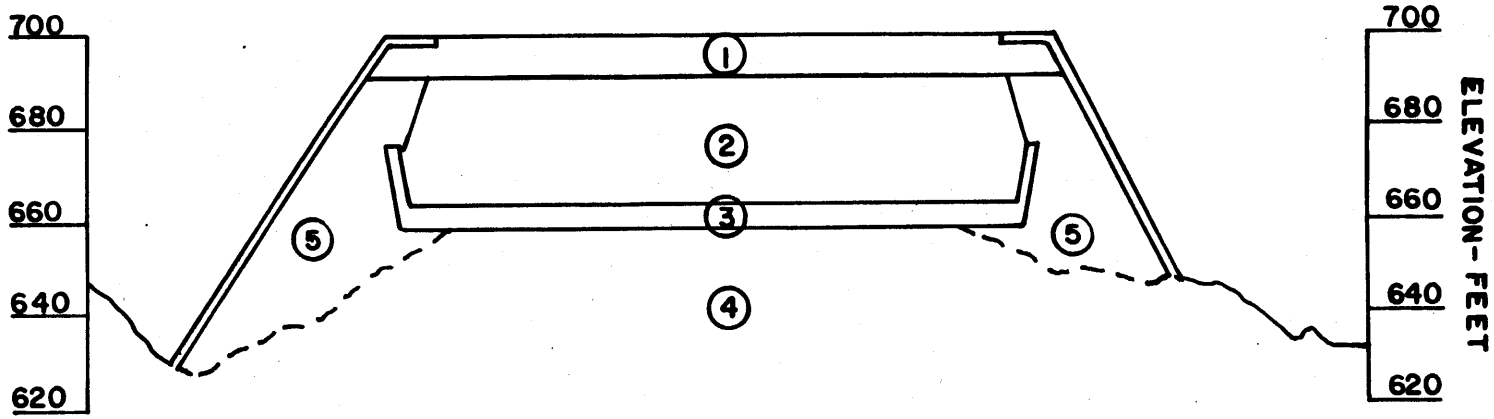
SCALE

PLAN VIEW OF CSS CELL CONFIGURATION

FIGURE 8.1

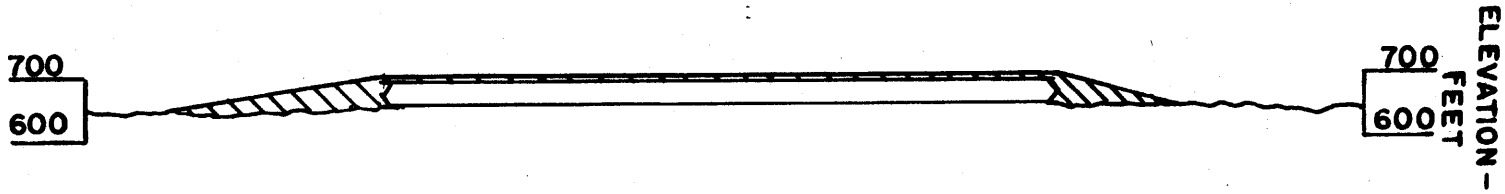
REPORT NO.: DOE/OR/21548-411		DRAWING NO.:
ORIGINATOR: KWL	DRAWN BY: AMA	DATE:

D:\3040CELL\3040UC4.DGN



DISPOSAL CELL SECTION

SCALE: 1" = 40' VERT.
1" = 300' HORIZ.

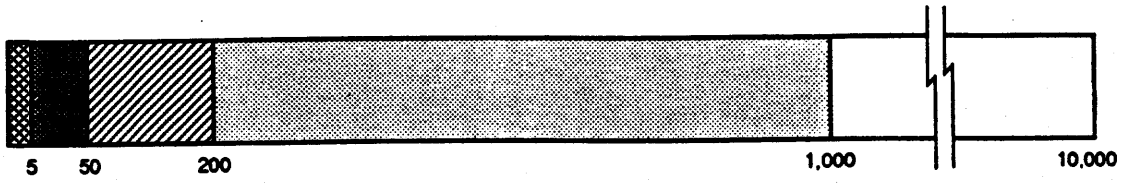


SCALE: 1" = 300'

LEGEND

1. COVER
2. WASTE
3. LINER & LEACHATE COLLECTION REMOVAL SYSTEM
4. FOUNDATION
5. CLEAN-FILL DIKE

DISPOSAL CELL CONFIGURATION		
FIGURE 8-2		
REPORT NO. DOE/OR/21548-411	DRAWING NO.	
ORIGINATOR	DRAWN BY	DATE



YEARS	PERIOD	PERFORMANCE
0 - 5	CONSTRUCTION	
5 - 50	SHORT TERM	OPERATION AND ACTIVE MAINTENANCE
50 - 200	MEDIUM TERM	MONITORING AND PASSIVE MAINTENANCE
200 - 1,000	LONG TERM	POSSIBLE MAINTENANCE
1,000 - 10,000	VERY LONG TERM	IN EQUILIBRIUM WITH ENVIRONMENT

DISPOSAL FACILITY PERFORMANCE PERIODS

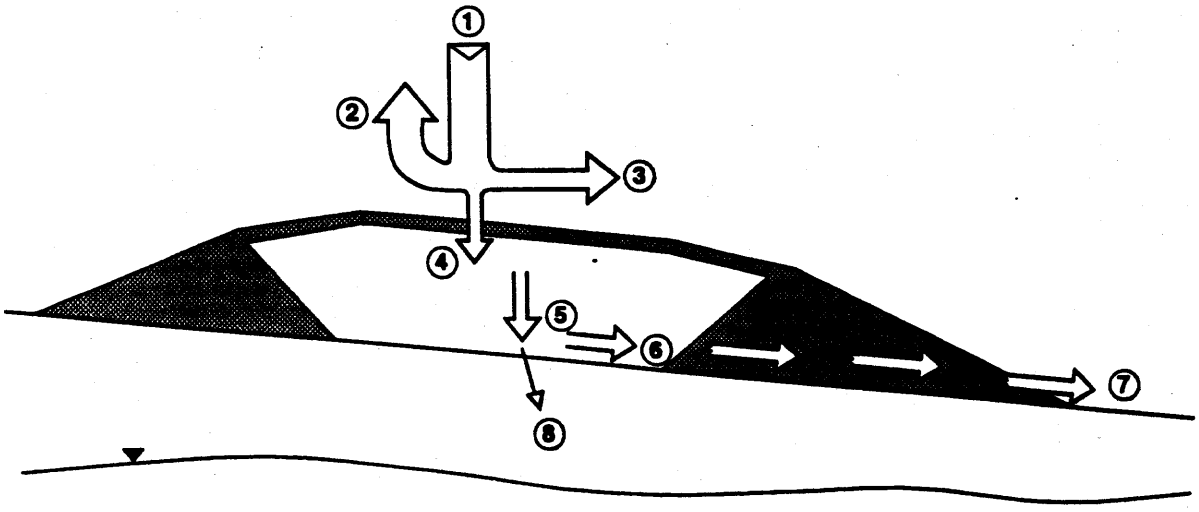
The disposal facility is designed to perform for 1,000 years to the extent reasonably achievable.

FIGURE 8-3

REPORT NO: DOE/OR/21548-411

ORIGINATOR	DRAWN BY	DATE
JC	MD/DJK	06/03/93

DISP FACL PERFORM PER



LEGEND	QUANTITIES (m^3/yr) AVG.	RANGE
1 PRECIPITATION	x_1	
2 EVAPOTRANSPIRATION	x_2	
3 RUNOFF	x_3	
4 COVER INFILTRATION	x_4	
5 SEEPAGE THROUGH WASTE	x_5	
6 LEACHATE COLLECTION SYSTEM FLOW	x_6	
7 SEEPAGE FROM CELL	3979 (2gpm)	
8 SEEPAGE THROUGH LINER	x_8	

NOTE: Quantities refer only to the top cover

DISPOSAL CELL TOP COVER HYDROLOGIC MODEL

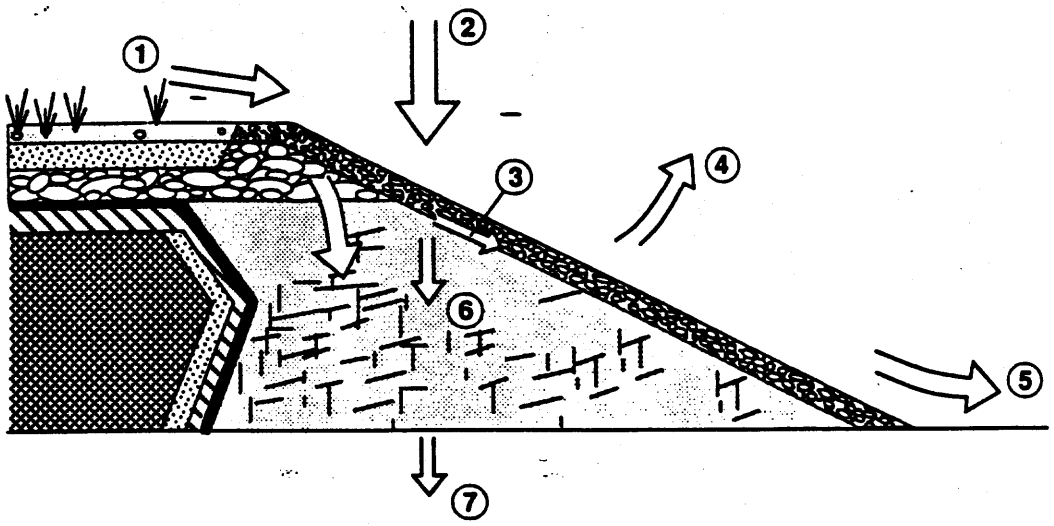
A small fraction of precipitation infiltrates the top cover, and leaves the cell via drains.

FIGURE 8-4 *REV-B*

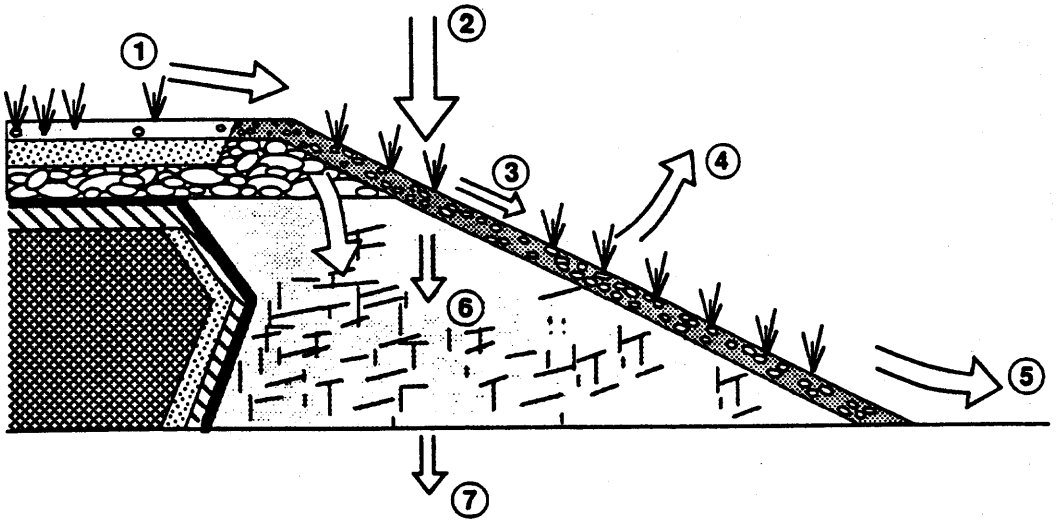
REPORT NO: DOE/OR/21548-411

ORIGINATOR:	DRAWN BY:	DATE:
JC	MD	08/05/92

DISP CELL HYDRO MOD



A) ROCK COVERED CLEAN-FILL DIKE SECTION WITH FLOW COMPONENTS



B) VEGETATED COVERED CLEAN-FILL DIKE SECTION WITH FLOW COMPONENTS

FLOW

1. TOP COVER RUNOFF
2. SIDE SLOPE INCIDENT PRECIPITATION
3. SIDE SLOPE RUNOFF
4. SIDE SLOPE EVAPOTRANSPIRATION
5. TOTAL CELL RUNOFF
6. DIKE INFILTRATION
7. SEEPAGE TO VADOSE ZONE

CLEAN-FILL DIKE WATER BALANCE MODEL FOR ROCK COVER

Some incident precipitation on the dike runs off and some infiltrates and seeps to the groundwater.

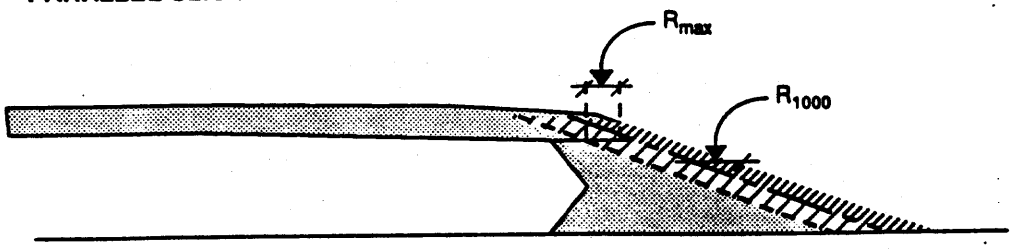
FIGURE 8-5

REPORT NO: DOE/OR/21548-411

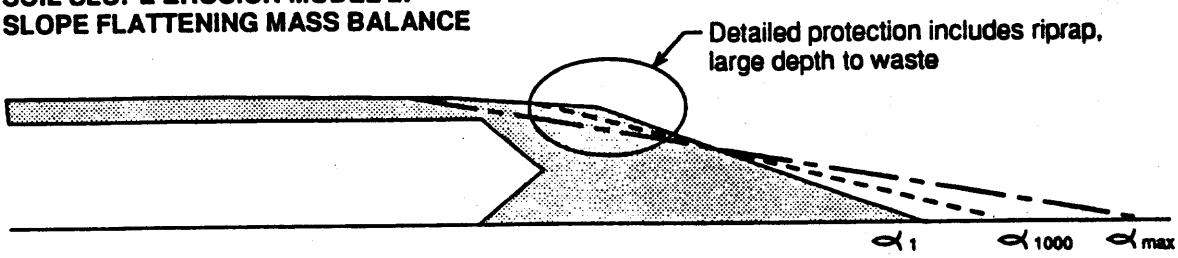
ORIGINATOR	DRAWN BY	DATE
JC	DJK	06/03/93

CLEAN FL DK WTR BAL MOD

SOIL SLOPE EROSION MODEL 1:
PARALLEL SLICE EROSION



SOIL SLOPE EROSION MODEL 2:
SLOPE FLATTENING MASS BALANCE



LEGEND

R_{1000} – SLOPE FACE RETREAT IN 1,000 YEARS

R_{max} – MAXIMUM FACE RETREAT FOR WASTE EXPOSURE: TIME OF RETREAT >1,000 YEARS

α_1 – INITIAL SLOPE ANGLE

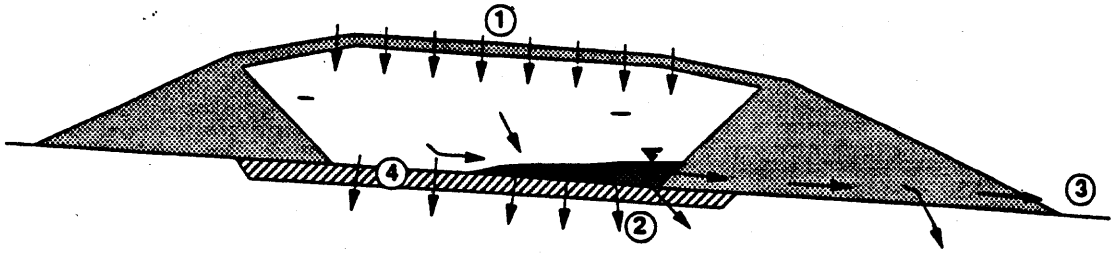
α_{1000} – SLOPE ANGLE AT 1,000 YEARS

α_{max} – MAXIMUM SLOPE ANGLE FLATTENING FOR WASTE EXPOSURE: TIME >1,000 YEARS

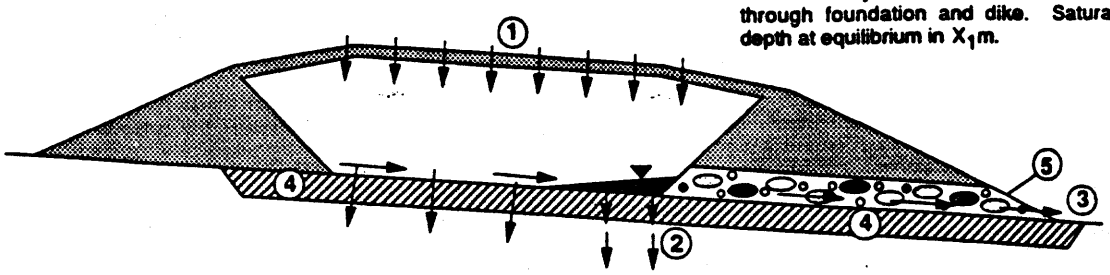
SOIL CLEAN-FILL DIKE EROSION MODELS
Face retreat in slope flattening of soil dike may occur depending on surrounding area geomorphologic change.

FIGURE 8-6

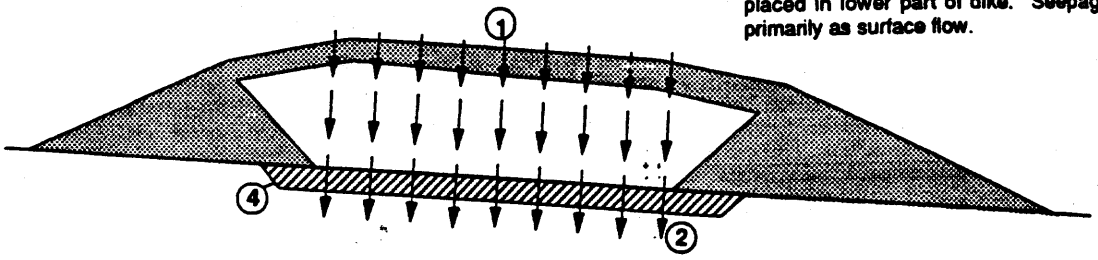
REPORT NO: DOE/OR/21548-411		
ORIGINATOR: JC	DRAWN BY: BR/DJK	DATE: 06/02/93



LONG-TERM THROUGH FLOW MODEL I
Cover infiltration exceeds basal liner seepage. Outlet drains blocked, liner system still intact. Saturated zone develops at cell low point. Increased hydraulic head increases seepage through foundation and dike. Saturated zone depth at equilibrium in X_1m.



LONG-TERM THROUGH FLOW MODEL II
Cover infiltration exceeds basal liner seepage through slightly degraded FML. Small saturated zone develops at cell low point. Seepage occurs primarily through high-permeability materials placed in lower part of dike. Seepage emerges primarily as surface flow.



LONG-TERM THROUGH FLOW MODEL III
The potential seepage through the basal liner (degraded FML) equals or exceeds cover infiltration or seepage from the waste. Accordingly flow is essentially vertically downward through the cell.

LEGEND

1. COVER INFILTRATION
2. SEEPAGE THROUGH BASAL LINERS
3. SURFACE SEEPAGE FROM CELL
4. BASAL LINERS
5. HIGHLY POROUS ZONE AT LEACHATE COLLECTION PIPES

LONG-TERM THROUGH FLOW MODELS

After cell abandonment, and possible failure of geomembranes and leachate collection system, the cover infiltration may flow to the groundwater or the surface, depending on cell layout features.

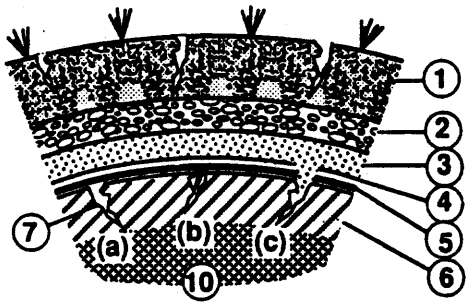
FIGURE 8-7

REPORT NO		
DOE/OR/21548-411		
ORIGINATOR	DRAWN BY	DATE
JC	MD/DJK	06/03/93

LONG-TERM FL-TH MOD

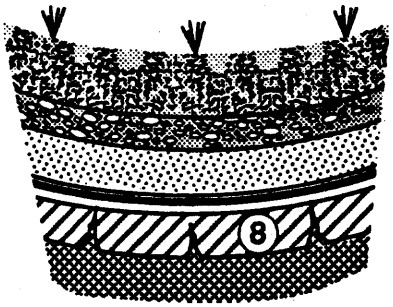
FEATURES THAT PRECLUDE FAILURE

- Dense or compacted wastes
- Avoiding discontinuities in waste type
- Thick cover components
- Overburden stress on radon barrier to prevent crack opening
- Soil with higher plasticity in radon barrier



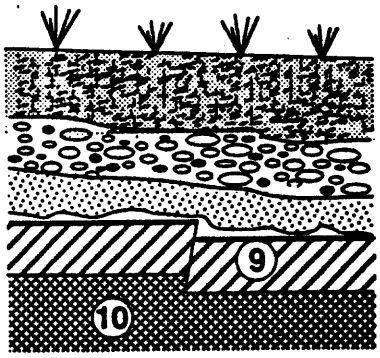
FAILURE SCENARIO I: CONVEX DEFORMATION

Convex deformation induces cracking of radon barrier and:
(a) FML and GCL bridge crack.
(b) Bentonite falls into crack and seals it.
(c) Sand falls into crack through breached FML and GCL.
Sands and cobbles do not crack. Random soil cracks by heat and by soil movement process.



FAILURE SCENARIO II: CONCAVE DEFORMATION

Concave deformation cracks bottom of radon barrier. Other soils placed into compression and do not crack. Increased radon flux through crack is stopped by GCL and FML layer.



FAILURE SCENARIO III: SHEAR DEFORMATION

Shear crack develops. GCL is disrupted. FML stretches. Sands and cobbles deform. Minor potential additional radon and water flux through deformation plane.

LEGEND

1. RANDOM SOIL
2. COBBLE BIOINTRUSION
3. SAND DRAIN
4. FLEXIBLE MEMBRANE LINER (FML)
5. GEOSYNTHETIC CLAY LINER (GCL)
6. RADON BARRIER SILT/CLAY
7. CONVEX DEFORMATION CRACK
8. CONCAVE DEFORMATION CRACK
9. SHEAR DEFORMATION CRACK
10. WASTE

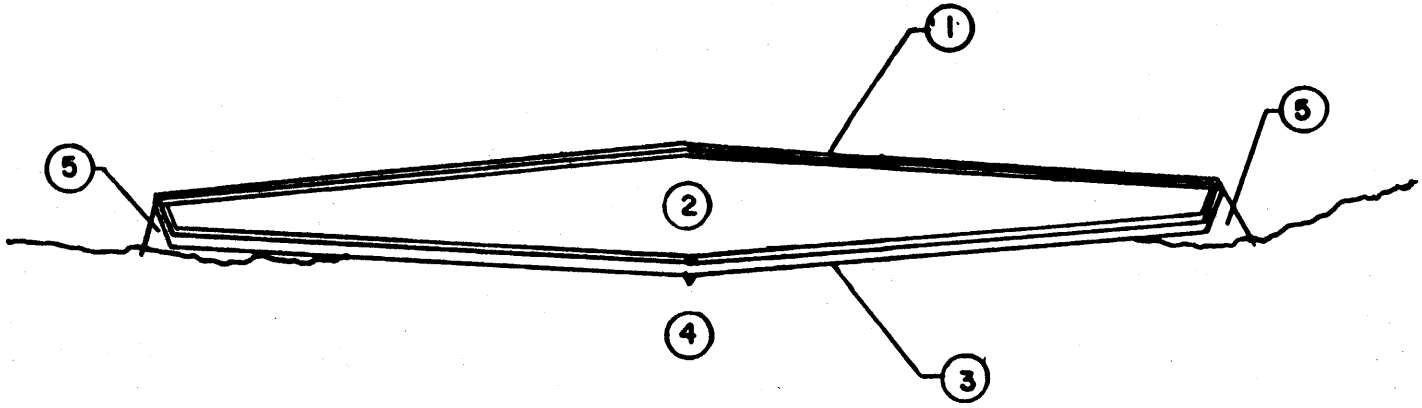
DEFORMATION-INDUCED CRACKING OF THE RADON BARRIER

Uneven settlement of the cell foundation and waste could deform and crack the radon barrier.

FIGURE 8-8

REPORT NO: DOE/OR/21548-411		
ORIGINATOR: JC	DRAWN BY: DJK/MD/EBR	DATE: 06/03/93

DEF INDUCED CRACK



NOTE: SEE FIGURE 8.7.2-2 FOR COVER AND LINER DETAILS

SCALE: 1" = 100'

LEGEND

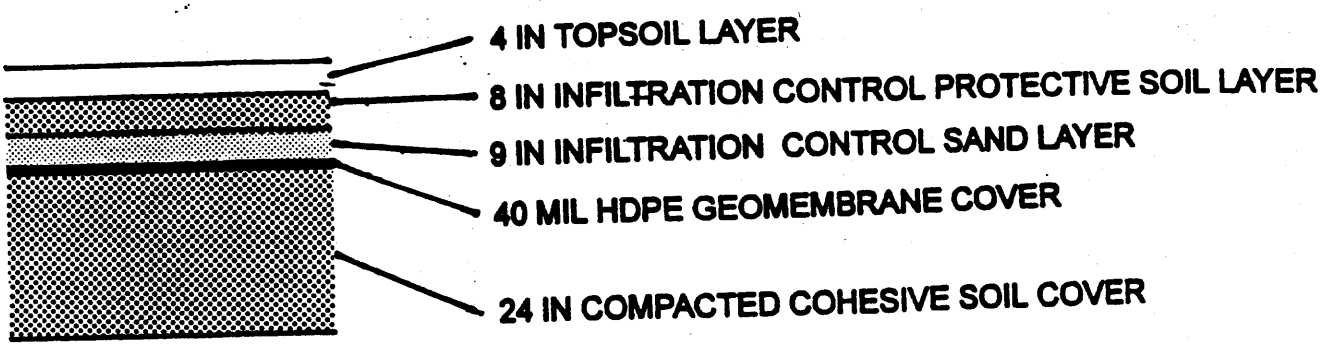
1. COVER
2. WASTE
3. LINER & LEACHATE COLLECTION REMOVAL SYSTEM
4. FOUNDATION
5. CLEAN-FILL DIKE

NEIS DESIGN
DISPOSAL CELL SECTION

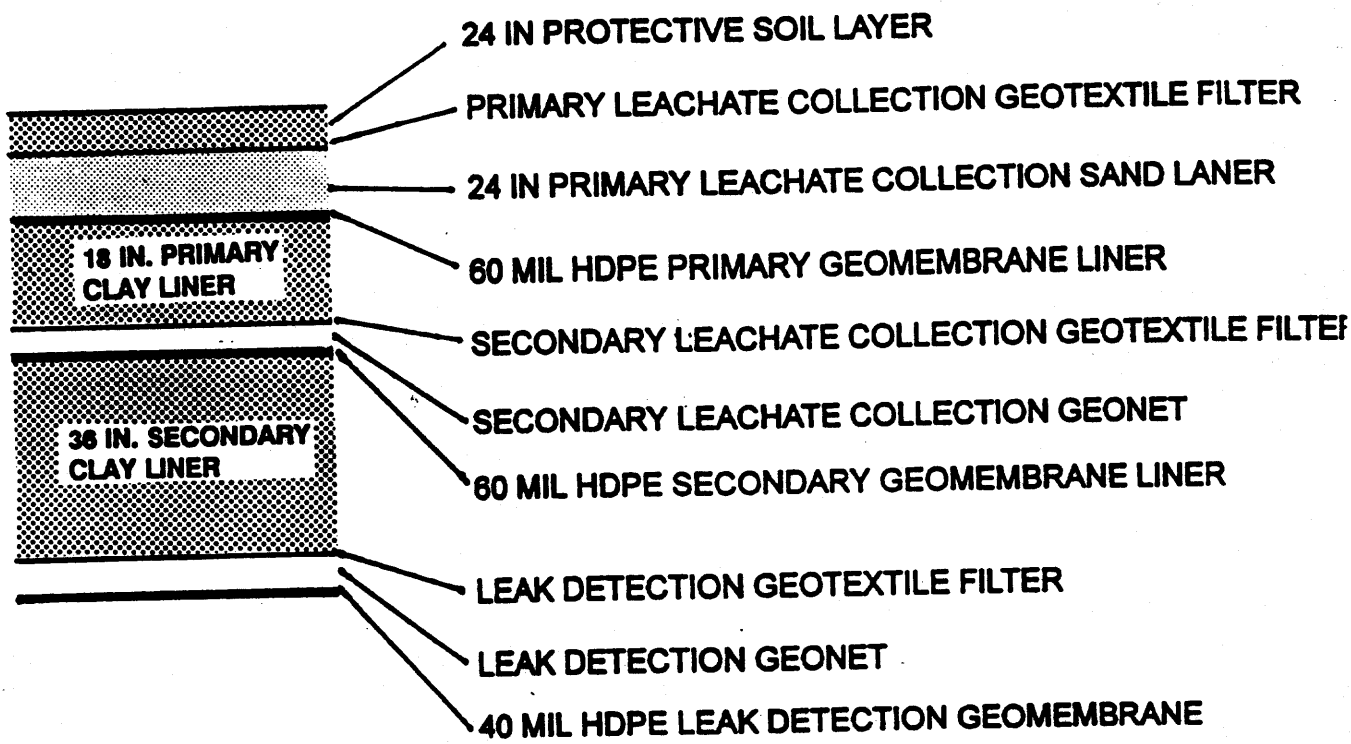
FIGURE 8-9

DOE/OR/21548-411

COVER SYSTEM



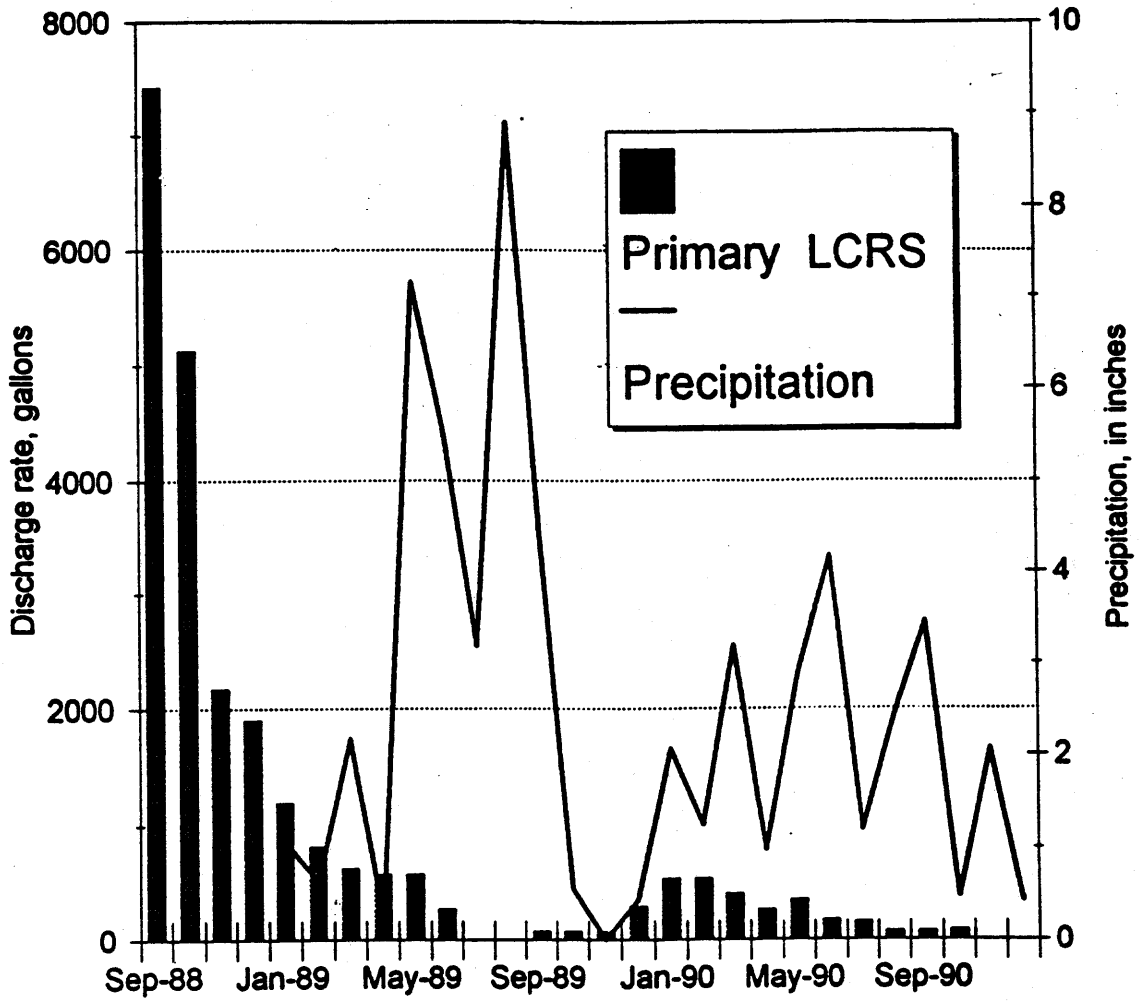
LINER SYSTEM



NEIS DESIGN-COVER AND LINER SYSTEM DETAILS

FIGURE 8-10

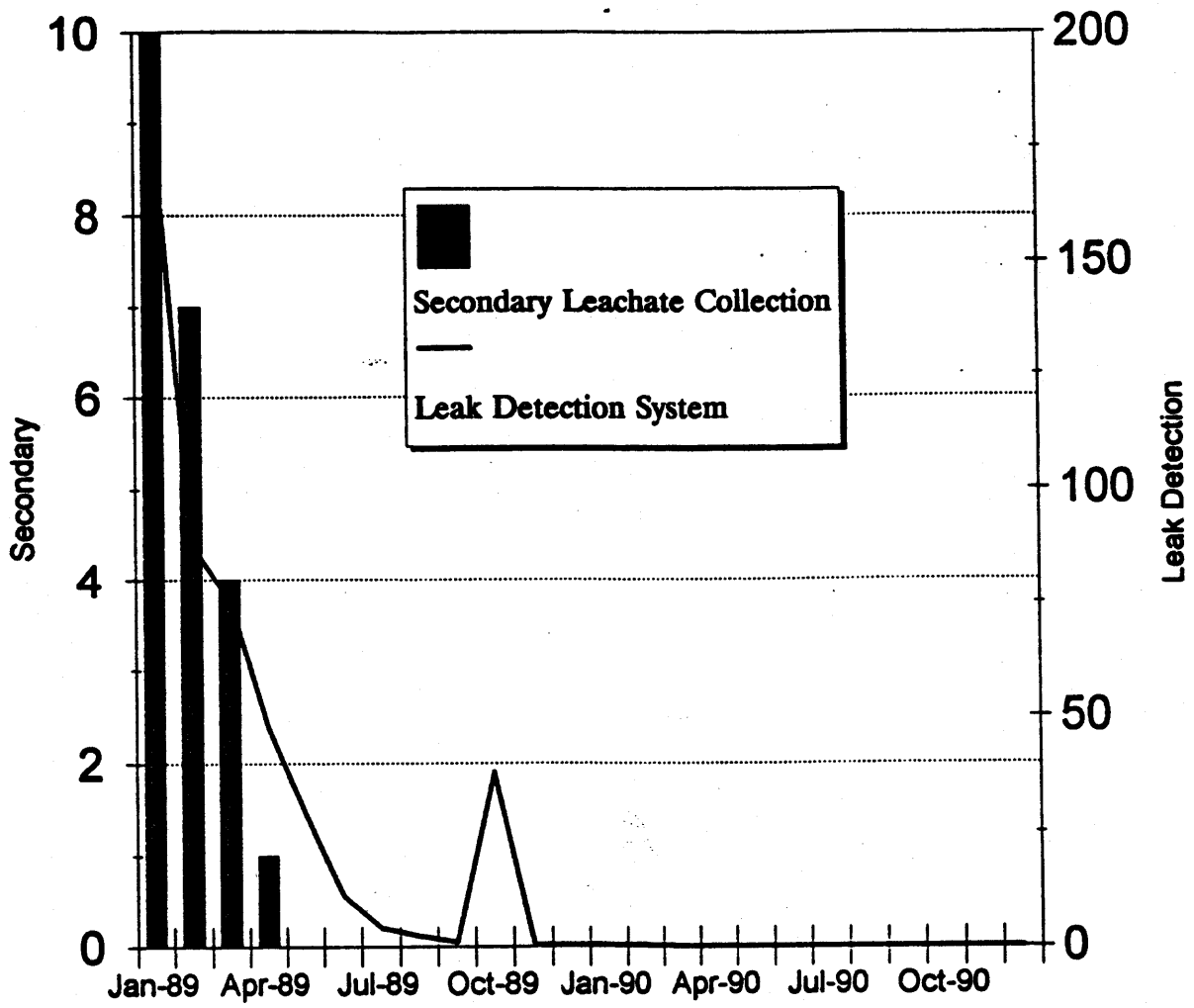
DOE/OR/21548-411



MOVING AVERAGE MONTHLY DISCHARGE
FROM
PRIMARY LEACHATE COLLECTION SYSTEM

FIGURE 8-11

REPORT NO. DOE/OR/21548-411	DRAWING NO.	
ORIGINATOR	DRAWN BY	DATE



MONTHLY DISCHARGE FROM NEIS LCRS, IN GALLONS

FIGURE 8-12

REPORT NO.	DRAWING NO.
DOE/OR/21548-411	

ORIGINATOR	DRAWN BY	DATE