33076

FINAL
PHASE III RI

VOLUME III
APPENDICES B, C, D, E, F, AND G

DRAKE CHEMICAL SITE
LOCK HAVEN, PENNSYLVANIA

AUGUST 1988
W.A. NO. 123-3L31

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FINAL

PHASE III RI

VOLUME III
APPENDICES B, C, D, E, F, AND G

DRAKE CHEMICAL SITE
LOCK HAVEN, PENNSYLVANIA

EPA WORK ASSIGNMENT NUMBER 123-3L31
UNDER
CONTRACT NUMBER 68-01-7250

PREPARED BY:
NUS CORPORATION
PITTSBURGH, PENNSYLVANIA

APPROVED BY:
EBASCO SERVICES INCORPORATED
LANGHORNE, PENNSYLVANIA

PREPARED BY:

DENNIS SMITH
SITE MANAGER
NUS CORPORATION

APPROVED BY:

RICHARD C EVANS, P.E.
REGIONAL MANAGER, REGION III
EBASCO SERVICES INCORPORATED

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AR302238

APPENDIX B-1

TEST PIT LOGS

TEST PIT LOG — **NUS CORPORATION**

PROJECT: Drake Chemical — TEST PIT NO: 1

PROJECT NO: 6207 — DATE: 11-13-87 — Level D

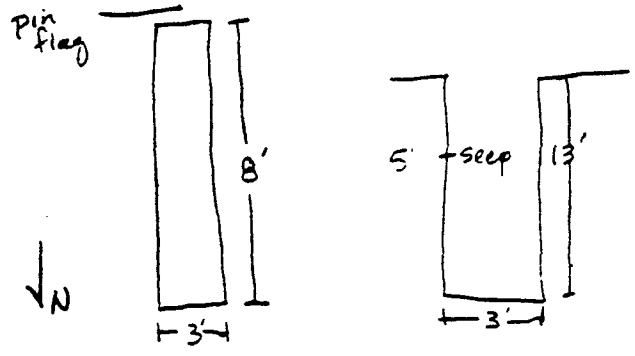
LOCATION: Lock Haven, PA

FIELD GEOLOGIST: C. Nieland

Construction King 880 B — R Cerroni — Penn Drilling

DEPTH (ft)	LITHOLOGY CHANGE (Depth, ft.)	MATERIAL DESCRIPTION (Soil Density / Consistency, Color)	USCS	REMARKS
1		Clay, black-brown, stiff	CL	
2		contains cement, wood, bricks,		odor in 3-4' zone
3		rounded pebbles		with yellow discoloration
4				
5		Black fill material - wood twigs,		Extremely wet, sewage odor
6		rounded pebbles		
7				
8		Clay, dark gray - stained from	CL	
9		sewage / fill layer above		
10		originally brown		
11		clay is soft, contains		
12		wood (large planks) and		
		rock slabs		

Test Pit Cross Section and / or Plan View



Not to scale

No indication of water table

REMARKS: Pit begun at 0930, completed at 1045, backfilled with removed material
All samples were grabs from backhoe bucket
Pit had water (≈2') from 3' down

PHOTO LOG: Camera #1 Sample #1 @ 1-2' photo # 23
Sample #2 @ 7-8' photo # 24
Sample #3 @ 11-12' photo # 27
Photos # 25, 26 of completed pit

TEST PIT

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AR302240

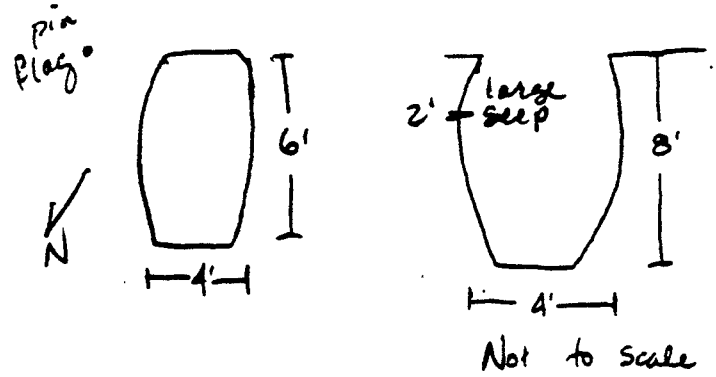
TEST PIT LOG — **NUS CORPORATION**

PROJECT: Drake Chemical — TEST PIT NO.: 2
PROJECT NO.: 620Y — DATE: 11-17-87 — Level D
LOCATION: Lock Haven, PA
FIELD GEOLOGIST: C. Nieland

Construction King 580B — R Cerroni — Penn Drilling

DEPTH (ft.)	LITHOLOGY CHANGE (Depth, ft.)	MATERIAL DESCRIPTION (Soil Density / Consistency, Color)	USCS	REMARKS
1		Sand, black w/organic material		
2	2			
3		Clay, lt. brown and gray, soft		@ 2' water pouring in from
4		in upper 2' wood planks and	CL	SE side of pit
5		cobbles, saturated throughout		
6				
7	7			
8	8	Sand, black intermixed with clay, stiff	SC	
9				
10				
11				
				Pit had ~2' water in
				bottom from 2' depth
				down

Test Pit Cross Section and / or Plan View



No indication of water table

REMARKS Pit begun at 1450, completed at 1580, backfilled with removed material. All samples were grabs from backhoe buckets.

PHOTO LOG Camera #1
Sample #1 @ 1-2' photo # 5 1450
Sample #2 @ 4-5' photo # 6 1505
Sample #3 @ 7-8' photo # 9 1515
Photo # 7, 8 of pit

TEST PIT

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AR302241

TEST PIT LOG — **NUS CORPORATION**

PROJECT: Drake Chemical — TEST PIT NO: 3

PROJECT NO: 620 Y — DATE: 11-17-87 — Level D

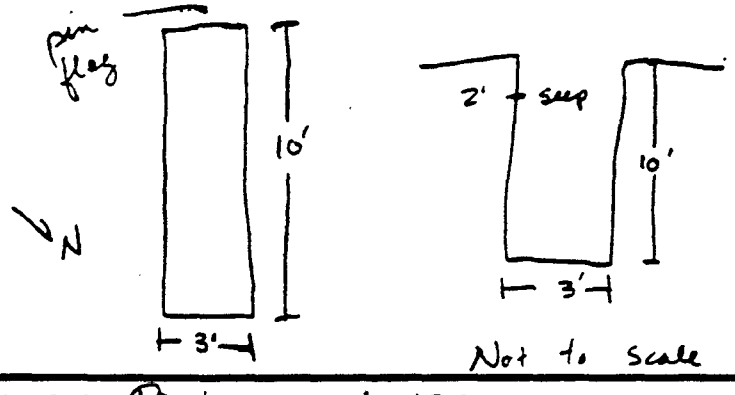
LOCATION: Lock Haven, PA

FIELD GEOLOGIST: C. Nieland

Construction King 580 B — R. Cerroni — Penn Drilling

DEPTH (ft.)	LITHOLOGY CHANGE (Depth, ft.)	MATERIAL DESCRIPTION (Soil Density / Consistency, Color)	USCS	REMARKS
1		Clay - black, brown with red	CL	contained red plastic
2		spotting, rock and ceramic pieces		bag with red dye, seeping
3		Clay, lt brown - orange, 2"-6"		
4		rock slabs, rounded cobbles		
5		clay is soft, easily rolled to ¼"		
6				
7				
8		Fill material - wood, clay, brick		Strong sewage odor, wet
9		Clay, yellow/green, plastic, soft	CL	
10		Stained gray and saturated		@ 10' pit began caving in
11		from fill material above		
12				
				Pit stopped due to
				caving

Test Pit Cross Section and / or Plan View



No indication of water table

REMARKS Pit begun at 1350, completed at 1445, backfilled with removed material

All samples were grabs from backhoe bucket

PHOTO LOG Camera #1

Sample #1 @ 1-2' photo # 35 1355

Sample #2 @ 7-8' photo # 1 1420

Sample #3 @ photo # 4 1435

Photo # 2, #3 of pit, N + E sides

Photo # 36 of plastic bag of dye, N side of pit

TEST PIT

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AR302242

TEST PIT LOG — **NUS CORPORATION**

PROJECT: Drake Chemical — TEST PIT NO: 4

PROJECT NO: 6209Y — DATE: 11-17-87 — Level D

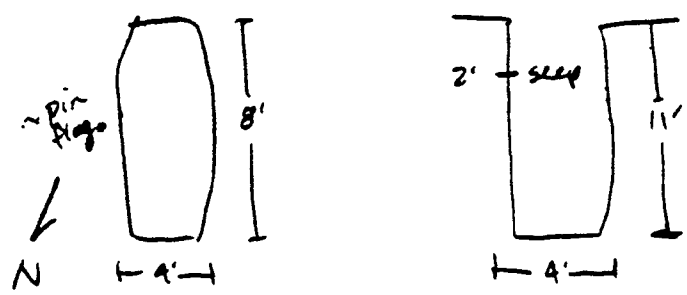
LOCATION: Lock Haven, PA

FIELD GEOLOGIST: C. Nieland

Construction King 5803 R Cermie Penn Drilling

DEPTH (ft)	LITHOLOGY CHANGE (Depth, ft.)	MATERIAL DESCRIPTION (Soil Density / Consistency, Color)	USCS	REMARKS
1	1	Sand, clay, organic material, black		
2		clay, brown-gray, stiff	CL	Slight odor and dk. brown
3	3			staining, wet @ 2'
4		Clay, brown sand, wood, rounded		Strong sewage odor
5		pebbles		Wet to 4', then dries
6				up so not saturated
7	7			
8		Sand, clay, black-gray, orange	SC	Very wet (from seep?) ~~to~~
9		large cobbles wood chips		~~4', 4~~ (CLW)
10				
11	11			
				1-2' of water in pit
				from 2' depth down

Test Pit Cross Section and / or Plan View



Not to scale

No indication of water table

REMARKS Pit begun at 1540, completed at 1650, backfilled with removed material, all samples grabs from backhoe bucket.

PHOTO LOG

Camera #1	Sample #1 @ 0-1'	photo # 10	1545
	Sample #2 @ 7-8'	photo # 11	1555
	Sample #3 @ 10-11'	photo # 14	1620
	Photo # 12, 13 of pit		

TEST PIT

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AR302243

TEST PIT LOG — **NUS CORPORATION**

PROJECT: Drake Chemical — TEST PIT NO: 5

PROJECT NO: 6204 — DATE: 11-18-87 — Level D

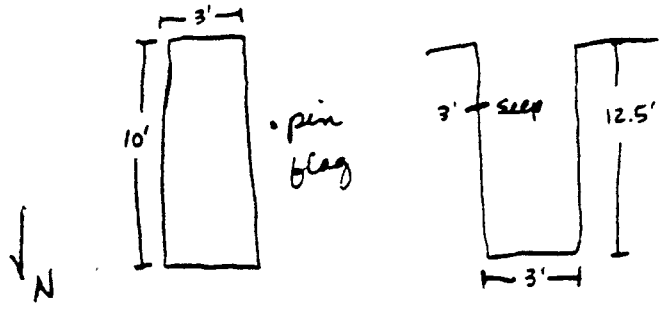
LOCATION: Lock Haven, PA

FIELD GEOLOGIST: C. Nieland

Construction King 580 B — R Cerroni — Penn Drilling

DEPTH (ft)	LITHOLOGY CHANGE (Depth, ft.)	MATERIAL DESCRIPTION (Soil Density / Consistency, Color)	USCS	REMARKS
1		Brown clay with rock fragments (~30-40%)	SC	
2		wood planks, plastic, rounded cobbles		
3		Sandy		Water at 3', oily sheen on surf
4	3.5	Black material, sand, twigs, roots, wood	—	Saturated
5	4.5			
6		Clay, orange/brown, soft, flexible	CL	
7		rolls to ¼"		
8				
9				
10				
11				
12	11.5	Gray/brown clay, sand, roots	CL	
13	12.5	w/black marbled appearance		

Test Pit Cross Section and / or Plan View



No indication of water table

Not to scale

REMARKS: Pit begun at 1330, completed at 1515, backfilled with material removed, all sample grabs from backhoe bucket.

PHOTO LOG — Camera #1

Sample #1	@ 1-2'	photo # 1	1345
Sample #2	@ 7-8'	photo # 2	1415
Sample #3	@ 12-13'	photo # 3	1430
Photos # 4, 5 of pit			

TEST PIT

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AR302244

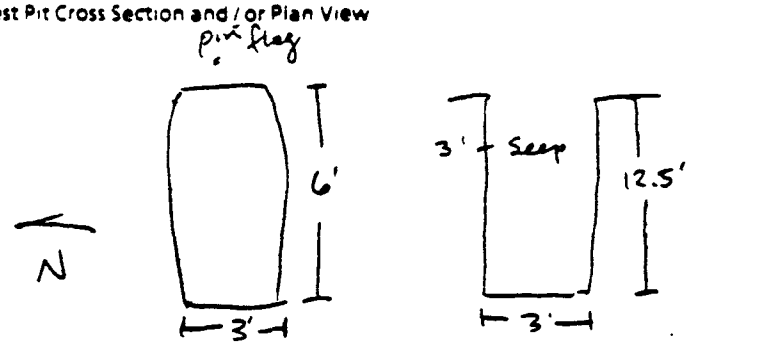
TEST PIT LOG — **NUS CORPORATION**

PROJECT: Drake Chemical — TEST PIT NO: 6
PROJECT NO: 6204 — DATE: 11-18-87 — Level D
LOCATION: Lock Haven, PA
FIELD GEOLOGIST: C Nieland

Construction King 580 B — R Cerroni — Penn Drilling

DEPTH (ft)	LITHOLOGY CHANGE (Depth, ft.)	MATERIAL DESCRIPTION (Soil Density / Consistency, Color)	USCS	REMARKS
1	1	Fill material (wood, bricks, sand, clay)		~50% rock fragments, slight odor
2		Lt brown - orange clay, soft	CL	
3		rock fragments, rounded cobbles		Seep at 3'
4				
5		changes to yellow/orange as		At 5', become moist
6		gradually goes down		and was sliding down
7		becomes intermixed with organic		sides
8		material - roots, etc →		sewage odor
9				
10				
11				
12				
13	▽	pit dug to 12.5' lt brown clay		at 12.5' > 1" water in
		stiff, crumbles, dry		bottom of pit - could be
				water table

Test Pit Cross Section and / or Plan View



Not to scale

REMARKS: Pit began at 0800, completed at 0930, backfilled with removed material, all samples grabs from backhoe bucket

PHOTO LOG — Camera #1
Sample #1 @ 1-2' — Photo #15 — 0810
Sample #2 @ 7-8' — Photo #16 — 0820
Sample #3 @ 12-13' — Photo #17 — 0850
Photos #18, 19 of pit

TEST PIT: TP-6

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TEST PIT LOG — NUS CORPORATION

PROJECT: DRAKE CHEM — TEST PIT NO: TP-7

PROJECT NO: 6209Y — DATE: 11/13/87 — LEVEL D PROTECTION

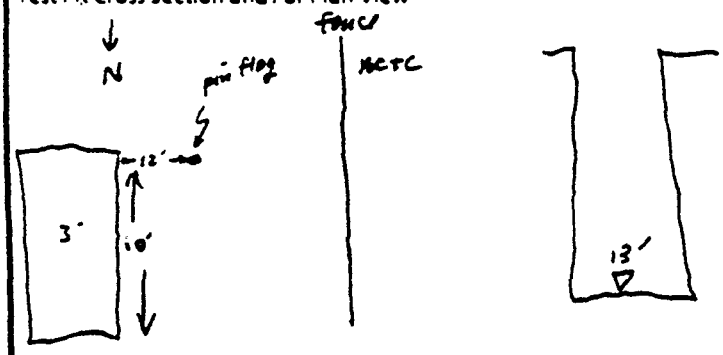
LOCATION: LOCK HAVEN, PA

FIELD GEOLOGIST: R. BETHEL, C. NIELAND

PENN DRILLING : CONSTRUCTION KING 580B — B. CERRONI

DEPTH (ft)	LITHOLOGY CHANGE (Depth, ft.)	MATERIAL DESCRIPTION (Soil Density / Consistency, Color)	USCS	REMARKS
1		Gravel w/ clay Fill (some sand), stiff	FILL	Buried wood, asphalt, brick, 4" orange/layer
2		saturated to moist, Drk Brn		0.5', stiff, crushes w/ finger, seeping in
3	2.5'	multicolored: red, orange, yellow fill		
4	4'	med. stiff clay w/ fine sand, some pebbles		cohesive, will roll into 1/8" string.
5		Blk to drk Brn fill mat., wood + bricks in		
6		sandy clay matrix, moist, FILL		
7		Brn clay w/ silt (silty clay from 6-6.5')	CL	will roll into 1/8" string
8				
9				
10				
11				
12				
13	13' ▽	TD ~ 13'		

Test Pit Cross Section and / or Plan View



REMARKS: Moved pit location ~12' E away from buried sewer and water lines. TO @ Encountered water @ ~13'. Sample #1 from 0-1', #2 from 6-7', #3 from 12-13'.

PHOTO LOG: #18: sample from 0-1', #19: sample from 6-7', #20: sample from 12-13', #21, 22: looking in test pit facing ESE.
Pit backfilled w/ original material 0900 11/13/87

TEST PIT: TP-7

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AR302246

TEST PIT LOG — **NUS CORPORATION**

PROJECT: Drake Chemical — TEST PIT NO: 9

PROJECT NO: 6207 — DATE: 11-18-87 — Level D

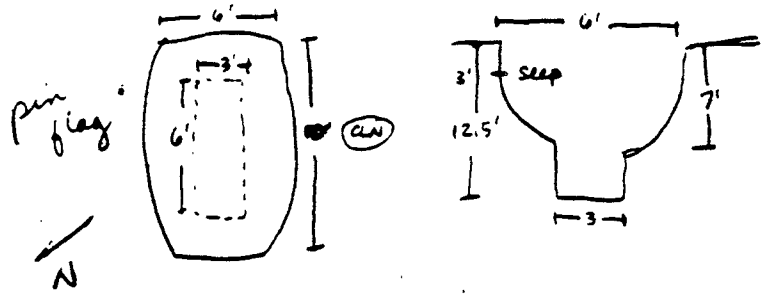
LOCATION: Lock Haven, PA

FIELD GEOLOGIST: C. Nieland

Construction King 580B @ Cerroni — Penn Drilling

DEPTH (ft)	LITHOLOGY CHANGE (Depth, ft.)	MATERIAL DESCRIPTION (Soil Density / Consistency, Color)	USCS	REMARKS
1		Orange/brown clay, stiff	CL	Some black, yellow, rust
2		rounded pebbles		discolorations
3	3			
4	4	Black fill, wood, sand, roots, etc. Clay		strong sewage odor, water seeping in
5	5	Clay, compact, soft, brown	CH	Strong sewage odor
6		Clay, sand, rock slabs, rounded cobbles	CL	very moist
7				
8	7.5			
9		lt brown clay, compact, soft	CH	
10				
11				
12				
13				← Bottom of pit, 12.5'

Test Pit Cross Section and / or Plan View



No indication of water table.

Not to scale

REMARKS: P7 began at 1015, completed at 1230, backfilled with removed material; all samples grabs from backhoe bucket

PHOTO LOG — Camera #1

Sample #1 @ 0-1'	photo # 20	1020	
Sample #2 @ 4.5'	photo # 21	1035	
Sample #3 @ 11-12'	photo # 22	1130	
Photo # 23, 24 of pit			

TEST PIT

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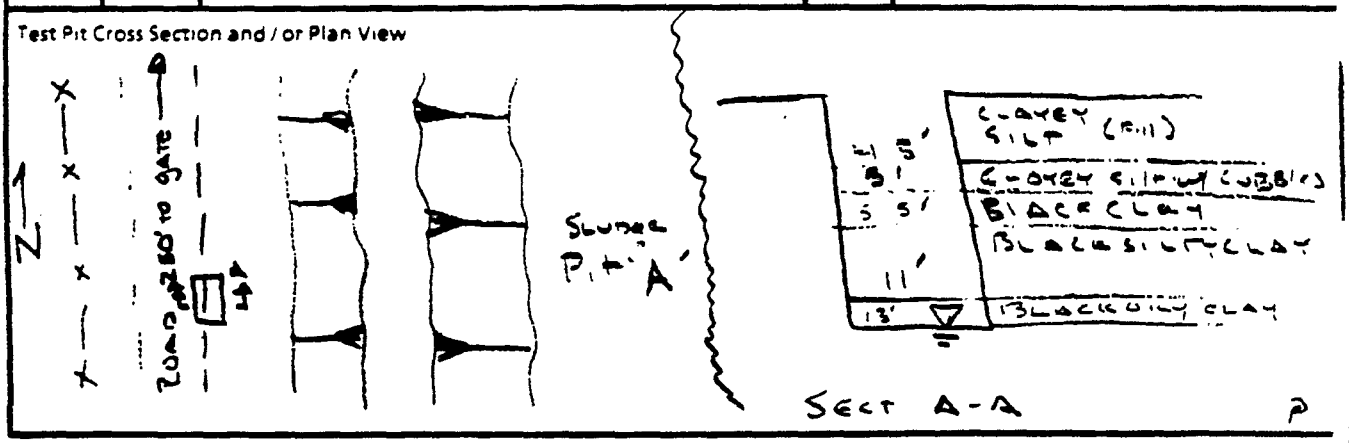
AR302247

TEST PIT LOG | NUS CORPORATION

PROJECT: DRAKE CHEMICAL | TEST PIT NO 10
PROJECT NO: 620Y | DATE: November 22, 1987
LOCATION: LOCK HAVEN, PA.
FIELD GEOLOGIST: Rick Bethel

DEPTH (ft)	LITHOLOGY CHANGE (Depth, ft.)	MATERIAL DESCRIPTION (Soil Density / Consistency, Color)	USCS	REMARKS
0		Red Brown Clayey silt	CL	Fill
4.5		w/Cobbles		
5		Black clay band		
5.5		Black silty clay w/ wood pieces	CL	SAMPLE 2 6'-8' 1030HRS
		Bricks, gravel		
11.		Black oily clay w/ light	CL	
		Brown streaks		SAMPLE 3 12'-13' 1050HRS
13	▽	Bottom of Hole WATER		

Test Pit Cross Section and / or Plan View



REMARKS
Sample #1 collected from TP-10 on Nov. 21

PHOTO LOG

TEST PIT 10

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AR302248

TEST PIT LOG — NUS CORPORATION

PROJECT: Drake Chemical — TEST PIT NO: 11

PROJECT NO: 6204 — DATE: 11/2/87

LOCATION: Lock Haven, PA

FIELD GEOLOGIST: J. Schultz

DEPTH (ft)	LITHOLOGY CHANGE (Depth, ft.)	MATERIAL DESCRIPTION (Soil Density / Consistency, Color)	USCS	REMARKS
1		Fill Material, Brick	Fill	
2		Wood, Wood Chips, Stones		
3		Brown, Very Loose Texture		
4				
5				
6		Green Gray Clay w/ Sand & Stones		
7		Gravel, Soft Paint, Possible Fill		
8		Black Sludge w/ Cobbles		
9		Black Clay w/ Cobbles & Gravel	CL	Can Roll Into 1/16" String
10		Brown Clay w/ Sand		Can Roll Into 1/16" String
11				
12		Brown & Black Clay, Stones		
13		Sand, Very Firm, Moist		Roll Into 1/16" String
14	14'	Ground H_2O Seep In Bottom Of Pit		

Test Pit Cross Section and / or Plan View

REMARKS: Pit Started At 1135, Completed At 1420. Water Table Was Hit At ~13.5'. All Samples Are Grab Samples. Hit Obstruction At ~4', Extended West End Of Pit.

PHOTO LOG: Sample #1 @ 0-2' Photo #1; Sample #2 @ 6-7' Photo #3; Sample #3 @ 12-13' Photo #4; Photos #5-6 Looking Into Pit

TEST PIT

PAGE ____ OF ____

AR302249

TEST PIT LOG — **NUS CORPORATION**

PROJECT: Drake Chemical — TEST PIT NO 12

PROJECT NO: 6201 — DATE: 11/21/87

LOCATION: Lock Haven PA

FIELD GEOLOGIST: J. Schultz

DEPTH (ft)	LITHOLOGY CHANGE (Depth, ft.)	MATERIAL DESCRIPTION (Soil Density / Consistency, Color)	USCS	REMARKS
1		Fill Material - Bricks, Rocks	Fill	
2		Wood, Wood Chips	↓	
3		Very Loose in Texture		
4				
5				
6				
7				
8		Water Seepage		
9		Firm Clay w/ Wood Chips	CL	Roll into 1/8" String
10		& Sand, Moist to Saturated, Black		Chemical Odor
11		Firm Clay, Mostly Brown w/		
12	12'	Black Streaks		

Test Pit Cross Section and / or Plan View

REMARKS ~4' of water in completed pit. Pit started at 1605, 11/20/ completed at 1030, 11/21/87. Could not distinguish if water table was hit and not used due to weather.

PHOTO LOG Sample #1 @ 1610 11/21/87 0-2' Photo #18
Sample #2 @ 0945, 11/21/87 9-10' Photo #19
Sample #3 @ 1000, 11/21/87 11'-12' Photo #20
Photos #21, 22, 23 of test pit.

TEST PIT 1

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AR302250

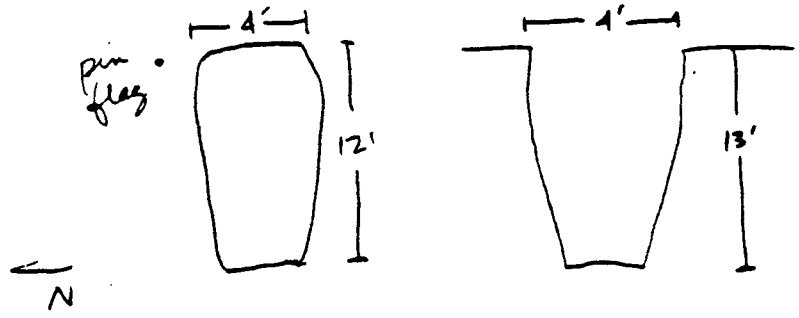
TEST PIT LOG — **NUS CORPORATION**

PROJECT: Drake Chemical — TEST PIT NO: 13 Level D
PROJECT NO: 6204 — DATE: 11-18,19-87
LOCATION: Lock Haven, PA
FIELD GEOLOGIST: C. Nieland

Construction King 580 B — R. Cerroni — Penn Drilling

DEPTH (ft.)	LITHOLOGY CHANGE (Depth, ft.)	MATERIAL DESCRIPTION (Soil Density / Consistency, Color)	USCS	REMARKS
1		Clay, sand, brown-black	SC	much fill-type material -
2		~30% rock fragments		wood, plastic, metal
3		Red and pink paints and dyes -		depth varied from 3'-5'
4		semi-liquid		deeper in west end,
5		also some fill material (wood,		also thicker toward west
6		metal)		
7				
8		Clay, dk gray-black containing	CL	
9		small roots, fibrous organic matter		
10		soft clay		rolls to 1/4"
11				
12				
13				→ 13.5' Bottom of pit

Test Pit Cross Section and / or Plan View



No indication of water table

Not to scale

REMARKS: Pit begun at 1600, 11-18-87, completed at 1045, 11-19-87
backfilled with material removed, all samples grabs from backhoe bucket.
Possibly some broken drums in upper 2 feet

PHOTO LOG — Camera #1
Sample #1 @ 1-2' photo # 13 1605 11/18
Sample #2 @ 7-8' photo # 12 0840 11/19
Sample #3 @ 12-13' photo # 14 0905 11/19
Photo # 10, 11 of removed materials
Photo # 15, 16, 17 of pit

(photo taken on 11/19)

TEST PIT

PAGE 1 OF 1

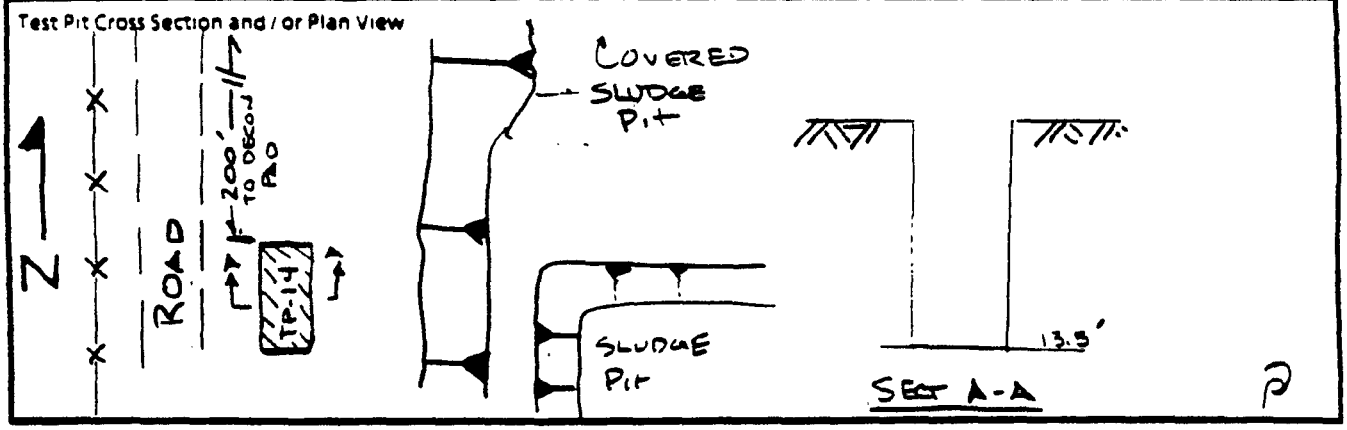
AR302251

TEST PIT LOG — NUS CORPORATION

PROJECT: DRAKE CHEMICAL LOCK HAVEN PA. TEST PIT NO 14
PROJECT NO G20Y DATE: 11/22/87
LOCATION: LOCK HAVEN, PA
FIELD GEOLOGIST: R. Berne

DEPTH (ft)	LITHOLOGY CHANGE (Depth, ft.)	MATERIAL DESCRIPTION (Soil Density / Consistency, Color)	USCS	REMARKS
0		GRAVELY [illegible]	GM	
4"		[illegible] SLUDGE w/ many	SM	Sample 0-2' 1400 HRS
		cobbles (≤6") bricks limestone		
		gravel		
3'		Tan-yellow sandy loam w/ some	SC	Fill
		granular matl.		
5.5'		Tan-yellow loam w/ stones	SC	
		up to 6", roots & roots		
6.5'		Wet clay yellow w/ black	CH	Sample 6.5'-9.0' 1430 HRS
		coloration (chemical stains		
		clay texture damaged		
		Roots & Branches in black matl.		
10.5		Black wet clay more yellow	CH	
		clay than 6.5-10.5'		
13.5'				Sample 13-14' 1450 HRS

Test Pit Cross Section and / or Plan View



REMARKS

PHOTO LOG
photo 14: 0-2' photo 15: 6.5'-9.0'
photo 16: pit 14 complete
photo 17: 13-14'

TEST PIT 14
PAGE 1 OF 1

AR302252

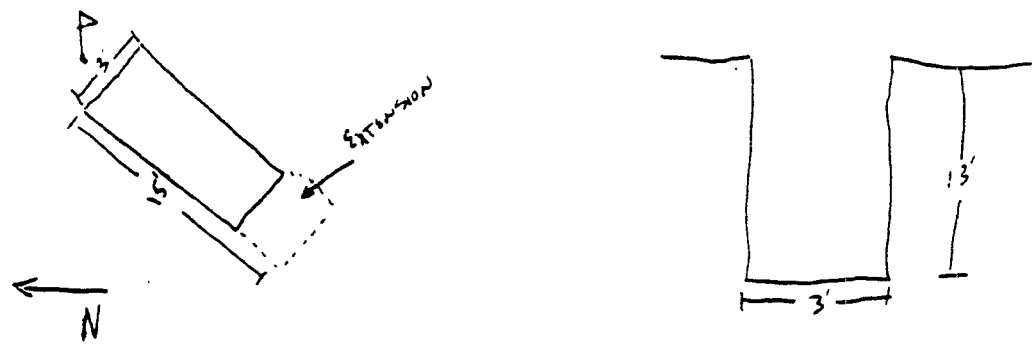
TEST PIT LOG — **NUS CORPORATION**

PROJECT: DRAKE CHEMICAL — TEST PIT NO: 16
PROJECT NO: 6201 — DATE: 11/20/87
LOCATION: LOCK HAVEN, PA
FIELD GEOLOGIST: J. SCHULTZ

CONSTRUCTION KING 5803 R. CERRONI PENN DRILLING

DEPTH (ft.)	LITHOLOGY CHANGE (Depth, ft.)	MATERIAL DESCRIPTION (Soil Density / Consistency, Color)	USCS	REMARKS
1		FILL MATERIAL - BRICKS, ROCKS	FILL	
2		WOOD, WOOD CHIPS		
3		IN CLAY SAND BROWN		
4		WOOD WOOD CHIPS APPEAR CHARRED		
5		FILL MATERIAL		
6		RECAPPERS, WOOD, WOOD		
7		CHIPS, BRICKS, ROCKS		
8		HIT POSSIBLE LINER AT 8' TAN SOIL		CONSISTENCY OF PUDDING
9		CLAY LIKE SUBSTANCE W/ GRAVEL	CL	
10		& SAND		
11				
12	REDDISH	CLAY LIKE SUBSTANCE W/ SAND		
13		MOIST TO SATURATED CANT ROLL INTO		NO WATER WAS SEEN
		STRING, VERY SOFT		IN BOTTOM OF HOLE

Test Pit Cross Section and / or Plan View



REMARKS PIT BEGAN AT 1300, COMPLETED AT 1520, BACKFILLED WITH REMOVED MATERIAL. ALL SAMPLES GRABS FROM BACKHOE. DISCONTINUED USE OF HAND DUE TO WEATHER, HR OBSTRUCTION, PIT EXTENDED 5'

PHOTO LOG SAMPLE #1 @ 1315 0-1' PHOTO #11
POSSIBLE LINER @ 1400 PHOTO #12
SAMPLE #2 @ 1435 8-10' PHOTO #13
SAMPLE #3 @ 1450 12-13' PHOTO #14
PHOTO #15, 16, 17 OF TEST PIT

TEST PIT 16
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AR302253

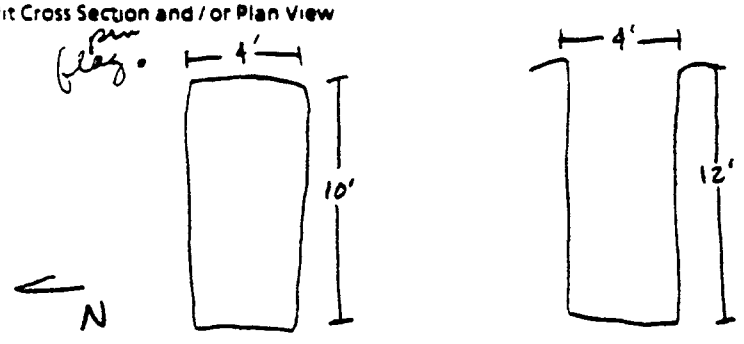
TEST PIT LOG — **NUS CORPORATION**

PROJECT: Drake Chemical — TEST PIT NO 17
PROJECT NO: 6204 — DATE: 11-19-87 — Level 3
LOCATION: Lock Haven, PA
FIELD GEOLOGIST: C. Nieland

Construction King 580B — R Cerroni — Penn Drilling

DEPTH (ft)	LITHOLOGY CHANGE (Depth, ft.)	MATERIAL DESCRIPTION (Soil Density / Consistency, Color)	USCS	REMARKS
1		Red/pink clay, fine lamination		consistency of puddens
2		at 8" turns tan		" "
3				
4		Black organic soil, roots, sand	SC	wet, but not
5		small rounded pebbles		saturated
6				possibly some type of fill
7				
8		Clay, green/brown, stiff, crumbly,		
9		mottled w/black clay	CL	
10		gains cohesiveness with depth		
11				
12				

Test Pit Cross Section and / or Plan View



Not to scale

REMARKS: Pit begun at 1500, completed at 1630, backfilled with material removed, all samples grabs from backhoe bucket

PHOTO LOG — Camera #1
Sample #1 @ 1-2' photo #1 1540
Sample #2 @ 7-8' photo #3 1540
Sample #3 @ 11-12' photo #4 1600
Photos #2, 5 of pit

TEST PIT 17

PAGE 1 OF 1

AR302254

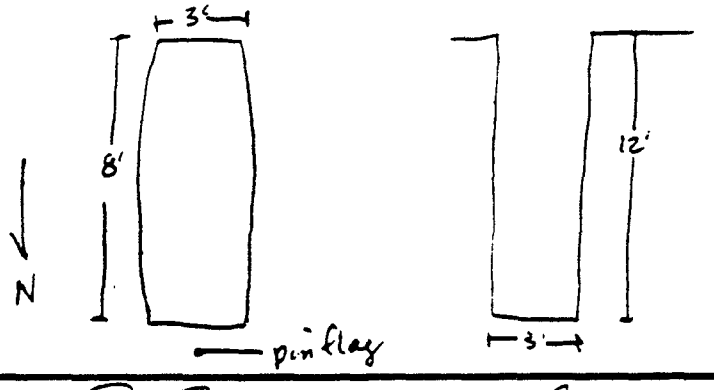
TEST PIT LOG — **NUS CORPORATION**

PROJECT: DRAKE CHEMICAL — TEST PIT NO: 20
PROJECT NO: 6204 — DATE: 11-20-87
LOCATION: LOCK HAVEN, PA
FIELD GEOLOGIST: C. NIELAND

CONSTRUCTION KING 580B — R. CERRONI — PENN DRILLING

DEPTH (ft)	LITHOLOGY CHANGE (Depth, ft.)	MATERIAL DESCRIPTION (Soil Density / Consistency, Color)	USCS	REMARKS
1		Fill material - rocks, bricks, corroded metal	FILL	
2		w/ brown sand and clay, wood	↓	
3			↓	
4		~~Fill mat~~ Tan, red, orange dyes		
5		laminated, semiplastic		
6			FILL	
7		BLACK CLAYEY MATERIAL DAMP		
8				
9		BROWN SANDY CLAY, DRY SMALL	CL	
10		ROOTS NOT DECAYED CLOSE TO BANK		
11				
12	▽			3" water in bottom of pit - water table

Test Pit Cross Section and / or Plan View



Not to scale

REMARKS: PIT BEGAN AT 0930, COMPLETED AT 1110, BACKFILLED. FILLED WITH REMOVED MATERIAL. ALL SAMPLES GRABS FROM BACKHOE BUCKET. HNU READINGS: 0 ppm SAMPLE #1, 1 ppm SAMPLE #2, 0 ppm SAMPLE #3.

PHOTO LOG: SAMPLE #1 @ 1-2' PHOTO #6
SAMPLE #2 @ 7-8' PHOTO #7
SAMPLE #3 @ 12-13' PHOTO #8
PHOTO #9, 10 OF PIT

TEST PIT 20

PAGE 1 OF 1

AR302255

TEST PIT LOG — **NUS CORPORATION**

PROJECT: Drake Chemical — TEST PIT NO: 21

PROJECT NO: 6207 — DATE: 11-19-87 — Level B

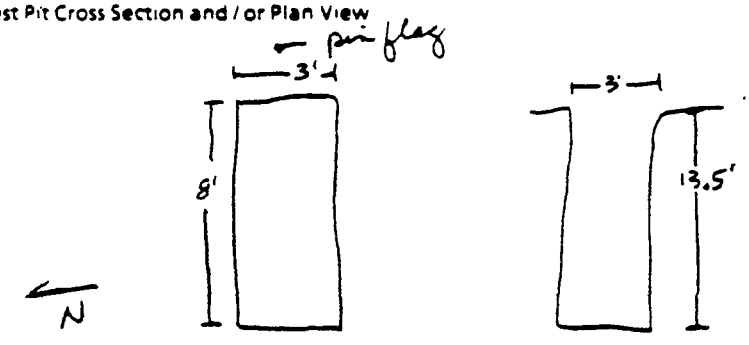
LOCATION: Lock Haven, PA

FIELD GEOLOGIST: C. Nieland

Construction King 580 B — R. Cerroni — Penn Drilling

DEPTH (ft)	LITHOLOGY CHANGE (Depth, ft)	MATERIAL DESCRIPTION (Soil Density / Consistency, Color)	USCS	REMARKS
1	0.5	Red laminated dye		semi-liquid
	1.0	Tan laminated dye		semi-liquid
2		Clay, greenish brown, stiff	CL	
3		wood, rock slabs, sand		
4				
5				
6				
7				
8				
9		At 9' clay becomes mottled black		
10		with sand, crumbly		
11				
12				
13	▽	-12.5' Water at bottom of pit -		@ 13.5' Bottom of pit
14		could be water table		

Test Pit Cross Section and / or Plan View



Not to scale

REMARKS: ~~Sample~~ (CLW) Pit begun at 1115, completed at 1300, backfilled with material removed, all samples grabs from backhoe bucket

PHOTO LOG — Camera #1

Sample #1 @ 0-1' photo #18 1147
Sample #2 @ 8-9' photo #19 1210
Sample #3 @ 12-13' photo #20 1230
Photos #21, 22 of pit

TEST PIT 21

PAGE 1 OF 1

TEST PIT LOG — **NUS CORPORATION**

PROJECT: DRAKE CHEMICAL — TEST PIT NO 22

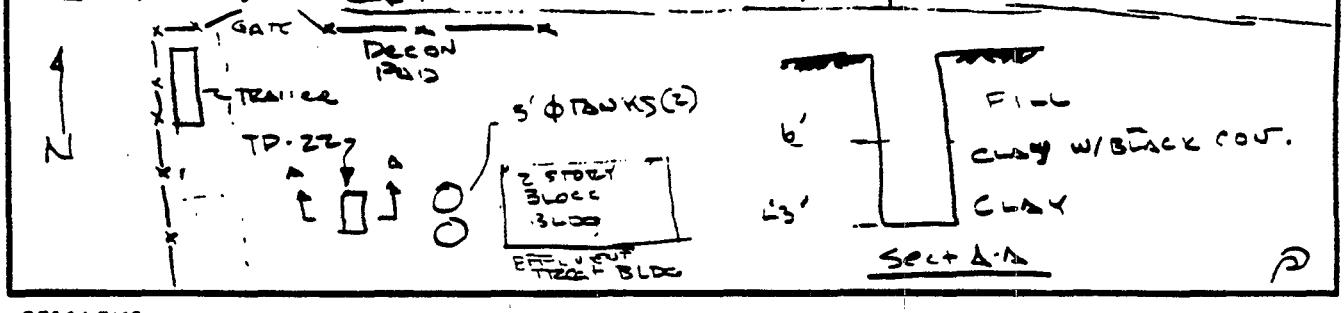
PROJECT NO 620 Y — DATE: November 22, 1987

LOCATION: Lock Haven PA

FIELD GEOLOGIST: R. Bennett

DEPTH (ft)	LITHOLOGY CHANGE (Depth, ft.)	MATERIAL DESCRIPTION (Soil Density / Consistency, Color)	USCS	REMARKS
0		2" Cinder Surface Loose granular	GM	sampled
		Brown Sandy silt, gravel (1/2")	MH	FILL
		Bricks, Asphalt chunks		
0.5'		3" Orange Brown Silt Layer	MH	
0.75		Dark Brown sandy silt	MH	
		Bricks, Loose Granular silt		
2.0		Black loam, soft some		
		granular material, bricks		
		Wood, large stones (6")		
3.0		1" Layer light grey cinders		
		granular 1/8"-1/4" size		FILL
6.0		white granular (sand size)		
		stuck material in clay		
		Yellow brown clay very soft,		sampled
8.0		with black streaks		
3.0		Yellow brown clay moist with pieces of wood in clay decreasing black streaks with depth - No water	CH	sampled

Test Pit Cross Section and / or Plan View



REMARKS

Samples collected 0-2', 6-7.5', 12-13'

PHOTO LOG #18: 0-2'; #19: 6-7.5'; #20: 12-13'
#21, TP 22 upon completion

TEST PIT 22

PAGE ... OF

AR302257

TEST PIT LOG — **NUS CORPORATION**

PROJECT: DRAKE CHEM — TEST PIT NO.: TP-24

PROJECT NO.: 620Y — DATE: 11/4/87

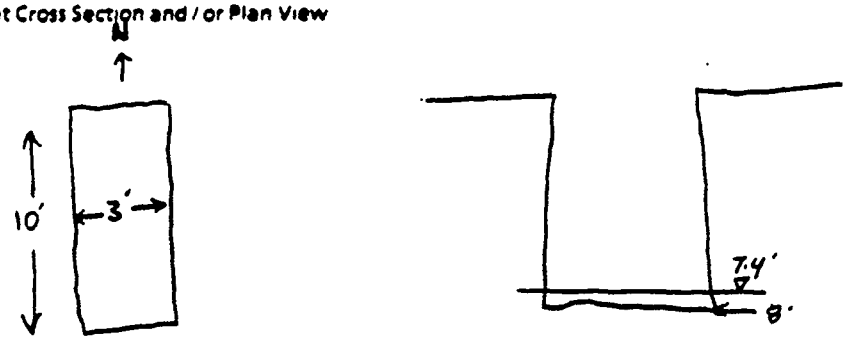
LOCATION: LOCK HAVEN PA

FIELD GEOLOGIST: R. BETHEL

PENN DRILLING — CONSTRUCTION KING SOB — E. DYE

DEPTH (Ft.)	LITHOLOGY CHANGE (Depth, Ft.)	MATERIAL DESCRIPTION (Soil Density / Consistency, Color)	USCS	REMARKS
1		Mixed PINK + BLK Hardened Sludge mat.		HNU 1ppm
2		Fill material consisting of Grey Brn Clay	CL	
3		intermixed w/ laminar sandstone fragments		
4		(yellow-brn.) Size range 0.5 - 6" long		HNU 0.5ppm
5		Damp to moist, Med. Stiff		
6		Clay w/ some sand, Dark gray to Blk.	CL	HNU reading = 2ppm
7	7.4' ▽	May contain sludge, moist to saturated		
8		~~Soft~~ RDB/1115 Soft		
		TD 8'		

Test Pit Cross Section and / or Plan View



REMARKS Pit collapsed @ approx. 5' and below
Sample #1 from 0-1', #2 from 4-5', #3 from 7-8'

PHOTO LOG #21, 22 → Test pit #24 - shot of open pit
#23 → Sampling of ~~8-8' sample~~ 7-8' sample pile
#24, 25, 26 → Backhoe stuck near Pit #24
#27 → Looking dike on E side of N waste Pond, near TP #24 facing E

TEST PIT TP 24

PAGE 1 OF 1

AR302258

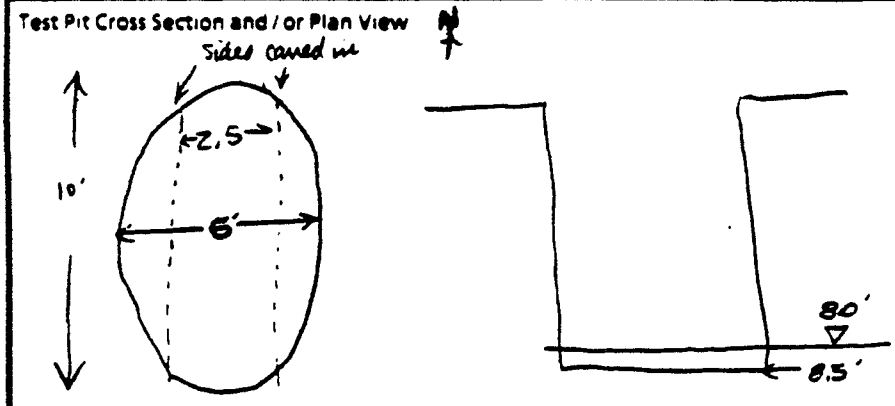
TEST PIT LOG — **NUS CORPORATION**

PROJECT: DRAKE CHEM — TEST PIT NO.: TP 25
PROJECT NO.: 6Z0Y — DATE: 11/5/87
LOCATION: LOCK HAVEN, PA
FIELD GEOLOGIST: R. BETHEL

PENN DRILLING — CONSTRUCTION KING 580B — E. DYE

DEPTH (ft.)	LITHOLOGY CHANGE (Depth, ft.)	MATERIAL DESCRIPTION (Soil Density / Consistency, Color)	USCS	REMARKS
1		Sludge mixture and sand, some clay	SM	Sides eventually caved in
2		Laminated, multicolored ranging white to		HNU 1.5 ppm Fill
3		gray & red. Lam. ranges from 1-3"		
4		Saturated, Very Loose		HNU 1.5 ppm
5				
6				
7		dark gray to blk. clay w/ sand. Also	CL	
8	~8.0' ▽	sludge throughout, saturated med. stiff		
		gray green Clay w/ wood chips throughout	CH	Possible clay Liner?
		Sticky stiff, moist (~~Clay Liner?~~) RDB		HNU - 1-3 ppm

Test Pit Cross Section and / or Plan View



REMARKS Sides collapsed during last sample collection. Approximate water depth at 8'. Sample #1 from 0-1', #2 from 4-5', #3 from 8-8.5'

PHOTO LOG #29 → Test pit #25, sample from 0-1'.
#30, 31 → Collapsed pit after removal of sample from 8-8.5' due to high water content.

TEST PIT TP 25

PAGE 1 OF 1

AR302259

TEST PIT LOG — **NUS CORPORATION**

PROJECT: DRAKE CHEM — TEST PIT NO.: TP-26

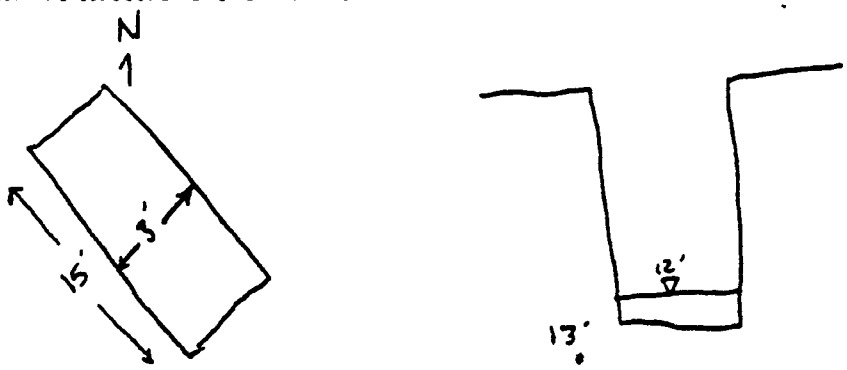
PROJECT NO.: 6204 — DATE: 11/6/87

LOCATION: LOCK HAVEN PA

FIELD GEOLOGIST: R. BETHEL — PENN DRILLING — CONSTRUCTION KING SEOB EARL DYE

DEPTH (Ft.)	LITHOLOGY CHANGE (Depth, Ft.)	MATERIAL DESCRIPTION (Soil Density / Consistency, Color)	USCS	REMARKS
1		Sand (Lt. brn) mixed w/ sludge (white-gray, red, brn) moist to sat., very loose		Fill w/ wood, rock mat. HNU 0ppm
2				
3				
4		Sandy clay (often mixed w/ sludge, moist loose, black and brown	CL	Wood debris throughout, not stratified HNU 0ppm
5				
6				
7				
8				
9				
10				
11				
12	▽ 12'	Sand w/ clay, loose, moist to saturated Lt. brn.	SC	HNU 0 ppm
13				

Test Pit Cross Section and / or Plan View



REMARKS Test pit excavated to 13', Possibly original overburden mat. at 11'. Sample #1 from 0-2', #2 from 4-5', #3 from 12-13'

PHOTO LOG #10: Sample pile #1, #11: Sample pile #2, #12: Sample pile #3, #13+14: Test pit #26 looking NW

TEST PIT TP-26

PAGE 1 OF 1

TEST PIT LOG — **NUS CORPORATION**

PROJECT: DRAKE CHEM — TEST PIT NO.: TP-27

PROJECT NO.: 620Y — DATE: 11/7/87

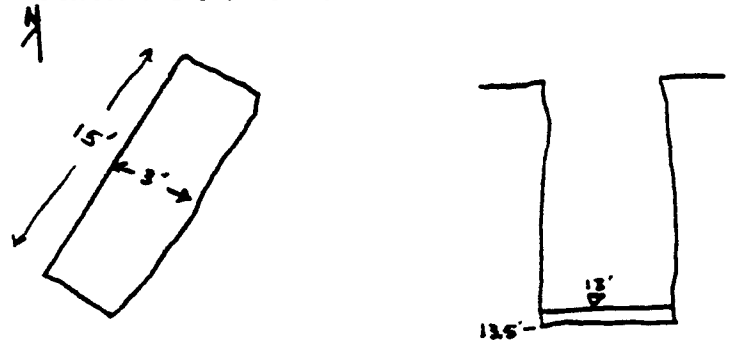
LOCATION: LOCK HAVEN

FIELD GEOLOGIST: R. BETHEL

PENN DRILLING — CONSTRUCTION KING 580 B — E. DYE

DEPTH (ft.)	LITHOLOGY CHANGE (Depth, ft.)	MATERIAL DESCRIPTION (Soil Density / Consistency, Color)	USCS	REMARKS
1		Humus topsoil rich in organics, Drk brn to blk,		Root mat. HNU 0 ppm.
2		damp.		
3		Clay w/ some sand, med. stiff, Red brn.	CL	Sticky, Fill
4		moist to damp (glass present)		
5		Sand w/ clay, med to fine gr. Brn, damp, Loose	SC	noncohesive HNU 1-4 ppm
6				HNU - 0 ppm
7		Clay, some sand, med. stiff, Brn, damp	CL	cohesive, roll into 1/8" string
8				
9				
10				
11		Sand, tr to some clay, loose, (med. gr.)	SC	HNU 0 ppm
12		moist to saturated		
13	13' ▽			

Test Pit Cross Section and / or Plan View



REMARKS: Test pit excavated to 13.5', No evidence of sludge or visible contamination, Sample #1 from 0-2', #2 from 5-6', #3 from 12-13.5'

PHOTO LOG: #7+8: in test pit looking N.E., #9: 3 piles of samples, #1 pile on left side

TEST PIT: TP-27

PAGE 1 OF 1

B-22 AR302261

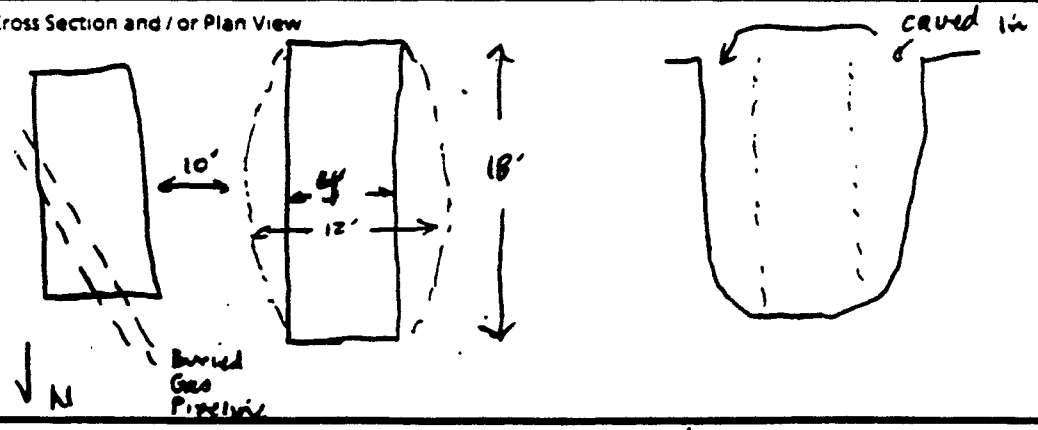
TEST PIT LOG — NUS CORPORATION

PROJECT: DRAKE
PROJECT NO: 620Y
DATE: 11/10/87
TEST PIT NO: TP-28
LOCATION: LOCK HAVEN, PA
FIELD GEOLOGIST: R. BETHEL
~~PENN DRILLING~~ ~~CONSTRUCTION KING~~ ~~B. CERRONI~~ RB 11/12/87

PENN DRILLING CONSTRUCTION KING 580B B. CERRONI

DEPTH (ft.)	LITHOLOGY CHANGE (Depth, ft.)	MATERIAL DESCRIPTION (Soil Density / Consistency, Color)	USCS	REMARKS
1		Fill, Limestone gravel + dark brn soil damp		Bricks present HNU 1ppm
2				
3			SC	
4		Fine gr. Sand, some clay mixed w/ sludge		
5		damp, yellow to cream + purple, stratified loose		Layers 1-3" thick purple crystals @ 2.5'
6		Sandy clay + sludge red, brn, blk, med stiff	CL	Moist
7		Blk sludge, w/ some sand + clay, saturated		HNU 5-6ppm
8		Sandy clay, moist, med. stiff brn w/ gray	CL	Can be rolled into 1/4" strands
9		streaks.		HNU 4ppm
10				
11				
12				
13				

Test Pit Cross Section and / or Plan View



REMARKS: Encountered gas line @ 4', moved pit 10' to west, Pit continually caved in when pit went below 7'. Made 4 attempts to reach water. Sample #1 from 0-2'; #2 from 5-6'; #3 from 12-13'

PHOTO LOG: Roll 3, Photo #1,2: caved test pit #28, Roll 2, Photo #21 sample pile from 0-2', #22,23,24 - Pit partially caved in

TEST PIT: TP-

PAGE 1 OF 1

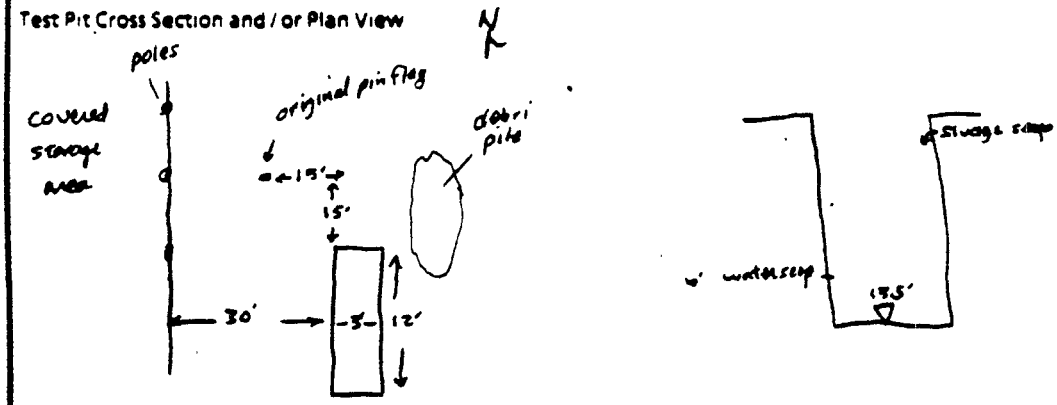
TEST PIT LOG — **NUS CORPORATION**

PROJECT: DRAKE CHEM — TEST PIT NO TP-30
PROJECT NO 620Y — DATE: 11/11/87
LOCATION: LOCK HAVEN, PA
FIELD GEOLOGIST: R. BETHEL

PENN DRILLING CONSTRUCTION KING 580B E. DNE

DEPTH (ft.)	LITHOLOGY CHANGE (Depth, ft.)	MATERIAL DESCRIPTION (Soil Density / Consistency, Color)	USCS	REMARKS
1		Asphalt (4" thick) on limestone gravel fill gray		Odor strong, Liquid waste sludge
2		saturated		seeping from gravel
3		Sandy clay, stiff, brn to yellow brn, damp	CL	Homogeneous, no stratification, strong
4				odor
5		Clayey sand, loose yellow brn to orange brn	SC	Rounded sandstone cobbles, ~1 pct
6		w/ depth, tr. cobbles		bucket range from 4-6" long
7				pace fill mat. homogeneous throughout
8				strong odor
9				
10				water seep @ 10' from N wall
11				
12				
13	13.5' ▽			
14		TD 13.5'		

Test Pit Cross Section and / or Plan View



REMARKS Completed pit depth @ 13.5'. Could not use HNU due to adverse weather conditions. Observed a small water seep @ 10' along N face of pit. Sample #1 from 1-2', #2 from 7-8', #3 from 11-12'

PHOTO LOG #5: Sample pile #1 (1-2'), #6: sample pile #2 (7-8') #7: Sample pile #3 (11-12'), #8+9: looking down in pit @ 13.5'

TEST PIT TP-30

PAGE 1 OF 1

TEST PIT LOG — **NUS CORPORATION**

PROJECT: DRAKE CHEM — TEST PIT NO.: TP-31

PROJECT NO: 620Y — DATE: 11/3/87

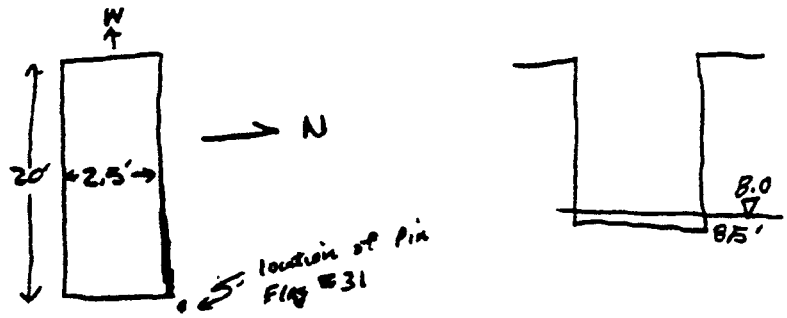
LOCATION: LOCK HAVEN PA

FIELD GEOLOGIST: R. BETHEL

PENN DRILLING CONSTRUCTION KING 580 B E. DYE

DEPTH (FT.)	LITHOLOGY CHANGE (Depth, Ft.)	MATERIAL DESCRIPTION (Soil Density / Consistency, Color)	USCS	REMARKS
1		Sand w/ silt fill, buried metallic debri	SM	HNU - 1ppm
2		plastic pipe, Very Loose, Drk Brn, moist		
3		Silty Clay mixed w/ Sludge, Very Soft, Red	CL	
4		Orange, Saturated		
5		Sandy clay, soft, Brown, Saturated ~~Soft~~ poorly	CL-ML	HNU · 1ppm
6		Sludge mixed w/ Sand, some clay, Saturated	CL	
7		Dark Brn.		
8	8.0'	Bright orange (80%) and Dark Green Sludge (20%)		Appeared to be paint sludge
9				HNU 4-6 ppm

Test Pit Cross Section and / or Plan View



REMARKS From 5' to 8' Sludge material was very "soupy" in consistency. Pit located on E side of Bldg. near debri pile. Future location of proposed monitor well #MW-M10B. Very strong odor from w/in pit. Hit water at 8.0ft. Sample #1 from 0-1.7', #2 from 5-5.5', #3 from 8-8.5

PHOTO LOG #12, #13 → Test pit #31 / #14 → Pile of mat. from 5-5½ level
#15 → Test pit down to 5½' / #16 → Sampled material from 8-8.5 level
#17 → Test pit down to 8½ ft.
#18 → R. Conley filling sample jars w/ sample between 8 and 8.5 ft.

TEST PIT TP 31

PAGE 1 OF 1

B-25 AR302264

TEST PIT LOG — NUS CORPORATION

PROJECT: DRAKE CHEM — TEST PIT NO.: TP-32
PROJECT NO.: 620Y — DATE: 11/5/87
LOCATION: LOCK HAVEN PA
FIELD GEOLOGIST: R. BETHEL

PENN DRILLING — CONSTRUCTION KING 580 B — E. DYE

DEPTH (FT.)	LITHOLOGY CHANGE (Depth, Ft.)	MATERIAL DESCRIPTION (Soil Density / Consistency, Color)	USCS	REMARKS
1		Sandy clay mixed w/ sludge, med. stiff	CL	(Layers) Bands ranging from 0.5-3", in
2		moist, laminated w/ alt. layers of red, gray, brn, blk		width. HNU: 0ppm, Fill mat.
3				
4		Fine sand, some clay mixed w/ sludge, very	SC	Running sands (caving) HNU 0ppm
5	5.2' ▽	loose, brown and gray to dk red, saturated		Fill mat.
6		Sandy clay mixed w/ sludge, ~~very soft~~ RBB 11/5	ML-CL	HNU 0ppm soft to med.
		color varies from brn, drk grn, red, & blk		stiff
		saturated to moist		
		TD 6.5'		

Test Pit Cross Section and / or Plan View

REMARKS: Test pit excavated to 6.5', sample #1 from 0-2', sample #2 from 4.5-5.0' Sample #3 from 5.5-6.0'

PHOTO LOG: #2: sample #1 pile from 0-2', #3: sample #2 from 4.5-5.0' #4: sample #3 pile from 5.5-6.0', #5+6: open pit looking SW

TEST PIT: TP-32

PAGE 1 OF 1

AR302265

TEST PIT LOG — NUS CORPORATION

PROJECT: DRAKE CHEM — TEST PIT NO: TP-33

PROJECT NO: 6207 — DATE: 11/11/87

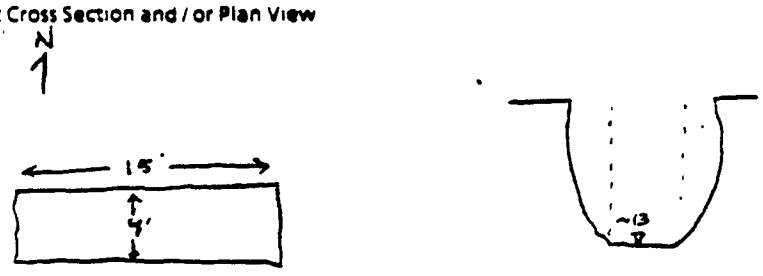
LOCATION: ~~DRAKE CHEM~~ EB 11/11 LOCK HAVEN PA

FIELD GEOLOGIST: R. BETHEL

PENN DRILLING — CONSTRUCTION KING 580B — E. DYE

DEPTH (ft)	LITHOLOGY CHANGE (Depth, ft.)	MATERIAL DESCRIPTION (Soil Density / Consistency, Color)	USCS	REMARKS
1		Clayey sand + sludge, very loose, moist to	SC	Stratified layers ranging from 1-3"
2		saturated, Red, gray, and white layers		thick, Discrete sludgy mat.
3		Blk. sludge mixed w/ sand + clay, very soft		"Soupy" pressure, sludge
4		saturated		
5		Clay w/ some sand, stiff, damp, lt to dark	CL	found wire in sed. (fill mat.)
6		gray, greenish gray w/ depth		Can roll into 1/4" stringer
7				
8		Clayey sand, loose, greenish gray, moist	SC	No evidence (visual) of sludge
9				
10				
11				
12	~13' ▽	Sand, some clay, moist to saturated, blk w/	SC	
13		gray streaks		

Test Pit Cross Section and / or Plan View



REMARKS: Could not use HNU in field due to adverse weather conditions. Did not see water in bottom of pit but sand @ 13' was saturated and very close to water table. Pit caved in @ 13', backhoe dangerously tilted + close to pit, had to stop excavation, stuck in sludge. Sample #1 from 0-2', #2 from 9-10', #3 from 12-13'

PHOTO LOG: #3: Shultz collecting spl. #1 (0-2') #4: ~~Sample #2~~ EB 11/11 inside pit @ 6', #5 Sample pile #2 (9-10'), #6-7 inside pit at 13'

TEST PIT: TP-33

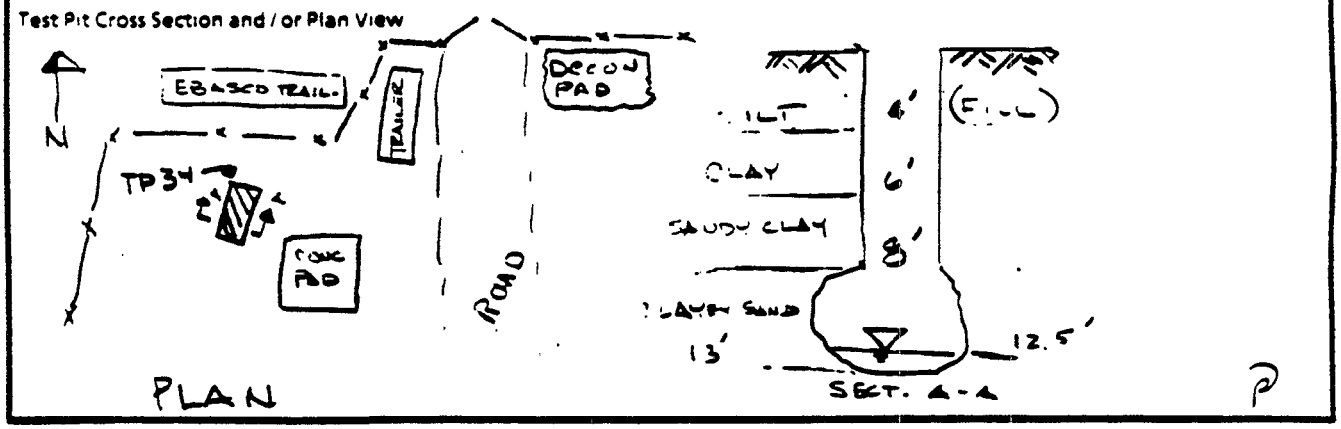
PAGE 1 OF 1

TEST PIT LOG — **NUS CORPORATION**

PROJECT: DRAKE C-[illegible]
PROJECT NO: 620 Y
LOCATION: LOCK HAVEN, PA
FIELD GEOLOGIST: R. Betnel
DATE: 11/23
TEST PIT NO: 34

DEPTH (Ft.)	LITHOLOGY CHANGE (Depth, ft.)	MATERIAL DESCRIPTION (Soil Density / Consistency, Color)	USCS	REMARKS
0.		Surface - Limestone gravel	GP	
4"				
		Black silt, some clay	ML	Fill
		small granular pieces (1/4"-1")		Sampled 0-2' 9:45 HRS
		Bricks, iron pipe		
4'		Yellow clay, soft, moist		
5.5		stiff red brown clay	CL	
		1/8" granular pieces 1/8", small		
		limestone pieces		
6'		Yellow Clay soft, moist	CH	Sampled 5-9' 1005 HRS
8'		Sandy Clay soft, moist	CL	
11.5'		Clayey sand, very wet, Yellow tan	SC	
12.5'	▽	Non flow of water enters pit		
13		Bottom of test pit		Sampled 12-13' 1020 HRS

Test Pit Cross Section and / or Plan View



REMARKS

PHOTO LOG
photo 22: 0-2' photo 23: 8-9' photo 24: 12-13'
photos 1, 2 & 3: completed test pit

TEST PIT 34

PAGE 1 OF 1

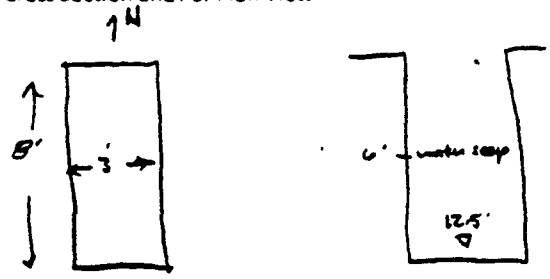
TEST PIT LOG — **NUS CORPORATION**

PROJECT: DRAKE CHEM — TEST PIT NO TP-37
PROJECT NO 620Y — DATE: 11/12
LOCATION: LOCK HAVEN, PA
FIELD GEOLOGIST: R. BETHEL

PENN DRILLING — CONSTRUCTION KING 580B — B. CERRONI

DEPTH (Ft.)	LITHOLOGY CHANGE (Depth, Ft.)	MATERIAL DESCRIPTION (Soil Density / Consistency, Color)	USCS	REMARKS
1		Asphalt, Limestone gravel Fill		0% LEL/O_2 RB 11/12/87
2		Sand, some clay, red to white, Loose to Med. Dense		Damp, crusty, wire mesh, fill ~~Bottom~~ Slivage, [illegible]
3		Sandy clay, damp, med. stiff, Brn Fill		Rolled into ½" stringers
4				became moist, more sticky w/
5				depth, contained cobbles, 5-8"
6				long, rubber boot @ 6' Fill Mat.
7				water seeping @ 6' (perched)
8		Gravel w/ lg. cobbles, saturated, Blk., Fill		twigs present, oily sheen on water
9				surf.
10		Sand, some clay, damp, med. dense, Fill		Asphalt present (.5-1' long), cobbles (1)
11				
12				0% LEL/O_2
13	12.5' ▽			found piece of plastic @ 13'
		TD 13'		

Test Pit Cross Section and / or Plan View



REMARKS Completed pit depth @ 13' water seep @ 6' on N wall of pit, Grab sample Sample #1 from 0-2', #2 from 5-6', #3 from 12 to 13', backfilled pit w/ material ~~taken~~ from pit after samples were collected

PHOTO LOG #13: Sample pile #1 (0-2'), #14: Sample pile #2 (5-6'), #16: Sample pile #3 (12-13'), #15: looking into pit @ 8.5'

TEST PIT TP[illegible]

PAGE 1 OF 1

TEST PIT LOG — **NUS CORPORATION**

PROJECT: DRAKE CHEM — TEST PIT NO.: TP-38

PROJECT NO.: 6207 — DATE: 11/6/87

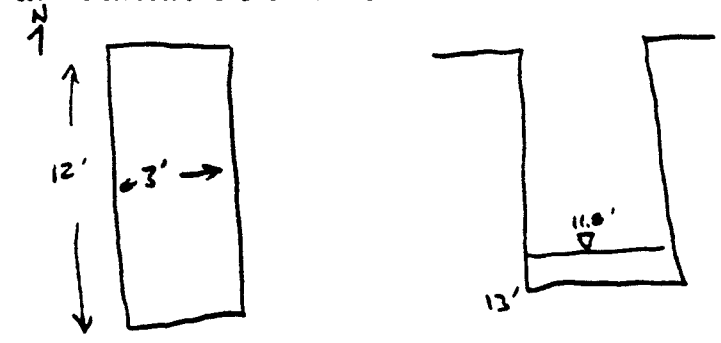
LOCATION: LOCK HAVEN PA

FIELD GEOLOGIST: R. BETHEL

PENN DRILLING — CONSTRUCTION KING 580 B — E. DYE

DEPTH (ft.)	LITHOLOGY CHANGE (Depth, ft.)	MATERIAL DESCRIPTION (Soil Density / Consistency, Color)	USCS	REMARKS
1		Sand w/ clay mixed w/ sludge Brn, Grays	SC	HNU 0ppm, Fill mat, buried wood
2		red, + grn layers 1-3" thick, moist, very loose		
3				
4		Sand, some clay, very loose, sat. brn to blk.	SC	HNU 0ppm
5				
6		Sandy clay, med stiff, moist to sat.	CL	HNU 0ppm no stratification
7		brn to brn and blk.		apparent
8				
9				
10				
11				
12	11.8' ▽			
13	TD			

Test Pit Cross Section and / or Plan View



REMARKS Test pit excavated to 13' water encountered at 16.8'
Dug at the edge of apparent lagoon ~~edge~~ RE 116 along North house.

PHOTO LOG #15: Sample Pile #1, #16: Sample Pile #2, #17: Sample Pile #3, #18+19: looking into test pit #38 From west to east

TEST PIT TP-38

PAGE 1 OF 1

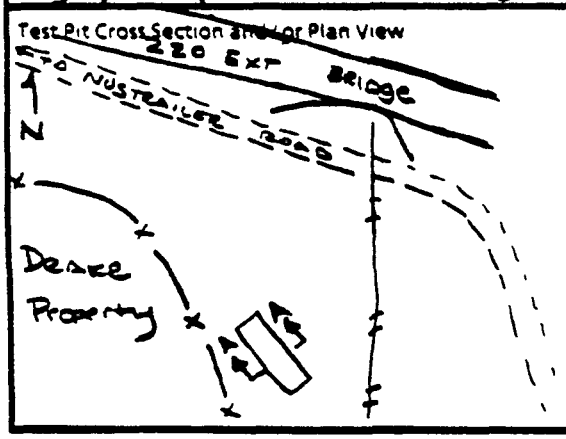
AR302269

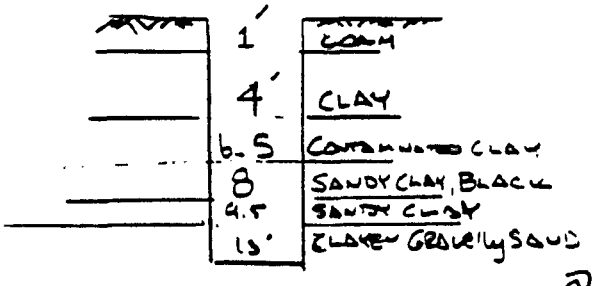
TEST PIT LOG — NUS CORPORATION

PROJECT: Drake Chemical — TEST PIT NO 39
PROJECT NO 620Y — DATE: 11/23/87
LOCATION: Lock Haven, Pa
FIELD GEOLOGIST: R. Bethel

DEPTH (ft.)	LITHOLOGY CHANGE (Depth, ft.)	MATERIAL DESCRIPTION (Soil Density / Consistency, Color)	USCS	REMARKS
0		Black Granular Cinders (1/4"-2")		
		black loam, roots	SCML	Fill
1		soft yellow clay, slightly moist plastic	CL	Sample 1 0-2' 1549 hrs
4		soft yellow clay - black chemical staining	CL	
		damaged texture		Sample 2 6'-7' 1600 hrs
6.5		Clay is solid Black		
8		Clay w/ black chemical staining,	SC	
		some sand		
9.5		Sandy clay w/ black chemical stains,	CL	
		some large stones ≤ 4"		
12		Damp Clayey Sand large cobbles	SC	
		black staining damp bad odor		
13		bottom of hole		Sample 3 12-13 1617 hrs

Test Pit Cross Section Sketch or Plan View





REMARKS

PHOTO LOG #10: 0-2' #11: 6'-7' #12: 12'-13'
#13: Completed pit #14: overall illustration

TEST PIT 39

PAGE 1 OF 1

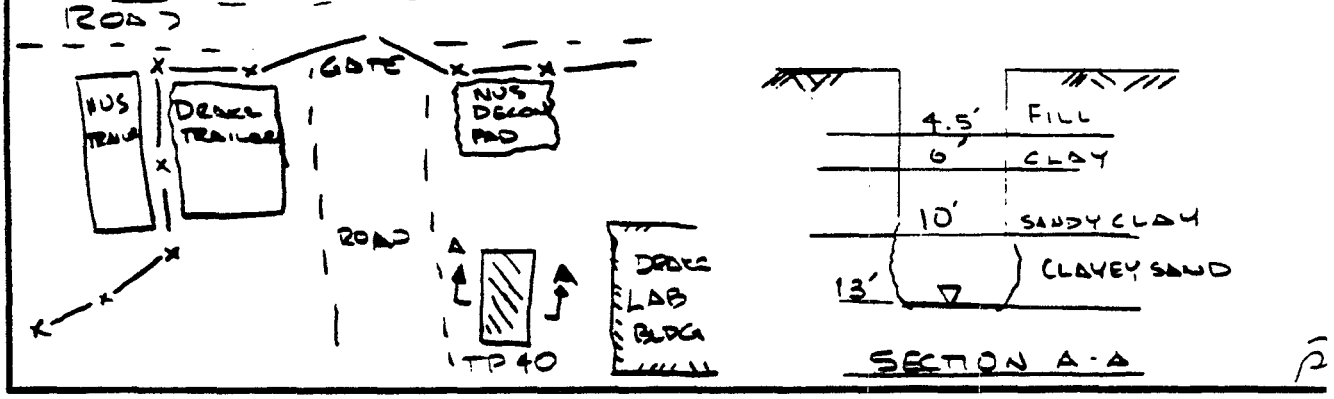
AR302270

TEST PIT LOG — NUS CORPORATION

PROJECT: Drake Chemical — TEST PIT NO: 40
PROJECT NO: 620Y — DATE: 11/23
LOCATION: Lock Haven, Pa
FIELD GEOLOGIST: R. Bethel

DEPTH (ft)	LITHOLOGY CHANGE (Depth, ft.)	MATERIAL DESCRIPTION (Soil Density / Consistency, Color)	USCS	REMARKS
0		Asphalt pavement		
4'		Fine black granular fill / ½' below		Fill
		surface orange band (red clay)		Sample 0-2' 1140HRS
4.5'		Yellow clay plastic soft Very little silt	CH	
6'		silty SAND, yellow, wet soft	SM	
				Sample 8-9' 1156 hrs
10'		SANDY CLAY wet yellow soft	SC-CH	
12'		clayey SAND, very wet	SC	
				Sample 12-13' 1210HRS
13'	▽	Bottom of hole (water)		

Test Pit Cross Section and / or Plan View



REMARKS

PHOTO LOG Photo 4: 0-2' Photo 5: 8-9'
Photo 6: overview TP-40 Photo 7: 12-13'
Photos seq. overview of TP-40

TEST PIT 40

PAGE 1 OF 1

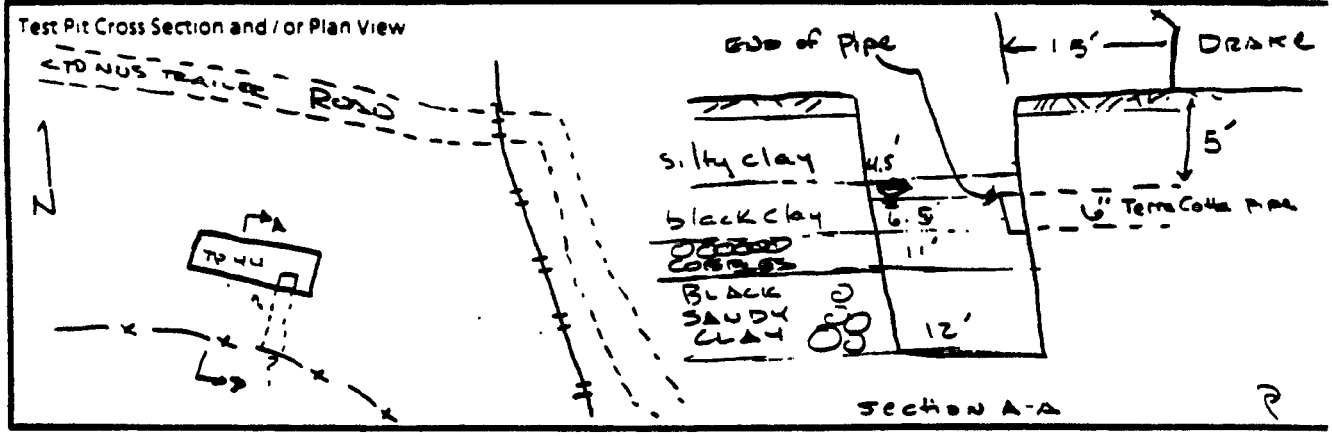
AR302271

TEST PIT LOG — **NUS CORPORATION**

PROJECT: DRAKE CHEMICAL — TEST PIT NO: 44
PROJECT NO: 6201 — DATE: 11/24
LOCATION: LOCK HAVEN PA
FIELD GEOLOGIST: Rick Bethel

DEPTH (ft)	LITHOLOGY CHANGE (Depth, ft.)	MATERIAL DESCRIPTION (Soil Density / Consistency, Color)	USCS	REMARKS
0		Black Clay loam (topsoil)	CL/SC	
4"		Yellow orange silty clay, dry	CL/SC	SAMPLE 1 0-2' @ 1030hrs
		dense		HNU-0
4.5'		Black clay sludge strong odor		SAMPLE 2 5'-6' @ 1140hrs
5'	▽	CLAY DRAIN PIPE from Drake		HNU=5ppm
6.5'		BLACK COATED Cobbles (6" size)		
11'		BLACK SANDY CLAY W/ LARGE		SAMPLE 3 11-12' @ 1210hrs
		(10") boulders very strong odor		HNU=1ppm
12'		Bottom of pit		

Test Pit Cross Section and / or Plan View



REMARKS
CLAY Pipe hit @ 5' - appears to be discharge from drain from Drake CHEM. - DISCHARGE IS BEER color Strong odor High flow (~5gpm) / Roy Schock & Dennis Smith observed pipe

PHOTO LOG #1 - 0'-2' #2: 5'-6' #6: 11'-12'
PHOTOS #3, #4, #5: Test pit & DRAIN PIPE

TEST PIT 44

PAGE 1 OF 1

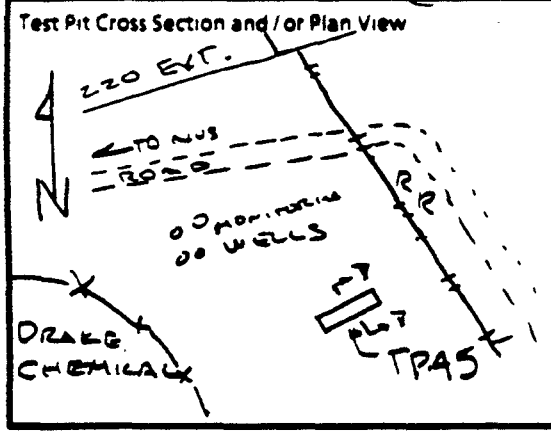
AR302272

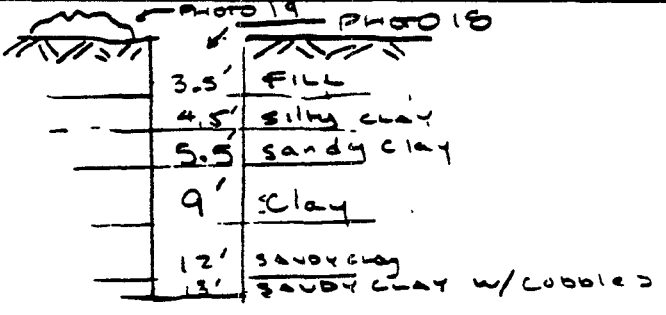
TEST PIT LOG — **NUS CORPORATION**

PROJECT: DRAKE CHEMICAL — TEST PIT NO: 45
PROJECT NO: 6204 — DATE: 11/24/87
LOCATION: Lock Haven, Pa
FIELD GEOLOGIST: R. Bethel

DEPTH	LITHOLOGY CHANGE (Depth, ft.)	MATERIAL DESCRIPTION (Soil Density / Consistency, Color)	USCS	REMARKS
0		Black Loam, some granular	SM-SC	
		material, grass covered		
3"		cinders, bottles, glassware		Sample 0-2' @ 735 HRS
		bricks near bottom, white		HNU = 0 ppm
		to orange red		
3.5'		Orange red silty clay, medium	CL	
		dense, slightly moist		
4.5'		Orange red sandy clay	SC	
		medium dense slightly moist		
		cohesive, some granular matl. <1/8"		
5.5		Orange red clay soft, damp	CH	
9'		sandy clay, orange red, very damp	SC	Sample 9.5-11' 755 HRS
				HNU = 0 ppm
12'		SANDY CLAY w/ large sandstone	CL	Sample 12-13' 807 HRS
13'		cobbles (6")		HNU = 0 ppm

Test Pit Cross Section and / or Plan View





SECTION A-A

REMARKS

PHOTO LOG #15: 0-2' #16: 9.5-11'
#17: 12-13' PHOTO #18: COMPLETED PIT
PHOTO #19 EXCAVATED MATERIALS

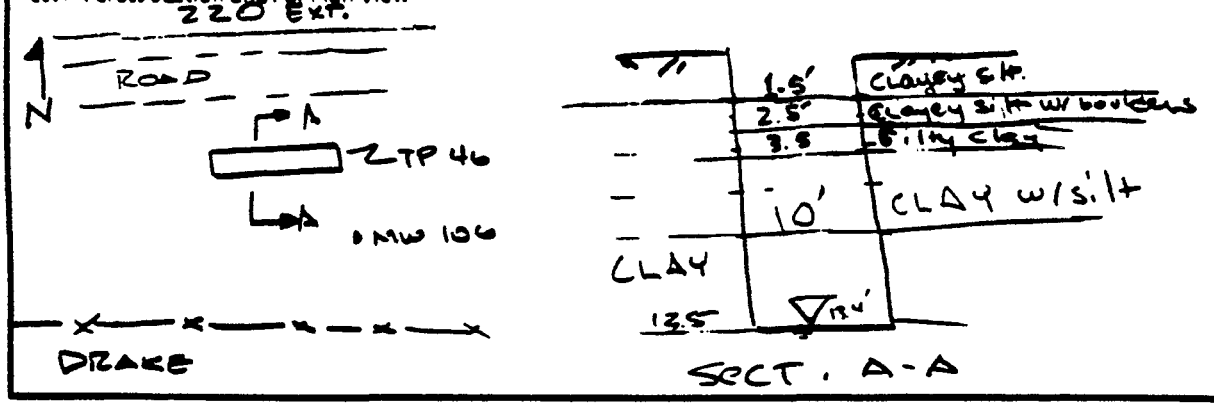
TEST PIT 45
PAGE 1 OF 1

TEST PIT LOG — NUS CORPORATION

PROJECT: DRAKE CHEMICAL — TEST PIT NO: 46
PROJECT NO: 6207 — DATE: NOV 25, 1987
LOCATION: LOCK HAVEN, PA
FIELD GEOLOGIST: RICK Bethel

DEPTH (ft)	LITHOLOGY CHANGE (Depth, ft.)	MATERIAL DESCRIPTION (Soil Density / Consistency, Color)	USCS	REMARKS
0		GRASS surface Vegetation		
0		Gray black clayey silt, rock	SC	
		fragments (1"-4" broken clay pipe		SAMPLE #1 0'-2' 1045HRS
1.5		LARGE boulders (8"-12") silt		
2.5		Gray & orange silty clay, small		
		gravel pieces 1/16"		
3.5		Orange Yellow clay, some silt	CL	-
		Moist medium stiff		Sample 2 07'-09' 1100HRS
10'		Yellow clay, moist, plastic	CH	
				SAMPLE 3 12'-13' 111[illegible]
13.4'	▽	WATER		
13.5		Bottom of hole		

Test Pit Cross Section and / or Plan View



REMARKS

PHOTO LOG #3: 0-2' #4: 7-9' #5: 12'-13'
#6, #7 completed p.t
#8, #9 overview of p.t location

TEST PIT 46

PAGE 1 OF 1

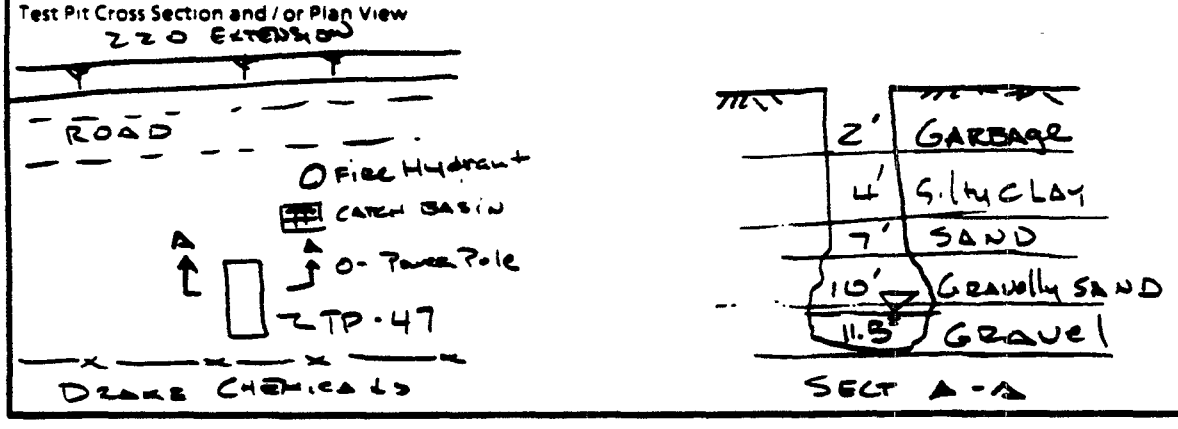
AR302274

TEST PIT LOG — **NUS CORPORATION**

PROJECT: Drake Chemical — TEST PIT NO: 47
PROJECT NO: 620Y — DATE: November 25, 1987
LOCATION: Lock Haven Pa
FIELD GEOLOGIST: Rick Bethol

DEPTH (ft)	LITHOLOGY CHANGE (Depth, ft.)	MATERIAL DESCRIPTION (Soil Density / Consistency, Color)	USCS	REMARKS
0		Garbage - bottles, cans bricks		
		black silt Loam	SM/SC	
2'		Orange yellow medium dense		SAMPLE 1 - 1'-3' 930 HRS
		silty clay		
4'		Yellow clayey SAND soft moist	CL	
7'		Yellow Sand, soft moist	SC	
		little clay, rounded gravel (2")		SAMPLE 2 8'-9' 945 HRS
10'		GRAVELLY SAND (cobbles 2"-6")	GM	
10.5	▽	WATER		
				Sample 3 - 10'-11' 1000 HRS
11.5		GRAVEL, some SAND (cobbles 1"-6")	GP	
		Bottom of Hole		

Test Pit Cross Section and / or Plan View



REMARKS

PHOTO LOG #22: 1'-3' #23: 8'-9'
#24: 10'-11'
#1, #2: Completed pit

TEST PIT 47

PAGE 1 OF 1

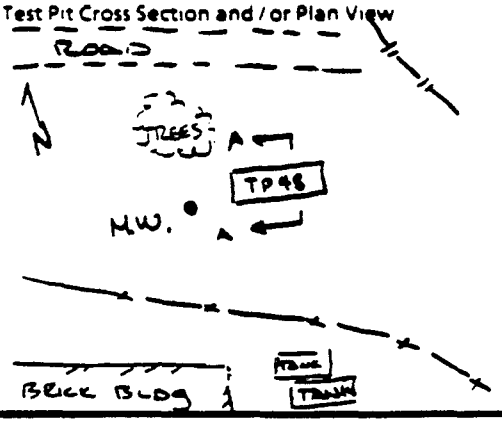
AR302275

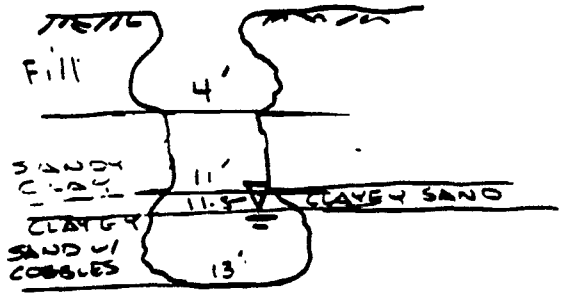
TEST PIT LOG — NUS CORPORATION

PROJECT: Drake Chemical — TEST PIT NO: 48
PROJECT NO: 620Y — DATE: November 24, 1987
LOCATION: Lock Haven, Pa.
FIELD GEOLOGIST: Rick Bethel

DEPTH (ft)	LITHOLOGY CHANGE (Depth, ft.)	MATERIAL DESCRIPTION (Soil Density / Consistency, Color)	USCS	REMARKS
		Surface - Grass Vegetation, Sumac Trees		
0		Black Loam, Cinders, reddog		Garbage!
		ashes bottles cans bricks		Sample 1 0-2' 1601 HRS
				HNU=0
4'		Yellow orange sandy clay	SC	
		soft, compressible		Sample 2 8'-9' 1615 HRS
				HNU=0
11'		Yellow orange clayey sand	SC	
		very wet, plastic		Sample 3 - 11'-12' 1630 HRS
11.5	▽	Water · Yellow Orange clayey		HNU=0
		sand w/ sandstone cobbles (8")		
13'		Bottom of Hole		

Test Pit Cross Section and / or Plan View





Section A-A

REMARKS

PHOTO LOG #12: 0-2'; #13: 8-9'; #14: 11-12'

TEST PIT

PAGE ..... OF

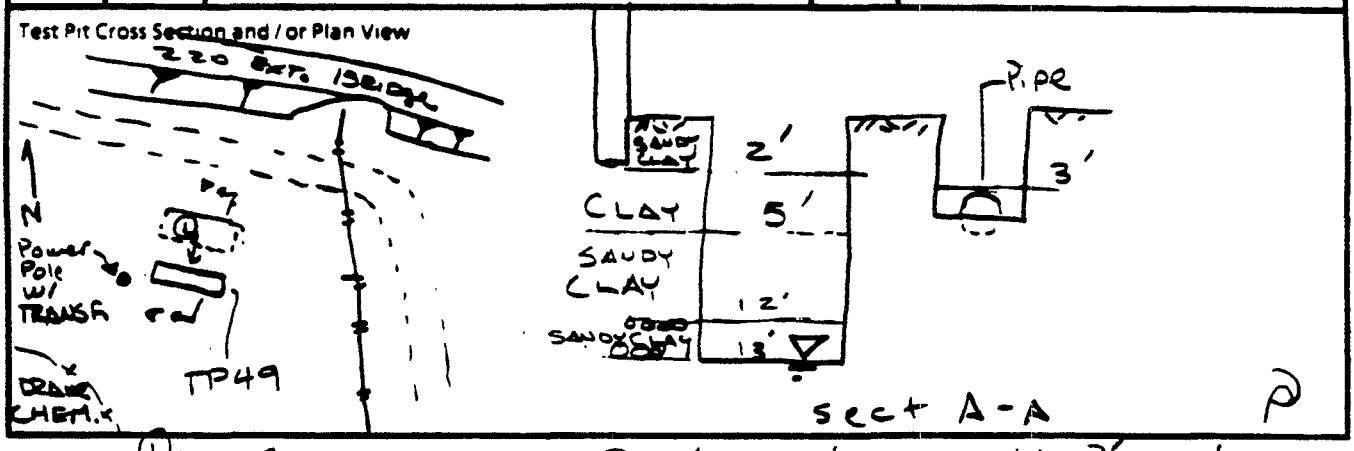
AR302276

TEST PIT LOG — **NUS CORPORATION**

PROJECT: DRAKE CHEMICAL — TEST PIT NO: 49
PROJECT NO: 6207 — DATE: NOV. 24, 1987
LOCATION: LOCK HAVEN, PA.
FIELD GEOLOGIST: R. BETHEL

DEPTH (ft)	LITHOLOGY CHANGE (Depth, ft.)	MATERIAL DESCRIPTION (Soil Density / Consistency, Color)	USCS	REMARKS
0		Brown SANDY CLAY, br. cts, glass		FILL
2'		Yellow orange soft plastic Clay	CL	SAMPLE 1 0-2' 1440HRS
3'	①	4" C.I. Pipe		HNU=0 ppm
5'		Yellow orange sandy clay soft	SC	
				SAMPLE 2 9'-10' 1500HRS
				HNU=0 ppm
12'		Orange SANDY CLAY, MANY stones	SC	Sample 3 · 11'-12' 1510hrs
		1-6" size, rounded; WET		HNU=0ppm
13'	▽	Bottom of hole		

Test Pit Cross Section and / or Plan View



REMARKS ① H.t CAST IRON PIPE @ 3', moved test pit 3' South

PHOTO LOG #7: 0-2' #8: 9'-10' #9: 11'-12'
#10, #11 completed pit

TEST PIT 49

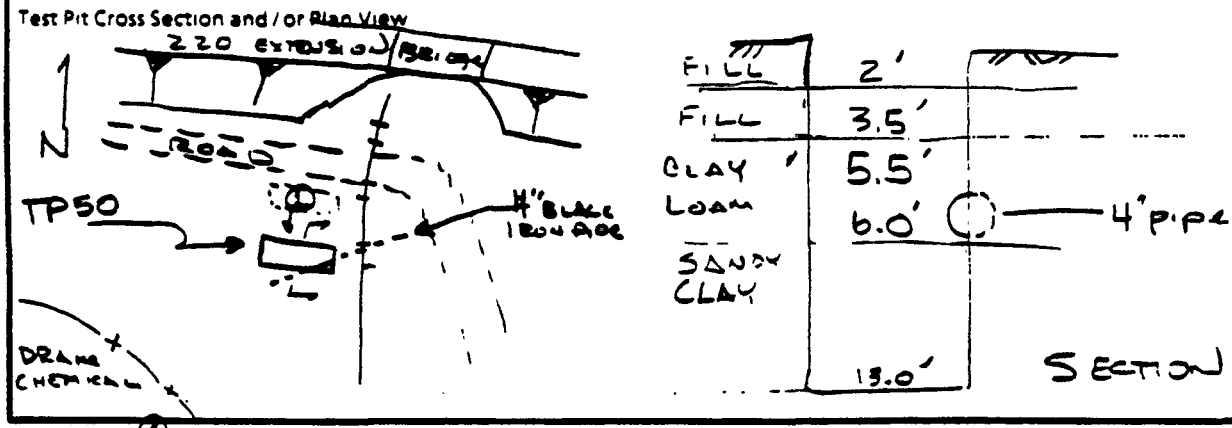
PAGE ____ OF ____

TEST PIT LOG — **NUS CORPORATION**

PROJECT: Drake Chemical — TEST PIT NO: 50
PROJECT NO: 620Y — DATE: 11/24/87
LOCATION: Lock Haven, PA
FIELD GEOLOGIST: Rick Bethel

DEPTH (ft)	LITHOLOGY CHANGE (Depth, ft.)	MATERIAL DESCRIPTION (Soil Density / Consistency, Color)	USCS	REMARKS
0'		Clayey, gravelly silt, brown	GC	
		moist gravelly particles 1/8"-4" size		Sample 0-2' 935 HRS
2'		grey-black silty gravel (1/4"-4" size	GM	
		(Cinders)		
3.5		CLAY LOAM, Orange, some small	CL	
		gravel pieces ≤ 1/4"		
5.5'		BLACK IRON PIPE 4"ϕ		
6.0'		Yellow orange soft SANDY clay	SC	
				Sample 8'-9' 1005 HRS
13'		Bottom of Pit		Sample 12-13' 1015 HRS
		No WATER		

Test Pit Cross Section and / or Plan View



REMARKS: Moved TP-50 20 ft. south due to proximity to roadway.

PHOTO LOG #20: 0-2' #21: 8'-9' #22: 12'-13' #23 & #24: Open pit

TEST PIT 50

PAGE 1 OF 1

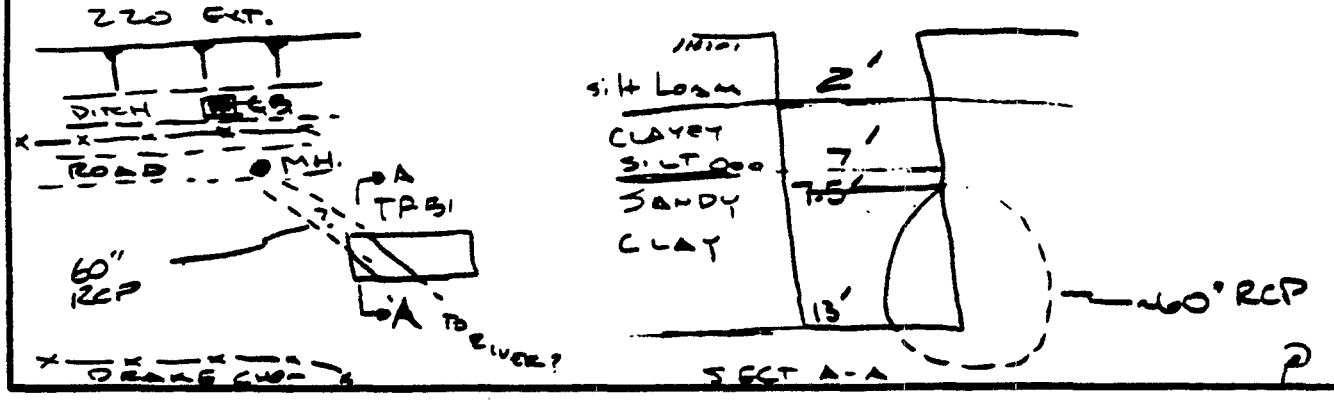
AR302278

TEST PIT LOG — NUS CORPORATION

PROJECT: DRAKE CHEMICAL — TEST PIT NO: 51
PROJECT NO.: 620Y — DATE: 11/25/87
LOCATION: LOCK HAVEN, PA
FIELD GEOLOGIST: RICK Bethel

DEPTH (ft.)	LITHOLOGY CHANGE (Depth, ft.)	MATERIAL DESCRIPTION (Soil Density / Consistency, Color)	USCS	REMARKS
		Surface = grass covered		
0'		TAN-GREY Silt Loam	SM/SC	FILL
		Broken ROCK (1/8"-2"), bricks		SAMPLE 1 0-2' 800HRS
2'		Brown CLAYEY silt, some angular	SM/SC	
		cobbles <2"		
7'		Brown SANDY CLAY, bricks, glass	SC	
				SAMPLE 2 9-10' 820HRS
7.5'		Top of 60"Φ RCP (DRAIN)		
				SAMPLE 3 12-13' 845HRS
13'		Bottom of hole		
		No WATER		

Test Pit Cross Section and / or Plan View



REMARKS
~60"Φ RCP STORM DRAIN FROM 220 EXTENSION @ 7.5'

PHOTO LOG #17: 0-2' #18: 9-10' #21: 12-13'
#19, #20: Completed test pit

TEST PIT 51
PAGE 1 OF 1

AR302279

APPENDIX B-2

BORING LOGS

BORING LOG — NUS CORPORATION

PROJECT. DRAKE CHEM
PROJECT NO. 620Y
ELEVATION. NA
WATER LEVEL DATA NA
(Date, Time & Conditions)

DATE. 11/21/87
FIELD GEOLOGIST R. BETHEL

BORING NO SB-15
DRILLER. E. DYE PENN DRILLING

SKID RIG #4, DRIVE AND WASH DRILLING METHOD

	SAMPLE NO & TYPE	DEPTH (ft)	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth ft)	MATERIAL DESCRIPTION* SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	USCS	REMARKS
(:045)	GRAB S-1	0-1'		1'/1'		V SOFT	RED TO GRAY	SLUDGE		SAND MIXED THRU OUT
					3.9' ▽ 11-21-87					
		5								
(:54c)	S-2 SS	5-10'		5'/5'			BLACK			SATURATED SAND, COBBLES, WIRE,
					7'					BRICKS, TWIGS PRESENT
						M. STIFF	DRK BRN TO BLK	CLAY, SOME SAND	CL	1" SAND LAYER AT 7', BLK. LOOSE, SAT. W/ SLUDGE
		10			9.5'		GRAY			
(1630)	S-3 SS	10-15'		5'/5'	10.5'	STIFF	W/TAN ORANGE MOTTLING	CLAY	CH	POSS LINER MAT
					11.5		GRAY/GRN BLACK	SLUDGE		VERY SOUPY (MAY BE FROM ABOVE CLAY)
					13.0	V. SOFT	GRAY TO BLK	SANDY CLAY		SAT., MIXED W/ SLUDGE (60%)
						STIFF	ORANGE AND GRAY	CLAY	CH	DAMP, DEF. LINER MAT.
		15			TD 15'					

REMARKS TOO COLD FOR HNU, READINGS FROM HEAD SPACE OF SAMPLE JARS. HYDRAULIC LINE BROKE ON RIG AFTER SAMPLE S-3 WAS OBTAINED, FLUID RAN DOWN HOLE (AT 15') STOPPED HOLE, SAMPLE S-1 OBTAINED W/ TROWEL, S-2, S-3 OBTAINED W/ 5' LONG, 5" DIAM TUBE POUNDED W/ 300LB. WT DROPPED 30". BACKFILLED BORING W/ BENTONITE 11/22 LEVEL D PROTECTION

BORING SB-15

PAGE 1 OF 1

* See Legend on Back

BORING LOG — NUS CORPORATION

PROJECT: DRAKE CHEM
PROJECT NO: 620Y
ELEVATION: NA
WATER LEVEL DATA (Date, Time & Conditions): NA
DATE: 11/18/87
FIELD GEOLOGIST: R BETHEL
BORING NO: SB-24
DRILLER: E DYE, PENN DR SKID RIG

SAMPLE NO & TYPE	DEPTH (ft)	BLOWS 5" OR 400 (ft)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth ft)	MATERIAL DESCRIPTION* SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	USCS	REMARKS
	5								
	10			10'					
(1610) S-1/SS			4.0/5.0		M. STIFF	LT. BRN	CLAY, TR. FINE SD + SILT	CL	0 PPM HNU MOIST to DAMP, [illegible] IN
				12'					1/16" STRING, PO[illegible]E
				13' ▽	M. STIFF	LT. BRN w/ GRY + BLK	SANDY CLAY	CL	GRY + BLK LAMINA[illegible] 2M THICK THRU OUT, MOIST
	15			TD 15'	LOOSE TO M. DENSE	LT. BRN	CLAYEY SAND, FINE GR.	SC	SAT., GRAY LENSIOD SHAPED (5-10mm) LAM 0 PPM HNU

REMARKS: DRIVE + WASH DRILL METHOD, 5" roller bit, 6" csg., 5' long + 5" diam. spoon for spls., 300 LB WT. dropped 30", SKID MOUNTED RIG #4 (400-611) HNU # N-6611, BACKFILLED BORING w/ BENTONITE (1700 11/18)

* See Legend on Back

BORING: SB-24
PAGE: 1 [illegible]

AR302282

BORING LOG — NUS CORPORATIO

PROJECT: DRAKE CHEM
PROJECT NO.: 620Y
DATE: 11/19/87
ELEVATION: NA
FIELD GEOLOGIST:
WATER LEVEL DATA: NA
(Date, Time & Conditions): NA
BORING NO: SB-25
DRILLER: E. DYE PENN DR., SKID RIG

	SAMPLE NO & TYPE	DEPTH (ft)	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth ft)	MATERIAL DESCRIPTION* SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	USCS	REMARKS
								SLUDGE		
		5								
		10								
(1230)	S-1/SS			5'/5'		M. STIFF	GRAY w/ BLK.	CLAY, TR. SILT	CL	0 PPM HNU, MOIST TO BLK MOTTLING
						M. STIFF	TAN TO LT. BRN	CLAY, SOME FINE GR. SAND + SILT, TR. GRAVEL	CL	GRAY MOTTLING THR INC. W/ DEPTH; WKL INTO 1/16" STRING, GRA ROUNDED SS, WATER, REL MOIST TO SAT.
		15			TD 15'	M. DENSE TO LOOSE	GRAY w/ LT. BRN	CLAYEY SAND, SOME GRAV.	SC	0 HNU BRN. RNDED SS GRA SAT., GRAY W/ LT. B MOTTLING THRUOUT, SA RED STAIN @ 18'-DYE

REMARKS: DRIVE + WASH DRILLING, 6" CSG. 5" ROLLER BIT, 5' LONG, 5" DIAM SPLG. TUBE DRIVEN W/ 300 LB WT. DROPPED 30". SKID MOUNTED RIG #4 (400-611) HNU #N-6611. BACKFILLED BORING W/ BENTONITE (1330 11/19)

BORING SB-25

PAGE 1 OF 1

* See Legend on Back

BORING LOG — NUS CORPORATION

PROJECT DRAKE CHEM
PROJECT NO 620Y
ELEVATION NA
WATER LEVEL DATA NA
(Date, Time & Conditions)

DATE 11/22/87
FIELD GEOLOGIST R BETHEL

BORING NO SB-28
DRILLER S. DYE, PENN DR.

SKID RIG #4 (400-611) DRIVE AND WASH DRILLING METHOD

SAMPLE NO & TYPE	DEPTH (ft)	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth ft)	MATERIAL DESCRIPTION* SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	USCS	REMARKS
	5								
	10								
S-1	14-17		3/3'	14' ▽	V. LOOSE	GRAY	SAND + GRAVEL, SOME CLAY	GC/SC	SAT. 0.4ppm HNU

REMARKS DROVE 6" CASING TO 14', SAMPLED FROM 14-17' W/ 5" TUBE, DRIVEN W/ 300LB. WT. DROPPED 30"

BORING SB-28

PAGE 1 OF 1

* See Legend on Back

SKS MOUNTED RIG SN # 430-611 #4

BORING LOG

NUS CORPORATION

PROJECT: DRAKE CHEM
PROJECT NO.: 620Y
ELEVATION: NA
WATER LEVEL DATA (Date, Time & Conditions): NA 11/13/87 1200 ; Clear Sunny 45°F

DATE: 11/13/87
FIELD GEOLOGIST: R BETHEL

BORING NO: SB-31
DRILLER: E. DYE
, PENN DRILLING; E DYE,
Level of Protection D ,

SAMPLE NO & TYPE	DEPTH (ft)	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth ft)	MATERIAL DESCRIPTION* SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	USCS	REMARKS
	5								
									drove casing to 9.7
S-1 (1240) GS	6.3'	1	0/2'						
	10								
S-2 (1300) SS		1 1 2	2/2	liner			sludge		found blue plastic @
S-3 (1330) SS		3 2 2 2	1.5/1.5	0-13' 11-13-87			gray clay very soft	MI-CL	liner mod.
							Sandy clay, moist to wet.	CL	Found blue plastic approx. 8' (may be fr above)
				TD 14.5'			Black sand, wet. very loose	SC	

REMARKS: filled 32oz jar w/ spl #S-3 1330

BORING SB-31

PAGE 1 OF 1

* See Legend on Back

Drive + Wash Method of Drilling, 4" casing, 3 7/8" Rotary Bit
3" Split Spoon, 2' long, 300 LB. wt. dropped 30"; Backfilled hole w/ bentonite 11/16

BORING LOG — NUS CORPORATION

PROJECT. DRAKE CHEM
PROJECT NO 620Y
ELEVATION NA
WATER LEVEL DATA NA
(Date, Time & Conditions) NA

DATE. 11/17/87
FIELD GEOLOGIST. R. BETHEL

BORING NO SB-31 (2nd ATTEMPT)
DRILLER. E. DYE SKID RIG #4

SAMPLE NO & TYPE	DEPTH (ft)	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth ft)	MATERIAL DESCRIPTION* SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	USCS	REMARKS
	1								
	5								
	10								
S-1/SS	11		5/5						
	12			11.5'		BLACK	GRAVEL (ANG. LS) + SLUDGE		SATURATED SLU[illegible]
				12.0'		BLACK	CLAY + BLK SLUDGE		LINER @ 11.5'
13.0'	13			12.5'	V. SOFT	GRAY	CLAY, SOME SILT	ML-CL	MOIST/DAMP
▽ 11-17-87				13.0'	SOFT/M.STIFF	GRAY W/BLK	CLAY, SOME FINE SAND	CL	MOIST TO SAT. ROLL THIN ST
	14				LOOSE	GRAY W/ BLACK	SAND (F. GR) W/ CLAY	SC	SAT., GRY W/ BLK LAM.
	15			15.0'					ROLL INTO 1/8" STRING
				TD 16'	LOOSE/ M. DENSE	BROWN W/ GRAY	SAND (F. GR), SOME CLAY	SC	SAT., BRN W/ GRY LAM.

REMARKS 5" Roller bit; 6" casing, sampling device: 5' long, 5" diam. split spoon, w/ catcher, 300# wt dropped 30", DRIVE + WASH DRILLING HNU (E-6602) NOT WORKING, SKID MOUNTED RIG #4, LEVEL D PROTECT'N

BORING SB-31

PAGE 2 OF 2

* See Legend on Back SERIAL # ON RIG 480-611 Backfilled boring w/ bentonite 11/18/87 (1345)

BORING LOG — NUS CORPORATION

PROJECT: DRAKE CHEM
PROJECT NO.: 620Y
DATE: 11/20/87
BORING NO: SB-32/MWM08
DRILLER: E. DYE
ELEVATION: 555.41'
FIELD GEOLOGIST: R. BETHEL
WATER LEVEL DATA: 546.85'
(Date, Time & Conditions): 1/25/88, 1050

	SAMPLE NO & TYPE	DEPTH (ft)	BLOWS 6" OR ROD (%)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth ft)	MATERIAL DESCRIPTION* SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	USCS	REMARKS
(0800)	S-1/SS	5								
					8.0' ▽ 11-20-87					
		10				LOOSE	GRAY	SAND, FN TO MED GR, SOME CLAY	SC	SAT. 1" BLK LAYER AT 8' BOUND.
						M. STIFF	BRN TO GRAY	SANDY CLAY TR. GRAV.	CL	SAT., ROLL INTO 1/4" STRING FOUND RND. BRN SS. GRAV.
		15				LOOSE	BLK TO BRN	SAND, SOME CLAY	SC	SAT., 1-3" BLK LAM. THRU
(0905)	S-2/SS		31 / 65			V DENSE	LT. BRN	SAND + GRAVEL, TR. FINES	SP/GP	WIDE RANGE OF SD + GR. SIZE
		20	65 / >100	2.0/2.0						
					TD 23'					

REMARKS: S-1, 5' long 5" diam. tube driven w/ 300# wt dropped 30", S-2, S-3 2" diam. split spoon, driven w/ 140# wt. dropped 30". Photo: 19-2# of S-1, #25 of S-2. Installed well to 21' (1500). DRIVE + WASH DR. METHOD. HNU (E-6602) NOT WORKING, SKID MOUNTED RIG #4 (#400-611) LEVEL D PROTECTION, SCREENED INT. 10-19'

BORING SB-32/MW

PAGE 1 OF 1

* See Legend on Back

BORING LOG — NUS CORPORATION

PROJECT. DRAKE CHEM
PROJECT NO. 620Y
DATE. 12-14-87
ELEVATION 557.25'
FIELD GEOLOGIST S. CONTI
WATER LEVEL DATA 545.52'
(Date, Time & Conditions) 1/25/88, 1404
BORING NO MW-M101
DRILLER. B GOLLIHUE

SAMPLE NO & TYPE	DEPTH (ft)	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth ft.)	MATERIAL DESCRIPTION* SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	USCS	REMARKS
							REFER TO MW-M102		

REMARKS Drilled to 25', water table well. Refer to MW-M102 for description. Installed screen 15.5-24.5'
Rig: Acker A.D. II

BORING M[illegible]
PAGE 1 OF 1

* See Legend on Back

BORING LOG — NUS CORPORATION

PROJECT: DRAKE CHEMICAL
PROJECT NO.: 620 Y
ELEVATION: 557.30'
WATER LEVEL DATA (Date, Time & Conditions): 545.29' 1/25/88, 1405
DATE: 12-11-87
FIELD GEOLOGIST: M.L. MENGEL
BORING NO: MW-M102
DRILLER: B. GOLLIHUE

SAMPLE NO & TYPE	DEPTH (Ft.)	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY / SAMPLE LENGTH	LITHOLOGY CHANGE (Depth Ft.)	MATERIAL DESCRIPTION* SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	USCS	REMARKS
	0								
S-1		4, 4,	1.7 / 2.0		LOOSE	BR	FINE SILTY SAND, TR. CLAY	SM	ROOT MATERIAL AT
	2	5, 5							TOP, DRY
	5								
S-2		5, 17	1.6 / 2.0	6.0	DENSE	BR	FINE SAND, SOME FINE	GP	SUB ROUNDED FINE
	7	21, 16					GRAVEL		GRAVEL, SUB ANGULAR
									SANDSTONE FRAGMENT
									DAMP
	10								
S-3		9, 9,	1.6 / 2.0		M. DENSE	BR			SUB ROUNDED SANDSTONE
	12	9, 7							FRAGMENTS
									HIT H_2O AT 14.0
	15			15.0					
S-4		18, 82	1.9 / 2.0		DENSE	BR	FINE TO COARSE SAND WITH		SANDSTONE FRAGMENTS
	17	30, 17					FINE TO COARSE GRAVEL		THROUGHOUT. COBBLES?
	20								
S-5		72 / .5	60 / .5		V. DENSE	BR			SUB ROUNDED SANDSTONE
	22								COBBLES IN CUTTINGS

REMARKS: RIG: ACKER A.O. 2 USED 6" SOLID STEMS TO 15, THAN 8" HOLLOW STEMS TO 42'. HIT BEDROCK AT 42'.

BORING MW-M10

PAGE 1 OF 2

* See Legend on Back

BORING LOG — NUS CORPORATION

PROJECT: DRAKE CHEMICAL
PROJECT NO.: 620 Y
ELEVATION:
WATER LEVEL DATA
(Date, Time & Conditions)

DATE: 12-12-87
FIELD GEOLOGIST: M L MENGEL

BORING NO: MW-M102
DRILLER: B GOLLIHUE

SAMPLE NO & TYPE	DEPTH (ft)	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY / SAMPLE LENGTH	LITHOLOGY CHANGE (Depth ft.)	MATERIAL DESCRIPTION* SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	USCS	REMARKS
	25								
S-6		40 / 61	.7 / 1.0		V. DENSE	BR	FINE TO COARSE SAND WITH	GP	WHITE + REDDISH SANDSTONE FRAGMENT
	27						FINE TO COARSE GRAVEL		THROUGHOUT, SUBROUND
	30								
S-7		11 / 57 / 63	1.5 / 1.5		V. DENSE	BR	FINE TO COARSE SAND WITH		SUBROUNDED
	32						FINE TO COARSE GRAVEL		
	35								
S-8		45 / 91	1.0 / 1.0		V DENSE	BR			
	37								
	40								
S-9		30 / 8 / 9 / 100	2.0 / 2.0		V. DENSE	BR			
	42						BLACK SHALE		BEDROCK AT 42'

REMARKS

BORING M[illegible]02

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* See Legend on Back

AR302290

BORING LOG — NUS CORPORATION

PROJECT: DRAKE CHEM
PROJECT NO.: 620Y
ELEVATION: 556.28'
WATER LEVEL DATA: 544.65'
(Date, Time & Conditions): 1/25/88, 1410
DATE: 12-15-87
FIELD GEOLOGIST: S. CONTI
BORING NO: MW-M103
DRILLER: B. GOLLIHUE

SAMPLE NO & TYPE	DEPTH (ft.)	BLOWS 6" OR ROD (ft.)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth ft.)	MATERIAL DESCRIPTION* SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	USCS	REMARKS
							REFER TO MW-M104		

REMARKS: ACKER ADT RIG. REFER TO MW-M104 FOR LITH. DESCRIPTION. TD of BORING 26', SCREENED INTERVAL 25.5-16.5'

BORING: MW-M

PAGE 1 OF 1

* See Legend on Back

BORING LOG — NUS CORPORATION

PROJECT: DRAKE CHEMICAL
PROJECT NO: 620Y
ELEVATION: 556.24'
WATER LEVEL DATA: 544.68'
(Date, Time & Conditions): 1/25/88, 1409
DATE: 12-14-87
FIELD GEOLOGIST: SJ CONTI
BORING NO: MW-M104
DRILLER: PENNA DRILLING
B. GOLLINUE

SAMPLE NO & TYPE	DEPTH (ft)	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth ft)	SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	USCS	REMARKS
	0.0	3/10	1.5/2.0			RED	CLAYEY SILT - SOME	ML	MOIST
S-1	2.0	12/16			STIFF	GRAY BRN	ROCK FRAG. TR		FILL MATL - SOME
					TO M.		BRICK & SLAG		NAT MATL - TR ORG.
					DENSE		(FILL)		
	5.0			5.0					
S-2		4/6	2.0/2.0		M DENSE	ORANG BRN	SILTY FINE SAND - TR	SM	MOIST - TR CLAY
	7.0	8/7					CLAY		IN TOP 6" OF THE SAMPLE
	10.0			10.0					
S-3		40/68	1.5/1.5		V. DENSE	ORANG BRN	SILTY FINE TO M. SAND -	SW	MOIST
	11.5	67					SOME GRAVEL AND		S-3 @ 4:37 PM SUB-ANG TO SUB
							S.S. GRAVEL FRAG.		ROUNDED GRAINS 1" Φ PIECE - VERY
									HARD DRIVING SPOON S. STONE GRAVEL
	15.0								HIT H2O @ 15'.
S-4		54/43	1.7/2.0		V. DENSE	BRN	SILTY SAND - SOME	SW	S-4 @ 4:55 PM
	17.0	18/59					GRAVEL AND		16.0-16.5 - M DENSE
							S.S GRAVEL FRAG		SILTY FINE SAND ZONE - SUB-ANG
									TO SUB R. GRAINS 1" Φ.
	20.0								
S-5		20/20	1.8/2.0		V DENSE	BRN	SILTY SAND AND	SW	MOIST → WET
	22.0	28/47					GRAVEL - TR		SUB-ANG → SUB-R.
							SAND STONE		GRAINS 1" Φ MAX SIZE IN SPOON
							GRAVEL		

REMARKS: ACKER ADII RIG. USING 140 LB HAMMER 30" DROP. 2" OD SPLIT-SPOON - HOLLOW STEM 4¼" ID - 8" OD AUGERS. FIRST SAMPLE @ 4:20 PM.

BORING MW-M104

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* See Legend on Back

BORING LOG — NUS CORPORATION

PROJECT: DRAKE CHEMICAL
PROJECT NO: 620Y
ELEVATION:
WATER LEVEL DATA (Date, Time & Conditions)
DATE: 12-15-87
FIELD GEOLOGIST: SJ CONTI
BORING NO: MWM104
DRILLER: PENN DRILL — B. GOLLIHUE

SAMPLE NO & TYPE	DEPTH (ft)	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY / SAMPLE LENGTH	LITHOLOGY CHANGE (Depth ft)	SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	USCS	REMARKS
	25.0								
S-6	26.0	25 / 60	0.7/1.0		V. DENSE	BRN	SILTY SAND - SOME	SW	WET
							GRAVEL		POOR REC - HARD
									DRILLING - DRILLS LIKE THERE ARE
									MORE COBBLES IN FORMATION
	30.0								
S-7		14 / 23	1.7/2.0		V. DENSE	BRN	SILTY SAND AND	SW	
	32.0	24 / 28					GRAVEL AND	GW	S-7 @ 8:20 AM MORE GRAVEL
							GRAVEL FRAGS		TOOK 8 oz JAR SAMPLE FOR ANAL
									HERE SUB ANG - TO SUB
	35.0								WET R. 1" Φ IS MAX IN
S-8		14 / 21	1.6/2.0		V. DENSE	BRN	SILTY SAND AND	SW	SPOON.
	37.0	24 / 27					GRAVEL	GW	WET - SUB ANG TO SUB-R GRAINS
									1-1½" Φ SIZE IN SPOON
	40.0					DARK			
S-9	41.0	15 / 155	.7/1.0	41.0	M HARD	GRAY	SILTY SHALE	VBR	S-9 @ 10:00 AM
									REF @ 41'
							BOTH @ 41.0'		CARBONACEOUS - VBR.
									CALCAREOUS ?

REMARKS: ACKER AD II RIG - 140 LB HAMMER - 30" DROP - USING 4¼" ID HOLLOW STEM AUGERS - 8" HOLE ±.

BORING MWM104

PAGE 2 OF 2

* See Legend on Back

BORING LOG — NUS CORPORATION

PROJECT: DRAKE CHEM
PROJECT NO.: 620Y
DATE: 12/1/87
BORING NO: MW-MIOS
DRILLER: B GOLLIHUE
ELEVATION: 556.16'
FIELD GEOLOGIST: R. BETHEL
WATER LEVEL DATA: 545.53'
(Date, Time & Conditions): 1/25/88, 1744
ACKER 32 HOLLOW STEM AUGER DRILL METHOD

SAMPLE NO & TYPE	DEPTH (ft)	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth ft.)	SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	USCS	REMARKS
S-1 SS	0-2'	8 10 10 4	1.5/2.0	2'			FILL		BRICK GRAVEL + CLAY, DRY
									0 PPM HNU
						RED BRN	SANDY CLAY	CL	DAMP CRUMBLY, V FIN
									OR SAND/SILT
	5'								
S-2/SS	5-7'	4 4 6 6	2.0/2.0						
	10'								
S-3/SS	10-12'	11 3 3 4	1.3/2.0	12'			SANDY CLAY, TR GRAVEL		SANDSTONE GRAV. [illegible] DAMP 0 ppm
							SAND + GRAVEL, SOME CLAY	GC/SC	
	15'			~15' ▽					
515' S-4/SS	15-17'	39 27 41 29	2.0/2.0			LT/DRK BROWN			SANDSTONE GRAV. SUBEND STREAK OF PURPLE IN SAND SATURATED CLAY M. STIFF RUNNING SANDS AT TOP (FR 12')
	20'			20'					
535' S-5/SS	20-22'	18 38 94 —	1.5/1.5			LT BRN TO GRAY	SANDY GRAVEL, TR CLAY	GP	PREDOM GRAV. SUBEND SS MULTICOLORED, RUNNING ?
	25'								

REMARKS: RIG: ACKER AD II HOLLOW STEM AUGER METHOD OF DRILLING
SAMPLED W/ 2" OD SPLIT SPOON DRIVEN W/ 140 LB. HAMMER
DROPPED 30", TD OF BORING: 106.2', SCREENED INTERVAL: 105.5'–86.5'

BORING [illegible]
PAGE 1 OF 5

* See Legend on Back

BORING LOG — NUS CORPORATION

PROJECT: DRAKE CHEM
PROJECT NO.: 620Y
ELEVATION:
WATER LEVEL DATA
(Date, Time & Conditions)

DATE: 12/1/87
FIELD GEOLOGIST: R BETHEL

BORING NO: MW-MIOS
DRILLER: B. GOLLIHUE

ACKER 62 HOLLOW STEM AUGER METHOD

SAMPLE NO & TYPE	DEPTH (ft)	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth ft.)	MATERIAL DESCRIPTION* SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	USCS	REMARKS
S-6/SS	25-27	13 29 41 32	20/20			BRN TO GRAY	SAND + GRAVEL, SOME CLAY	GC/SC	CLAY M STIFF - LAYERS CI-2 W/ HIGHER % CLAY DISTR.
									THRU OUT. PREDOM SAND + SS GRAVEL (SUBRND); CBS
									GR SAND, OFFW ANU
	30'								
S-7/SS	30-32'	40 50	0.4/2.0			GRAY	SAND + GRAVEL	SP/GP	NOT A GOOD SAMPLE, LO MOST OF IT, HAD TO JERK
				32'					SPOON REPEATEDLY, SAMPLE CONTAINED PREDOM. SAND
						DRK GRAY	SAND W/ GRAVEL, Tr. CLAY	SP	NO CLAY? RUNNING SANDS CAN
									UP TO 10' IN 10" AUGER FINE TO CRS. GR. Sand
	35'								Gravel pea-size, feldspar sand grains, subrnd. more
									material type of alluv dep. also some SS frag. as
									described above.
	40'								
12/2/87 0900 S-8/SS	40-42'	62		40.5'		BLACK	CLAYSTONE		odor still present @ HNU
							(MARCELLUS FORMATION)		
	45'								
	50'								

REMARKS: Drilled w/ 10" Hollow stem augers. Samples collected w/ 2" OD split spoon driven w/ 140# wt. dropped 30" for entire hole every

BORING MW-MIOS

PAGE 2 OF 5

* See Legend on Back

BORING LOG — NUS CORPORATION

PROJECT DRAKE CHEM
PROJECT NO. 620Y
ELEVATION
WATER LEVEL DATA
(Date, Time & Conditions)

DATE 12-2-87
FIELD GEOLOGIST R BETHEL

BORING NO MW-M-05
DRILLER B. GOLLINUE

SAMPLE NO & TYPE	DEPTH (ft)	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth ft)	MATERIAL DESCRIPTION* SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	USCS	REMARKS
	50			10" HOLLOW STEM AUGER →					DID NOT SAMPLE FROM 40' TO 55'
	55								
									HIGH TO MOD & FRACTS
C-1	55-60	3.7/5.0 34%	4.0/5.0			BLACK	CLAYSTONE / SHALE		BLOCKY TO V. BROKEN
									CRUMBLY MAT. 57-60'
	60								CALCITE VEIN ALONG HORIZ FRACT. @ 57', SAT[illegible] FROM
C-2	60-65	0/5.0 0%	4.9/5.0						HORIZ FRACT W/ INFILLED CALCITE, V. BROKEN: 63-65
									BROKEN: 60-63' SAT. IN FRACTS
	65								
C-3	65-72	1.3/7.0 19%	7.0/7.0	NX CORE ←					FEW HOR FRACT. MAINLY MOD TO LOW & FRACTS. V. BROKEN TO BROKEN
									NO CALCITE OBSERVED SAT. IN FRACTS
	70								
	75								

REMARKS SET 4" PVC CASING TO 55'

BORING M[illegible]5

PAGE 3 OF 5

* See Legend on Back

BORING LOG — NUS CORPORATION

PROJECT: DRAKE CHEM
PROJECT NO.: 6207
ELEVATION:
WATER LEVEL DATA
(Date, Time & Conditions)

DATE: 12-7-87
FIELD GEOLOGIST: R BETHEL

BORING NO: MW-MIC5
DRILLER: B GOLLHUE

SAMPLE NO & TYPE	DEPTH (ft)	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY / SAMPLE LENGTH	LITHOLOGY CHANGE (Depth ft.)	MATERIAL DESCRIPTION* SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	USCS	REMARKS
	75				M. HARD	BLACK	CLAYSTONE / SHALE		
C-4	72-80'	28/80 / 35%	80/80						CRUMBLY ZONE @ 5.5'-5 BLOCKY TO V BROKEN
	80								1 HOR FRACT @ 76' NO CALCITE OBSERVED IN FRACTS. MOD. TO LOW % FRACT.
C-5	80-86	2.1/7.6 / 28%	76/76						BLOCKY TO V FRACT, MOD. TO LOW % FRACT.
	85								1 HOR. FRACT. @ 87.6' FILLED W/ CALCITE. SOME MICRO FRACT. ALSO FILLED W/ CC @ 82'
									CRUMBLY ZONES @ 83.5' (1 + @ 86' (2")
C-6	86-92	0.7/4.4 / 7%	2.9/4.4						HORIZ. FRACT. W/ CALCITE INFILLING, ALSO LOW % FRACT. BROKEN THRU OUT
	90			← NX CORE →					
	95								
C-7	92-100'	5.4/8.0 / 68%	6.9/8.0						BLOCKY, FOW % FRACT. SEP. BY 6" NO INTERVAL OF COMPETA ROCK
	100								

REMARKS

BORING MW-MIC5

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* See Legend on Back

AR302297

BORING LOG — NUS CORPORATION

PROJECT: DRAKE CHEM
PROJECT NO: 620Y
ELEVATION
WATER LEVEL DATA
(Date, Time & Conditions)

DATE: 12-7-87
FIELD GEOLOGIST: R. BETHEL

BORING NO: MW-MIOS
DRILLER: B. GOLLINVE

SAMPLE NO & TYPE	DEPTH (ft)	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth ft)	MATERIAL DESCRIPTION* SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	USCS	REMARKS
	100'								
Y					M HARD	BLACK	CLAYSTONE /SHALE		HIGH TO LOW ∠ FRACTS SOME FRACT'S FILLED W/ CALCITE
C-8	100-105'	30/50 60%	5.0/50	↑ NX CORE					CRUMBLY, GROUND UP ZONE (POSS. FAULT?) AT 103'
									BLOCKY
	105'			TD 105'					

REMARKS: REAMED HOLE TO 106.2'

BORING M[redacted]25

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* See Legend on Back

B-58

AR302298

BORING LOG — NUS CORPORATION

PROJECT: DRAKE CHEM
PROJECT NO.: 620Y
ELEVATION: 554.72'
WATER LEVEL DATA: 544.99'
(Date, Time & Conditions): 1/25/88, 1533
DATE: 11/24/87
FIELD GEOLOGIST: R BETHEL
BORING NO: MW-M106
DRILLER: PENN DR E DYE
SKID RIG #4 (400-611) DRIVE + WASH DRILLING METHOD

SAMPLE NO & TYPE	DEPTH (ft)	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth ft.)	SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	USCS	REMARKS
S-1 SS	0-1.5	11 5 7	1.5/1.5			DRK BRN	SOIL		TO 6", W/ ROOTS
					STIFF	GRAY TO BROWN	SANDY CLAY w/ SOME GRAV.	CL	0ppm HNU, DAMP
	5			5'					
S-2 SS	5-7	9 6 8 8	1.7/2.0		STIFF	LT. BRN	CLAY, TR/SOME SAND	CL	FINE GR. SD, ROLL INTO FINE STRING, MOIST
	10								
S-3 SS	10-12	3 6 11 70	2.0/2.0	11' 8-24-87 12'	V. STIFF				ROUNDED, BRN, SS GRAV AT BOTTOM OF SPOON
						BRN w/ GRAY	SAND + GRAVEL, SOME CLAY	GC/SC	
	15						INCREASE IN GRAVEL		
S-4 SS	15-17	16 10 15 21	1.4/2.0		M. DENSE	BRN w/ GRAY			
	20								
S-6	20-21	19 100	1.0/1.0		V. DENSE	LT TO DK BRN	GRAVEL + SAND, SOME CLAY		
				TD 25.5'					

REMARKS: SS: Split Spoon sampler (2" OD), driven w/ 140 LB wt. dropped 30"
LEVEL D PROTECTION. INSTALLED WELL TD @ 25.5'
SCREENED INT: 22'-12'

BORING: MW-M106

PAGE 1 OF 1

* See Legend on Back

AR302299

BORING LOG

NUS CORPORATION

PROJECT DRAKE CHEM

BORING NO MW-M107

PROJECT NO 620Y

DATE: 12/3/87

DRILLER B. GOLLIHUE

ELEVATION: 556.00'

FIELD GEOLOGIST R. BETHEL

WATER LEVEL DATA 544.25'

(Date, Time & Conditions) 1/25/88 ; 1525

SAMPLE NO & TYPE OR RQD	DEPTH (ft) OR RUN NO	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth ft) OR SCREENED INTERVAL	MATERIAL DESCRIPTION: SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	USCS OR ROCK CLASS	REMARKS
							REFER TO SOIL BORING		
							DESCRIPTION LOG FROM		
							E-2 FOR DESCRIPTION		
							TO 40'		

REMARKS

BORING MW-M11

PAGE 1 OF 4

BORING LOG — NUS CORPORATION

PROJECT: DRAKE CHEM
PROJECT NO: 620Y
ELEVATION: 556.00'
WATER LEVEL DATA (Date, Time & Conditions): 544.25' 1/25/88, 1525 ACKER 62
DATE: 12/3/87
FIELD GEOLOGIST: R BETHEL
BORING NO: MW-M107
DRILLER: B GOLLIHUE

SAMPLE NO & TYPE	DEPTH (ft)	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY / SAMPLE LENGTH	LITHOLOGY CHANGE (Depth ft.)	SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	USCS	REMARKS
	40'				M HARD	WHITE	SANDSTONE BOULDER + SAND	GR SP	RECOVERY INCLUDED 2' RUNNING SANDS ABOVE
				41.3'	M HARD	BLACK	SHALEY CLAYSTONE		SS BOULDER, REC. 1.8' OF SHALE ROCK FRAGME
C-1	40-48'	0.4/8.0 5%	3.8/8.0				(HIGHLY FRACTURED)		CLAYSTONE V. BRKN, WEAT
									HNU - 0 ppm
	45'								
C-2	48-50'	0/2 0%	2'/2'						HIGH ∠ FRACT'S,
	50'								CALCITE FORMING ALON
									SOME FRACT'S
C-3	50-53'	0.4/3.0 13%	3/3'						HNU 0 ppm
	55'								
C-4	53-59	1/6 17%	3.8'/6.0'						
	60'								
C-5	59-64.5	4/5.5 73%	5.5'/5.5'						BLOCKY, HIGH TO MOD. ∠ FRACT'S
									HNU: 0 ppm
	65'								

REMARKS: Drilled to bedrock w/ 10" hollow stem auger (40') set 4" PVC csg. to 39.5'
NX coring from 40' to 104'; Foamy water, silt odor came out of water during initial coring run (C-1: 40'-48')
Sample S-1 taken from core barrel from run C-1 @ 1030

* See Legend on Back

BORING MW-M107
PAGE 2 OF 4

AR302301

BORING LOG — NUS CORPORATION

PROJECT: DRAKE CHEM
PROJECT NO: 620Y
ELEVATION:
WATER LEVEL DATA
(Date, Time & Conditions)

DATE: 12/3/87
FIELD GEOLOGIST: R. BETHEL

BORING NO: MW-M07
DRILLER: B. GOLLIHUE

ACKER #2

SAMPLE NO & TYPE	DEPTH (FT)	BLOWS 5 OR RQD (%)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth ft)	MATERIAL DESCRIPTION* SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	USCS	REMARKS
	65'				M HARD	BLACK	SHALEY CLAYSTONE		HIGH TO MOD. & FRACT'S BLOCKY TO BROKEN
C-6	64.5-71'	9/46.5 68%	6.5/6.5						HNU 0 ppm
	70'								
C-7	71-75'	1.9/40 48%	4.0/4.0						BLOCKY TO BROKEN HIGH TO MOD. & FRACT. ONE HORIZ. FRACT. ~5"
	75'								
C-8	75-80'	36/50 72%	5.0/5.0						FEWER HIGH & FRACT'S. MOD TO LOW & FRACT'S. HORIZ FRACT. THRUOUT SOME CALCITE INFILLING OF FRACT'S
	80'								HNU 0 ppm
C-9	80-85'	23/50 46%	5.0/5.0						
	85'								
C-10	85-90'	26/50 52%	5.0/5.0						zone of intense fract 6-8' 88', Blocky from 85-87' w/calcite infilling of 1/2" Horiz. fract. ~~[illegible]~~ calcite infilling, also less fract w/depth, low to mod. # fract's.
	90'								

REMARKS

BORING MW-M1C

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* See Legend on Back

BORING LOG — NUS CORPORATION

PROJECT: DRAKE CHEM
PROJECT NO: 620Y
ELEVATION
WATER LEVEL DATA
(Date, Time & Conditions)

DATE: 12/3/87
FIELD GEOLOGIST: ACKER 62

BORING NO: MW-M107
DRILLER: B. GOLLIHUE

SAMPLE NO & TYPE	DEPTH (ft)	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth ft)	MATERIAL DESCRIPTION* SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	USCS	REMARKS
	90				M. HARD	BLACK	SHALEY CLAYSTONE		SEE PREV. PAGE
C-11	90-95	3.2/5.0 64%	40/5.0						
	95								
	100								
C-12	95-104	5.8/9.0 64%	90/9.0						
				CORED TO 104'					
	105								
				TD 108'					

REMARKS: REAMED BORING TO 108' SCREENED INT. 86'-105'

BORING: M[illegible]

PAGE 4 OF 4

* See Legend on Back

BORING LOG — NUS CORPORATION

PROJECT: DRAKE CHEMICAL
PROJECT NO.: 620 Y
ELEVATION: 554.14'
WATER LEVEL DATA: 542.52'
(Date, Time & Conditions): 1/25/88, 1512
DATE: 11-10-87
FIELD GEOLOGIST: M.L. MENGEL
BORING NO: MW-M109
DRILLER: B GOLLIHUB

SAMPLE NO & TYPE	DEPTH (ft.)	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY / SAMPLE LENGTH	LITHOLOGY CHANGE (Depth ft.)	MATERIAL DESCRIPTION* SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	USCS	REMARKS
	0								
S-1		5, 7	1.5 / 2.0		STIFF	BR	FINE SAND, SOME SILT	SM	TR TAN CLAY .5-1.0
	2	6, 7							DRY
	5			5.0			FINE SILTY SAND		DRY
S-2		7, 4	2.0 / 2.0						
	7	7, 6							
	10				↓				
S-3		4, 4	1.5 / 2.0		DENSE		FINE SILTY SAND, TR CLAY		COARSE GRAVEL AT 12.0'
	12	5, 45							DAMP, HIT H_2O AT 13.0'
				13.0					PER DRILLER
	15							↓	
* S-4	16	25, 65	.9 / 1.0		V. DENSE		FINE TO MED SAND, SOME	SP	BLACK + BLUE GREEN ROCK
							FINE TO COARSE GRAVEL		FRAGMENTS. POSSIBLE
									SANDSTONE FRAGMENTS
	20								
S-5	21	170	.5 / .5				FINE TO MEDIUM GRAINED		SUB ROUNDED.
							SAND AND FINE TO COARSE		POSSIBLE BOULDERS!
							GRAVEL		
					↓	↓	↓ ↓	↓	

REMARKS: Rig: ACKER A.D. II USED 6" SOLID STEM AUGERS DOWN TO 25' THAN SWITCHED TO 10" HOLLOW STEM AUGERS.
* COLLECTED SAMPLE FOR CHEMICAL ANALYSIS (DC 59-1516)

* See Legend on Back

BORING MW-M109
PAGE 1 OF 5

AR302304

BORING LOG — NUS CORPORATION

PROJECT: DRAKE CHEMICAL
PROJECT NO.: 020 Y
DATE: 11-10-87
BORING NO: MW-M109
DRILLER: B GOLLIHUE
ELEVATION:
FIELD GEOLOGIST: M.L. MENGEL
WATER LEVEL DATA (Date, Time & Conditions) —

SAMPLE NO. & TYPE	DEPTH (ft.)	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY / SAMPLE LENGTH	LITHOLOGY CHANGE (Depth ft.)	MATERIAL DESCRIPTION* SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	USCS	REMARKS
	25								
S-6	26	35 / 75	1.0 / 1.0						
	30								
S-7	30.5	85	.5 / .5						SUB ROUNDED TO SUB ANGULAR GRAVEL
	35								
S-8		10 / 25	1.5 / 2.0						
	37	50 / 100		36.5'	SOFT	OR BR	CLAYEY SHALE		WEATHERED
	40								GROUTED CASING IN PLACE AT 40'
C-1		20/40 / 50%	2.0 / 4.0					BR	SATURATED IN FRACTURE WEATHERED AT 40', MORE ANGULAR AT 42.
	44								
C-2		.7/40 / 18%	3.3 / 4.0					VBR	HIGHLY FRACTURED IRON STAINED IN FRAC. SATURATED
	48								
C-3		.5/20 / 25%	2.0 / 2.0					BR	IRON STAINED IN FRAC.
	50								

REMARKS: CORED USING A 2" DIAMOND BIT (WIRE LINE RETRIEVAL)

BORING MW-M109

PAGE 2 OF 5

* See Legend on Back

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AR302305

BORING LOG — NUS CORPORATION

PROJECT: DRAKE CHEMICAL
PROJECT NO.: 620 Y
DATE: 11-12-87
BORING NO: MW-M109
DRILLER: B. GOLLINJE
ELEVATION:
FIELD GEOLOGIST: M. L. MENGEL
WATER LEVEL DATA
(Date, Time & Conditions) —

SAMPLE NO & TYPE	DEPTH (Ft.)	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY / SAMPLE LENGTH	LITHOLOGY CHANGE (Depth Ft.)	MATERIAL DESCRIPTION* SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	USCS	REMARKS
	50								
					SOFT	GR BL	CLAYEY SHALE	BL	CALCITE VEINS
									WEATHERED FRACTURES
									SATURATED
C-4		60/100 60%	10.0 / 10.0						
	60								
								M-BL	FRACTURED AT 64'
									NUMEROUS BREAKS 68'-70'
									(SATURATED)
C-5		80/100 80%	10.0 / 10.0						
	70							M-BL	SATURATED IN FRACTURE
									HIGHLY FRACTURED AT
									79'
C-6		90/100 90%	10.0 / 10.0		↓	↓	↓	↓	

REMARKS

BORING MW-M109

PAGE 3 OF 5

* See Legend on Back

BORING LOG — NUS CORPORATION

PROJECT: DRAKE CHEMICAL
PROJECT NO.: 620Y
DATE: 1-12-87
BORING NO: MW-M.09
DRILLER: B GOLLINGE
ELEVATION:
FIELD GEOLOGIST: M.L MENGEL
WATER LEVEL DATA:
(Date, Time & Conditions) —

SAMPLE NO & TYPE	DEPTH (ft.)	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY / SAMPLE LENGTH	LITHOLOGY CHANGE (Depth ft.)	MATERIAL DESCRIPTION* SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	USCS	REMARKS
C-6									
									LIMESTONE? 77-78
	80					GREY		BR	LIMESTONE? 81.0-81.5
									HIGHLY FRACTURED BETWEEN
									82.5-84.0 + 87'
									CALCITE VEINS
C-7		7.0/10.0 70%	10.0/10.0						
	90			90'	HARD		SHALEY LIMESTONE		
C-8		2.4/4.0 60%	3.3/4.0						
	94								
								BR	HIGHLY FRACTURED, SAT.
C-9		.4/3.0 13%	2.8/3.0						STAINED IN FRACTURES
	97								
C-10		.5/3.0 16%	2.5/3.0						
	100								

REMARKS

BORING MW-[redacted]

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* See Legend on Back

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AR302307

BORING LOG — NUS CORPORATION

PROJECT: DRAKE CHEMICAL
PROJECT NO.: 620 Y
DATE: 11-12-87
BORING NO: MW-M109
DRILLER: B. GOLLIHUE
ELEVATION:
FIELD GEOLOGIST: M.L. MENDEL
WATER LEVEL DATA:
(Date, Time & Conditions) —

SAMPLE NO & TYPE	DEPTH (ft.)	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth ft.)	MATERIAL DESCRIPTION* SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	USCS	REMARKS
	100				HARD	GREY	SHALEY LIMESTONE	BR	HIGHLY FRAC. CLAY DEP-
C-11		.4/30 13 %	2.6 / 3.0						BUILT UP IN FRACTURES
	103								@ 100' . VERTICAL CALCITE
									VEINS THROUGHOUT, SAT.
C-12		4.0/7.0 57 %	5.5 / 7.0						BROKEN TO BLOCKY 103'-110'
									WEATHERED FRACTURES
	110								

REMARKS: INSTALLED WELL AT 104'. SCREEN LENGTH TOTALED 14.5'

BORING MW-M109

PAGE 5 OF 5

* See Legend on Back

BORING LOG — NUS CORPORATION

PROJECT: DRAKE CHEMICAL SITE
BORING NO: MW-M112
PROJECT NO.: 620 Y
DATE: 11-16-87
DRILLER: B. GOLLIHUB
ELEVATION: 552.86'
FIELD GEOLOGIST: M.L. MENGEL
WATER LEVEL DATA: 542.35'
(Date, Time & Conditions): 1/25/88, 1506

SAMPLE NO & TYPE	DEPTH (ft)	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY / SAMPLE LENGTH	LITHOLOGY CHANGE (Depth ft)	MATERIAL DESCRIPTION* SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	USCS	REMARKS
S-1	0'-2'	6, 5 / 5, 5	1.3 / 2.0		LOOSE	BR	FINE SILTY SAND, TR CLAY	SM	BLACK ASH FILL TO 1
				2.0					ROOT MATERIAL -
									BRICK FRAGMENTS
S-2	5'-7'	4, 5 / 6, 11	2.0 / 2.0		M DENSE	BR	FINE SILTY SAND	SM	
* S-3	10'-12'	21, 23 / 18, 18	1.8 / 2.0	12.0	U. DENSE	BR	FINE SAND, TR FINE TO	SP	HIT H_2O AT 12' [illegible]
							COARSE GRAVEL, SOME		SUB ROUNDED [illegible]
							SILT		SANDSTONE FRAGMEN
S-4	15'-17'	26, 31 / 30, 36	1.9 / 2.0		U. DENSE	BR	FINE TO COARSE SAND,	SP	SATURATED
							TR FINE GRAVEL SOME		SUB ANGULAR GRAVEL
							SILT		SANDSTONE FRAGMEN
S-5	20'-22'	18, 50 / 51, 65	1.0 / 2.0		U DENSE	BR			TR COARSE GRAVEL
									DAMP

REMARKS: COLLECTED SAMPLE FOR CHEMICAL ANALYSIS AT S-3 (DCS 12-1012)

BORING MW[illegible]2

PAGE 1 OF 2

* See Legend on Back

BORING LOG

NUS CORPORATION

PROJECT: DRAKE CHEMICAL SITE
PROJECT NO.: 620 Y
ELEVATION:
WATER LEVEL DATA
(Date, Time & Conditions)

DATE: 11-17-87
FIELD GEOLOGIST: M L MENGEL

BORING NO: MW-M112
DRILLER: B GOLLIHUE

SAMPLE NO & TYPE	DEPTH (ft)	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY / SAMPLE LENGTH	LITHOLOGY CHANGE (Depth ft)	MATERIAL DESCRIPTION* SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	USCS	REMARKS
S-6	25-27	19,30 / 16,26	1.5 / 2.0		DENSE	BR	FINE TO COARSE SAND AND	SP	SATURATED SUB
							FINE TO COARSE GRAVEL,		ANGULAR SANDSTONE
							TR. SILT		FRAGMENTS
S-7	30-32	9,11 / 15,23	2.0 / 2.0		DENSE	BR			TR. SUBROUNDED SANDSTONE
S-8	35-36	29,69	1.0 / 1.0	35'	SOFT	GRLY	CLAYEY SHALE 35'		WEATHERED
							BEDROCK		

REMARKS: INSTALLED WELL AT 35' USING 9' OF SCREEN.
ACTUAL SCREENED INTERVAL 34.3'-25.3'

BORING MW-M112

PAGE 2 OF 2

* See Legend on Back

BORING LOG — NUS CORPORATION

PROJECT. DRAKE CHEMICAL SITE — BORING NO MW-M113
PROJECT NO 620Y — DATE. 11-18-87 — DRILLER B GOLLIHUE
ELEVATION 551.72' — FIELD GEOLOGIST M L MENGEL
WATER LEVEL DATA 540.73'
(Date, Time & Conditions) 1/25/88, 1438

SAMPLE NO & TYPE	DEPTH (ft)	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth ft)	MATERIAL DESCRIPTION* SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	USCS	REMARKS
							REFER TO MW-M114		

REMARKS DRILLED TO TOP OF BEDROCK 46', FOR LITHOLOGIC DESCRIPTION SEE BORING LOG FOR MW-M114. INSTALLED OVERBURDEN WELL WITH 9' SCREEN. 35.3-44.3'

BORING MW-M113
PAGE 1 OF 1

* See Legend on Back

BORING LOG — NUS CORPORATION

PROJECT: DRAKE CHEMICAL SITE
PROJECT NO: 620 Y
ELEVATION: 552.49'
WATER LEVEL DATA: 540.73'
(Date, Time & Conditions): 1/25/88, 1439
DATE: 11-18-87
FIELD GEOLOGIST: M. MENDEL
BORING NO: MW-M114
DRILLER: B. GOLLIHOE

SAMPLE NO & TYPE	DEPTH (FT)	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY / SAMPLE LENGTH	LITHOLOGY CHANGE (Depth ft)	MATERIAL DESCRIPTION* SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	USCS	REMARKS
S-1	0'-2'	4,10 / 7,6	1.4 / 2.0		M. DENSE	BR	FINE SILTY SAND, TR CLAY		TOP ROOT MATERIAL +
				2.0					FILL
S-2	5'-7'	6,6 / 6,12	2.0 / 2.0			BR	FINE SAND, TRACE SILT		SANDSTONE FRAGMEN
									AT 7.0 DRY
S-3	10-12'	6,5 / 4,7	2.0 / 2.0			BR			TR COARSE SAND, SUB
									ROUNDED SANDSTONE
									FRAGMENTS, MOIST
				15.0					
S-4	15-17	18,21 / 26,28	2.0 / 2.0		V. DENSE	BR	FINE TO COARSE SAND,		HIT H_2O AT ≈ 15'
							LITTLE FINE GRAVEL		TRACE SUB ROUNDED
									SANDSTONE FRAGMENTS
S-5	20-22'	18,40 / 30,28	1.5 / 2.0						

REMARKS: RIG: ACKER A.D. II

BORING MW-M114

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* See Legend on Back

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AR302312

BORING LOG — NUS CORPORATI

PROJECT. DRAKE CHEMICAL SITE
PROJECT NO. 620 Y
ELEVATION
WATER LEVEL DATA
(Date, Time & Conditions)

DATE. 11-18-87
FIELD GEOLOGIST M. L. MENGEL

BORING NO MW-M11H
DRILLER B. GOLLINGE

SAMPLE NO & TYPE	DEPTH (ft)	BLOWS 6" OR ROD (ft)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth ft)	MATERIAL DESCRIPTION* SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	USCS	REMARKS
* S-6	25-27	9 14 / 37 39	1.2 / 2.0		V. DENSE	BL OR	FINE TO COARSE SAND,		TRACE SUBROUNDED
							LITTLE FINE GRAVEL		SANDSTONE &
									CALCITE FRAGMENTS
S-7	30-32	25 35 / 26 34	1.0 / 2.0			BR			LITTLE COURSE GRAVEL
									TRACE SUB ROUNDED
									SANDSTONE FRAGM
S-8	35'-37'		/						NOT ABLE TO [redacted]
									SAMPLE DUE TO RUN
									SANDS.
	46'			46.0					
						GREY	BLAKEY SHALE		PER DRILLER?
							GROUTED CASING IN PLACE 50'		

REMARKS * COLLECTED DUP SAMPLE AT SAMPLE S-6
INSTALLED CASING IN PLACE AT 50'

BORING M[redacted]

PAGE 2 OF 5

* See Legend on Back

BORING LOG — NUS CORPORATION

PROJECT: DRAKE CHEMICAL SITE
PROJECT NO. 6204
ELEVATION:
WATER LEVEL DATA
(Date, Time & Conditions)

DATE: 11-19-87
FIELD GEOLOGIST: M L MENGEL

BORING NO: MW-M114
DRILLER: B GOLLINGE

SAMPLE NO & TYPE	DEPTH (ft)	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY / SAMPLE LENGTH	LITHOLOGY CHANGE (Depth ft)	MATERIAL DESCRIPTION* SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	USCS	REMARKS
	50				SOFT	GREY	SHALEY CLAYSTONE	BR-GL	FRACTURED AT 50'
									SATURATED
C-1		.4/8.0 5%	3.0/8.0						
	58								
C-2		1.0/2.0 50%	2.0/2.0						WEATHERED SUB ROUNDED
	60								SANDSTONE FRAGMENTS
									DAMP
									BEDDING PLANES, HIGH
									ANGLE FRACTURING 64'
C-3		2.1/7.0 30%	4.2/7.0						SATURATED IN FRACTURES
	67								
C-4		3.0/3.0 0%	3.0/3.0						
	70								
									SATURATED IN FRACTURES
C-5		.9/7.0 13%	5.9/7.0		↓	↓	↓	↓	

REMARKS: CORED USING 2" DIAMOND BIT CORE BARREL (WIRE LINE METHOD)

BORING MW-M114

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* See Legend on Back

B-74

AR302314

BORING LOG — NUS CORPORATION

PROJECT: DRAKE CHEMICAL
PROJECT NO.: 620 Y
DATE: 11-19-87
BORING NO: MW-M114
DRILLER: B GOLLINGE
ELEVATION:
FIELD GEOLOGIST: M L MENGEL
WATER LEVEL DATA
(Date, Time & Conditions)

SAMPLE NO & TYPE	DEPTH (ft)	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY / SAMPLE LENGTH	LITHOLOGY CHANGE (Depth ft)	MATERIAL DESCRIPTION* SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	USCS	REMARKS
	77				SOFT	GREY	SHALEY CLAYSTONE	BA-BL	
C-6		2.6/3.0 86%	3.5/3.0						SATURATED IN FRACTURES
	80								AT 78'-79'
									SATURATED IN FRAC
C-7		3.3/100 33%	8.5/100						
									HIGH ANGLE VERTICAL
									FRAC AT 86' VERY
									BROKEN AT 86'-90'
	90								
C-8		0/4.5 0%	3.3/4.5						HIGH ANGLE FRAC 91' 45'
									SATURATED
	94.5								
C-9		0.9/5.5 16%	5.5/5.5						HIGHLY FRAC.
	100								

REMARKS

BORING MW-M114

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* See Legend on Back

B-75

AR302315

BORING LOG — NUS CORPORATION

PROJECT: DRAKE CHEMICAL
PROJECT NO.: 620 Y
ELEVATION:
WATER LEVEL DATA
(Date, Time & Conditions)

DATE: 11-19-87
FIELD GEOLOGIST: M.L. MENGEL

BORING NO: MW-M114
DRILLER: B. GOLLINGE

SAMPLE NO & TYPE	DEPTH (ft)	BLOWS 6" OR ROD (%)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth ft)	MATERIAL DESCRIPTION* SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	USCS	REMARKS
	100								
C-10		.5/50 10%	4.5/50		SOFT	GREY	SHALEY CLAYSTONE	N.BR	FRAC, VERY BROKEN
									SAT. IN FRAC.
	105								
C-11		.8/50 16%	3.8/5.0						
	110								
							BOTTOM		

REMARKS: INSTALLED WELL AT 110' USING 19' OF SCREEN
SCREENED INTERVAL: 90.3' - 109.3'

BORING: MW-M11

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* See Legend on Back

BORING LOG — NUS CORPORATION

PROJECT: DRAKE CHEMICAL SITE
PROJECT NO.: 620 Y
ELEVATION: 547.48'
WATER LEVEL DATA: 540.38'
(Date, Time & Conditions): 1/25/88, 1452

BORING NO: MW-M115
DATE: 11-22-87
DRILLER: B. GOLLINUE
FIELD GEOLOGIST: M.L. MENGEL

SAMPLE NO & TYPE	DEPTH (ft)	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY / SAMPLE LENGTH	LITHOLOGY CHANGE (Depth ft)	MATERIAL DESCRIPTION* SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	USCS	REMARKS
S-1	0'-2'	2, 6 / 7, 8	1.3 / 2.0		M. DENSE	BR	FINE SILTY SAND, TR CLAY	SM	ROOT MATERIAL AT TOP
				5.0					
S-2	5'-7'	9, 15 / 13, 15	2.0 / 2.0		M DENSE	BR	FINE SILTY CLAY, TR SAND	CL	
				10.0					
* S-3	10'-12'	2, 3 / 3, 4	.8 / 2.0		LOOSE	GREY	FINE SILTY CLAY, TR. FINE SAND	CL	TRACE SANDSTONE FRAGMENTS, SAT. WIT H_2O AT 10.0
S-4	15'-17'	5, 6 / 2, 4	1.3 / 2.0		LOOSE	GREY	SILTY CLAY, TR FINE SAND	CL	
				18.0					SAND+GRAVEL AT 18.0 PER DRILLER
S-5	20-22	1, 2 / 5, 18	.8 / 2.0		M. DENSE	BR	FINE TO COARSE SAND, AND FINE TO COARSE GRAVEL	SP	SUB ROUNDED SANDSTONE FRAGMENTS

REMARKS: * S-3 COLLECTED FOR CHEMICAL ANALYSIS
TD @ 37' INSTALLED 9' SCREEN FROM 34.3 TO 25.3'

BORING MW-M115

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* See Legend on Back

AR302317

BORING LOG — NUS CORPORATION

PROJECT DRAKE CHEMICAL SITE
PROJECT NO. 620 Y
ELEVATION.
WATER LEVEL DATA
(Date, Time & Conditions)

DATE. 11-22-87
FIELD GEOLOGIST: M.L. MENGEL

BORING NO MW-M115
DRILLER.

SAMPLE NO & TYPE	DEPTH (Ft.)	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY / SAMPLE LENGTH	LITHOLOGY CHANGE (Depth Ft.)	MATERIAL DESCRIPTION* SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	USCS	REMARKS
S-6	25'-26'	65,92	1.0 / 1.0		V DENSE	BR	FINE TO COARSE SAND AND	SP	SUB ROUNDED SANDSTO
							FINE TO COARSE GRAVEL		FRAGMENTS
S-7	30'-32'	25,30 35,40	1.4 / 2.0		V-DENSE				REDDISH SANDSTONE
									FRAGMENTS
				35.0					
S-8	36-36.5'	50,45 50	1.5 / 1.5		V DENSE	GREY	SILTY CLAY WITH FINE TO		SANDSTONE FRAG.
							COARSE SAND		
S-9	37'-38	50,50	1.0 / 1.0		V-DENSE	GREY	SHALEY CLAYSTONE		
							BOTTOM 37'		

REMARKS

BORING MW-M115

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* See Legend on Back

AR302318

BORING LOG — NUS CORPORATION

PROJECT: DRAKE CHEMICAL SITE
BORING NO: MW-M116
PROJECT NO.: 620Y
DATE: 11-21-87
DRILLER: B. GOLLIHUE
ELEVATION: 551.57'
FIELD GEOLOGIST: M.L. MENGEL
WATER LEVEL DATA
(Date, Time & Conditions)

SAMPLE NO & TYPE	DEPTH (ft)	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth ft)	MATERIAL DESCRIPTION* SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	USCS	REMARKS
							FOR LITHOLOGIC DESCRIPTION		
							SEE BORING LOG FOR		
							MW-M117		
							BOTTOM 25.0		

REMARKS: SET WELL AT 24.0 USING 9' SCREEN FROM 23.3' TO 14.3'
TD @ 25'

BORING: MW-[illegible]

PAGE 1 OF 1

* See Legend on Back

BORING LOG — NUS CORPORATION

PROJECT: DRAKE CHEMICAL SITE
PROJECT NO.: 620 Y
ELEVATION: 551.69'
WATER LEVEL DATA: 541.03'
(Date, Time & Conditions): 1/25/88, 1449
DATE: 11-21-87
FIELD GEOLOGIST: M.L. MENGEL
BORING NO: MW-M117
DRILLER: B GOLLINGER

SAMPLE NO & TYPE	DEPTH (ft)	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY / SAMPLE LENGTH	LITHOLOGY CHANGE (Depth ft)	MATERIAL DESCRIPTION* SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	USCS	REMARKS
S-1	0'-2'	5,9, 10,8	1.9/2.0		M DENSE	BR	FINE SILTY SAND, SOME CLAY	ML	ROOT MATERIAL AT SURFACE DRY
S-2	5'-7'	6,9, 9,8	2.0/2.0				FINE SILTY SAND, TR. CLAY	ML	DRY
S-3	10'-12'	17,10, 18,16	1.7/2.0	10.0	DENSE	BR	FINE SAND, SOME SILT	SM	TR. FINE GRAVEL SANDSTONE FRAGMENTS MOIST
				15.0					
S-4	15,17	26,26 34,32	1.7/2.0		V DENSE	BR	FINE TO COARSE SAND AND FINE GRAVEL, TR SILT	SP	SUB ROUNDED GRAVEL SANDSTONE COBBLE AT 17', BLACK STAINED AT 17'
* S-5	20'-22'	15-18 22-30	1.8/2.0						SANDSTONE FRAG. SUB ROUNDED GRAVEL

REMARKS: * COLLECTED SAMPLE FOR CHEMICAL ANALYSIS

BORING MW-M117

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* See Legend on Back

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AR302320

BORING LOG — NUS CORPORATION

PROJECT: DRAKE CHEMICAL SITE
PROJECT NO.: 620 Y
ELEVATION
WATER LEVEL DATA
(Date, Time & Conditions)

DATE: 11-21-87
FIELD GEOLOGIST: M.L. MENGEL

BORING NO: MW-M117
DRILLER: B GOLLINUE

SAMPLE NO & TYPE	DEPTH (ft)	BLOWS 6" OR ROD (ft)	SAMPLE RECOVERY / SAMPLE LENGTH	LITHOLOGY CHANGE (Depth ft)	MATERIAL DESCRIPTION* SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	USCS	REMARKS
S-6	25-26.5	38.39 / 50	1.5 / 1.5		V DENSE	BR	FINE TO COARSE SAND + FINE TO COARSE GRAVEL, TR SILT	SP	SUB ANGULAR GRAVEL RED + BROWN SANDSTONE FRAGMENTS
S-7	30-30.5	82	0.3 / 0.5		V DENSE	BR	FINE TO COARSE SAND AND SILT, TR CLAY		COBBLES (SANDSTONE)
S-8	35-36.5	28.45 / 57	1.5 / 1.5		V DENSE	BR	FINE TO COARSE SAND + FINE TO COARSE GRAVEL, TR SILT		REDDISH SANDSTONE FRAGMENTS
S-9	40-41'	40.55	1.0 / 1.0		V. DENSE	GREY	SHALEY CLAYSTONE BOTTOM 41'		40.5

REMARKS: INSTALLED WELL AT 40' USING A 9' SCREEN. FROM 39.3' TO 30.3' TD OF BORING @ 41'

BORING MW-M117

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* See Legend on Back

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AR302321

BORING LOG

NUS CORPORATION

PROJECT: DRAKE CHEM

BORING NO MW-M11B

PROJECT NO.: 620Y

DATE: 12-16-87

DRILLER: E. DYE

ELEVATION: 553.25'

FIELD GEOLOGIST: R BETHEL

WATER LEVEL DATA 539.79'

(Date, Time & Conditions) 1/25/88, 1426

SAMPLE NO & TYPE	DEPTH (Ft.)	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth Ft.)	MATERIAL DESCRIPTION* SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	USCS	REMARKS
							REFER TO MW-M12B FOR		
							LITH. DESCRIPTION		

REMARKS REFER TO MW-M12B FOR LITH. DESCRIPTION : INSTALLED 9' SCREEN FROM 24' TO 15' ; TD OF BORING @ 25'

BORING MW-M11

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* See Legend on Back

B-82

AR302322

BORING LOG — NUS CORPORATION

PROJECT. DRAKE CHEM
PROJECT NO. 620Y
ELEVATION NA
WATER LEVEL DATA NA
(Date, Time & Conditions) NA

DATE. 12-16-87
FIELD GEOLOGIST R BETHEL

BORING NO MW-M119 (1ST) : SOIL BORING
DRILLER. E DYE

PENN DRILLING MOBILE BC

SAMPLE NO & TYPE	DEPTH (ft)	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY / SAMPLE LENGTH	LITHOLOGY CHANGE (Depth ft.)	MATERIAL DESCRIPTION* SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	USCS	REMARKS
	50'								
(0920) SS S-1	50-55	21 18 17	1.2 / 1.5		HARD	GRAY	CLAY	CL	DAMP, CRUMBLY, LOOKS LIKE CLAYSTONE (LIMEY)
				55' TD					
SS S-2	55-56.5	50 - -	0 / 1.5		HARD	GRAY	LIMESTONE		NO RECOVERY, FOUND PIECE OF LS ON BIT AT 55'

REMARKS Sample S-1 for CLP anal.: DCS-18-50515
Drilled w/ 10" Hollow stem auger, sampled w/ 2" O.D. split spoon
TD 55' FILLED HOLE W/ CEMENT/BENT. GROUT AND PROBED MW-M119 FOR CONFIRMATION OF LITHOLOGY COMPARED TO MW-M120, UNSUCCESSFULLY ATTEMPTED TO SET MW-M118 IN THIS BORING, GROUTED BORING TO SURFACE.

BORING MW-M119
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* See Legend on Back

B-83

BORING LOG — NUS CORPORATION

PROJECT: DRAKE CHEM
PROJECT NO.: 620Y
ELEVATION: 553.39'
WATER LEVEL DATA: 539.85'
(Date, Time & Conditions): 1/25/88, 1428
DATE: 12-17-87
FIELD GEOLOGIST: R. BETHEL
BORING NO: MW-M119 (2nd)
DRILLER: E. DYE
PA DRILLING MOBILE B2

SAMPLE NO & TYPE	DEPTH (ft)	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY / SAMPLE LENGTH	LITHOLOGY CHANGE (Depth ft.)	MATERIAL DESCRIPTION* SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	REFER TO MW-M120 FOR LITH DESCRIPT'N FROM 0' TO 35' MATERIAL CLASSIFICATION	USCS	REMARKS
	35								
SS S-1	35-36.5	3 15 100	0.3 / 1.5		V. DENSE	BRN	SANDY GRAVEL w/ CLAY	GC	Gravel jammed up split spoon resulting in poor recovery. Med. to fine gr. sand. Subrnd. gravel, SS frag's
SS S-2	40-41.5	23 60 40	1.3 / 1.5		V. DENSE	BRN	- -	GC	
				45					
SS S-3	45-47	60 - - -	0.8 / 0.5		V. DENSE	BRN TO GRAY	SAND + GRAVEL, SOME CLAY	GC/SC	Round to subrnd. gravel. Fine size & larger rivers. Channel dep. w/ water + sandy zones. Also SS frag's
				50'					
SS S-4	50-52	23 40 70 -	1.3 / 2.0		HARD	GRAY	CLAY / CLAYSTONE	CL	DAMP TO DRY, CRUMBLY. TOP OF BEDROCK 50-55'
				TD=50'					

REMARKS: Hit water @ ~15', Drilled w/ 10" Hollow stem augers, sampled w/ 2" OD split spoon driven w/ 140 LB. Hammer dropped 30". set well: screen @ 49-40'; TD @ 50'

BORING: MW-M119

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* See Legend on Back

REFER TO MW-M120 FOR LITH DESC. FROM 0' TO 35'

BORING LOG

NUS CORPORATION

PROJECT. DRAKE CHEMICAL SITE

BORING NO MW-M120

PROJECT NO. 620 Y

DATE. 12-7-87

DRILLER. E DYE

ELEVATION: 552.29

FIELD GEOLOGIST. M L MENGEL

WATER LEVEL DATA 539.68'

(Date, Time & Conditions) 1/25/88, 1427

SAMPLE NO & TYPE	DEPTH (ft)	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY / SAMPLE LENGTH	LITHOLOGY CHANGE (Depth ft)	MATERIAL DESCRIPTION* SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	USCS	REMARKS
S-1	0-1.5	2, 3, 4	1.3 / 1.5		LOOSE	BR	FINE SILTY SAND, TR CLAY	SM	POOR MATERIAL A -DV
S-2	5-7	12, 7, 8, 8	20 / 20		M DENSE	BR	FINE SILTY SAND	SM	SANDSTONE FRAGMEN AT 6.0'
S-3	10-12	3, 4, 4, 3	20 / 20		LOOSE	BR			MOIST
				15.0'					HIT H2O AT 13' PER DRILLER
S-4	15-17	3, 6, 8, 25	20 / 20		DENSE	BR.	FINE TO MED GRAINED SAND, TRACE SILT	SM	SATURATED SILTY CLAY LAYER AT 16' SUB ROUNDED GRAVEL AT 17'
S-5	20-22	22, 17, 14, 16	20 / 20		DENSE	BR	FINE TO COARSE SAND, AND COARSE GRAVEL	SP/GP	SUB ROUNDED GRAV

REMARKS Rig: MOBILE B-80 6" SOLID STEM AUGERS TO 30', THEN SWITCHED TO 10" HOLLOW STEM.

BORING - M

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* See Legend on Back

B-85

AR302325

BORING LOG — NUS CORPORATION

PROJECT: DRAKE CHEMICAL SITE
PROJECT NO.: 620 Y
DATE: 12-7-87
BORING NO: MW-M12D
DRILLER: E. Oye
ELEVATION:
FIELD GEOLOGIST:
WATER LEVEL DATA
(Date, Time & Conditions)

SAMPLE NO & TYPE	DEPTH (Ft.)	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY / SAMPLE LENGTH	LITHOLOGY CHANGE (Depth Ft.)	MATERIAL DESCRIPTION* SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	USCS	REMARKS
S-6	25-27½	22 / 50	.5 / 1.0		V. DENSE	BR	FINE TO COARSE SAND + GRAVEL	SP / GP	COBBLES
S-7	30-32½	86	.5 / .5		V DENSE	BR			WHITE SANDSTONE FRAGMENT
									COULD NOT SPLIT
									SPOON BEYOND 30'
									DUE TO RUNNING SAND

REMARKS

BORING MW-M12

PAGE 2 OF 6

* See Legend on Back

BORING LOG — NUS CORPORATION

PROJECT: DRAKE CHEMICAL SITE — BORING NO: MW-M120
PROJECT NO.: 620 Y — DATE: 12-8-87 — DRILLER: E. DYE
ELEVATION — FIELD GEOLOGIST: M. L. MENGEL
WATER LEVEL DATA
(Date, Time & Conditions)

SAMPLE NO & TYPE	DEPTH (ft)	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY / SAMPLE LENGTH	LITHOLOGY CHANGE (Depth ft)	MATERIAL DESCRIPTION* SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	USCS	REMARKS
				55.0					HIT UNIFORM SAND AT 55' PER DRILLER
S-8	58-60	13, 22, 30, 25	20/20		U. DENSE	BR	FINE TO MEDIUM GRAINED SAND, TR SILT	SM	VERY UNIFORM
S-9	68-70	18, 57, 100R	.8/1.3	69.0	V. DENSE	GRY	SHALEY CLAY, LITTLE SAND, TR SILT	CL	SAND INTERBEDDED THROUGH CLAY

REMARKS

BORING MW-M1

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* See Legend on Back

AR302327

B-87

BORING LOG — NUS CORPORATION

PROJECT: DRAKE CHEMICAL
PROJECT NO.: 620 Y
ELEVATION
WATER LEVEL DATA
(Date, Time & Conditions)

DATE: 12-9-83
FIELD GEOLOGIST: M.L. MENGEL

BORING NO: MW-M120
DRILLER: E DVE

SAMPLE NO & TYPE	DEPTH (ft)	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY / SAMPLE LENGTH	LITHOLOGY CHANGE (Depth ft.)	MATERIAL DESCRIPTION* SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	USCS	REMARKS
S-10	80-82	25 25 25 33	20/20		HARD TO V. DENSE	GREY	GREY CLAY WITH FINE TO MEDIUM SAND, TR SILT	CL	SAND LAYERS BEDDED THROUGHOUT CLAY
S-11	83-84	100	.3/.5		HARD	GREY	SHALEY CLAY, TR. SILT	CL	
				90'					CUTTINGS AT 90' CONTM GREY CLAY
S-12	95-97	101	.6/.6		HARD	GREY	CLAY, TR SILT	CL	

REMARKS

BORING MW-M12

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* See Legend on Back

B-88

AR302328

BORING LOG — NUS CORPORATION

PROJECT: DRAKE CHEM
PROJECT NO.: 620Y
ELEVATION
WATER LEVEL DATA
(Date, Time & Conditions)

DATE: 12-9-87
FIELD GEOLOGIST: M MENGEL / R. BETHEL

BORING NO: MW-M120
DRILLER: E. DYE

SAMPLE NO & TYPE	DEPTH (ft)	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY / SAMPLE LENGTH	LITHOLOGY CHANGE (Depth ft)	MATERIAL DESCRIPTION* SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	USCS	REMARKS
	100								
SS S-13	105-105.5	100	0.3 / 0.3		HARD	BK GRAY	CLAY	CL	
SS S-14	110-110.5	150	0.3 / 0.3	BEDROCK 110'	MED. HARD	DLK GRAY	SHALEY CLAYSTONE		SUBANG: SHALE FRAG W/IN CLAY
	115'								
									HIGHLY FRACT'SD BEDR FROM 110-120; WILL SE 4" CSG. NEAR 120'
S-15	120-120.3'	100	0.3 / 0.3	120'					BLOCKY W/ FRACT THRUO
					MED. HARD	GRAY	LIMESTONE		EVIDENCE OF FRACT'S W/ ANGULAR PIECES O
				122'					RE. CEMENTED AT RA ORIENTATIONS. THRUO
C-1	120-125	1.5/5.0 30%	3.4 / 5.0		MED SOFT	LT. GRAY	LIME-RICH CLAYSTONE		CLAYSTONE W/ RE. FRAG'TS THRUOUT - P FAULT GOUGE

REMARKS

BORING M

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* See Legend on Back

B-89

AR302329

BORING LOG — NUS CORPORATION

PROJECT: DRAKE CHEM
PROJECT NO.: 620Y
ELEVATION:
WATER LEVEL DATA
(Date, Time & Conditions)

DATE: 12-14-87
FIELD GEOLOGIST: R. BETHEL

BORING NO: MW-M120
DRILLER: E. DYE

SAMPLE NO & TYPE	DEPTH (Ft.)	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY / SAMPLE LENGTH	LITHOLOGY CHANGE (Depth Ft.)	MATERIAL DESCRIPTION* SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	USCS	REMARKS
				126	MED HARD	GRAY	LIMESTONE		BLOCKY VERT FRACT INFILL W/ BLK CC ALSO [illegible] & FRAC
					MED. SOFT	DRK GRAY	LIMEY CLAYSTONE		HIGHLY FRACTED W/ 2 SETS OF VERT FRACT'S PERPENDICULAR FAULT GOUGE
C-2	125-131	0.3/6.0 5%	34 / 6.0						
				131'					
C-3	131-134'	0/3 0%	30 / 3.0		MED. SOFT TO MED. HARD	GRAY TO DRK GRAY	LIMESTONE + CLAYSTONE		ALT. LAYERS OF LIMESTONE AND CLAYSTONE, V. BROKEN LS LAYERS ~1-3"
						DRK GRY TO BLK	SHALEY LIMESTONE + CLAYSTONE		V. BROKEN, ALT LAYERS OF SHALEY LS + CLAYSTONE HIGHLY FRACT.
C-4	134-141'	0.9/7.0 13%	23 / 7.0						
				TD 141'					

REMARKS

BORING MW-M120

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* See Legend on Back

AR302330

BORING LOG — NUS CORPORATION

PROJECT: DRAKE CHEMICAL SITE — BORING NO MW-M122
PROJECT NO. 620 Y — DATE: 11-24-87 — DRILLER: B. GOLLIHUE
ELEVATION: 556.29' — FIELD GEOLOGIST: M.L. MENGEL
WATER LEVEL DATA 542.50'
(Date, Time & Conditions) 1/25/88, 1415

SAMPLE NO & TYPE	DEPTH (ft)	BLOWS 6 OR ROD (%)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth ft)	MATERIAL DESCRIPTION* SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	USCS	REMARKS
S-1	0-2'	4.6 / 8.8	.6 / 2.0		M. DENSE	BR	SILTY SAND TR CLAY	SM	ROOT MATERIAL NEAR TOP
S-2	5-7'	4.3 / 5.7	2.0 / 2.0	6.0	M. DENSE	BR	FINE SILTY SAND		DRY
S-3	10-12	6.5 / 7.34	1.7 / 2.0		DENSE	BR	FINE GRAINED SAND, TR SILT		SANDSTONE FRA[illegible]T IN BOTTOM AT 12
				15.					
S-4	15-17'	18.[illegible]	1.0 / 1.0		U. DENSE	BR	FINE TO COARSE SAND, TR FINE GRAVEL	SP	SUB ANGULAR SANDSTONE FRAGMENTS HIT H_2O AT 15.0 LARGE COBBLES, 8" IN CUTTINGS. (SANDSTONE)
S-5	20-22'	16.24 / 50	1.0 / 1.5		U. DENSE	BR	FINE TO COARSE SAND AND FINE GRAVEL		SUB ROUNDED GRAVEL REDDISH SANDSTONE FRAGMENTS

REMARKS RIG: ACKER A.D. II DRILLED USING 6" SOLID STEM AUGERS TO 20' THAN SWITCHED TO 10" HOLLOW STEM.

BORING MW[illegible]2

PAGE 1 OF 2

* See Legend on Back

AR302331

BORING LOG — NUS CORPORATION

PROJECT: DRAKE CHEMICAL SITE
PROJECT NO.: 620Y
ELEVATION:
WATER LEVEL DATA
(Date, Time & Conditions)

DATE: 11-24-87
FIELD GEOLOGIST: M.L. MENGEL

BORING NO: MW-M12
DRILLER: B GOLLIHUE

SAMPLE NO & TYPE	DEPTH (Ft.)	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY / SAMPLE LENGTH	LITHOLOGY CHANGE (Depth ft.)	MATERIAL DESCRIPTION* SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	USCS	REMARKS
S-6	25'-27'	4,7 / 18,52	2.0 / 2.0		V. DENSE	BR	FINE SILTY SAND, SOME	SM	TR FINE SUB ROUNDED
				27.0			CLAY		GRAVEL, SANDSTONE
							FINE TO MEDIUM SAND. TR		FRAGMENTS AT 27'
							SILT		VERY UNIFORMED
S-7	30-32	13,13 / 10,19	1.3 / 2.0		M DENSE	BR			
S-8	35-37	18,21 / 19,10	1.3 / 2.0		M. DENSE	BR			MORE SILT AT 37'
S-9	40'-42'	6,3 / 6,6	2.0 / 2.0		DENSE	BR			COARSE SAND & FINE
									SUB ROUNDED GRAVEL AT 42
				46' REDRX					WASH, POSSIBLE BEDROCK
									AT BOTTOM OF SPOON
S-10	50'-51'	100	1.0 / 1.0		V. DENSE		BLACK SHALE (CLAYSTONE)		DRY

REMARKS: INSTALLED WELL AT 45' USING 9' OF SCREEN FROM 44.3' TO 35.3'. TD OF BORING @ 51' REDROCK AT 46' BASED ON MW-M12.3

BORING: MW-M12

PAGE 2 OF 2

* See Legend on Back

BORING LOG — NUS CORPORATION

PROJECT: DRAKE CHEMICAL SITE
BORING NO: MW-M123
PROJECT NO: 620 Y
DATE: 11-23-87
DRILLER: B GOLLIHUE
ELEVATION: 556.13
FIELD GEOLOGIST: M.L. MENGEL
WATER LEVEL DATA: 542.45'
(Date, Time & Conditions): 1/25/88, 1417

SAMPLE NO & TYPE	DEPTH (ft)	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth ft.)	MATERIAL DESCRIPTION* SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	USCS	REMARKS
							REFER TO MW-M122 FOR		
							LITH. DESCRIPTION FROM		
							0' TO 50'		
							NO DESCRIPTION FROM		
							50-60' ALTHOUGH		
							BASED ON CUTTINGS IT		
							IS FRACTURED SHALE		
							BEDROCK		

REMARKS

BORING M[illegible]2

PAGE 1 OF 4

* See Legend on Back

AR302333

BORING LOG — NUS CORPORATION

PROJECT: DRAKE CHEMICAL SITE
BORING NO.: MW-M123
PROJECT NO.: 620 Y
DATE: 11-23-87
DRILLER: B. GOLLINUE
ELEVATION:
FIELD GEOLOGIST: M.L. MENGEL
WATER LEVEL DATA
(Date, Time & Conditions)

SAMPLE NO & TYPE	DEPTH (ft)	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth ft.)	MATERIAL DESCRIPTION* SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	USCS	REMARKS
									HIT ROCK AT 46.0

REMARKS

BORING MW-M123

PAGE 2 OF 4

* See Legend on Back

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AR302334

BORING LOG — **NUS CORPORATION**

PROJECT: DRAKE CHEMICAL SITE
PROJECT NO.: 620 Y
ELEVATION:
WATER LEVEL DATA
(Date, Time & Conditions)

DATE: 11-24-87
FIELD GEOLOGIST: M.L. MENDEL

BORING NO MW-M123
DRILLER: B. GOLLIHUE

SAMPLE NO & TYPE	DEPTH (ft.)	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth ft.)	MATERIAL DESCRIPTION* SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	USCS	REMARKS
	60								
C-1		0/4.5 0%	4.0/4.5		MOD HARD	BLACK	SHALE		HIGHLY FRAC. VERY BROKEN
	64.5								
C-2		0/2.5 0%	2.5/2.5						
	67								
C-3		0/3.0 0%	3.0/3.0						
	70								
C-4		2.9/5.5 52%	5.5/5.5						BROKEN 5" SECTIONS

REMARKS CEMENTED CASING IN PLACE AT 59'

BORING MW-M123

PAGE 3 OF 4

* See Legend on Back

B-95

AR302335

BORING LOG — NUS CORPORATION

PROJECT: DRAKE CHEMICAL
PROJECT NO.: 6204
ELEVATION:
WATER LEVEL DATA
(Date, Time & Conditions)

DATE: 11-24-87
FIELD GEOLOGIST: M.L. MENGEL

BORING NO: MW-M23
DRILLER: B. GOLLINGE

SAMPLE NO & TYPE	DEPTH (ft.)	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth ft.)	MATERIAL DESCRIPTION* SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	USCS	REMARKS
	75.5								
C-5		2.0/4.5 44%	4.5/4.5		M. HARD	BLACK	SHALE		FRAC, BROKEN
	80								

REMARKS

BORING MW-M1

PAGE 4 OF 4

* See Legend on Back

B-96

AR302336

BORING LOG — NUS CORPORATION

PROJECT: DRAKE CHEM
PROJECT NO: 620Y
ELEVATION: 556.61'
WATER LEVEL DATA: 541.35'
(Date, Time & Conditions): 1/25/88, 1417 ACKER 62
DATE: 11/30/87
FIELD GEOLOGIST: R BETHEL
BORING NO: MW-M124
DRILLER: B Gollance, Penn Drilling

SAMPLE NO & TYPE	DEPTH (ft)	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY / SAMPLE LENGTH	LITHOLOGY CHANGE (Depth ft)	SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	USCS	REMARKS
S-1/SS	0-2'	5 / 27	1.5/2.0	1'		BRN	Soil		crs sand +
		22 / 19				GRAY GREEN	CLAY + GRAVEL	CL/GC	FILL, LS GRAV (GRAY) in gro
									green clay, Damp, 0ppm +
	5'								
S-2/SS	5-7	10 / 14	1.0/2.0						damp, 0ppm HNU
		8 / 4		7'					
							CLAY	CL	
	10'								
S-3/SS	10-12	3 / 2	2.0/2.0			GRAY-GREEN	CLAY		MOIST, STICKY. 0 [illegible]
		3 / 4		12'					
				13'		DARK GRAY	CLAY		MOIST, WOOD CHIPS, 0ppm +
						LT. GRAY w/ ORANGE	CLAY	CH	Lt. gray w/ orange mottling
	15'								
(1215) S-4/SS	15-17	9 / 9	2.0/2.0	16'					
		10 / 11					SANDY CLAY	CL	Moist to sat.
				~18'					
	20'			20'					
S-5/SS	20-22	10 / 15	1.2/2.0			Lt GRAY	SAND + GRAVEL, TR. CLAY	SP/GP	Sat., sand to w/ gravel subrnd.
		19 / 17							
	25'								

REMARKS: DRILLED w/ 10" Hollow stem augers, sampled w/ 2" O.D. split spoon driven w/ 140LB wt dropped 30" for entire hole except 5'

BORING MW-M12

PAGE 1 OF 3

* See Legend on Back

BORING LOG — NUS CORPORATION

PROJECT DRAKE CHEM
PROJECT NO. 620Y
ELEVATION
WATER LEVEL DATA
(Date, Time & Conditions)

DATE 11/30/87
FIELD GEOLOGIST

BORING NO MW-M124
DRILLER B. Gallahue, PENN DRILL N

ACKER 62

SAMPLE NO & TYPE	DEPTH (ft.)	BLOWS 6" OR ROD (ft.)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth ft.)	MATERIAL DESCRIPTION* SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	USCS	REMARKS
	25'								
S-6/SS	25-27'	21 22	2.0/2.0			LT. GRAY	SAND + GRAVEL w/ SOME CLAY	GC/SC	SAT (Sample) Subrnd SS gra Tr of purple clay, prodom
		22 23				TAN			Change in color @ 26.5'
	30'								
(415) S-7/SS	30-32'	51 72	1.5/1.5			LT GRAY	SAND + GRAVEL, TR. CLAY	SP/GP	H gray SS, red-purple SS, tr. white feldsp. comprise gravel (subrnd.) 0 ppm HNU
		77 —							
	35'								
S-8/SS	35-37'	94 —	0.5/0.5			DRK BRN	SAND + GRAVEL, TR. TO SOME CLAY		0 ppm HNU
		—							
	40'			40'					
(1619) S-9/SS	40-42	4 12	2.0/2.0	41'		BLUE GRAY	SANDY CLAY AND CLAY	SC-CL	0.5' SANDY CLAY, TR. GRAVEL 0.5' CLAY, MOIST
		34 44				TAN	SAND + GRAVEL, SOME CLAY	GC/SC	SAT., SS grav. (subrnd.) 0 ppm HNU
	45'								
(1650) S-10/SS	45-47	8 19	1.5/2.0			TAN TO GRAY	SAND + GRAVEL, SOME CLAY		TOP .6' PREDOM CRSE SAND, SAT.
		27 50							
	50'								

REMARKS

BORING MW-M

PAGE 2 OF 3

* See Legend on Back

B-98

AR302338

BORING LOG — NUS CORPORATION

PROJECT: DRAKE CHEM
PROJECT NO: 620Y
ELEVATION:
WATER LEVEL DATA
(Date, Time & Conditions)

DATE: 11/30/87
FIELD GEOLOGIST: R. BETHEL, DICK

BORING NO: MW-M124
DRILLER: B. GOLLAHUE

SAMPLE NO & TYPE	DEPTH (ft.)	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth ft.)	MATERIAL DESCRIPTION* SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	USCS	REMARKS
S-11/SS	50-52'	14 / 30	1.5/1.5	51		TAN TO GRAY	SAND + GRAVEL, SOME CLAY	GC/SC	
		37				DRK GRAY TO BLACK	CLAYSTONE		

REMARKS: TD @ 51.5' SCREENED 9' FROM 49' TO 40'

BORING: MW-M124

PAGE 3 OF 3

* See Legend on Back

BORING LOG — NUS CORPORATION

PROJECT: DRAKE CHEM
PROJECT NO.: 620Y
DATE: 12-9-87
BORING NO: MW-M12S (SB101)
DRILLER: B. GOLLIHUE
ELEVATION: 553.53'
FIELD GEOLOGIST: R. BETHEL
WATER LEVEL DATA: 543.04'
(Date, Time & Conditions) 1/25/88, 1520

SAMPLE NO & TYPE	DEPTH (Ft.)	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth, Ft.)	MATERIAL DESCRIPTION* SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	USCS	REMARKS
							BORING WAS NOT		
							LOGGED FROM 0 TO 60'		
							BORING WAS DRILLED		
							TO LOCATE BURIED		
							CHANNEL AND CONVERTED		
							TO MONITORING WELL		
							LOCATION ONCE THE		
							CHANNEL WAS CONFIRMED		

REMARKS

BORING MW-M12S (S

PAGE 1 OF 3

* See Legend on Back

B-100

AR302340

BORING LOG — NUS CORPORATION

PROJECT: DRAKE CHEM
PROJECT NO: 620Y
ELEVATION:
WATER LEVEL DATA
(Date, Time & Conditions)

DATE: 12-9-87
FIELD GEOLOGIST: R BETHEL

BORING NO: SB-101 / MW-M12S
DRILLER: B. GOLLIWE

PENN DRILLING : ACKER 62

SAMPLE NO & TYPE	DEPTH (Ft.)	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY / SAMPLE LENGTH	LITHOLOGY CHANGE (Depth Ft.)	MATERIAL DESCRIPTION* SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	USCS	REMARKS
	60								
SS S-1	60-62		2.0 / 2.0	61.5'	DENSE	DRK. BRN	SAND w/ GRAVEL	SP	Crs. Sand w/ Pea-Sized Gravel; Sub-rnd grain Some white qtz + feldspar
									Fine gr. Sand, silt + minor clay
						LT. BRN	SAND, some SILT, tr. CLAY	SM	Photo: #15+16
	65								
SS S-2	65-67	35 / 40 / 98	2.0 / 2.0		V. DENSE	LT BRN	SAND, some Gravel, tr. CLAY	SP	Grav. subrnd. Feldsp. + ss frags., SAND med.-fine grains Photo: #17
							DEC. IN GRAV. CONTENT W/ DEPTH		
	70								
SS S-3	70-72	40 / 110	1.0 / 1.0		V. DENSE	LT. BRN	SAND, tr. GRAV, tr CLAY	SP	Fine gr. SAND, SS frags. Photo: #18
	75								
SS S-4	75-77	3 / 19 / 52	1.5 / 1.5		V. DENSE	LT. BRN	SAND, some SILT, CLAY	SM	FINE gr. SAND Photo #19
	80								
SS S-5	81-83				V. DENSE	DK. BRN w/ BROWN	SAND w/ GRAVEL	SP	Same mat. as found in S-1 (60-61.5')
						LT BRN	SAND, some SILT, CLAY	SM	Fine gr. SAND Photo: #20

REMARKS: DRILLED TO 60' w/ 6" Solid stem augers, 60-100' w/ 8" Hollow stem augers, Sampled w/ 2" OD split spoon driven w/ 140 LB hammer dropped 30". Photos taken w/ camera #2

* See Legend on Back

BORING SB-1[illegible]

BORING LOG — NUS CORPORATION

PROJECT: DRAKE CHEM
PROJECT NO.: 620Y
ELEVATION:
WATER LEVEL DATA
(Date, Time & Conditions)

DATE: 12-10-87
FIELD GEOLOGIST: R. BETHEL

BORING NO: SB-101 / MW-M125
DRILLER: B. GOLLIHUE

SAMPLE NO & TYPE	DEPTH (ft.)	BLOWS 6" OR ROD (%)	SAMPLE RECOVERY / SAMPLE LENGTH	LITHOLOGY CHANGE (Depth ft.)	MATERIAL DESCRIPTION* SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	USCS	REMARKS
	85								
SS S-6	85-87	30 / 40 / 30 / 85	2.0 / 2.0		V. Dense	LT. Brn	SAND w/ some gravel	SP	Fine to med. gr. sand Gravel sub. rnd to sub ang. SS frag's. (5-10%) Photo #21
	90'			90'					
SS S-7		10 / 35 / 45 / 50	2.0 / 2.0		V. Dense	LT. BRN	SAND, Tr to Some Silt	SM	Fine gr. sand, 10-30% silt, very clean Photo #22
	95'								
SS S-8		4 / 25 / 45 / 50	1.8 / 2.0		V. Dense	LT. BRN		SM	Photo #23
				98'					
	100'				HARD	LT GRAY	LIMESTONE BEDROCK		According to driller. Could not retrieve samp Based on cuttings on roller bit.

REMARKS: Familiar odor present at the water table surface down to 50-60'

BORING: SB101/MW

PAGE 3 OF 3

* See Legend on Back

B-102

AR302342

APPENDIX C-1

FIELD PERMEABILITY TEST DATA: PUMPING TEST

NUS CORPORATION
A Halliburton Company

SITE NAME DRAKE CHEM
WELL MEASURED MW-M105
PUMPING WELL

COMPUTED ____ CHECKED ____
PROJECT NO 6204
PAGE 1 OF 2

- DISTANCE FROM PUMPING WELL (ft) (r) ____
- PUMPING RATE (gpm) (Q) 1.42 GPM
- STATIC H_2O LEVEL (ft) (t_0) 12.83' Top of Riser
- PUMP SETTING FEET BELOW MONITORING POINT ~45'
- TIME PUMPING START OR STOP (t_0) 11:04
- MONITORING POINT Top of PVC Riser Pipe
- ELEVATION OF MONITORING POINT (ft above MSL) ____

DATE	TIME 11:04	(t) MIN SINCE PUMP START OR STOP	WATER LEVEL MEASUREMENTS HELD	CUT	DTW	(s) DD or RECOV. (ft) DRAWDOWN	REMARKS
1-8-88		0				0	
		0.01				-0.37	
		.02				-0.30	
		.03				-0.21	
		.05				-1.37	
		.10				-2.84	
		.15				-2.56	
		.20				-2.68	
		.25				-2.66	
		.30				-2.61	
		.417				-2.39	
		.50				-2.43	
		.75				-2.08	
		1.00				-1.92	
		1.25				-1.89	
		1.50				-1.77	
		1.75				-2.01	
		2.00				-2.31	
		2.5				-3.55	
		3.0				-4.94	
		3.5				-5.39	
		4.0				-5.23	
		5.0				-6.04	
		6.0				-5.85	
		7.0				-6.11	
		8.0				-6.15	
		9.0				-6.52	
		10.0				-6.59	
		12.0				-6.89	
		14.0				-6.93	
		16.0				-6.29	
		18.0				-6.61	

AR302344

NUS CORPORATION
A Halliburton Company

SITE NAME DRAKE CHEM
WELL MEASURED MW-MID5
PUMPING WELL

COMPUTED ____ CHECKED ____
PROJECT NO 6204
PAGE 2 OF 2

- DISTANCE FROM PUMPING WELL (ft) (r) 0
- PUMPING RATE (gpm) (Q) 1.42 GPM
- STATIC H_2O LEVEL (ft X t_0) 12.83' Top of Riser
- PUMP SETTING FEET BELOW MONITORING POINT
- TIME PUMPING START OR STOP (t_0) 11:04
- MONITORING POINT Top of PVC Riser Pipe
- ELEVATION OF MONITORING POINT (ft above MSL)

DATE	TIME	(t) MIN SINCE PUMP START OR STOP	WATER LEVEL MEASUREMENTS			(s) DD or RECOV. (ft)	REMARKS
			HELD	CUT	DTW		
		20.0				-6.87	
		24.0				-6.70	
		28.0				-6.72	
		32.0				-7.16	
		36.0				-6.92	
		40.0				-6.68	
		50.0				-6.57	
		60.0				-7.26	
		70.0				-7.40	
		80.0				-7.15	
		90.0				-7.01	
		100.0				-7.16	

DATA SHEET FOR PUMPING TEST (OBSERVATION WELL)
OR
IN-SITU HYDRAULIC CONDUCTIVITY TEST

Site Number b20Y.03/552.03

Site Name DRAKE CHEM

Type of Test SHORT TERM PUMPING TEST

Location/
Well No. MW-M105
OBSERVATION WELL: MW-E3

Test No. 1

Start Time 1105

Duration ~100 min.

Name of Observer R. BETHEL / M. MENGEL

Drawdown measured by HERMIT: 20PSI PRESS. TRANSDUCER

Water level measurement reference point Top of riser pipe

Barometric Pressure NA (20°F)

Static water level before test 12.83'

Water sample collected
before test
after test

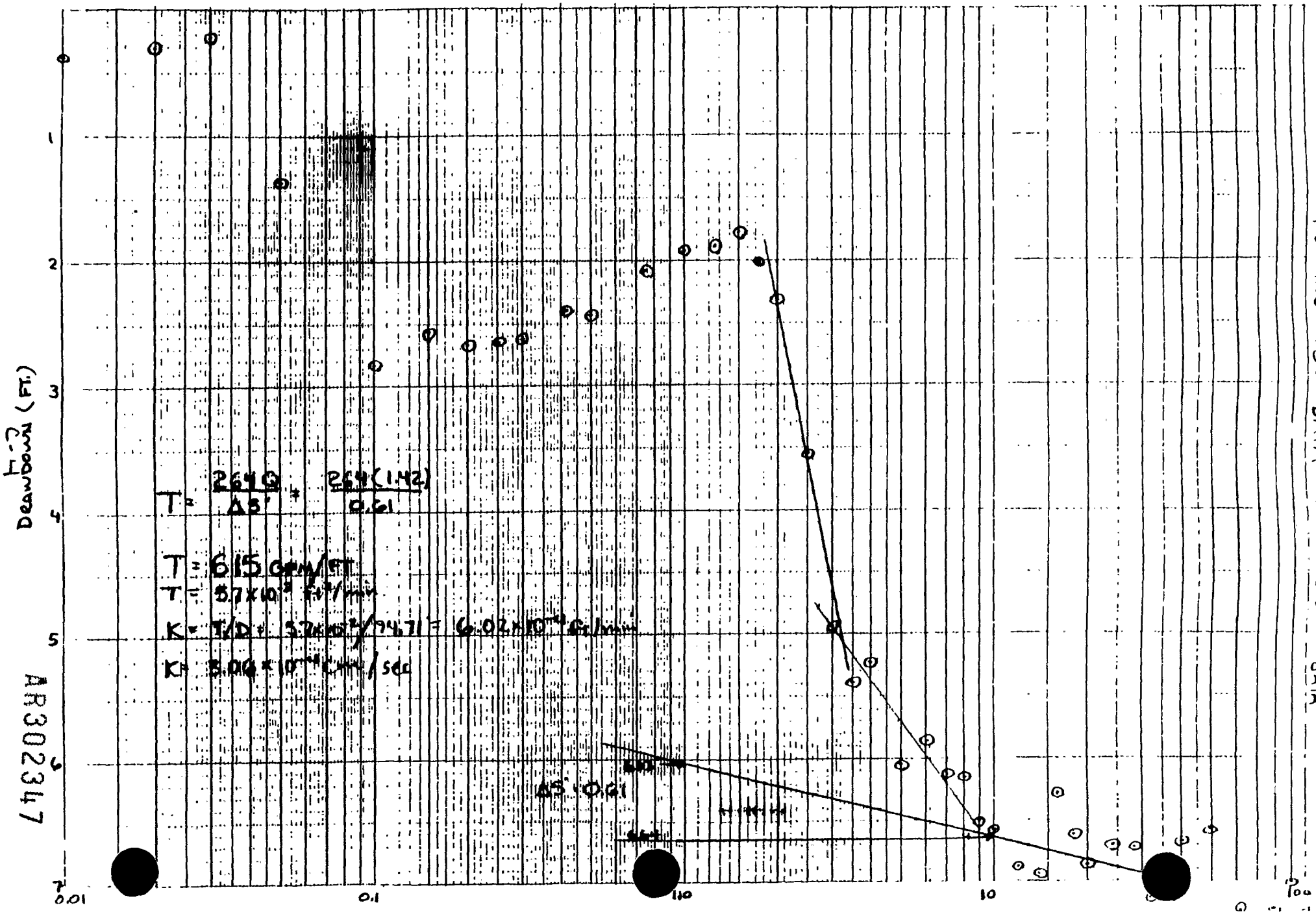
Date	Time	Depth to Water (Ft)	Drawdown or Head (Ft)	Correction	Corrected Drawdown or Head (Ft)	Elapsed Time (Min)	Remarks
	1107					2	1GAL/40 sec.
	1115					10	" /45 sec
	1125					20	" /43 sec
	1135					30	" /44 sec
	1145					40	" /43 sec
	1155					50	" /42 sec
	1205					60	" /42 sec
	1215					70	" /42 sec
	1225					80	" /42 sec
	1235					90	" /41 sec
	1245					100	" /42 sec

AR302346

K+E SEMI-LOGARITHMIC 4 CYCLES X 70 DIVISIONS
KEUFFEL & ESSER CO. MADE IN U.S.A.

API TEST TA AW
46 5010 MW-M105

PUMPING TEST DATA MW-M105 DATA



C-4

AR302347

NUS CORPORATION
A Halliburton Company

SITE NAME DRAKE CHEM
WELL MEASURED MW-M105
PUMPING WELL

COMPUTED ____ CHECKED ____
PROJECT NO 620Y
PAGE 1 OF 1

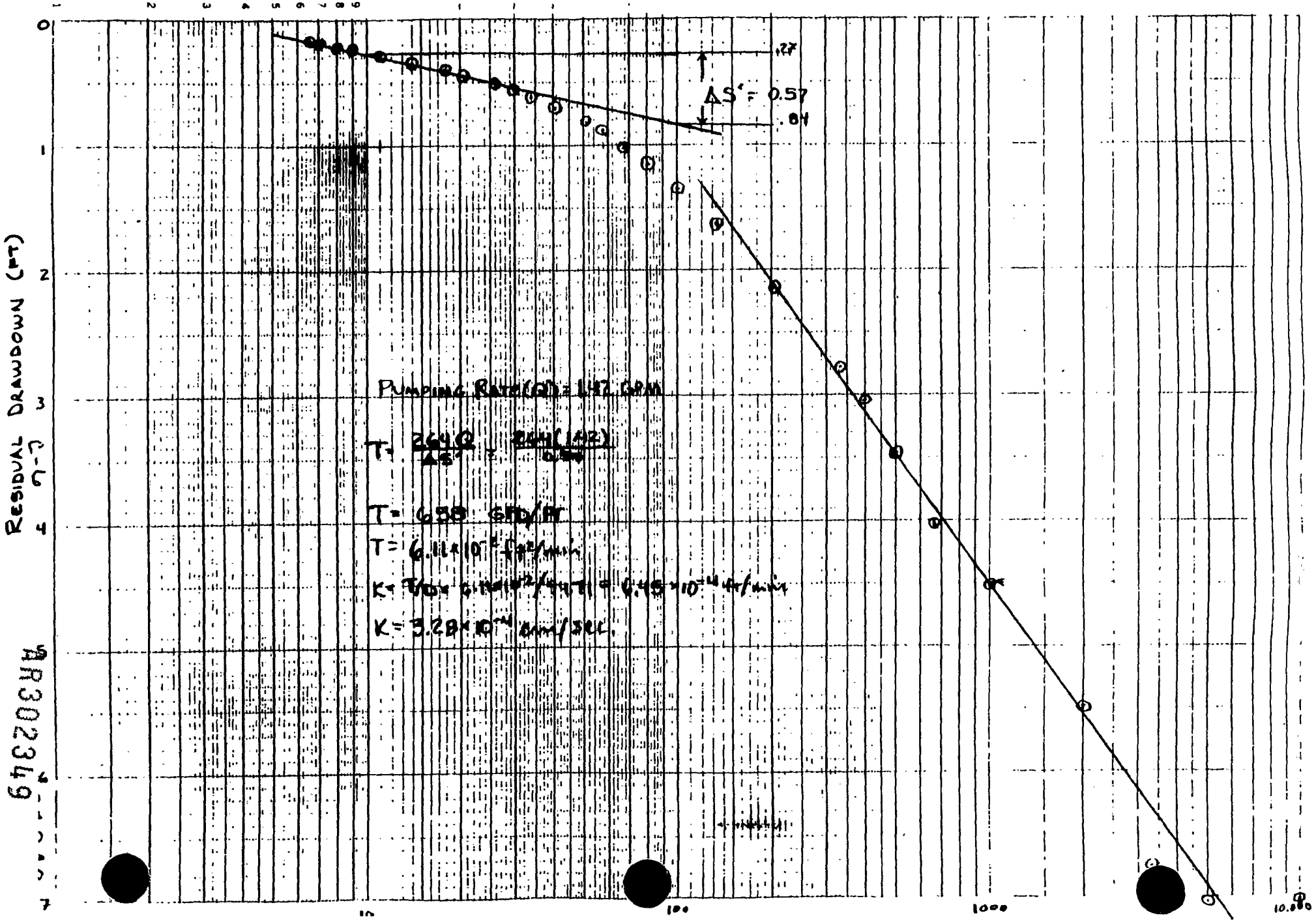
- DISTANCE FROM PUMPING WELL (ft) (r) 0
- PUMPING RATE (gpm) (Q) RECOVERY DATA
- STATIC H_2O LEVEL (ft) (t_0) ____
- PUMP SETTING FEET BELOW MONITORING POINT ____
- TIME PUMPING START OR STOP (t_0) ____
- MONITORING POINT ____
- ELEVATION OF MONITORING POINT (ft above MSL) ____

DATE	TIME t	(t) MIN SINCE PUMP START OR STOP t'	WATER LEVEL MEASUREMENTS: RATIO ~~HELD~~ t/t'	CUT	DTW	(s) DD or RECOV. (ft)	REMARKS RECOVERY DATA
1-8-88	100.01	.01	10,000			-7.03	
	100.02	.02	5001			-7.04	
	100.03	.03	3334			-6.75	
	100.05	.05	2001			-5.48	
	100.1	.10	1001			-4.52	
	100.15	.15	668			-4.03	
	100.2	.20	501			-3.47	
	100.25	.25	401			-3.04	
	100.30	.30	334			-2.78	
	100.50	.50	201			-2.14	
	100.75	.75	134			-1.66	
	101	1.0	101			-1.35	
	101.25	1.25	81			-1.16	
	101.5	1.50	68			-1.01	
	101.75	1.75	58			-0.89	
	102	2.00	51			-0.82	
	102.5	2.50	41			-0.70	
	103	3.0	34			-0.62	
	103.5	3.5	30			-0.57	
	104	4.0	26			-0.52	
	105	5	21			-0.45	
	106	6	18			-0.40	
	108	8	14			-0.33	
	110	10	11			-0.28	
	112	12	9			-0.24	
	114	14	8			-0.21	
	116	16	7			-0.18	
	118	18	6.5			-0.16	

AR302348

K+E SEMI-LOGARITHMIC 46 6010 KEUFFEL & ESSER CO. MADE IN U.S.A.

MW-M105



AR302349

NUS CORPORATION
A Halliburton Company

SITE NAME DRAKE CHEM
WELL MEASURED M-M107
PUMPING WELL

COMPUTED ____ CHECKED ____
PROJECT NO 6264
PAGE 1 OF 2

- DISTANCE FROM PUMPING WELL (ft) (r) ____
- PUMPING RATE (gpm) (Q) ≈ 61 gpm / up to 68 min
- STATIC H_2O LEVEL (ft) (s_o) 12.92'
- PUMP SETTING FEET BELOW MONITORING POINT ____
- TIME PUMPING START OR STOP (t_o) ____
- MONITORING POINT Top of riser pipe
- ELEVATION OF MONITORING POINT (ft above MSL) ____

DATE	TIME	(t) MIN SINCE PUMP START OR STOP	WATER LEVEL MEASUREMENTS			(s) DD or RECOV. (ft)	REMARKS
			HELD	CUT	DTW		
1-7-88	1656	0.0000				00	PUMPING TEST DATA
		0.0099				-.08	
		0.0200				-.24	
		0.0300				-.81	
		0.0500				-1.54	
		0.0666				-.24	
		0.0833				-1.87	
		0.1000				-2.15	
		0.1500				-2.04	
		0.2000				-2.09	
		0.2500				-2.18	
		0.3000				-2.26	
		0.5000				-2.58	
		1.0000				-2.82	
		1.5000				-2.91	
		2.0000				-2.83	
		2.5000				-3.10	
		3.0000				-3.57	
		3.5000				-4.08	
		4.0000				-4.36	
		4.5000				-4.94	
		5.0000				-5.01	
		6.0000				-5.38	
		7.0000				-5.53	
		8.0000				-5.79	
		9.0000				-5.67	
		10.00				-5.75	
		12.00				-5.90	
		14.00				-5.87	
		16.00				-6.07	
		18.00				-6.07	
		20.00				6.00	

AR302350

INUS CORPORATION
A Halliburton Company

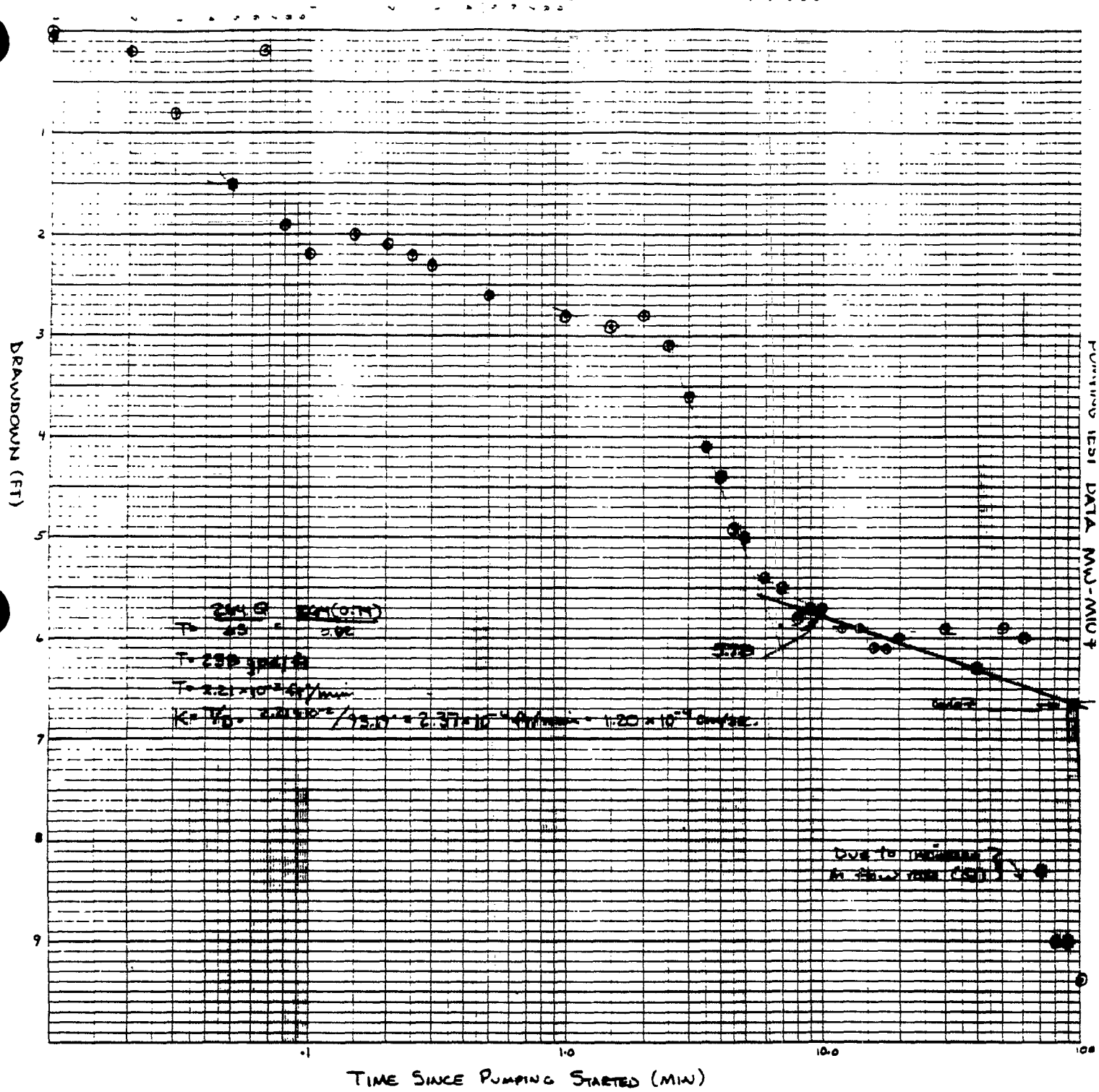
SITE NAME DRAKE CHEM
WELL MEASURED MW-M107
PUMPING WELL

COMPUTED ____ CHECKED ____
PROJECT NO 6209Y
PAGE 2 OF 2

- DISTANCE FROM PUMPING WELL (ft) (r) _____
- PUMPING RATE (gpm) (Q) _____
- STATIC H_2O LEVEL (ft) (s_o) _____
- PUMP SETTING FEET BELOW MONITORING POINT
- TIME PUMPING START OR STOP (t_o) _____
- MONITORING POINT _____
- ELEVATION OF MONITORING POINT (ft above MSL) _____

DATE	TIME	(t) MIN SINCE PUMP START OR STOP	WATER LEVEL MEASUREMENTS			(s) DD or RECOV. (ft)	REMARKS
			HELD	CUT	DTW		
		30.00				-5.91	
		40.00				-6.28	
		50.00				5.94	
		60.00				5.97	
		70.00				8.31	
		80.00				8.99	
		90.00				9.08	
		100.00				9.38	

K+E SEMI-LOGARITHMIC 4 CYCLES X 70 DIVISIONS KEUFFEL & ESSER CO. 46 6010



AR302352

NUS CORPORATION
A Halliburton Company

SITE NAME DRAKE CHEM
WELL MEASURED MW-M107
PUMPING WELL

COMPUTED ____ CHECKED ____
PROJECT NO 620Y
PAGE 01

- DISTANCE FROM PUMPING WELL (ft) (r) ____
- PUMPING RATE (gpm) (Q) 0.74 GPM
- STATIC H_2O LEVEL (ft X t_0) ____
- PUMP SETTING FEET BELOW MONITORING POINT ____
- TIME PUMPING START OR STOP (t_0) ____
- MONITORING POINT ____
- ELEVATION OF MONITORING POINT (ft above MSL) ____

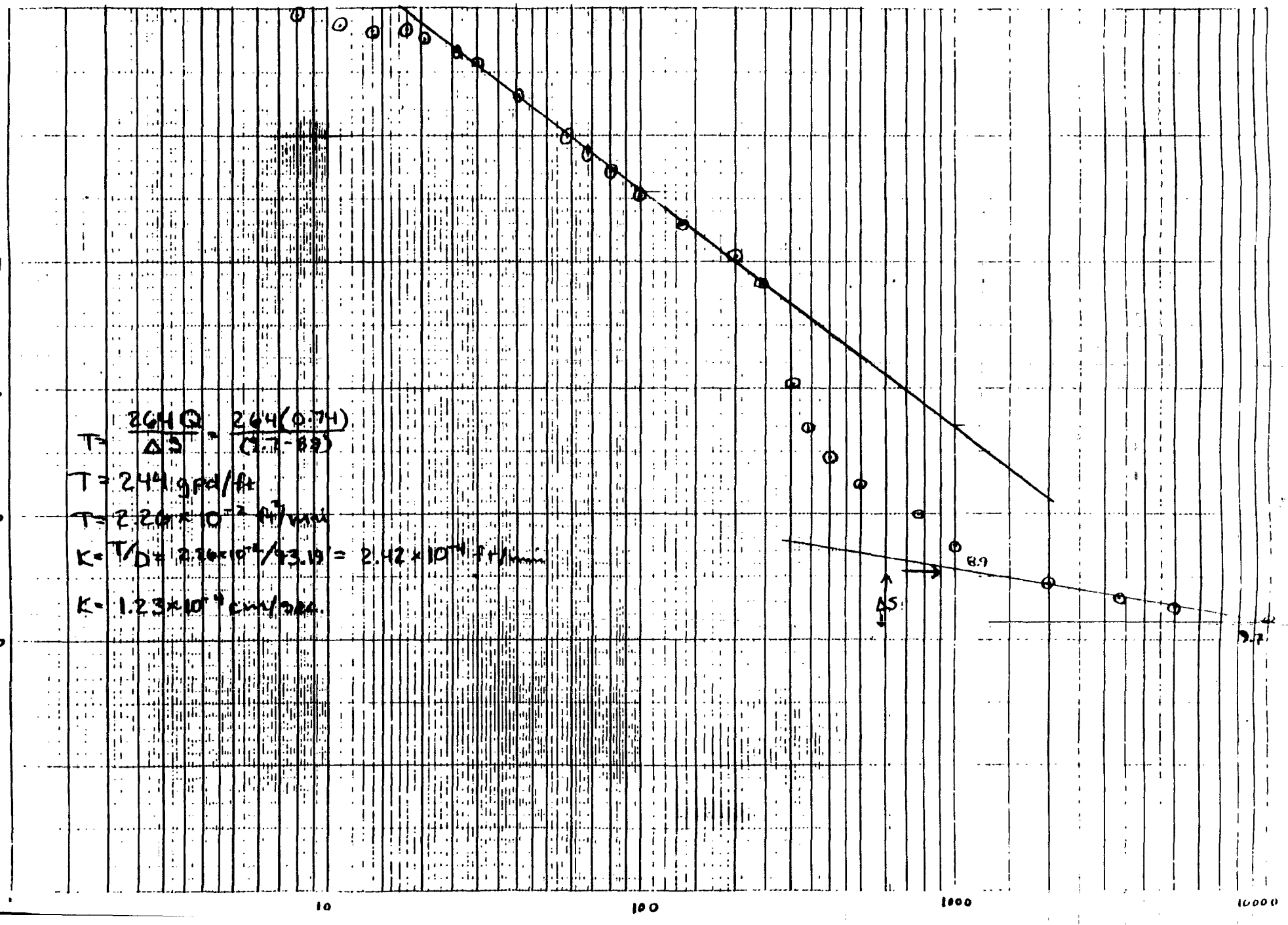
DATE	TIME t 18:36	(t) MIN SINCE PUMP START OR STOP t'	WATER LEVEL MEASUREMENTS: RATIO ~~HELD~~ t/t'	CUT	DTW	(s) DD or RECOV (ft)	REMARKS (RECOVERY) RESIDUAL DRAWDOWN DATA
1-7-88	100.01	.01	10000			-9.64	
	100.02	.02	5001			-9.51	
	100.03	.03	3334			-9.37	
	100.05	.05	2001			-9.10	
	100.10	.10	1001			-8.53	
	100.15	.15	668			-8.02	
	100.20	.20	501			-7.55	
	100.25	.25	401			-7.09	
	100.30	.30	334			-6.61	
	100.33	.33	304			-5.92	
	100.417	.417	241			-4.38	
	100.50	.50	201			-3.94	
	100.75	.75	134			-3.41	
	101.00	1.0	101			-2.97	
	101.25	1.25	81			-2.59	
	101.50	1.50	68			-2.28	
	101.75	1.75	58			-2.00	
	102.0	2.0	51			-1.76	
	102.5	2.5	41			-1.37	
	103	3.0	34			-1.06	
	103.5	3.5	30			-0.84	
	104	4.0	26			-0.63	
	105	5.0	21			-0.46	
	106	6.0	18			-0.33	
	108	8.0	14			-0.19	
	110	10.0	11			-0.13	
	112	12.0	9			-0.08	
	114	14.0	8			-0.05	
	116	16.0	7			-0.04	
	118	18.0	6.6			-0.02	
	120	20	6			-0.01	

AR302353

K+E SEMI-LOGARITHMIC 4 CYCLES X 70 DIVISIONS KEUFFEL & ESSER CO. MADE IN U.S.A.

46 6010

MW-M107



$T = \frac{264Q}{\Delta S} = \frac{264(0.74)}{(9.7-8.9)}$

$T = 244$ gpd/ft

$T = 2.26 \times 10^{-2}$ ft²/min

$K = T/D = 2.26 \times 10^{-2}/93.19 = 2.42 \times 10^{-4}$ ft/min

$K = 1.23 \times 10^{-9}$ cm/sec.

C-11

AR302354

NUS CORPORATION
A Halliburton Company

SITE NAME DRAKE CHEM
WELL MEASURED MW-M109
PUMPING WELL

COMPUTED ____ CHECKED ____
PROJECT NO 620Y
PAGE 1 OF 2

- DISTANCE FROM PUMPING WELL (ft) (r) ____ - PUMPING RATE (gpm) (Q) 5.29 GPM
- STATIC H_2O LEVEL (ft) (s_o) 13.93' Top of casing - PUMP SETTING FEET BELOW MONITORING POINT ~35'
- TIME PUMPING START OR STOP (t_o) 15:49 - MONITORING POINT Top of casing
- ELEVATION OF MONITORING POINT (ft above MSL) ____

DATE	TIME	(t) MIN SINCE PUMP START OR STOP	WATER LEVEL MEASUREMENTS			(s) DD or RECOV. (ft)	REMARKS
			HELD	CUT	DTW		
	15:49					DRAWDOWN	PUMPING TEST DRAWDOWN
1-8-88		0.017				-0.78	DATA
		0.020				-0.91	
		0.023				-1.02	
		0.027				-1.20	
		0.030				-1.36	
		0.033				-1.50	
		0.050				-2.18	
		0.067				-2.33	
		0.083				-2.85	
		0.100				-3.31	
		0.117				-3.49	
		0.133				-3.63	
		0.1500				-3.88	
		0.167				-4.04	
		0.183				-4.19	
		0.200				-4.35	
		0.217				-4.48	
		0.28				-4.68	
		0.283				-4.83	
		0.300				-4.92	
		0.33				-5.03	
		0.417				-5.32	
		0.500				-5.60	
		0.75				-5.80	
		1.00				-5.73	
		1.25				-5.92	
		1.50				-6.06	
		1.75				-5.88	
		2.00				-6.04	
		2.50				-6.13	
		3.00				-6.21	
		3.50				-6.18	

NUS CORPORATION
A Halliburton Company

SITE NAME DRAKE CHEM
WELL MEASURED MW-M109
PUMPING WELL

COMPUTED ___ CHECKED ___
PROJECT NO 620Y
PAGE 2 OF 2

- DISTANCE FROM PUMPING WELL (ft) (r) ___
- PUMPING RATE (gpm) (Q) 5.29 GPM
- STATIC H_2O LEVEL (ft) (s_o) ___
- PUMP SETTING FEET BELOW MONITORING POINT ___
- TIME PUMPING START OR STOP (t_o) ___
- MONITORING POINT ___
- ELEVATION OF MONITORING POINT (ft above MSL) ___

DATE	TIME	(t) MIN SINCE PUMP START OR STOP	WATER LEVEL MEASUREMENTS			(s) DD or RECOV. (ft)	REMARKS
			HELD	CUT	DTW		
1-8-88		4.00				-6.23	
		4.50				-6.28	
		5.50				-6.30	
		6.00				-5.91	
		8.00				-6.21	
		10.00				-6.13	
		12.00				-5.72	
		14.00				-5.75	
		16.00				-5.82	
		20.00				-5.90	
		24.00				-6.45	
		28.00				-6.05	
		32.00				-5.75	
		36.00				-6.43	
		40.00				-6.61	
		50.00				-6.61	
		62.00				-6.76	
		70.00				-6.92	
		80.00				-6.86	
		90.00				-6.34	
		98.00				-6.16	

AR302356

DATA SHEET FOR PUMPING TEST (OBSERVATION WELL)
OR
IN-SITU HYDRAULIC CONDUCTIVITY TEST

Site Number 620Y03/552.03

Site Name DRAKE CHEM

Type of Test SHORT TERM PUMPING TEST

Location/ Well No. MW-M109

Test No. 1

Start Time ~1552

Duration 98 MIN. (GENERATOR RAN OUT OF GAS)

Name of Observer R BETHEL / M MENGLE

Drawdown measured by HERMIT 20 PSI PRESS TRANSDUCE

Water level measurement reference point TOP OF RISER PIPE

Barometric Pressure NA (25°F SNOW)

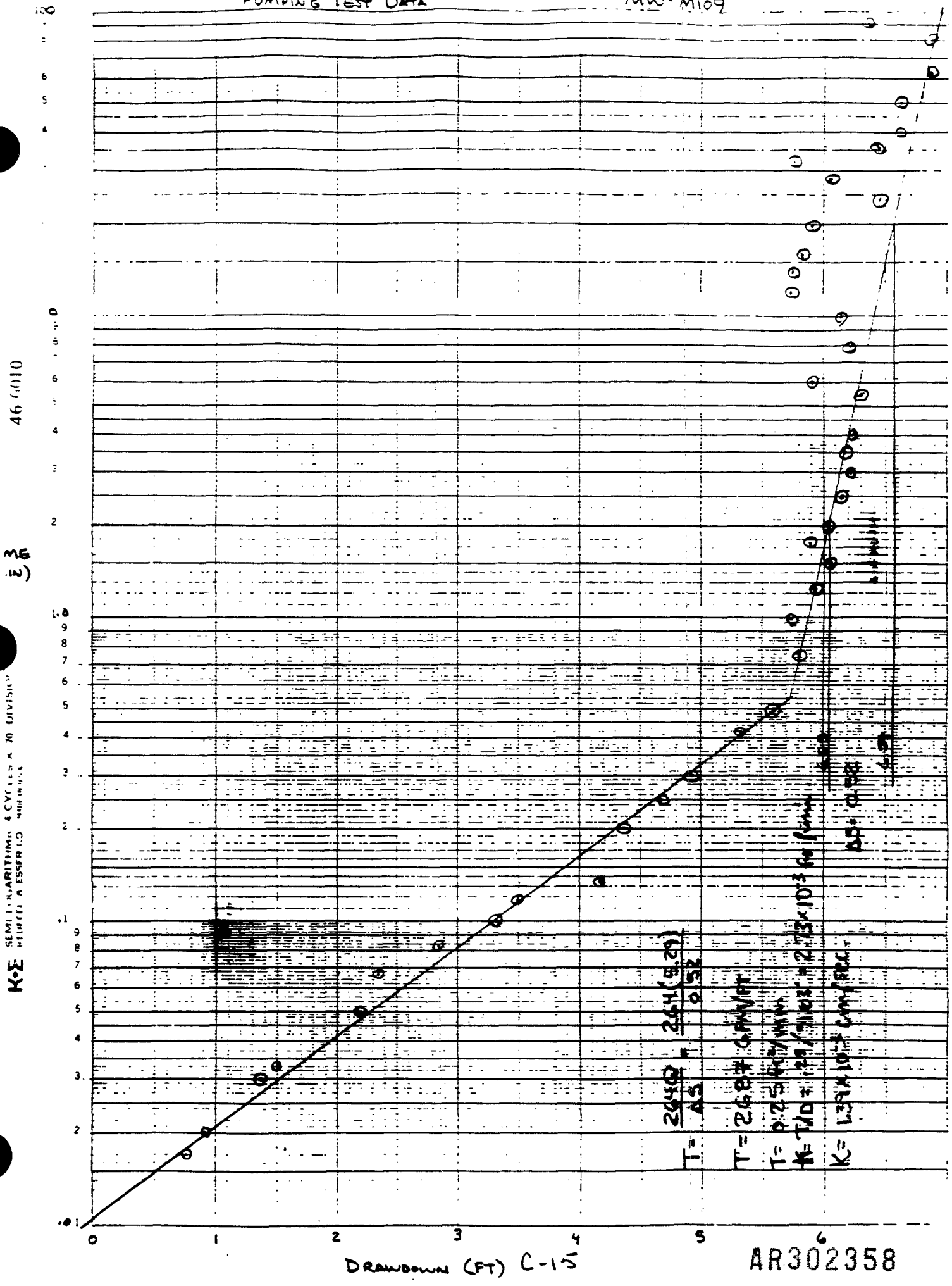
Static water level before test 13.93'

Water sample collected before test _____ after test _____

Date	Time	Depth to Water (Ft)	Drawdown or Head (Ft)	Correction	Corrected Drawdown or Head (Ft)	Elapsed Time (Min)	Remarks
1-8-88	1556					4 min	3 GAL / 34 SEC
	1602					10 min	3 GAL / 34 SEC
	1612					15 MIN	3 GAL / 34 SEC.
	1622					20 MIN	3 GAL 34 SEC.
	1632					30 MIN	" "
	1642					40 MIN	" "
	1652					50 MIN	" "
	1707					65 MIN	" "
	1727					85 MIN	" "
						95 MIN	

AR302357

PUMPING TEST DATA MW-M109



C-15

AR302358

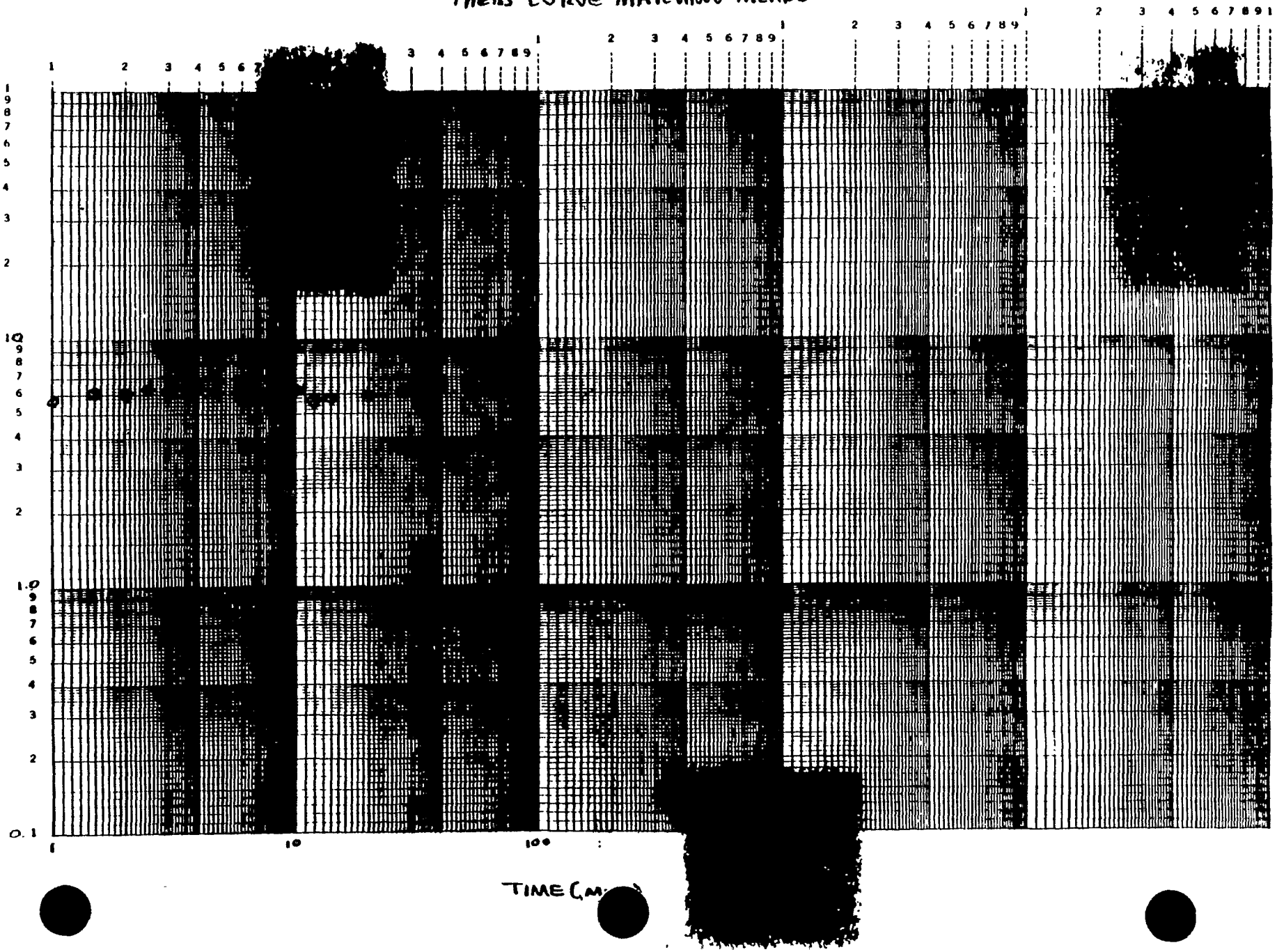
K·E LOGARITHMIC 3 x 5 CYCLES
KEUFFEL & ESSER CO. MADE IN U.S.A.

46 7522

PUMPING TEST DATA

MW M109

THEIS CURVE MATCHING METHOD



C-16

AR302359

NUS CORPORATION
A Halliburton Company

SITE NAME DRAKE CHEM
WELL MEASURED MW-M125
PUMPING WELL

COMPUTED ____ CHECKED ____
PROJECT NO 620Y
PAGE 1 OF

- DISTANCE FROM PUMPING WELL (ft) (r) ____ - PUMPING RATE (gpm) (Q) ____
- STATIC H_2O LEVEL (ft X t_0) 12.40' Top of Riser - PUMP SETTING FEET BELOW MONITORING POINT 0.65GPM
- TIME PUMPING START OR STOP (t_0) ____ - MONITORING POINT Top of Riser Pipe
- ELEVATION OF MONITORING POINT (ft above MSL) ____

DATE	~~TIME~~ t 16:01	(t) MIN SINCE PUMP START OR STOP t'	WATER LEVEL MEASUREMENTS RATIO ~~HELD~~ t/t'	CUT	DTW	(s) DD or RECOV. (ft)	REMARKS
1-7-88	100.01	0.01	10000			11.46	
	100.02	0.02	5001			11.41	
	100.03	0.03	3334			11.32	
	100.05	0.05	2001			11.16	
	100.10	0.10	1001			10.88	
	100.15	0.15	668			10.40	
	100.20	0.20	501			9.58	
	100.25	0.25	401			9.31	
	100.30	0.30	334			9.01	
	100.50	0.50	201			8.67	
	100.75	0.75	134			8.28	
	101	1.00	101			7.82	
	101.25	1.25	81			7.33	
	101.5	1.50	68			6.77	
	101.75	1.75	58			6.14	
	102	2.00	51			5.80	
	102.5	2.5	41			5.43	
	103	3.0	34			5.03	
	103.5	3.5	30			4.59	
	104	4.0	26			4.12	
	104.5	4.5	23			3.38	
	105	5.0	21			2.25	
	105.5	5.5	19			2.04	
	106	6.0	18			1.81	
	108	8.0	14			1.38	
	110	10.0	11			0.72	
	112	12.0	9			0.35	
	114	14.0	8			0.22	
	116	16.0	7			0.17	
	118	18.0	6.6			0.10	

AR302360

DATA SHEET FOR PUMPING TEST (OBSERVATION WELL)
OR
IN-SITU HYDRAULIC CONDUCTIVITY TEST

Site Number 620Y/552

Site Name DRAKE CHEM

Type of Test SHORT TERM PUMPING

Location/
Well No. MW-M125

Test No. 1

Start Time 1400 (1-7-88)

Duration 100 min.

Name of Observer R Bethel/M mengel

Drawdown measured by Hermit 20 PSI Press Transducer

Water level measurement reference point top of riser pipe

Barometric Pressure NA (5°F)

Static water level before test 12.40'

Water sample collected
before test
after test

$\frac{1}{1.54} - \frac{2}{1}$

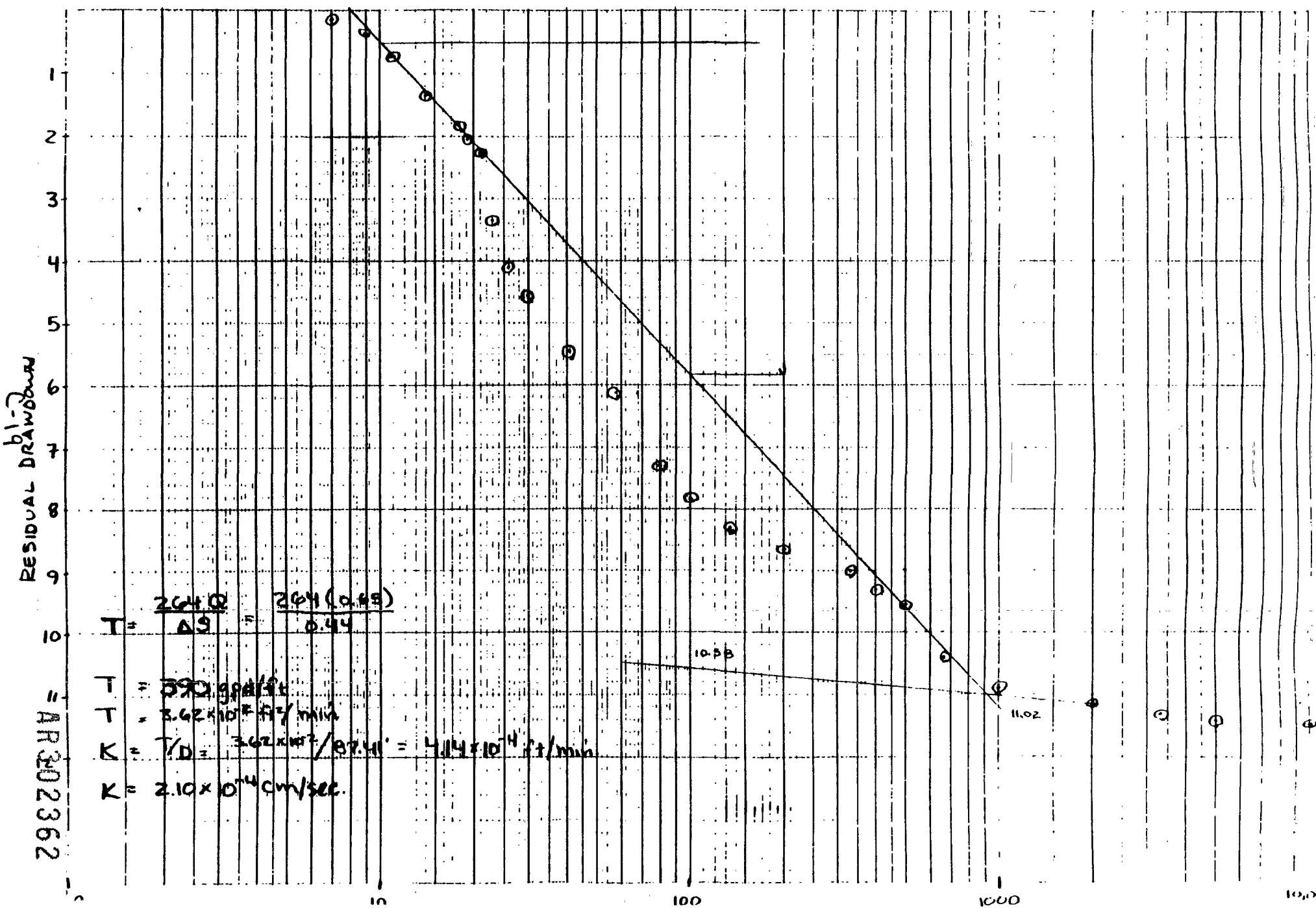
Date	Time	Depth to Water (Ft)	Drawdown or Head (Ft)	Correction	Corrected Drawdown or Head (Ft)	Elapsed Time (Min)	Remarks
1-7-88	1400					0	3472' Hand Bailer
↓	1402					2 min.	1 gal a min.
	1405					5 min.	1 gal per 1.5 min.
	1415					15 min.	1 gal / 1.5 min.
	1420					20 min.	1 gal / 1 min. 35 sec.
	1435					35 min.	1 gal / 1 min. [illegible]
	1455					55 min.	1 gal / 1 min. [illegible] sec.
	1515					75 min	1 gal / 1 min. 40 sec.
							1 gal / 1 min. 45 sec.

AR302361

K·E SEMI-LOGARITHMIC 4 CYCLES X 70 DIVISIONS KEUFFEL & ESSER CO. 46 6010

51 . 1 D.

MW-M125



$T = \frac{264Q}{\Delta s} = \frac{264(0.69)}{0.44}$

T = 390 gpd/ft

T = 3.62×10^{-2} ft²/min

K = T/D = 3.62×10^{-2} / 87.41' = 4.14×10^{-4} ft/min

K = 2.10×10^{-4} cm/sec.

AR302362

NUS CORPORATION
A Halliburton Company

SITE NAME DRAKE CHEM
WELL MEASURED MW-M125
PUMPING WELL

COMPUTED ___ CHECKED ___
PROJECT NO 6207
PAGE 1 OF 2

- DISTANCE FROM PUMPING WELL (ft) (r) ___
- PUMPING RATE (gpm) (Q) 0.65 GPM
- STATIC H_2O LEVEL (ft X ¼) 12.40' top of Riser
- PUMP SETTING FEET BELOW MONITORING POINT ___
- TIME PUMPING START OR STOP (¼) ___
- MONITORING POINT Top of Riser Pipe
- ELEVATION OF MONITORING POINT (ft above MSL) ___

DATE	START TIME 13:58	(t) MIN SINCE PUMP START OR STOP START	WATER LEVEL MEASUREMENTS HELD	CUT	DTW	(s) DD or RECOV. (ft) DRAWDOWN	REMARKS
1-7-88		0.01				0	
		.02				0	
		.03				.01	
		.05				0	
		.10				0	
		.15				.04	
		.20				.14	
		.25				.33	
		.30				.62	
		.33				.88	
		.417				1.59	
		.50				3.32	
		.75				4.49	
		1.0				6.04	
		1.25				7.04	
		1.5				8.11	
		1.75				9.16	
		2.0				10.19	
		2.5				11.18	
		3.0				12.19	
		3.5				12.81	
		4.0				13.33	
		5.0				13.63	
		6.0				13.46	
		8.0				14.32	
		10.0				14.36	
		12.0				14.17	
		14.0				14.48	
		16.0				14.28	
		20.0				14.51	
		24.0				14.58	
		28.0				14.78	
		32.0				14.62	
		36.0				14.85	

NUS CORPORATION
A Halliburton Company

SITE NAME DRAKE CHEM
WELL MEASURED MW-M12S
PUMPING WELL

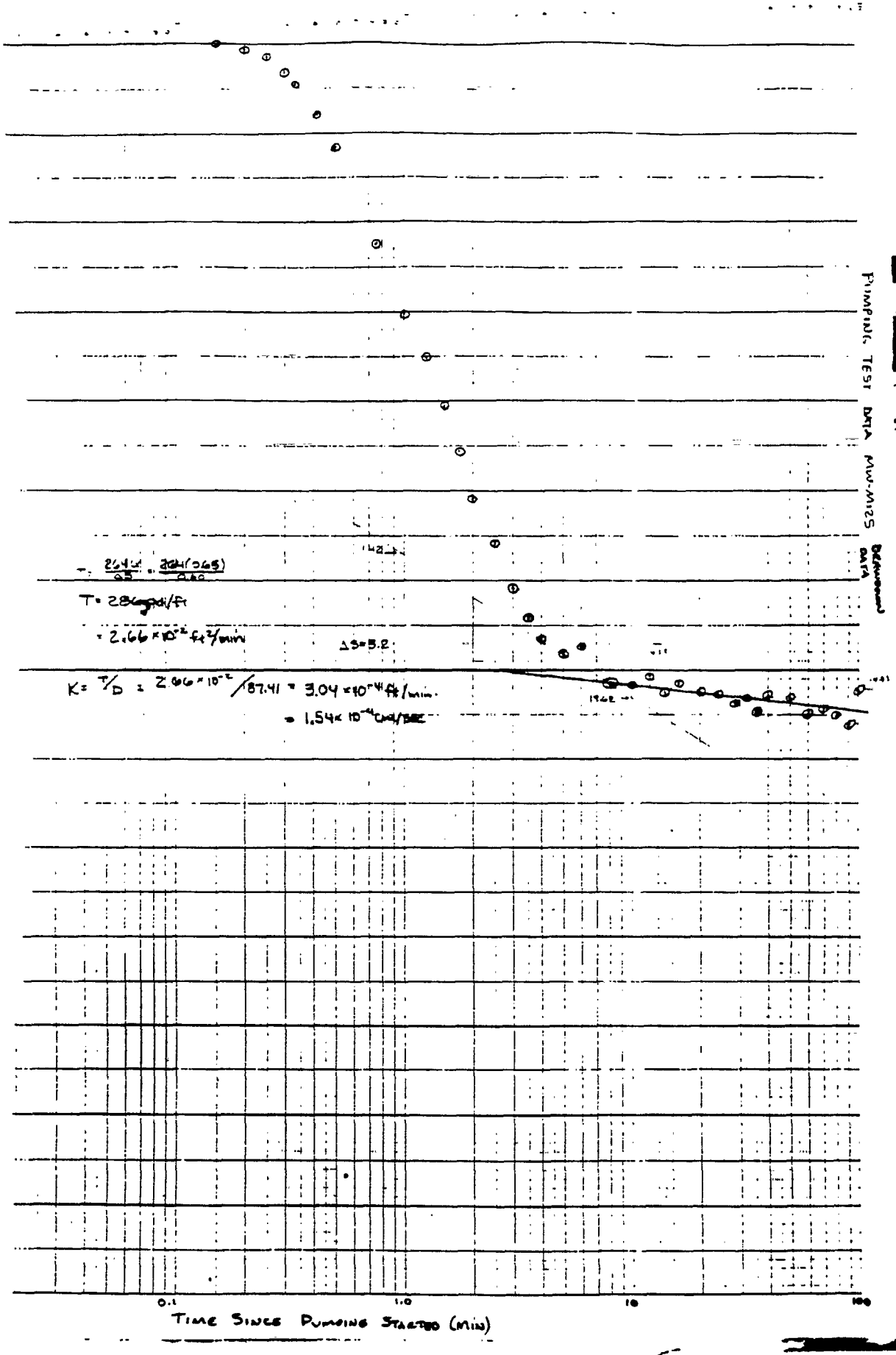
COMPUTED ____ CHECKED ____
PROJECT NO 6204
PAGE 2 OF 2

- DISTANCE FROM PUMPING WELL (ft) (r) ____
- PUMPING RATE (gpm) (Q) 0.65 GPM
- STATIC H_2O LEVEL (ft X to) 12.40' Top of Riser
- PUMP SETTING FEET BELOW MONITORING POINT ____
- TIME PUMPING START OR STOP (to) ____
- MONITORING POINT Top of Riser Pipe
- ELEVATION OF MONITORING POINT (ft above MSL) ____

DATE	START TIME	(t) MIN SINCE PUMP START OR STOP	WATER LEVEL MEASUREMENTS			(s) DD or RECOV. (ft)	REMARKS
			HELD	CUT	DTW		
	13:58						
1-7-88		40				14.59	
		50				14.62	
		60				14.99	
		70				14.84	
		80				15.02	
		90				15.22	
		100				14.46	

K+E

Pumping Test Drawdown Data
MW-M125



$= \frac{264Q}{\Delta s} = \frac{264(265)}{\Delta s}$

$T = 28$ gpd/ft

$= 2.66 \times 10^{-2}$ ft²/min

$\Delta s = 5.2$

$K = T/D = 2.66 \times 10^{-2} / 87.41 = 3.04 \times 10^{-4}$ ft/min

$= 1.54 \times 10^{-4}$ cm/sec

AR302365

APPENDIX C-2

FIELD PERMEABILITY TEST DATA: SLUG TEST

NUS CORPORATION
A Halliburton Company

SITE NAME DRAKE CHEMICAL
WELL MEASURED MW-M101
PUMPING WELL

COMPUTED ____ CHECKED ____
PROJECT NO 620Y
PAGE 1 OF 1

- DISTANCE FROM PUMPING WELL (ft) (r) _____
- PUMPING RATE (gpm) (Q) _____
- STATIC H_2O LEVEL (ft) (s_0) _____
- PUMP SETTING FEET BELOW MONITORING POINT _____
- TIME PUMPING START OR STOP (t_0) _____
- MONITORING POINT _____
- ELEVATION OF MONITORING POINT (ft above MSL) _____

DATE	TIME	(t) MIN SINCE PUMP START OR STOP	WATER LEVEL MEASUREMENTS			(s) DD or RECOV. (ft)	REMARKS
			HELD	CUT	DTW	RUN #1	RUN #2
		0.0000				3.71	3.75
		0.0033				3.41	3.58
		0.0066				3.21	3.22
		0.0099				3.05	3.05
		0.0133				2.88	2.88
		0.0166				2.73	2.72
		0.0200				2.57	2.50
		0.0233				2.42	2.43
		0.0266				2.28	2.27
		0.0300				2.14	2.12
		0.0333				2.03	2.00
		0.0500				1.52	1.46
		0.0666				1.12	1.06
		0.0833				.82	.76
		0.1000				.60	.54
		0.1166				.43	.38
		0.1333				.31	.27
		0.1500				.22	.19
		0.1666				.15	.12
		0.1833				.11	.08
		0.2000				.08	.06
		0.2166				.05	.04
		0.2333				.04	.03
		0.2500				.03	.02
		0.2666				.02	.01

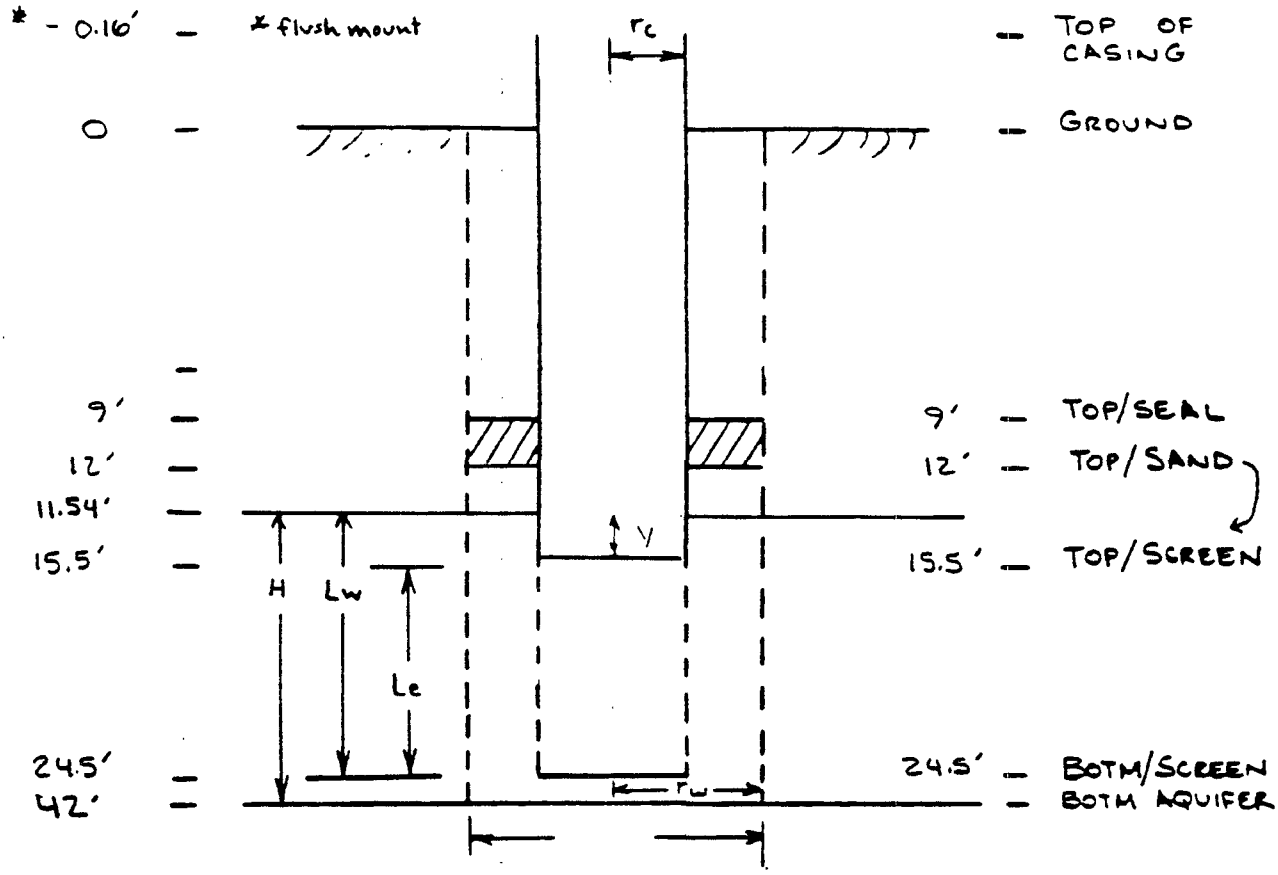
AR302367

NUS CORPORATION AND SUBSIDIARIES — STANDARD CALCULATION SHEET

CLIENT	FILE NO	BY	PAGE 1 OF
EPA - Drake Chem	620Y	RDB	
SUBJECT Slug Test Calculations MW-M101		CHECKED BY JS	DATE 2/17/88

CALCULATIONS: (BOUWER & RICE)

DEPTH (FT.) WELL CONSTRUCTION



$H = 42' - 11.54' = 30.46'$

$L_w = 24.5' - 11.54' = 12.96'$

$L_e = 24.5 - 15.5 = 9.0'$

$r_c = 0.083'$

$r_w = 0.42'$

$L_e/r_w = 9 / 0.42 = 21.43'$

$A = 2.17$

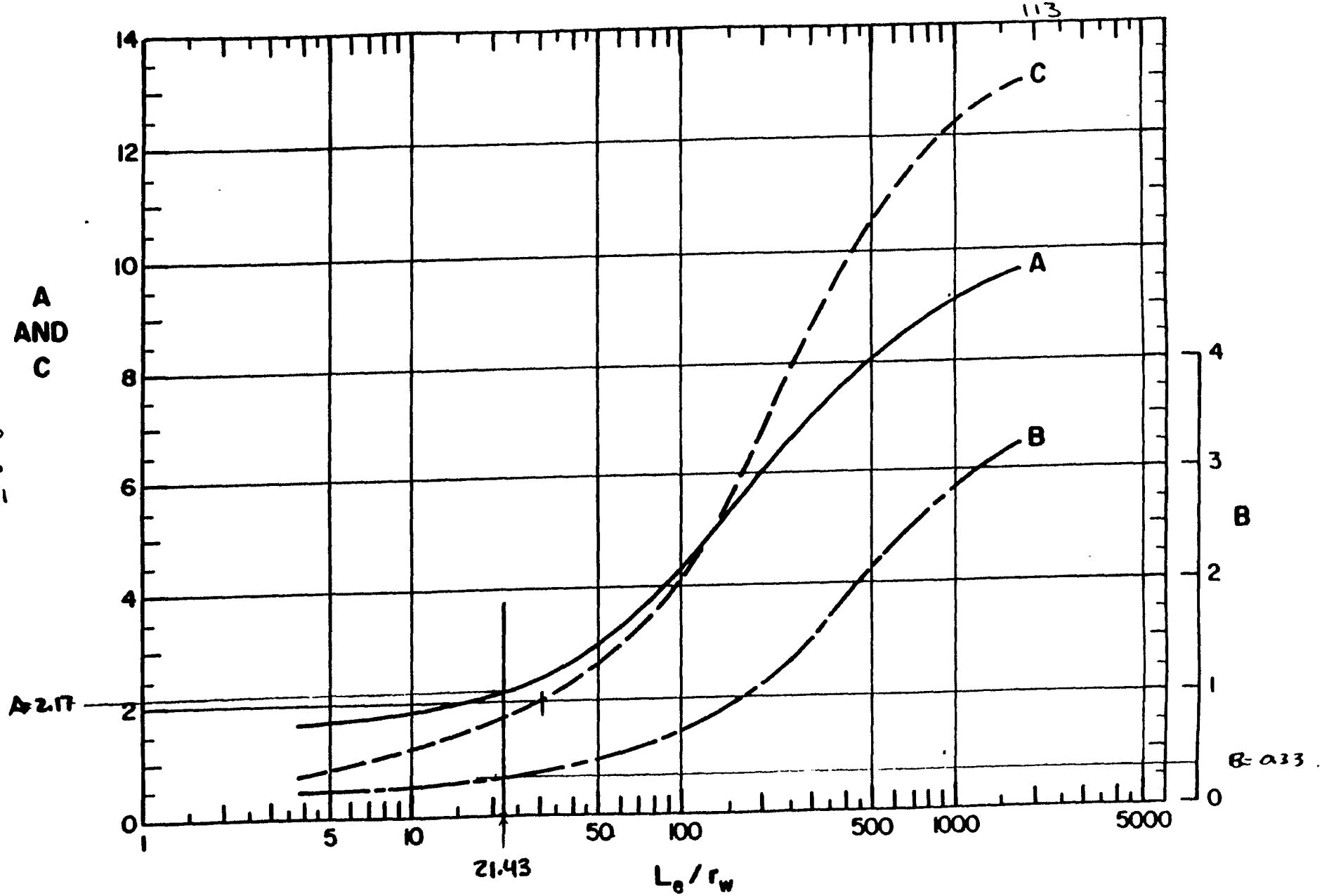
$B = 0.33$

$C =$

NUS 1554 REVISED 0285

AR302368

102 114
103 122
104 124
112
113



C-25

AR302369

CLIENT: EPA · DRAKE CHEM	FILE NO.: 620Y	BY: RDB	PAGE 3 OF
SUBJECT: SLUG TEST CALC'S. MW-M 101		CHECKED BY: JS	DATE: 2-22-88

$$\ln R_e/r_w = \left[\frac{1.1}{\ln(L_w/r_w)} + \frac{A + B\ln[(H-L_w)/r_w]}{L_e/r_w}\right]^{-1}$$

$$\ln R_e/r_w = \left[\frac{1.1}{\ln(12.96'/0.42')} + \frac{2.17 + (0.33)\ln[(30.46-12.96)/0.42]}{21.43}\right]^{-1}$$

$$\ln R_e/r_w = \left[0.32 + 0.159\right]^{-1}$$

$$\ln R_e/r_w = 2.08$$

$$K = \frac{r_c^2 \ln(R_e/r_w)}{2L_e} \cdot \frac{1}{t} \ln Y_0/Y_t$$

$$K = \frac{(0.083)^2(2.08)}{2(9.0)} \cdot \frac{1}{0.06} \ln\left(\frac{3.65}{1.10}\right)$$

$$K = (7.96 \times 10^{-4})(16.67)(1.20)$$

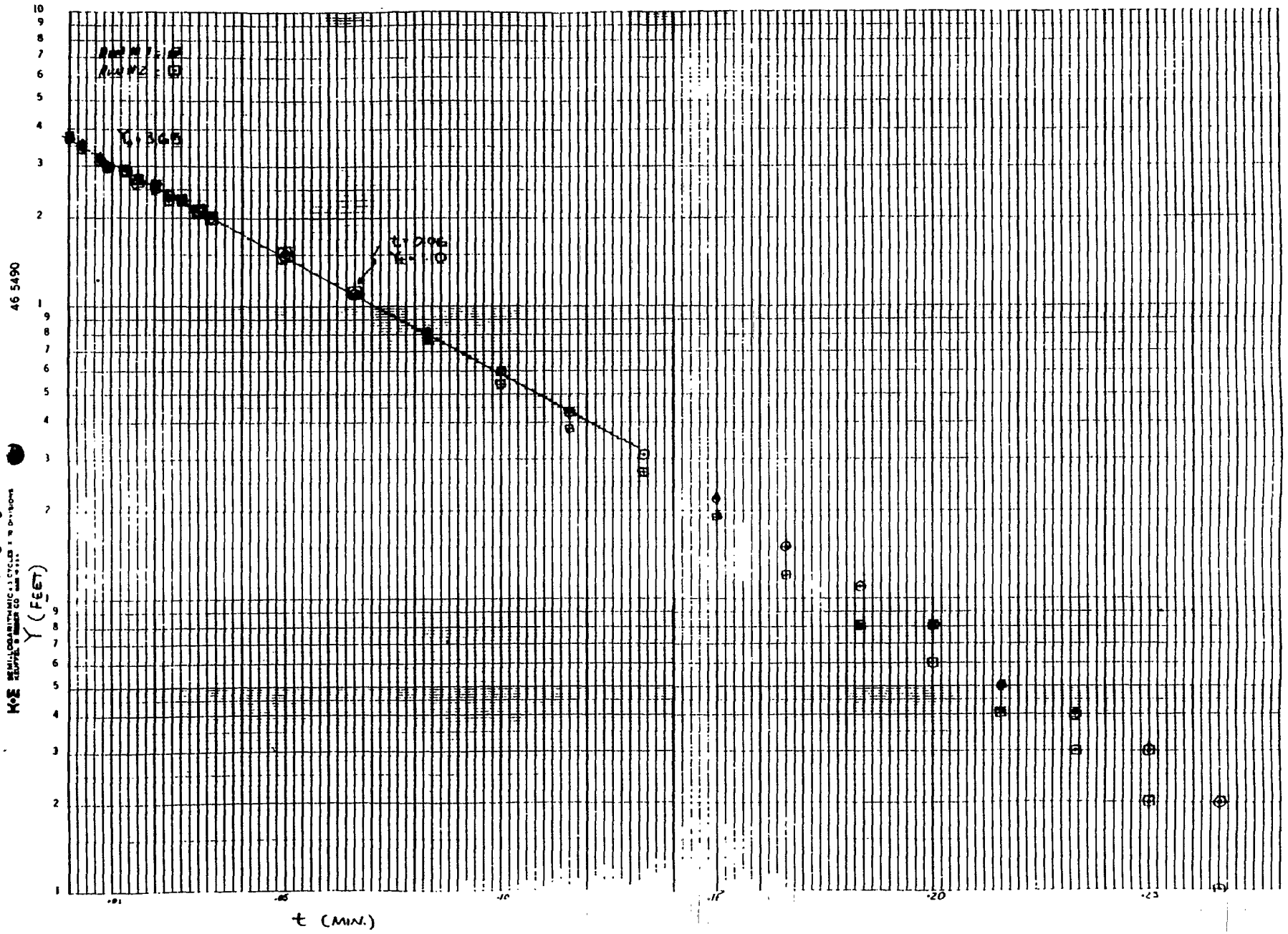
$$K = 1.59 \times 10^{-2} \text{ ft/min.}$$

$$K = 8.08 \times 10^{-3} \text{ cm/sec.}$$

$$T = K \cdot D = (1.59 \times 10^{-2} \text{ ft/min.})(30.46 \text{ ft}) = 4.84 \times 10^{-1} \text{ ft}^2/\text{min.}$$

$$= 5217 \text{ gpd/ft.}$$

CHEMICAL [redacted] SLUG TEST DATA MW-M101



C-27

AR302371

NUS CORPORATION
A Halliburton Company

SITE NAME DRAKE CHEMICAL
WELL MEASURED MW-M102
PUMPING WELL

COMPUTED ____ CHECKED ____
PROJECT NO 6204
PAGE 1 OF 1

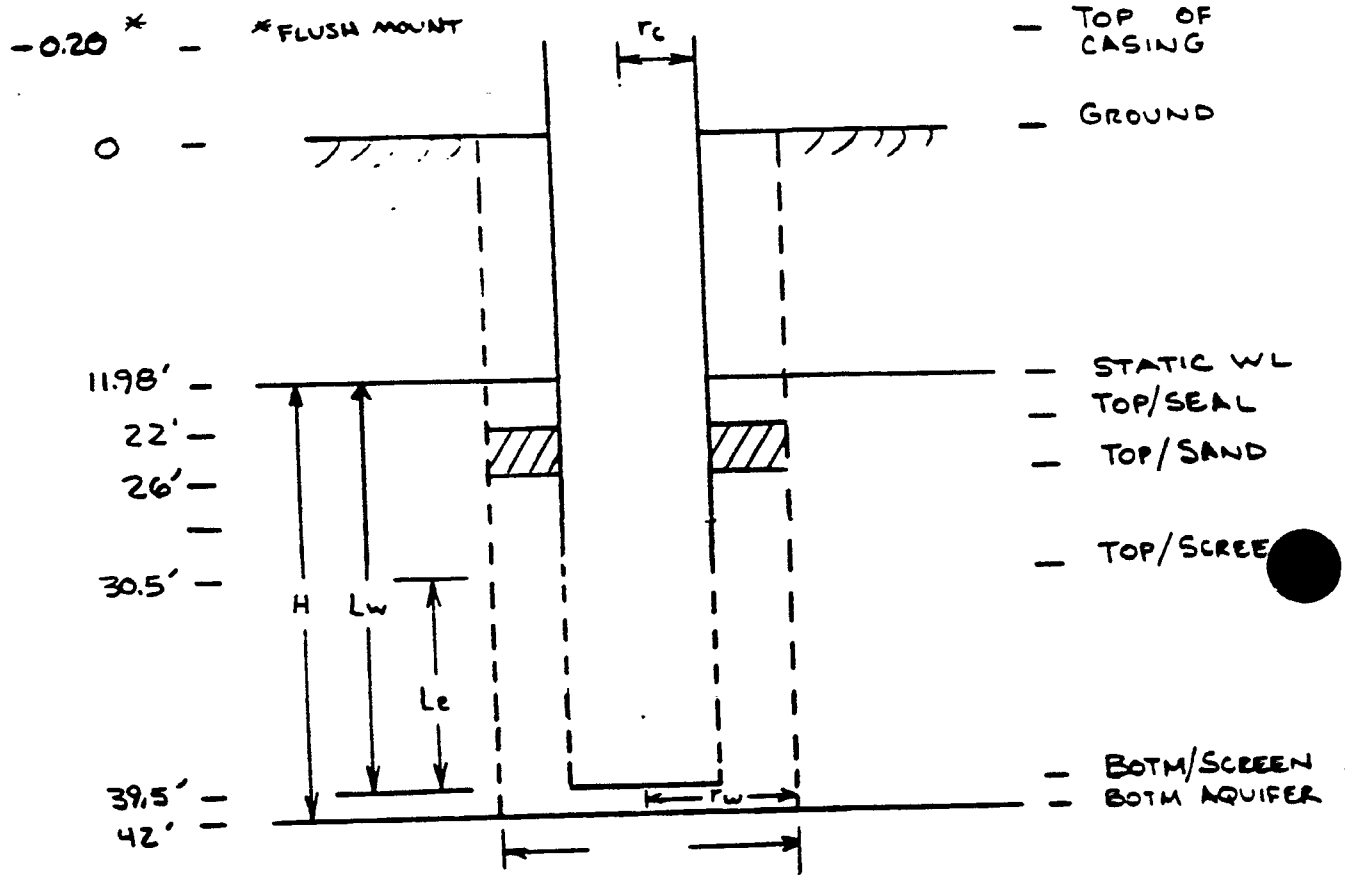
- DISTANCE FROM PUMPING WELL (ft) (r) ____ - PUMPING RATE (gpm) (Q) ____
- STATIC H_2O LEVEL (ft) (s_o) ____ - PUMP SETTING FEET BELOW MONITORING POINT ____
- TIME PUMPING START OR STOP (t_o) ____ - MONITORING POINT ____
- ELEVATION OF MONITORING POINT (ft above MSL) ____

DATE	TIME	(t) MIN SINCE PUMP START OR STOP	WATER LEVEL MEASUREMENTS			(s) DD or RECOV. (ft)	REMARKS
			HELD	CUT	DTW	RUN #1	RUN #2
1-6-87	1456	0.0000				5.35	3.81
		0.0099				4.91	3.25
		0.0200				4.53	2.90
		0.0300				4.22	2.59
		0.0500				3.70	2.09
		0.0666				3.28	1.75
		0.0833				2.93	1.45
		0.1000				2.63	1.20
		0.1166				2.34	1.00
		0.1333				2.10	.83
		0.1500				1.87	.69
		0.1666				1.67	.57
		0.1833				1.48	.46
		0.2000				1.32	.38
		0.2166				1.16	.32
		0.2333				1.03	.26
		0.2500				.90	.22
		0.2666				.79	.18
		0.2833				.69	.16
		0.3000				.61	.13
		0.3166				.53	.11
		0.3333				.46	.10
		0.4167				.22	.06
		0.5000				.12	.04
		0.5833				.06	.04
		0.6667				.04	.03
		0.7500				.03	.02

CLIENT EPA - DRAKE CHEM	FILE NO 620Y	BY RDB	PAGE 1 OF
SUBJECT SLUG TEST CALC. MW-M102		CHECKED BY JS	DATE 2-17-88

CALCULATIONS: (BOUWER & RICE)

DEPTH (FT.) WELL CONSTRUCTION



$H = 42' - 11.98' = 30.02'$

$L_w = 39.5 - 11.98' = 27.52'$

$L_e = 39.5 - 30.5' = 9.0'$

$r_c = 0.083'$

$r_w = 0.42'$

$L_e/r_w = 9/0.42 = 21.43'$

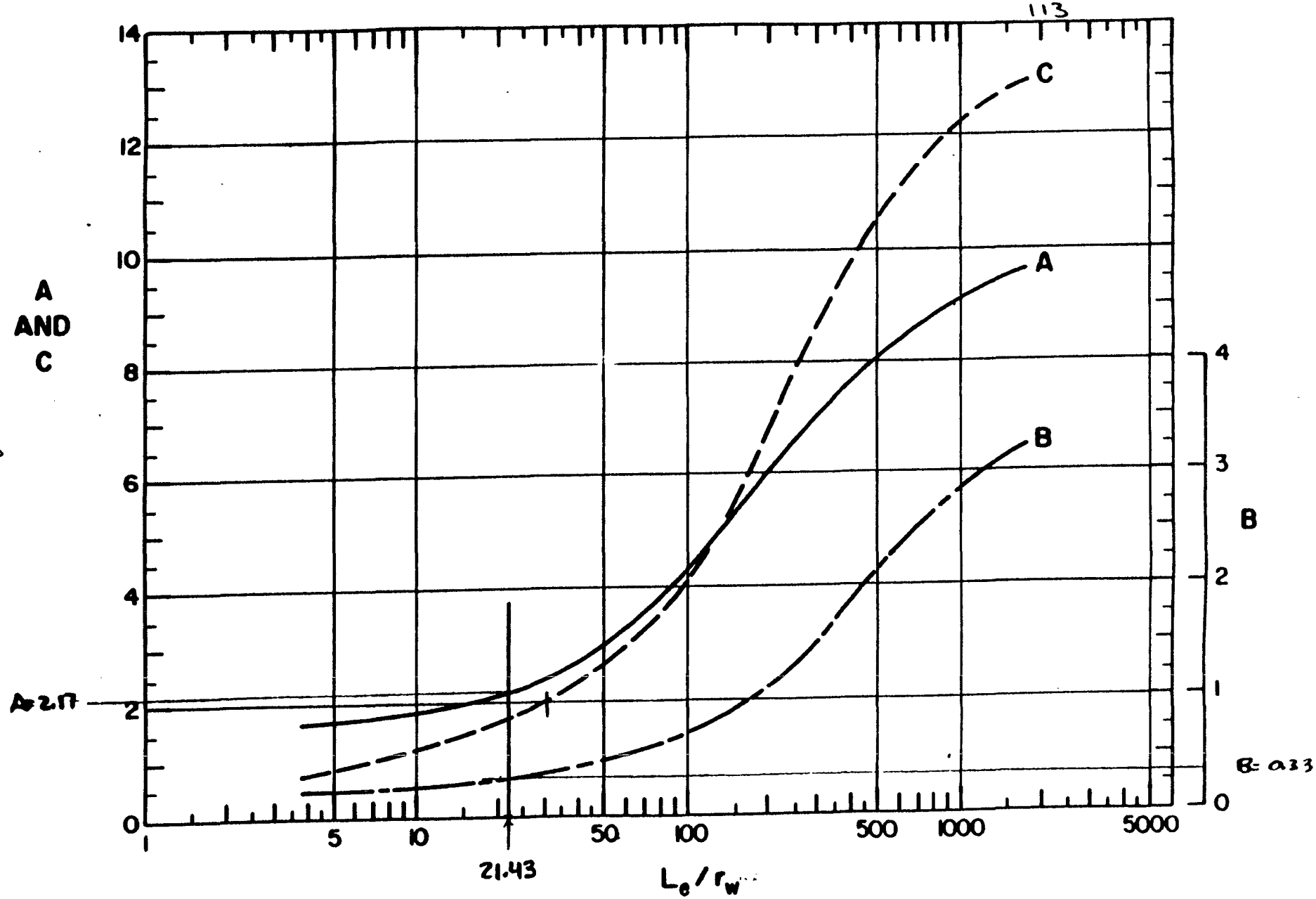
$A = 2.17$

$B = 0.33$

$C =$

102 103 104 112 113

122 124



C-30

AR302374

CLIENT	FILE NO.	BY	PAGE 3 OF
EPA · DRAKE CHEM	620Y	RDB	
SUBJECT: SLUG TEST CALC'S. MW-M102		CHECKED BY: JS	DATE: 2-22-88

$$\ln R_e/r_w = \left[\frac{1.1}{\ln(L_w/r_w)} + \frac{A + B\ln[(H-L_w)/r_w]}{L_e/r_w}\right]^{-1}$$

$$\ln R_e/r_w = \left[\frac{1.1}{\ln(27.52/0.42)} + \frac{2.17 + (0.33)\ln[(30.02'-27.52')/0.42]}{21.43}\right]^{-1}$$

$$\ln R_e/r_w = \left[0.263 + 0.129\right]^{-1}$$

$$\ln R_e/r_w = 2.55$$

$$K = \frac{r_c^2 \ln(R_e/r_w)}{2L_e} \cdot \frac{1}{t} \ln Y_0/Y_t$$

$$K = \frac{(0.083)^2(2.55)}{2(9.0)} \cdot \frac{1}{0.15} \ln\left(\frac{3.70}{0.70}\right)$$

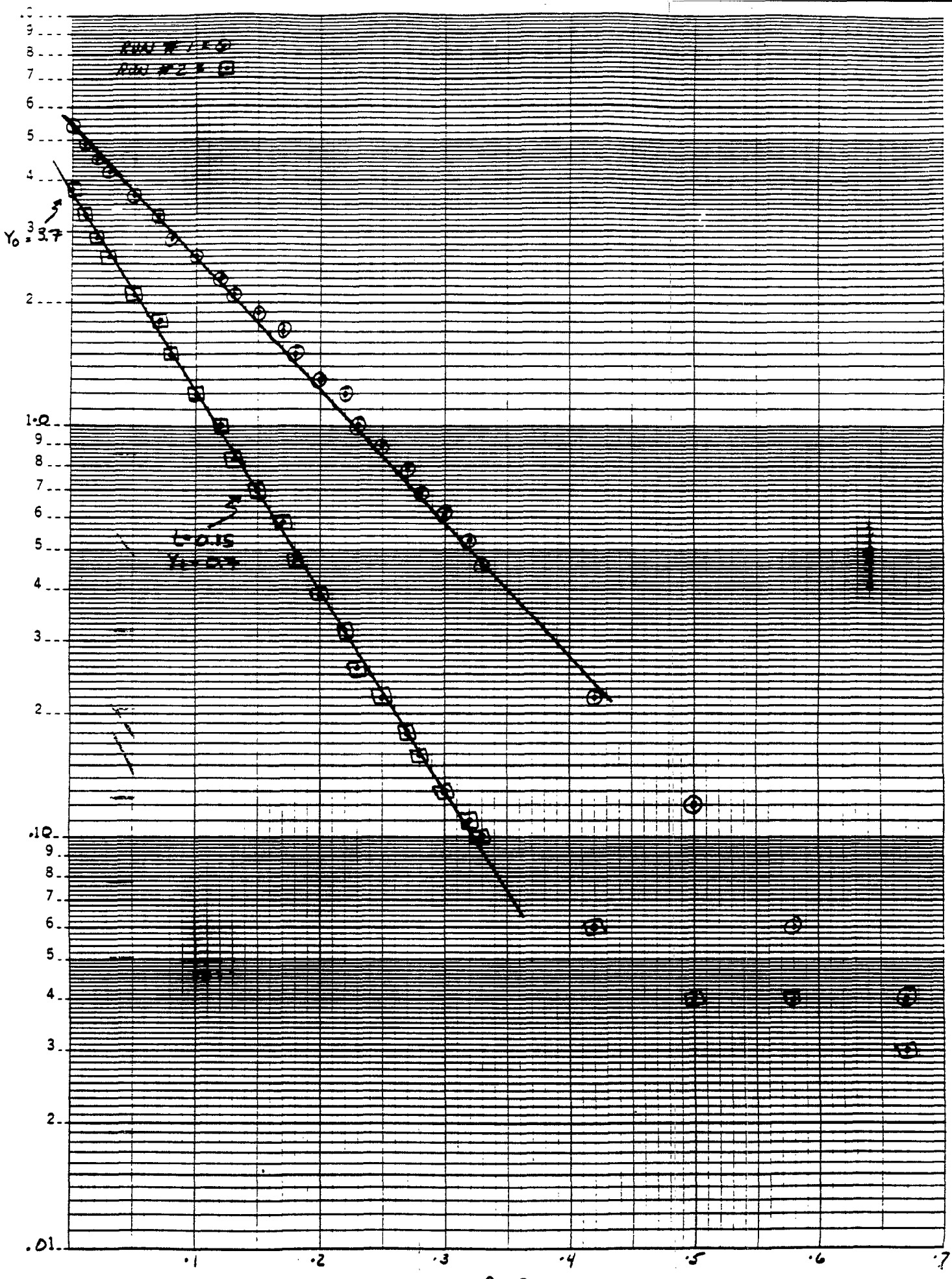
$$K = (9.74 \times 10^{-4})(6.67)(1.66)$$

$$K = 1.08 \times 10^{-2} \text{ ft/min.}$$

$$K = 5.49 \times 10^{-3} \text{ cm/sec.}$$

$$T = K \cdot D = (1.08 \times 10^{-2} \text{ ft/min})(30.02 \text{ ft}) = 0.324 \text{ ft}^2/\text{min.}$$

$$= 3490 \text{ gpd/ft}$$



C-32

AR302376

NUS CORPORATION
A Halliburton Company

SITE NAME DRAKE CHEMICAL
WELL MEASURED MW-M103
PUMPING WELL

COMPUTED ____ CHECKED ____
PROJECT NO 6204
PAGE 1 OF 1

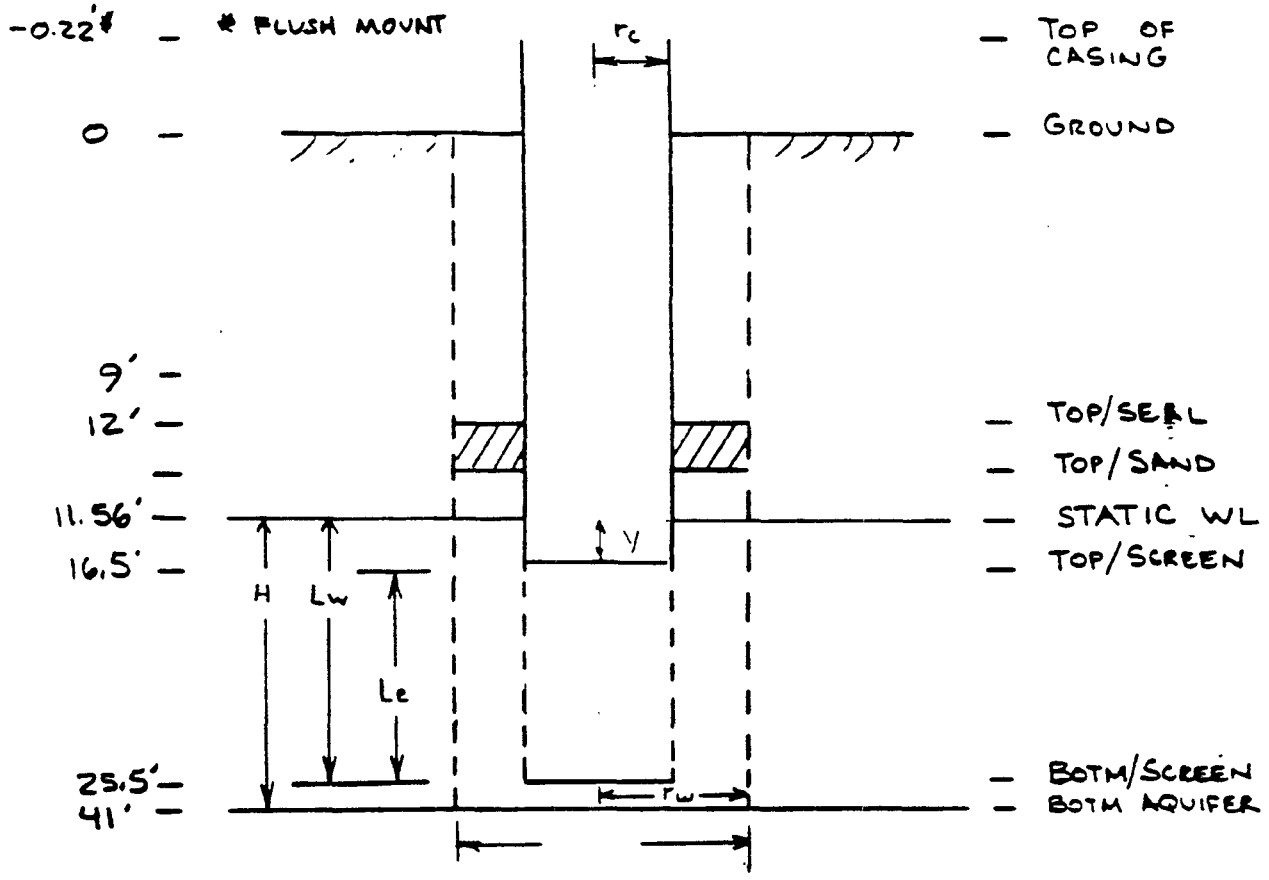
- DISTANCE FROM PUMPING WELL (ft) (r) ____ - PUMPING RATE (gpm) (Q) ____
- STATIC H_2O LEVEL (ft) (s_o) ____ - PUMP SETTING FEET BELOW MONITORING POINT ____
- TIME PUMPING START OR STOP (t_o) ____ - MONITORING POINT ____
- ELEVATION OF MONITORING POINT (ft above MSL) ____

DATE	TIME	(t) MIN SINCE PUMP START OR STOP	WATER LEVEL MEASUREMENTS			(s) DD or RECOV. (ft)	REMARKS
			HELD	CUT	DTW	RUN #1	RUN #2
1-6-88	1141	0.0000				5.47	3.58
		0.0500				3.57	2.26
		0.1000				2.45	1.48
		0.1500				1.73	.99
		0.2000				1.23	.67
		0.2500				.89	.47
		0.3000				.66	.33
		0.4167				.37	.17
		0.5000				.27	.12
		0.6667				.19	.05
		0.7500				.16	.04
		1.0000				.12	.02
		1.5000				.05	.01
		2.0000				.01	.00

NUS CORPORATION AND SUBSIDIARIES			STANDARD CALCULATION SHEET
CLIENT EPA DRAKE CHEM	FILE NO 620Y	BY RDB	PAGE 1 OF
SUBJECT. SLUG TEST CALC. MW-M103		CHECKED BY JS	DATE 2-17-88

CALCULATIONS: (BOUWER & RICE)

DEPTH (FT.) WELL CONSTRUCTION



$H = 41' - 11.56' = 29.44'$

$L_w = 25.5' - 11.56' = 13.94'$

$L_e = 25.5' - 16.5' = 9.0'$

$r_c = 0.083'$

$r_w = 0.42'$

$L_e/r_w = 9/0.42' = 21.43$

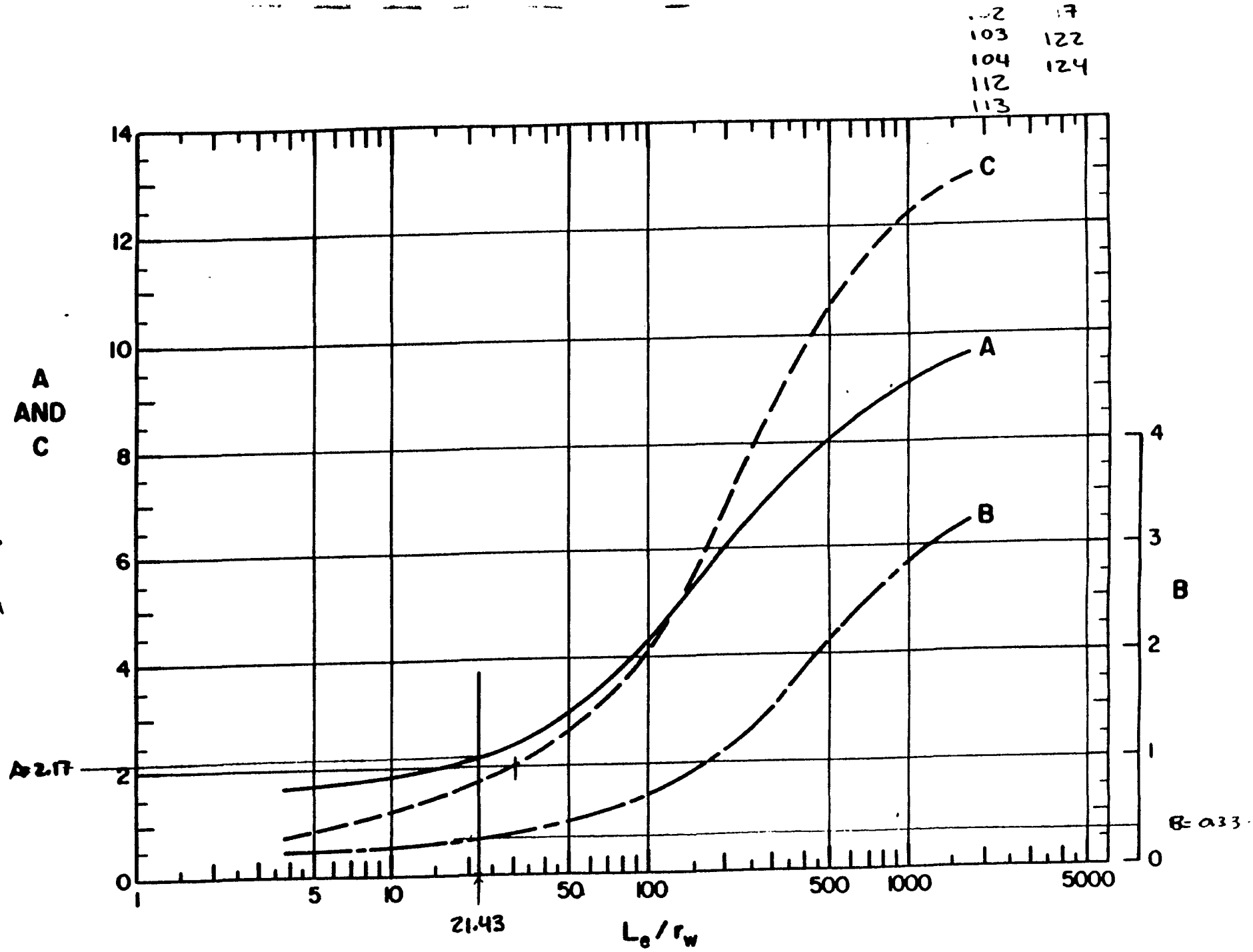
$A = 2.17$

$B = 0.83$

$C =$

NUS 155A REVISED 0285

AR302378


102
103
104
112
113
17
122
124
A AND C
B
C
A
B
A=2.17
B=0.33
21.43
L_e / r_w
0
2
4
6
8
10
12
14
1
5
10
50
100
500
1000
5000
0
1
2
3
4

AR302379

CLIENT: EPA · DRAKE CHEM	FILE NO 620Y	BY RDB	PAGE 3 OF
SUBJECT: SLUG TEST CALC'S. MW-M 103		CHECKED BY: JS	DATE 2-22-88

$$\ln R_e/r_w = \left[\frac{1.1}{\ln(L_w/r_w)} + \frac{A + B\ln[(H-L_w)/r_w]}{L_e/r_w}\right]^{-1}$$

$$\ln R_e/r_w = \left[\frac{1.1}{\ln(13.94/0.42)} + \frac{2.17 + (0.33)\ln[(29.44' - 13.94')/0.42]}{21.43'}\right]^{-1}$$

$$\ln R_e/r_w = \left[0.314 + 0.157\right]^{-1}$$

$$\ln R_e/r_w = 2.12$$

$$K = \frac{r_c^2 \ln(R_e/r_w)}{2L_e} \cdot \frac{1}{t} \ln Y_0/Y_t$$

$$K = \frac{(0.083)^2(2.12)}{2(9.0)} \cdot \frac{1}{0.25} \ln\left(\frac{3.35}{0.47}\right)$$

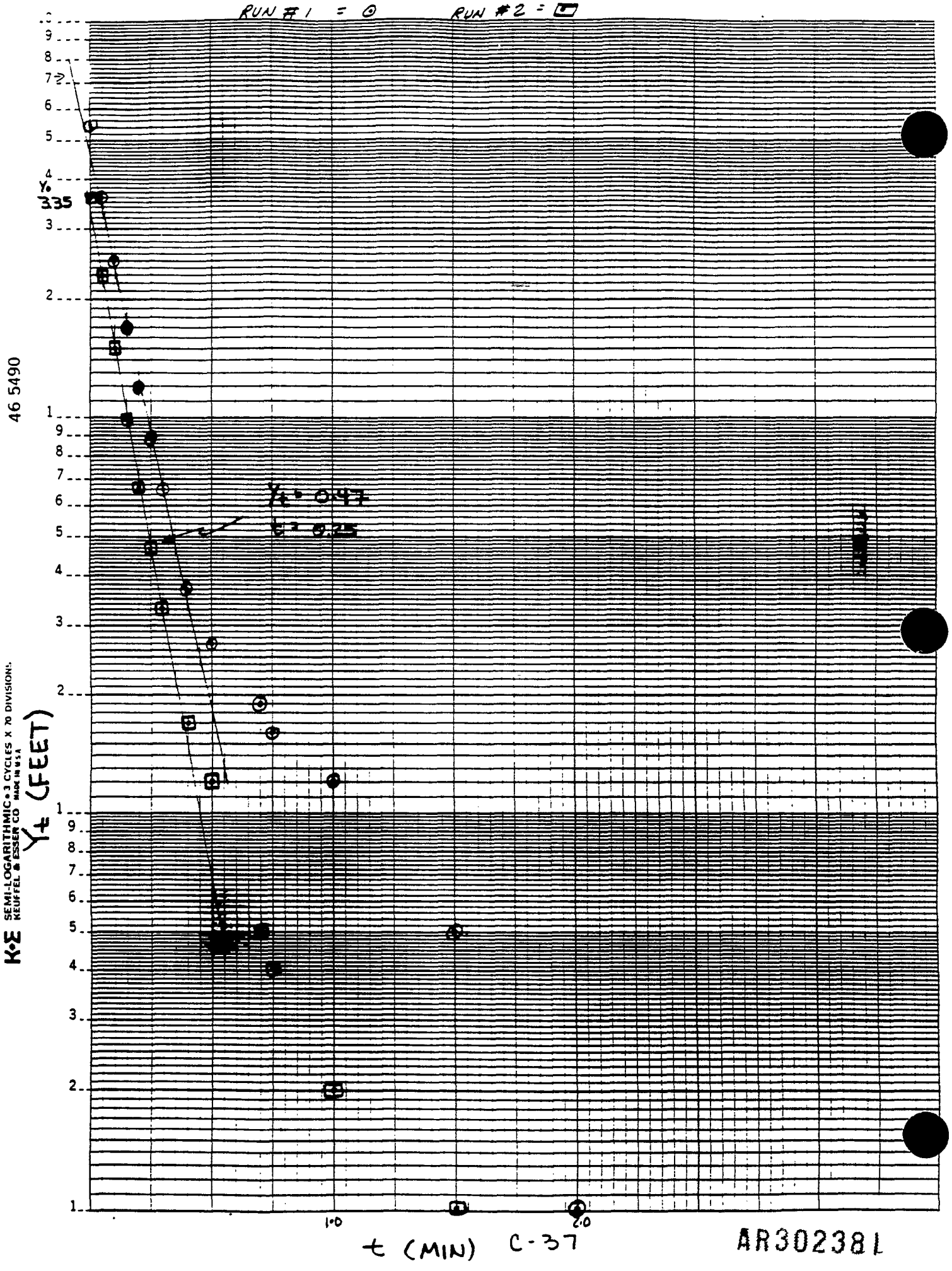
$$K = (8.11 \times 10^{-4})(4)(1.96)$$

$$K = 6.36 \times 10^{-3} \text{ ft/min.}$$

$$K = 3.23 \times 10^{-3} \text{ cm/sec.}$$

$$T = K \cdot D = (6.36 \times 10^{-3} \text{ ft/min.})(29.44) = [illegible] \text{ ft}^2/\text{min.}$$

$$= 2014 \text{ gpd/ft}$$



C-37

AR302381

NUS CORPORATION
A Halliburton Company

SITE NAME DRAKE CHEM
WELL MEASURED MW-M104
PUMPING WELL

COMPUTED ____ CHECKED ____
PROJECT NO ____
PAGE ____ OF ____

- DISTANCE FROM PUMPING WELL (ft) (r) ____ - PUMPING RATE (gpm) (Q) ____
- STATIC H_2O LEVEL (ft) (t_0) 11.27 top of riser - PUMP SETTING FEET BELOW MONITORING POINT ____
- TIME PUMPING START OR STOP (t_0) ____ - MONITORING POINT top of riser - flush mount
- ELEVATION OF MONITORING POINT (ft above MSL) ____

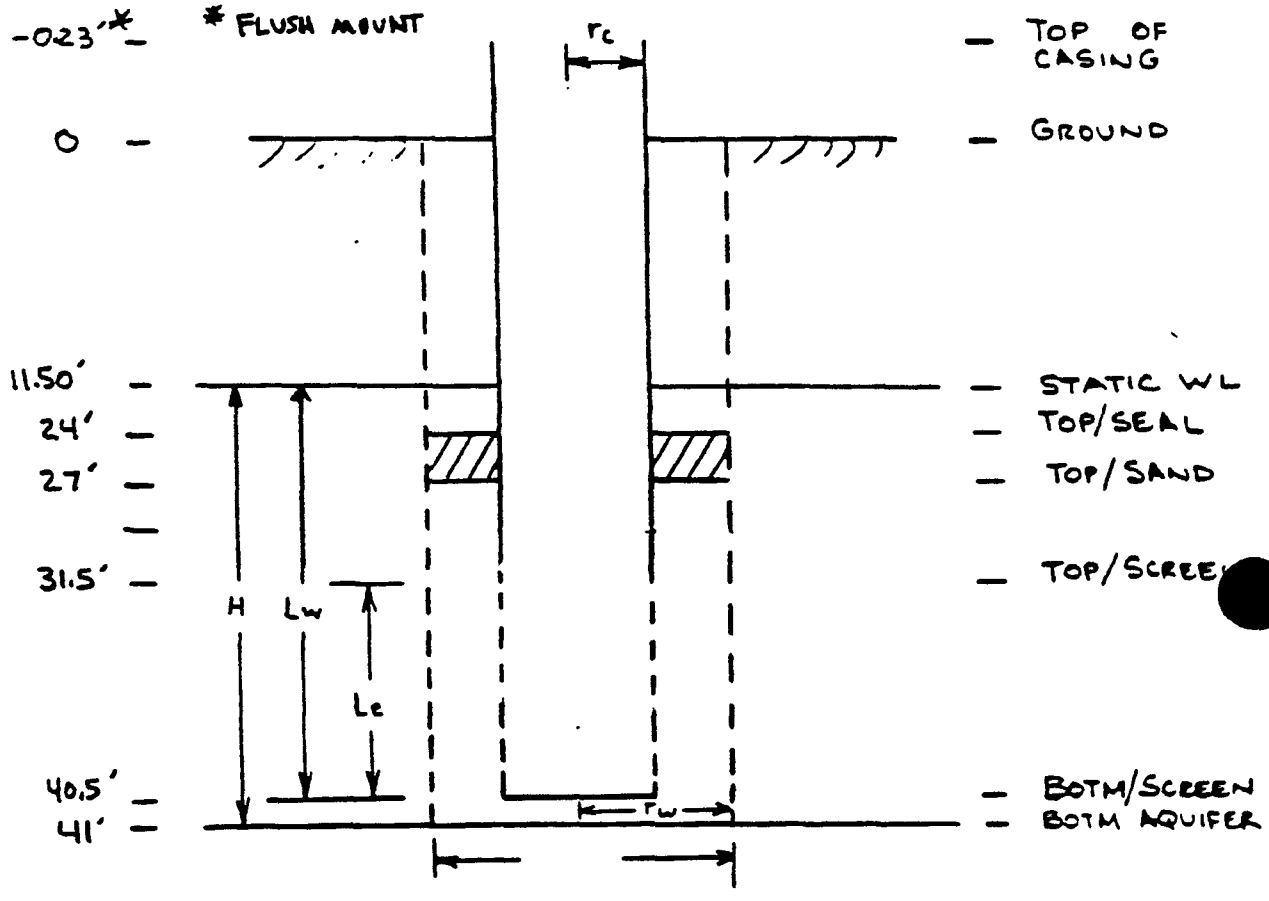
DATE	TIME 13:57	(t) MIN SINCE PUMP START OR STOP	WATER LEVEL MEASUREMENTS HELD	CUT	DTW Run #1	(s) DD or RECOV. (ft) Run #2	REMARKS
1-6-88	0.0				3.87'	4.07'	
	0.01				3.17'	3.43'	
	0.02				2.64'	2.83'	
	0.03				2.29'	2.39'	
	0.05				1.63'	1.73'	
	0.067				1.26'	1.31'	
	0.083				0.97'	1.01'	
	0.10				0.77'	0.80'	
	0.15				0.42'	0.43'	
	0.20				0.26'	0.26'	
	0.25				0.18'	0.18'	
	0.30				0.13'	0.13'	
	0.50				0.07'	0.06'	
	0.75				0.04'	0.03'	
	1.0				0.03'	0.02	
	1.25				0.02'	0.02	
	1.50				0.02'	0.01	

AR302382

CLIENT	FILE NO	BY	PAGE 1 OF
EPA · DRAKE CHEM	620Y	RDB	
SUBJECT SLUG TEST CALC MW-M104		CHECKED BY JS	DATE 2-17-88

CALCULATIONS: (BOUWER & RICE)

DEPTH (FT.) WELL CONSTRUCTION



$H = 41 - 11.50 = 29.5'$

$L_w = 40.5 - 11.50 = 29.0'$

$L_e = 40.5 - 31.5 = 9.0'$

$r_c = 0.083'$

$r_w = 0.42'$

$L_e/r_w = 9/0.42 = 21.43$

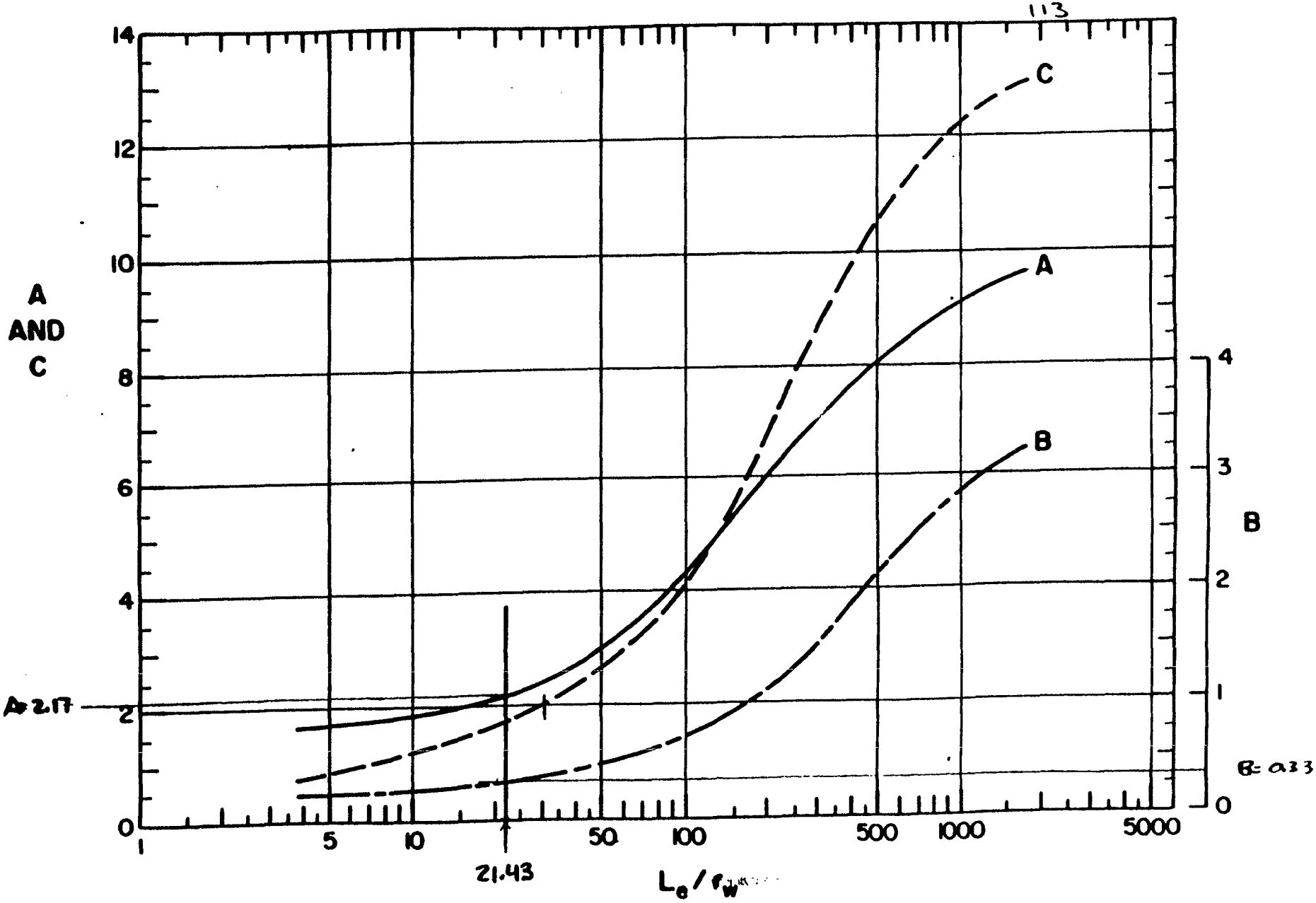
$A = 2.17$

$B = 0.33$

$C =$

102
103
104
112
113

117
122
124



C-40

AR302384

CLIENT	FILE NO	BY	PAGE 3 OF
EPA · DRAKE CHEM	620Y	ROB	
SUBJECT SLUG TEST CALC'S. MW-M104		CHECKED BY JS	DATE 2-22-88

$$\ln R_e/r_w = \left[\frac{1.1}{\ln(L_w/r_w)} + \frac{A + B\ln[(H-L_w)/r_w]}{L_e/r_w}\right]^{-1}$$

$$\ln R_e/r_w = \left[\frac{1.1}{\ln(29.0/0.42)} + \frac{2.17 + (0.33)\ln[(29.5-29.0)/0.42]}{21.43}\right]^{-1}$$

$$\ln R_e/r_w = \left[0.260 + 0.104\right]^{-1}$$

$$\ln R_e/r_w = 2.75$$

$$K = \frac{r_c^2 \ln(R_e/r_w)}{2L_e} \cdot \frac{1}{t} \ln Y_0/Y_t$$

$$K = \frac{(0.083)^2(2.75)}{2(9.0)} \cdot \frac{1}{0.10} \ln\left(\frac{4.0}{0.73}\right)$$

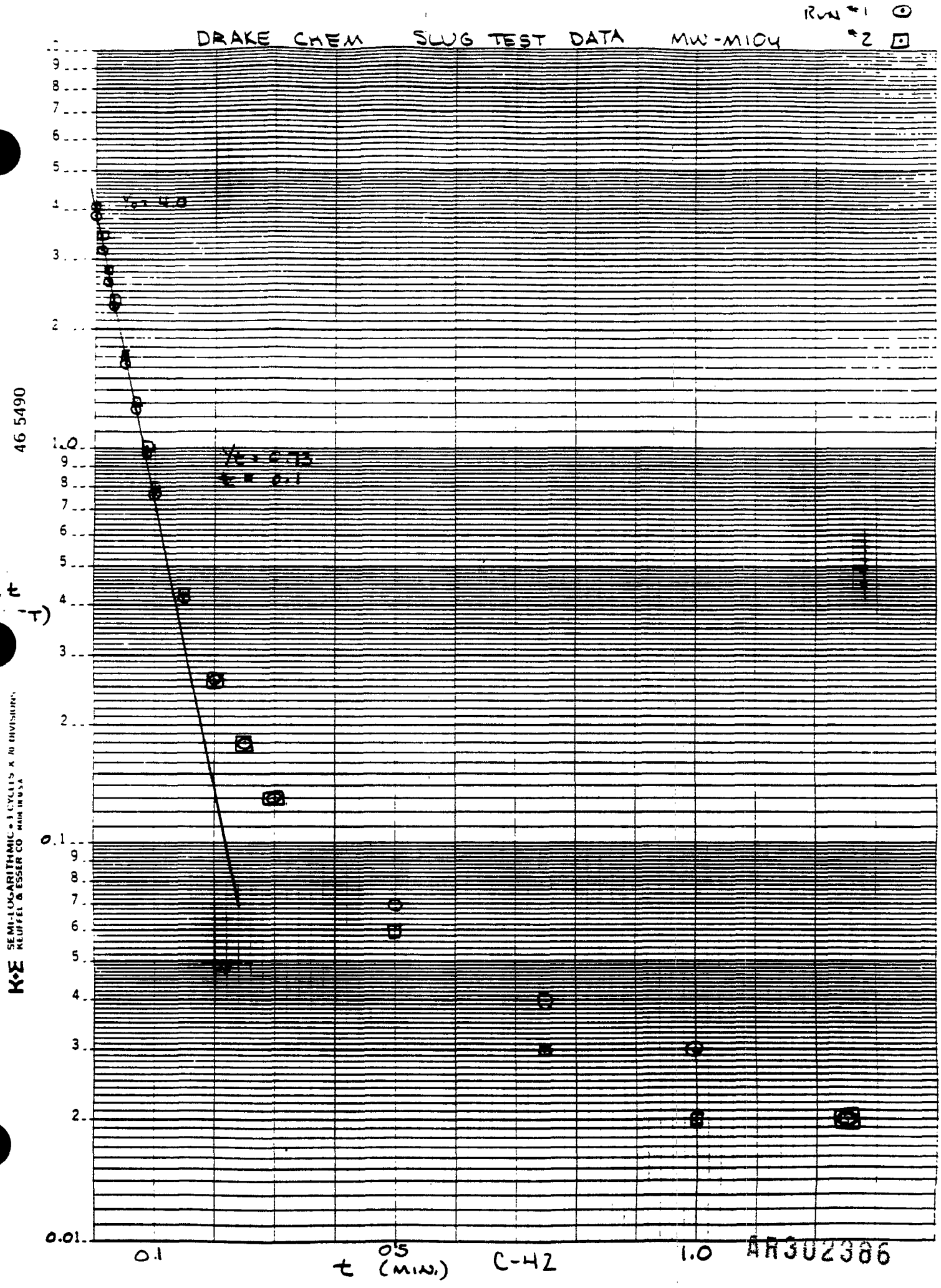
$$K = (1.05\times10^{-3})(10)(1.70)$$

$$K = 1.78\times10^{-2} \text{ ft/min.}$$

$$K = 9.04\times10^{-3} \text{ cm/sec}$$

$$T = K\cdot D = (1.78\times10^{-2} \text{ ft/min.})(29.5') = 0.525 \text{ ft}^2/\text{min.}$$

$$= 5655 \text{ gpd/ft.}$$


RUN #1
DRAKE CHEM SLUG TEST DATA MW-M104
#2
$V_0 = 4.8$
$Y_t = 0.73$
$t = 0.1$
$\frac{1}{t}$
$(-T)$
0.01
0.1
1.0
0.5
t (MIN.)
K+E SEMI-LOGARITHMIC 3 CYCLES X 10 DIVISIONS
KEUFFEL & ESSER CO. MADE IN U.S.A.
46 5490
C-42
AR302386

NUS CORPORATION
A Halliburton Company

SITE NAME DRAKE CHEM
WELL MEASURED MW-M105 Runs #1+2
PUMPING WELL

COMPUTED ____ CHECKED ____
PROJECT NO ____
PAGE ____ OF

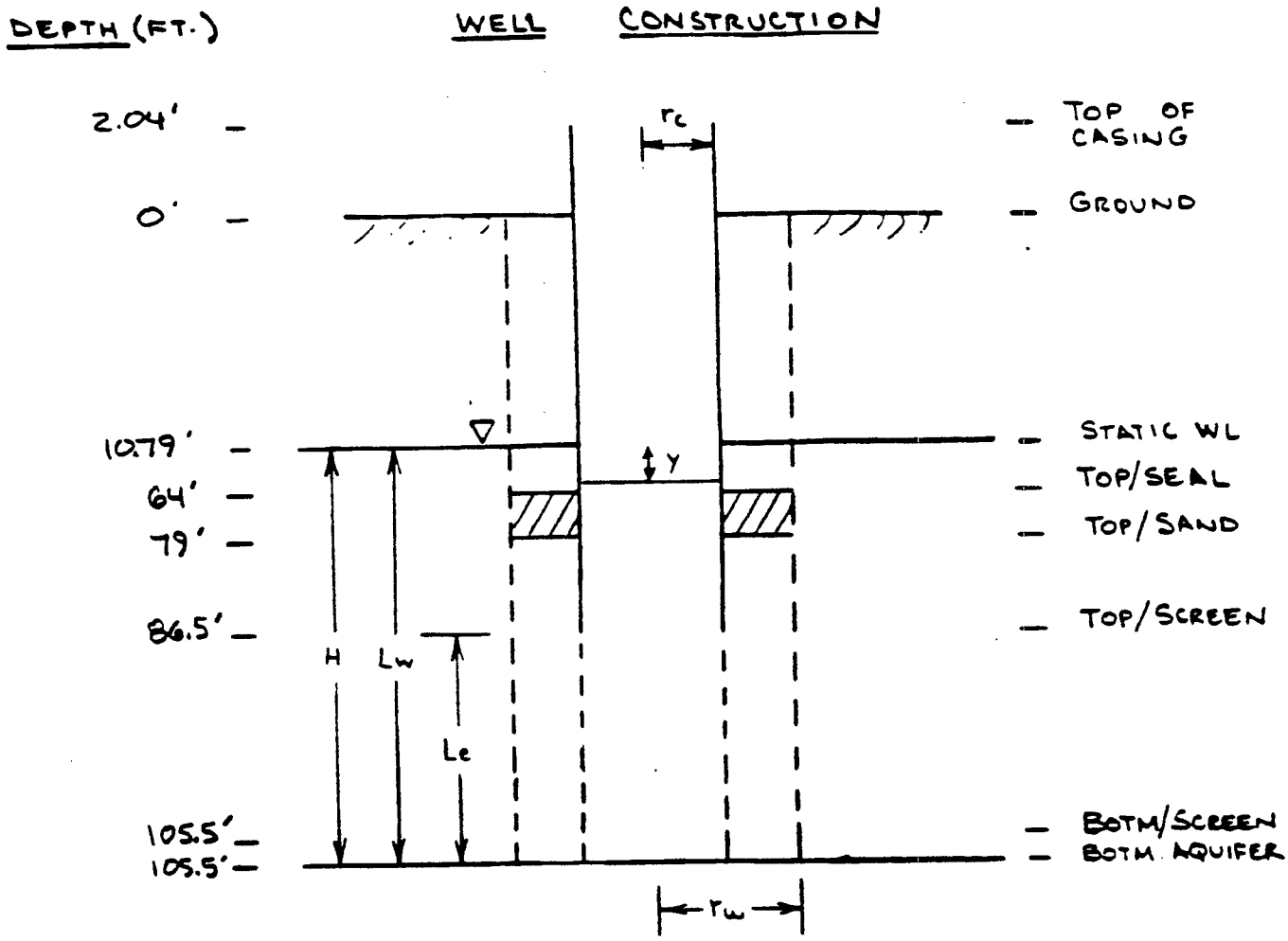
- DISTANCE FROM PUMPING WELL (ft) (r) ____ - PUMPING RATE (gpm) (Q) ____
- STATIC H_2O LEVEL (ft X t_0) 12.83' Top of Riser - PUMP SETTING FEET BELOW MONITORING POINT ____
- TIME PUMPING START OR STOP (t_0) ____ - MONITORING POINT ____
- ELEVATION OF MONITORING POINT (ft above MSL) ____

DATE	TIME 0842	(t) MIN SINCE PUMP START OR STOP	WATER LEVEL MEASUREMENTS HELD	CUT	DTW Run #1	(s) DD or RECOV. (ft) Run #2	REMARKS
1-7-88	0				-5.75	-6.16	
	0.01				-5.63	-5.93	
	0.02				-5.69	-5.87	
	0.03				-5.58	-5.79	
	0.05				-5.47	-5.65	
	0.10				-5.15	-5.33	
	0.15				-4.85	-5.02	
	0.20				-4.58	-4.74	
	0.25				-4.32	-4.48	
	0.30				-4.09	-4.23	
	0.417				-3.58	-3.72	
	0.50				-3.26	-3.38	
	0.667				-2.69	-2.80	
	0.75				-2.45	-2.55	
	1.0				-1.84	-1.93	
	1.25				-1.39	-1.46	
	1.50				-1.05	-1.11	
	1.75				-0.79	-0.85	
	2.0				-0.60	-0.65	
	2.5				-0.35	-0.39	
	3.0				-0.22	-0.25	
	3.5				-0.13	-0.16	
	4.0				-0.09	-0.11	
	4.5				-0.06	-0.09	
	5.0				-0.04	-0.07	
	5.5				-0.03	-0.06	
	6.0				-0.02	-0.05	
	6.5				-0.02	-0.04	
	7.0				-0.01	-0.04	
	7.5				-0.01	-0.03	
	8.0				-0.01	-0.03	
	8.5				-0.01	-0.02	
	9.0				-0.01	-0.02	
	9.5				-0.00	-0.02	

AR302387

NUS CORPORATION AND SUBSIDIARIES			STANDARD CALCULATION SHEET
CLIENT EPA - DRAKE CHEM	FILE NO 620Y	BY RDB	PAGE 1 OF
SUBJECT SLUG TEST CALC. MW-M105		CHECKED BY JS	DATE 2-17-88

CALCULATIONS: (BOUWER & RICE)



$H = 105.5' - 10.79' = 94.71'$

$L_w = 105.5' - 10.79' = 94.71'$

$L_e = 105.5 - 86.5' = 19'$

$r_c = 0.083'$

$r_w = 0.162'$

$L_e/r_w = 19/0.162 = 117.3$

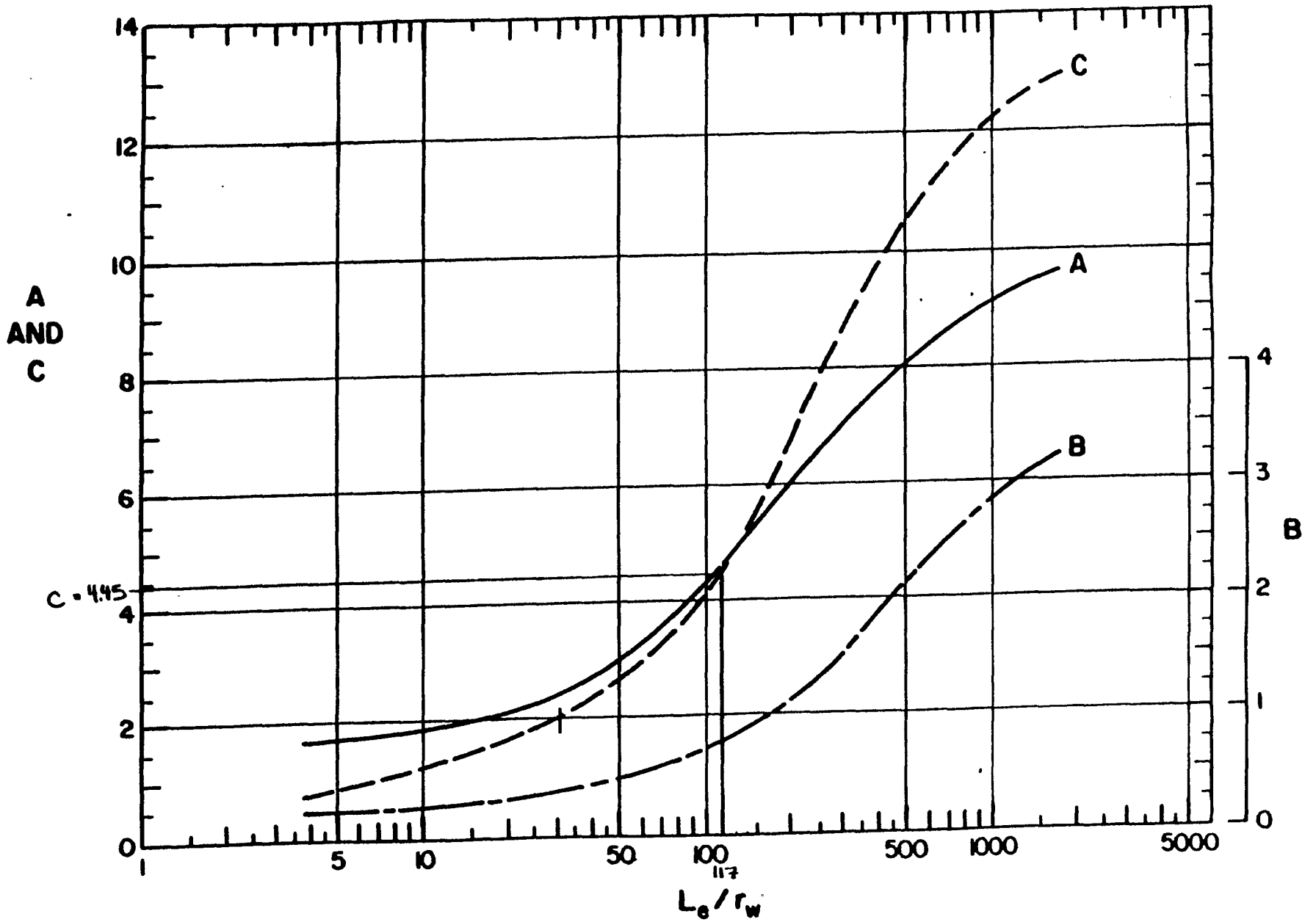
A =

B =

C = 4.45

NUS 155A REVISED 0285

-N
107
114
120



C-45

AR302389

D = H THEREFORE:

$$\ln R_e/r_w = \left[\frac{1.1}{\ln (L_w/r_w)} + \frac{C}{L_e/r_w}\right]^{-1}$$

$$\ln R_e/r_w = \left[\frac{1.1}{\ln(94.71/0.162)} + \frac{4.45}{(19/0.162)}\right]^{-1}$$

$$\ln R_e/r_w = \left[0.173 + 0.038\right]^{-1}$$

$$\ln R_e/r_w = 4.74$$

$$K = \frac{r_c^2 \ln (R_e/r_w)}{2L_e} \frac{1}{t} \ln Y_0/Y_t$$

$$K = \frac{(0.083)^2 \cdot (4.74)}{2(19)} \left(\frac{1}{1.5}\right) \cdot \ln\left(\frac{5.7}{1.05}\right)$$

$$K = (8.59 \times 10^{-4})(0.667)(1.69)$$

$$K = 9.68 \times 10^{-4} \text{ ft/min}$$

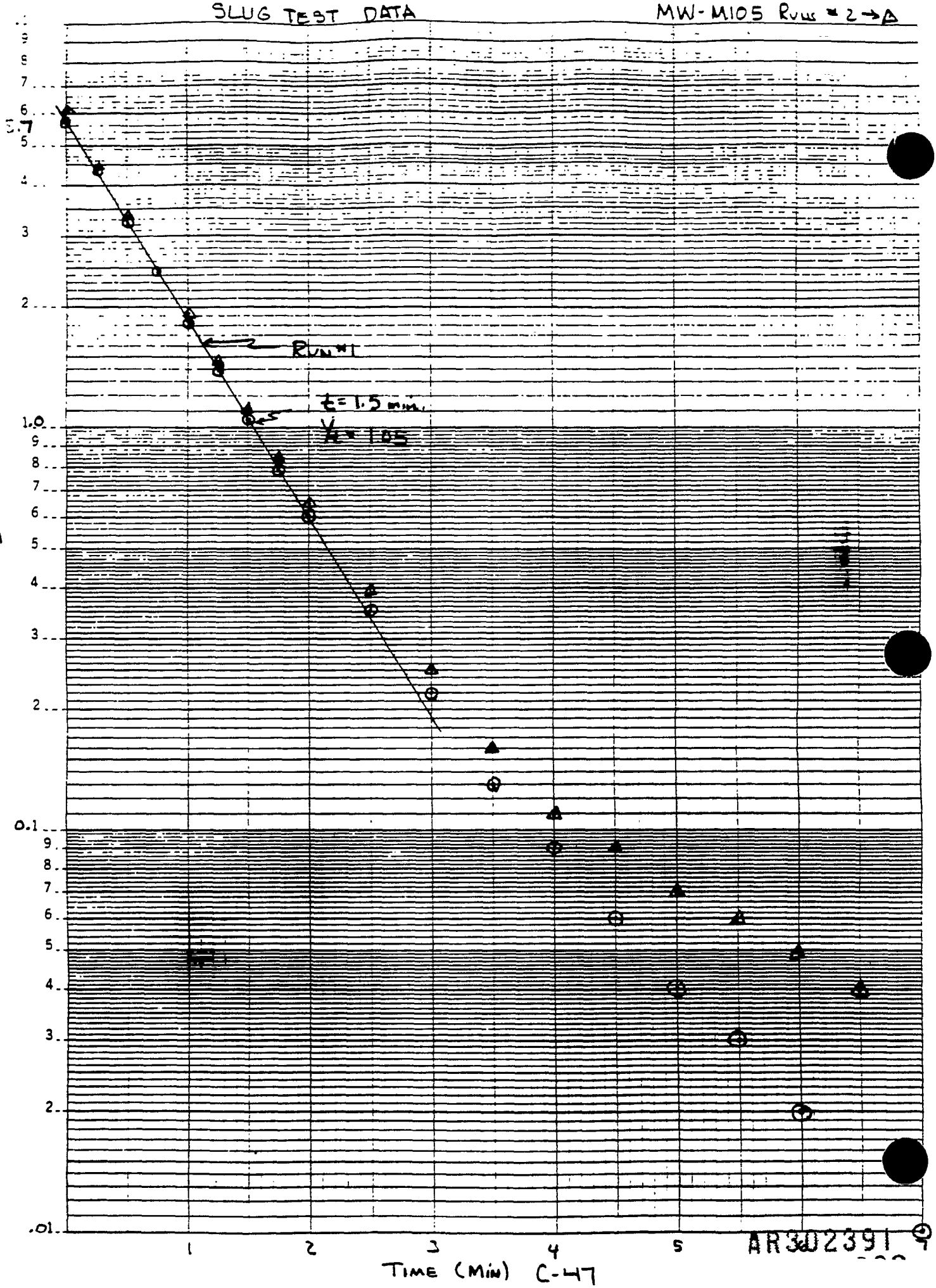
$$K = 4.92 \times 10^{-4} \text{ cm/sec}$$

$$T = K \cdot D = (9.68 \times 10^{-4} \text{ ft/min})(105.5 - 40.5) = 6.29 \times 10^{-2} \text{ ft}^2/\text{min}.$$

678 gpd/ft

SLUG TEST DATA

MW-M105 Run # 2 → Δ



AR302391

C-47

NUS CORPORATION
A Halliburton Company

SITE NAME DRAKE CHEM
WELL MEASURED MW-M106 Runs #1+2
PUMPING WELL

COMPUTED ____ CHECKED ____
PROJECT NO ____
PAGE ____ OF ____

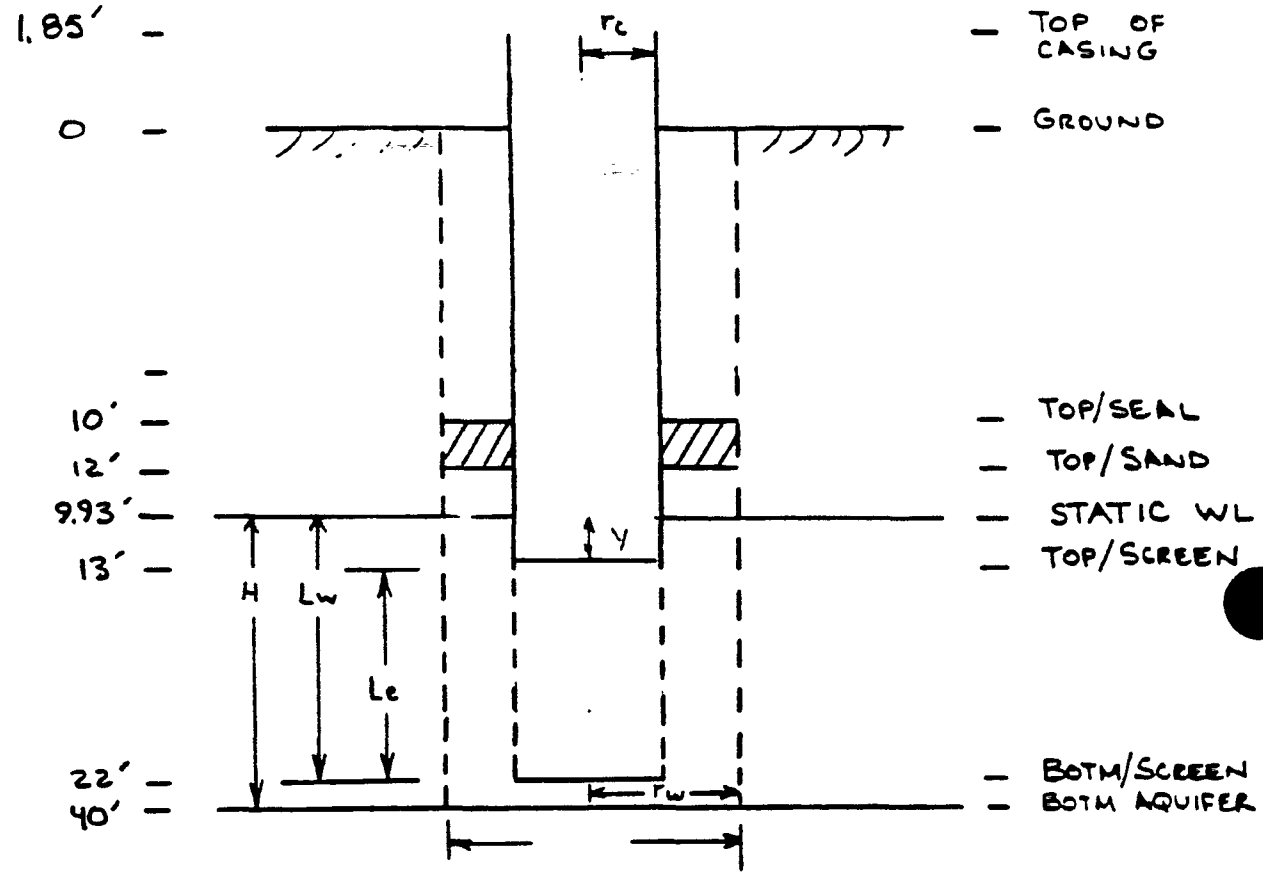
- DISTANCE FROM PUMPING WELL (ft) (r) ____
- PUMPING RATE (gpm) (Q) ____
- STATIC H_2O LEVEL (ft) (s_o) 11.78' Top of riser
- PUMP SETTING FEET BELOW MONITORING POINT ____
- TIME PUMPING START OR STOP (t_o) ____
- MONITORING POINT ____
- ELEVATION OF MONITORING POINT (ft above MSL) ____

DATE	TIME	(t) MIN SINCE PUMP START OR STOP	WATER LEVEL MEASUREMENTS			(s) DD or RECOV. (ft)	REMARKS
			HELD	CUT	DTW		
	0930				Run #1	Run #2	
1-7-88		0			-5.01	-4.31	
		0.01			-4.62	-4.04	
		0.02			-4.28	-3.75	
		0.03			-4.00	-3.51	
		0.05			-3.51	-3.10	
		0.067			-3.15	-2.81	
		0.083			-2.86	-2.57	
		0.10			-2.61	-2.36	
		0.133			-2.20	-2.01	
		0.15			-2.02	-1.86	
		0.20			-1.60	-1.51	
		0.25			-1.30	-1.24	
		0.30			-1.08	-1.04	
		0.417			-0.74	-0.74	
		0.50			-0.59	-0.61	
		0.75			-0.34	-0.38	
		1.00			-0.24	-0.26	
		1.25			-0.17	-0.20	
		1.50			-0.12	-0.15	
		1.75			-0.09	-0.12	
		2.0			-0.07	-0.10	
		2.5			-0.04	-0.08	
		3.0			-0.03	-0.06	
		3.5			-0.01	-0.04	
		4.0			-0.01	-0.03	
		4.5				-0.03	
		5.0				-0.02	
		5.5				-0.01	
		6.0				-0.01	
		6.5					
		7.0					
		7.5					

CLIENT EPA DRAKE CHEM	FILE NO 620Y	BY RDB	PAGE 1 OF
SUBJECT SLUG TEST CALC. MW-M106		CHECKED BY JS	DATE 2-18-88

CALCULATIONS: (BOUWER & RICE)

DEPTH (FT.) WELL CONSTRUCTION



$H = 40 - 9.93' = 30.07'$

$L_w = 22' - 9.93 = 12.07'$

$L_e = 22' - 13' = 9.0'$

$r_c = 0.083'$

$r_w = 0.25'$

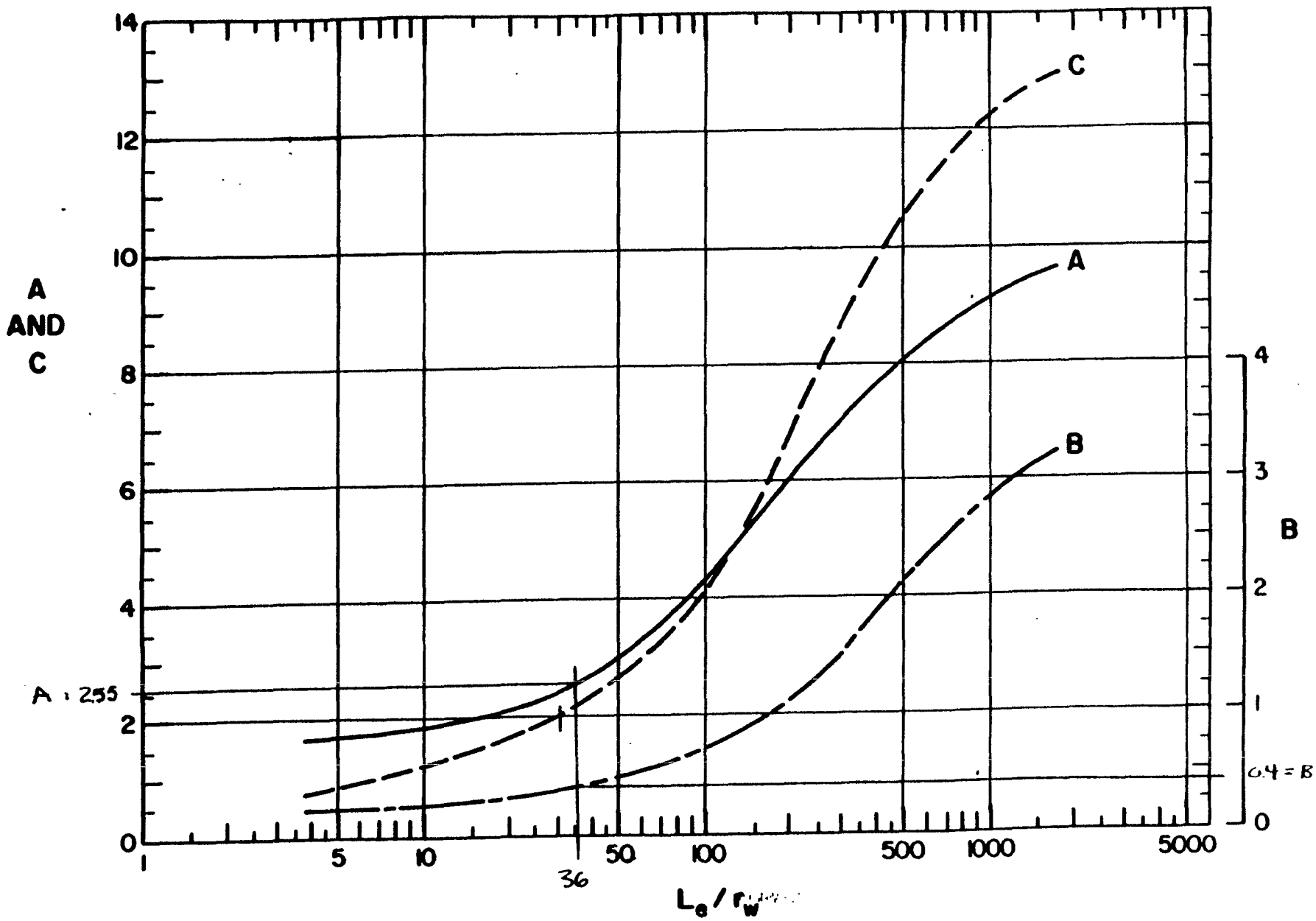
$L_e/r_w = 36$

$A = 2.55$

$B = 0.4$

$C =$

MV .106
125



C-50

AR302394

CLIENT: EPA · DRAKE CHEM	FILE NO. 620Y	BY. RDB	PAGE 3 OF
SUBJECT: SLUG TEST CALC'S. MW-M 106		CHECKED BY. JS	DATE 2-22-88

$$\ln R_e/r_w = \left[\frac{1.1}{\ln(L_w/r_w)} + \frac{A + B\ln[(H-L_w)/r_w]}{L_e/r_w}\right]^{-1}$$

$$\ln R_e/r_w = \left[\frac{1.1}{\ln(12.07/0.25)} + \frac{2.55 + (0.4)\ln[(30.07-12.07)/0.25]}{36}\right]^{-1}$$

$$\ln R_e/r_w = \left[0.284 + 0.118\right]^{-1}$$

$$\ln R_e/r_w = 2.49$$

$$K = \frac{r_c^2 \ln(R_e/r_w)}{2L_e} \cdot \frac{1}{t} \ln Y_0/Y_t$$

$$K = \frac{(0.083)^2(2.49)}{2(9.0)} \cdot \frac{1}{0.25} \ln\left(\frac{4.05}{1.3}\right)$$

$$K = (9.53\times10^{-4})(4.0)(1.14)$$

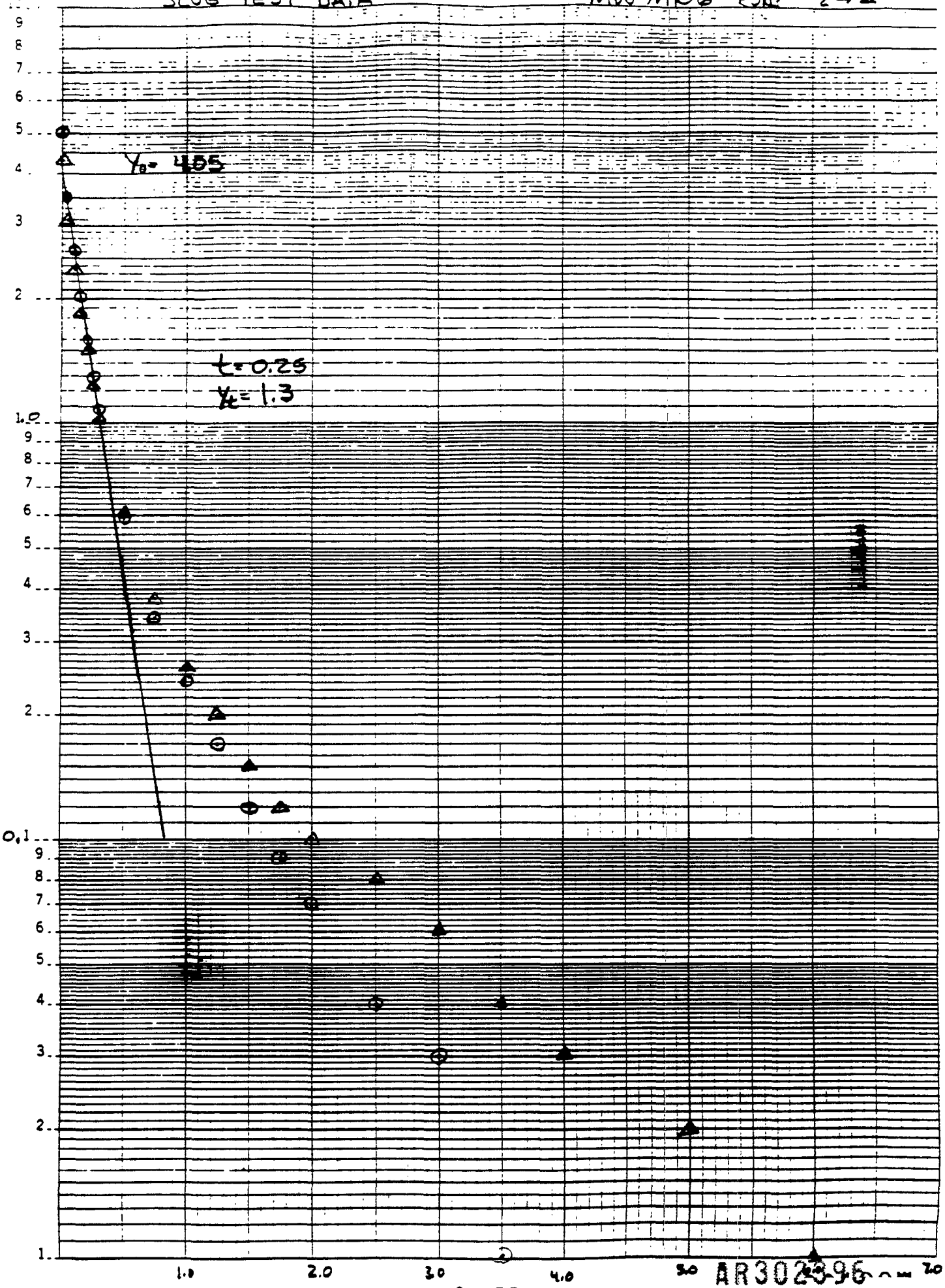
$$K = 4.35\times10^{-3}\ \text{ft/min.}$$

$$K = 2.21\times10^{-3}\ \text{cm/sec.}$$

$$T = K\cdot D = (4.35\times10^{-3}\ \text{ft/min})(30.07) = 0.131\ \text{ft}^2/\text{min.}$$

$$= 1411\ \text{gpd/ft.}$$

SLUG TEST DATA MW-M06 Run #2 → △



46 5490

K+E SEMI-LOGARITHMIC • 3 CYCLES X 70 DIVISIONS KEUFFEL & ESSER CO. MADE IN U.S.A.

AR302396

C-52

NUS CORPORATION
A Halliburton Company

SITE NAME DRAKE CHEM
WELL MEASURED MW-M107 Runs #1+2
PUMPING WELL

COMPUTED ____ CHECKED ____
PROJECT NO ____
PAGE ____ OF ____

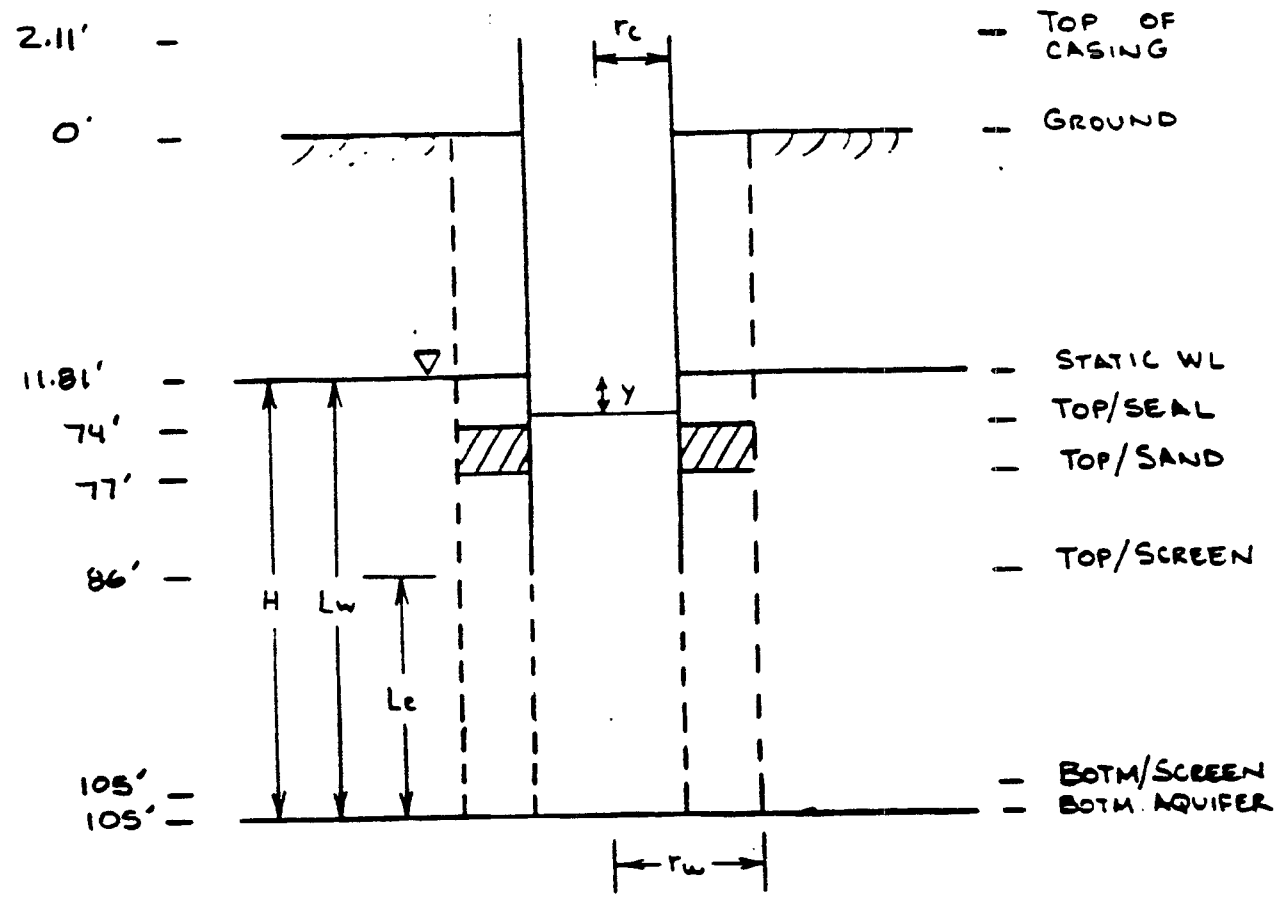
- DISTANCE FROM PUMPING WELL (ft) (r) ____
- PUMPING RATE (gpm) (Q) ____
- STATIC H_2O LEVEL (ft) (t_0) 13.92' Top of Riser
- PUMP SETTING FEET BELOW MONITORING POINT ____
- TIME PUMPING START OR STOP (t_0) ____
- MONITORING POINT ____
- ELEVATION OF MONITORING POINT (ft above MSL) ____

DATE	TIME 1707	(t) MIN SINCE PUMP START OR STOP	WATER LEVEL MEASUREMENTS HELD	CUT	DTW Run #1	(s) DD or RECOV. (ft) Run #2	REMARKS
1-6-88	0				-9.53	-9.59	
	0.05				-9.18	-9.32	
	0.10				-8.93	-9.03	
	0.15				-8.67	-8.76	
	0.20				-8.45	-8.51	
	0.25				-8.23	-8.28	
	0.30				-8.03	-8.07	
	0.417				-7.57	-7.60	
	0.50				-7.27	-7.29	
	0.75				-6.43	-6.43	
	1.00				-5.68	-5.67	
	1.25				-5.01	-5.00	
	1.50				-4.41	-4.39	
	1.75				-3.89	-3.86	
	2.0				-3.42	-3.39	
	2.5				-2.63	-2.60	
	3.0				-2.02	-1.99	
	3.5				-1.55	-1.53	
	4.0				-1.18	-1.16	
	4.5				-0.89	-0.89	
	5.0				-0.68	-0.68	
	5.5				-0.52	-0.52	
	6.0					-0.40	
	6.5					-0.31	
	7.0					-0.24	
	7.5					-0.18	
	8.0					-0.14	
	8.5					-0.10	
	9.0					-0.08	
	9.5					-0.06	
	10.0					-0.05	

NUS CORPORATION AND SUBSIDIARIES			STANDARD CALCULATION SHEET
CLIENT EPA - DRAKE CHEM	FILE NO 620Y	BY RDB	PAGE 1 OF
SUBJECT SLUG TEST CALC. MW-M 107		CHECKED BY JS	DATE 2-18-88

CALCULATIONS: (BOUWER & RICE)

DEPTH (FT.) WELL CONSTRUCTION



$H = 105' - 11.81' = 93.19'$

$L_w = 105' - 11.81' = 93.19'$

$L_e = 105' - 86' = 19$

$r_c = 0.083'$

$r_w = 0.162$

$L_e/r_w = 19/0.162 = 117.3$

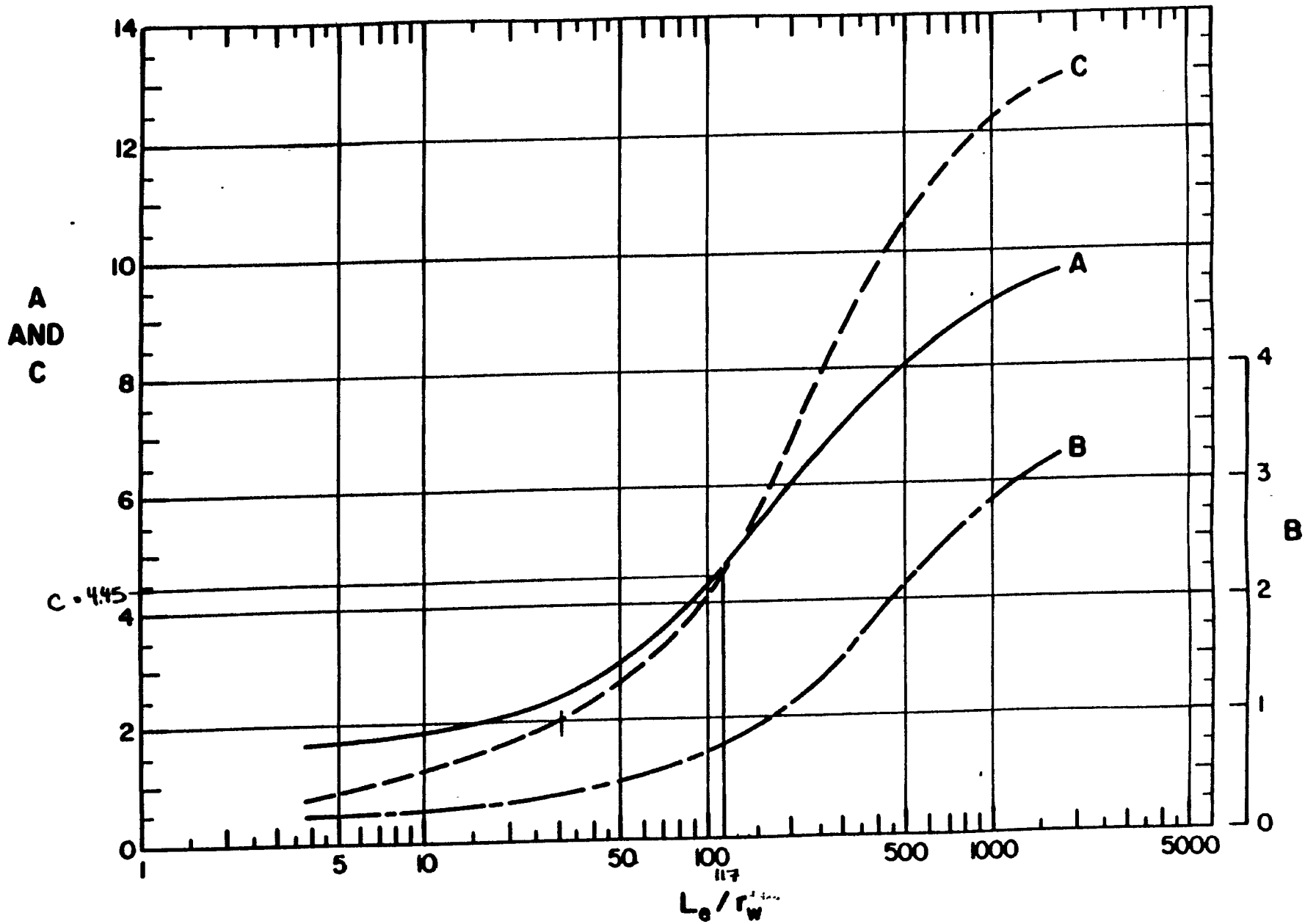
$A =$

$B =$

$C = 4.45$

NUS 1554 REVISED 0285

107
114
120



AR302399

D = H THEREFORE:

$$\ln R_e/r_w = \left[\frac{1.1}{\ln (L_w/r_w)} + \frac{C}{L_e/r_w}\right]^{-1}$$

$$\ln R_e/r_w = \left[\frac{1.1}{\ln(93.19/0.162)} + \frac{4.45}{(19/0.162)}\right]^{-1}$$

$$\ln R_e/r_w = \left[0.173 + 0.038\right]^{-1}$$

$$\ln R_e/r_w = 4.74$$

$$K = \frac{r_c^2 \ln (R_e/r_w)}{2L_e} \frac{1}{t} \ln Y_0/Y_t$$

$$K = \frac{(0.083)^2 \cdot (4.74)}{2(19)} \frac{1}{(6.0)} \cdot \ln\left(\frac{9.55}{0.4}\right)$$

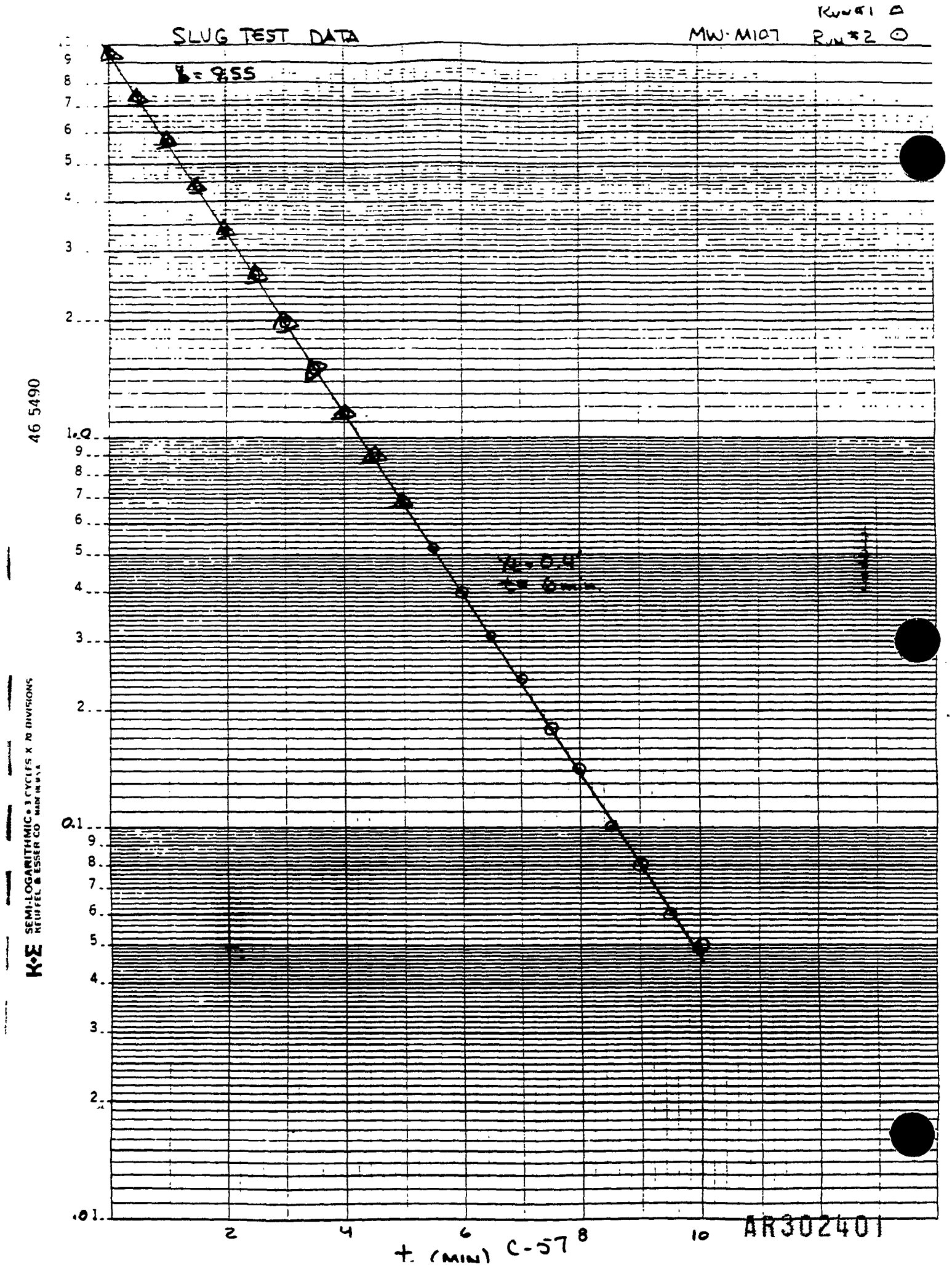
$$K = (8.59 \times 10^{-4})(0.167)(3.17)$$

$$K = 4.55 \times 10^{-4} \text{ ft/min.}$$

$$K = 2.31 \times 10^{-4} \text{ cm/sec.}$$

$$T = K \cdot D = (4.55 \times 10^{-4} \text{ ft/min})(105-41) = 2.91 \times 10^{-2} \text{ ft}^2/\text{min}$$

$$= 313 \text{ gpd/ft}$$


SLUG TEST DATA
MW-M107
Run #1 △
Run #2 ○
b = 8.55
Y = 0.4'
t = 6 min.
t (MIN)
46 5490
K+E SEMI-LOGARITHMIC 3 CYCLES X 70 DIVISIONS
KEUFFEL & ESSER CO. MADE IN U.S.A.
AR302401
C-57

NUS CORPORATION
A Halliburton Company

SITE NAME DRAKE CHEMICAL
WELL MEASURED MW-M108
PUMPING WELL

COMPUTED ____ CHECKED ____
PROJECT NO 6204
PAGE 1 OF 1

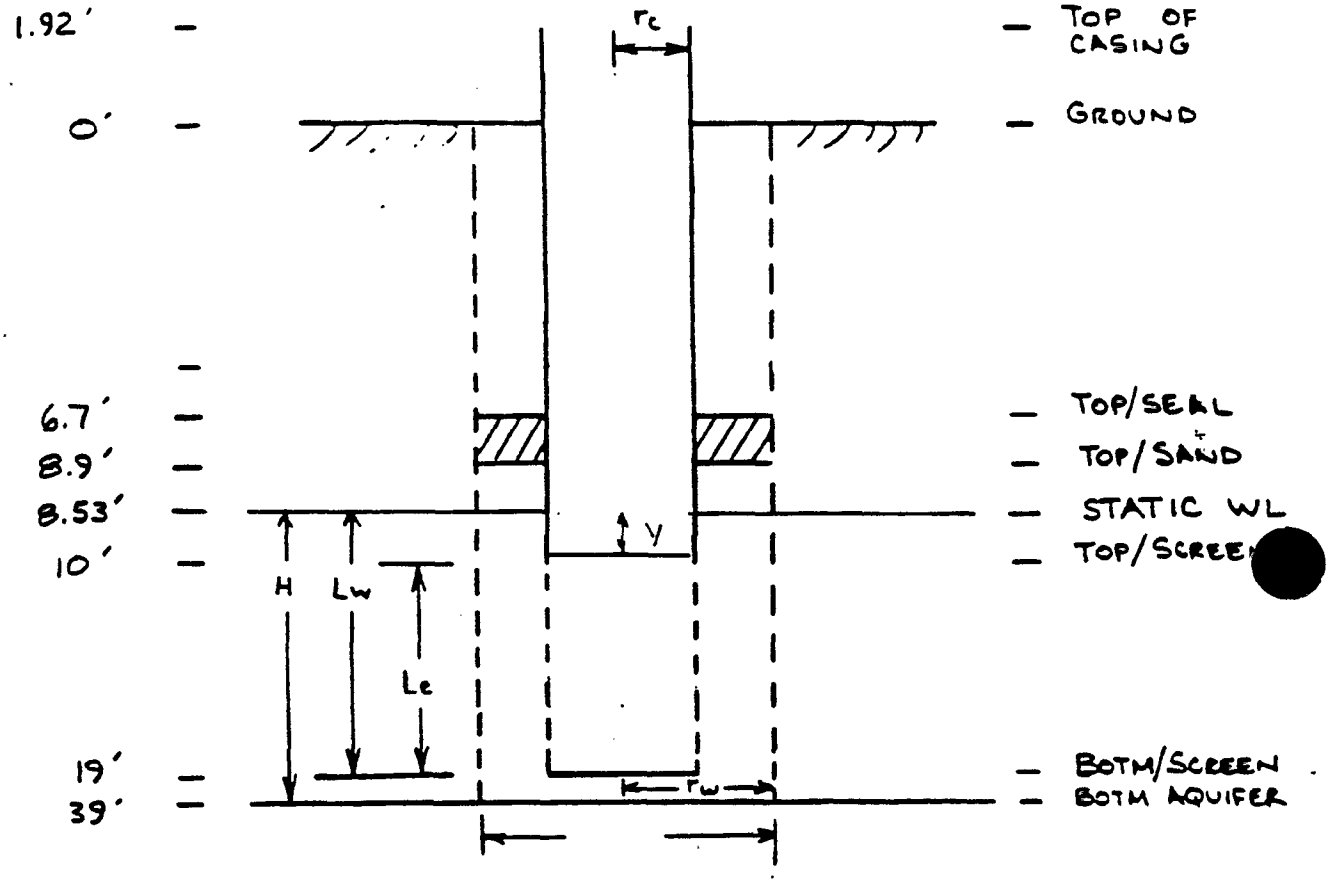
- DISTANCE FROM PUMPING WELL (ft) (r) ____
- PUMPING RATE (gpm) (Q) ____
- STATIC H_2O LEVEL (ft) (s_o) ____
- PUMP SETTING FEET BELOW MONITORING POINT ____
- TIME PUMPING START OR STOP (t_o) ____
- MONITORING POINT ____
- ELEVATION OF MONITORING POINT (ft above MSL) ____

DATE	TIME	(t) MIN SINCE PUMP START OR STOP	WATER LEVEL MEASUREMENTS			(s) DD or RECOV. (ft)	REMARKS
			HELD	CUT	DTW	RUN #1	RUN #2
1-8-88	0854	0.0000				1.98	2.51
		0.1000				1.07	1.15
		0.2000				.89	.94
		0.3000				.78	.82
		0.5000				.62	.66
		0.5833				.58	.62
		0.6667				.54	.57
		0.8333				.46	.51
		0.9167				.44	.48
		1.000				.41	.45
		1.5000				.28	.35
		2.0000				.21	.26
		3.0000				.11	.16
		4.0000				.08	.11
		5.0000				.04	.07
		6.0000				.02	.05

CLIENT EPA DRAKE CHEM	FILE NO 620Y	BY RDB	PAGE 1 OF
SUBJECT SLUG TEST CALC. MW-M 108		CHECKED BY	DATE

CALCULATIONS: (BOUWER & RICE)

DEPTH (FT.) WELL CONSTRUCTION



$H = 39' - 8.53' = 30.47'$

$L_w = 19' - 8.53' = 10.47'$

$L_e = 19 - 10' = 9.0'$

$r_c = 0.083'$

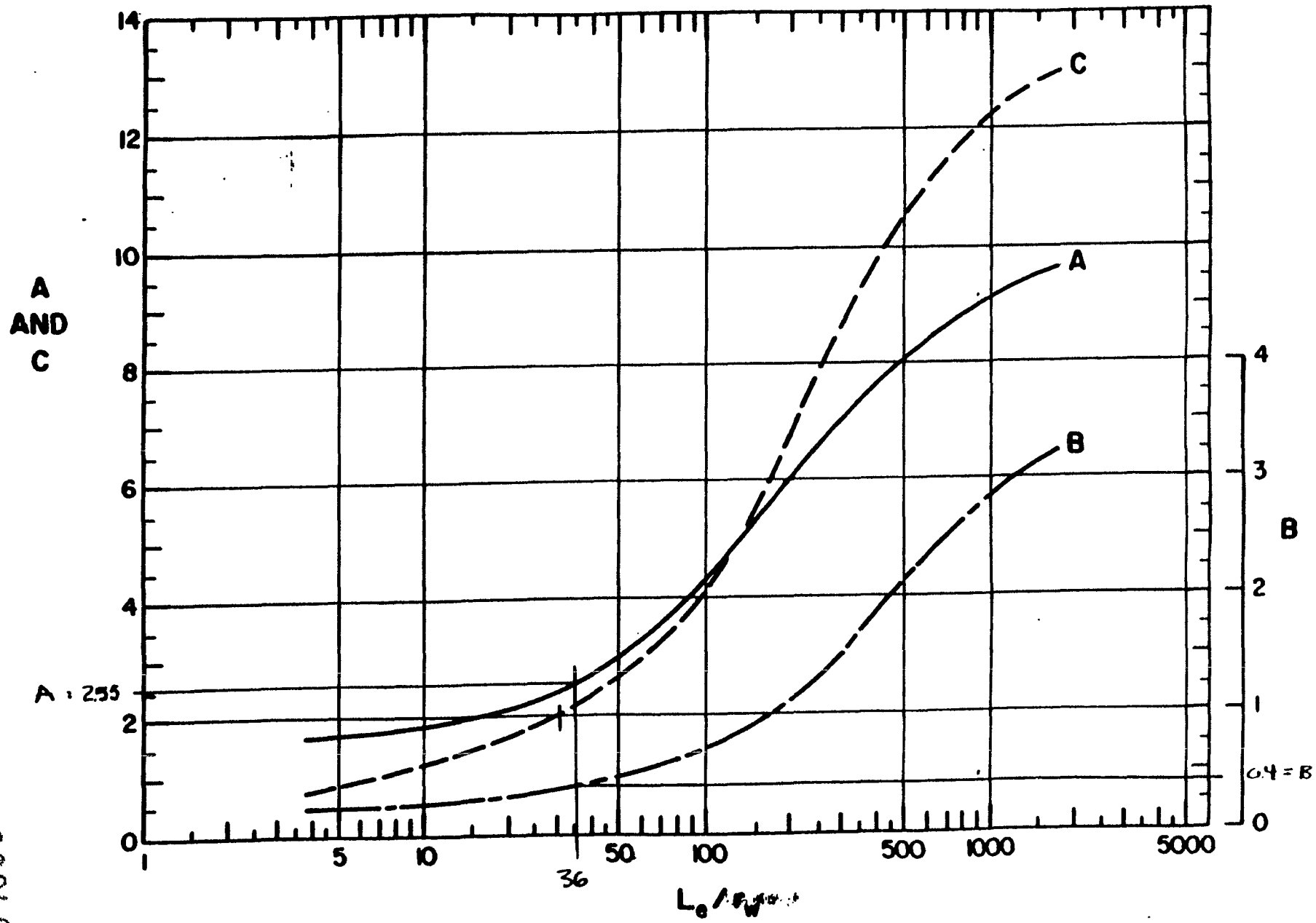
$r_w = 0.25'$

$L_e/r_w = 9.0'/0.25' = 36'$

$A = 2.55$

$B = 0.40$

$C =$



AR302404

$$\ln R_e/r_w = \left[\frac{1.1}{\ln(L_w/r_w)} + \frac{A + B\ln[(H-L_w)/r_w]}{L_e/r_w}\right]^{-1}$$

$$\ln R_e/r_w = \left[\frac{1.1}{\ln(10.47/0.25)} + \frac{2.55 + (0.40)\ln[(30.47-10.47)/0.25]}{36}\right]^{-1}$$

$$\ln R_e/r_w = \left[0.294 + 0.120\right]^{-1}$$

$$\ln R_e/r_w = 2.42$$

$$K = \frac{r_c^2 \ln(R_e/r_w)}{2L_e} \cdot \frac{1}{t} \ln Y_0/Y_t$$

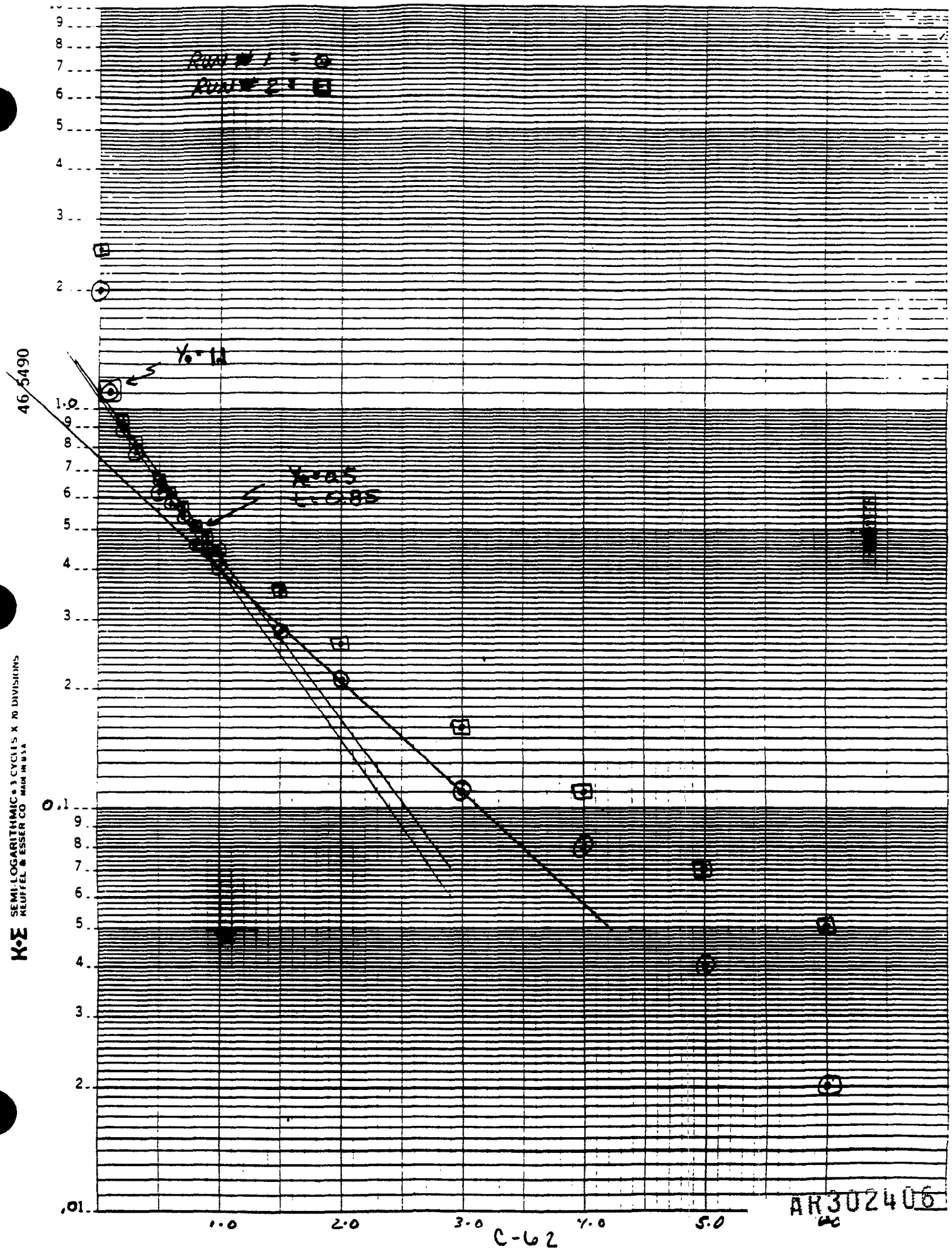
$$K = \frac{(0.083)^2(2.42)}{2(9.0)} \cdot \frac{1}{0.85} \ln\left(\frac{1.1}{0.5}\right)$$

$$K = (9.26 \times 10^{-4})(1.18)(0.788)$$

$$K = 8.61 \times 10^{-4} \text{ ft/min.}$$

$$K = 4.37 \times 10^{-4} \text{ cm/sec.}$$

$$T = K \cdot D = (8.61 \times 10^{-4} \text{ ft/min})(30.47) = 2.62 \times 10^{-2} \text{ ft}^2/\text{min.}$$
$$= 282 \text{ gpd/ft.}$$


Run #1 = ⊗
Run #2 = ⊡
Y₀ = 1.2
Y₀ = 0.5
t = 0.85
46 5490
K+E SEMI-LOGARITHMIC 3 CYCLES X 70 DIVISIONS
KEUFFEL & ESSER CO. MADE IN U.S.A.
1.0
0.1
.01
1.0
2.0
3.0
4.0
5.0

AR302406

NUS CORPORATION
A Halliburton Company

SITE NAME DRAKE CHEMICAL
WELL MEASURED MW-M109
PUMPING WELL

COMPUTED ___ CHECKED ___
PROJECT NO 620Y
PAGE 1 OF 1

- DISTANCE FROM PUMPING WELL (ft) (r) ___ - PUMPING RATE (gpm) (Q) ___
- STATIC H_2O LEVEL (ft) (t_0) ___ - PUMP SETTING FEET BELOW MONITORING POINT ___
- TIME PUMPING START OR STOP (t_0) ___ - MONITORING POINT ___
- ELEVATION OF MONITORING POINT (ft above MSL) ___

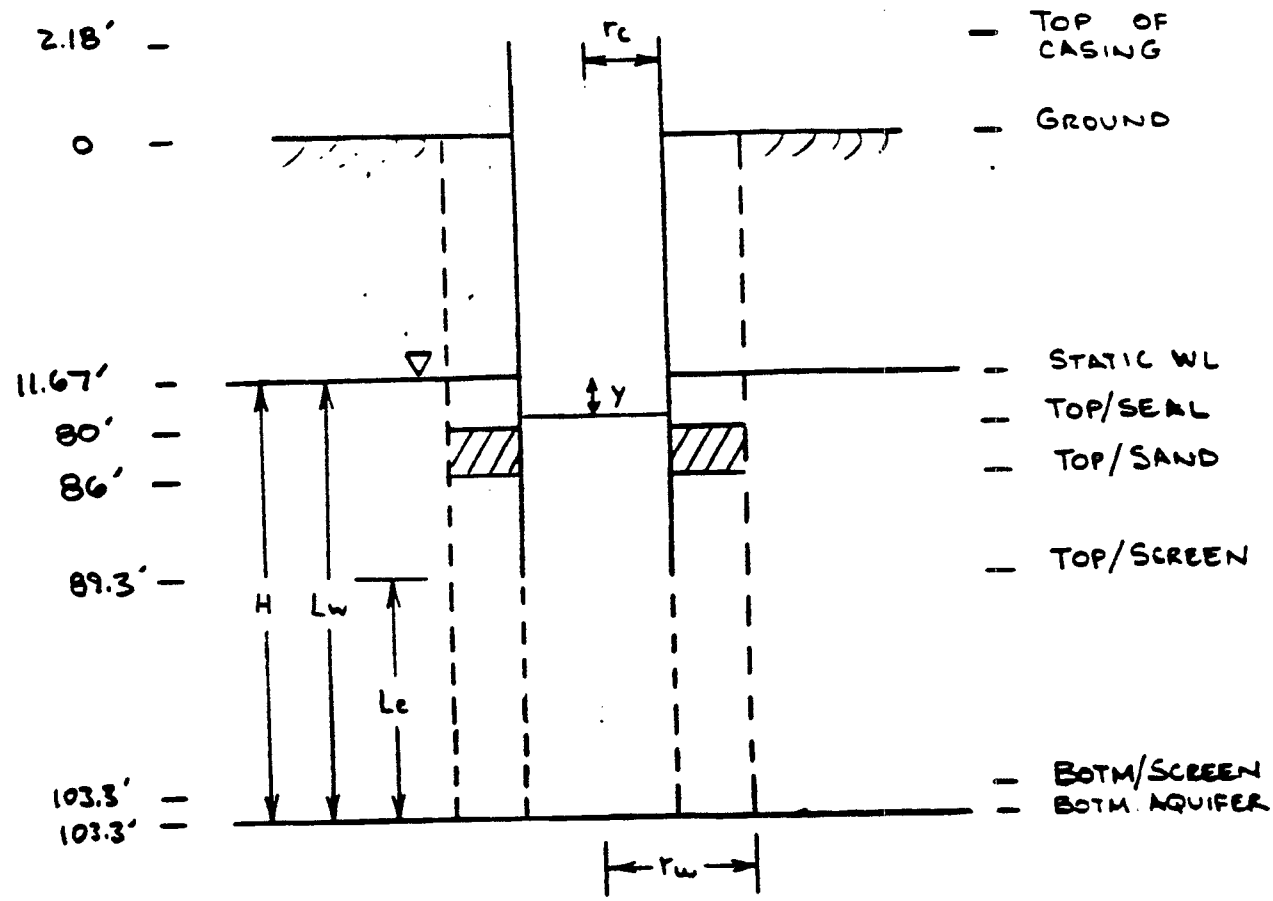
DATE	TIME	(t) MIN SINCE PUMP START OR STOP	WATER LEVEL MEASUREMENTS			(s) DD or RECOV. (ft)	REMARKS
			HELD	CUT	DTW	RUN #1	RUN #2
1-6-88	1622	0.0000				7.58	5.93
		0.0099				7.13	5.82
		0.0200				6.86	5.24
		0.0300				6.35	4.99
		0.0500				5.67	4.31
		0.0666				5.17	3.87
		0.0833				4.71	3.47
		0.1000				4.29	3.12
		0.1500				3.22	2.23
		0.2000				2.38	1.56
		0.2500				1.73	1.07
		0.3000				1.24	.72
		0.5000				.30	.14
		0.7500				.05	.02
		1.0000					

NUS CORPORATION AND SUBSIDIARIES — STANDARD CALCULATION SHEET

CLIENT	FILE NO	BY	PAGE 1 OF
EPA - DRAKE CHEM	620Y	RDB	
SUBJECT SLUG TEST CALC. MW-M109		CHECKED BY JS	DATE 2-18-88

CALCULATIONS: (BOUWER & RICE)

DEPTH (FT.) WELL CONSTRUCTION



$H = 103.3' - 11.67' = 91.63'$

$L_w = 103.3' - 11.67' = 91.63'$

$L_e = 103.3' - 89.3' = 14.0'$

$r_c = 0.083'$

$r_w = 0.162'$

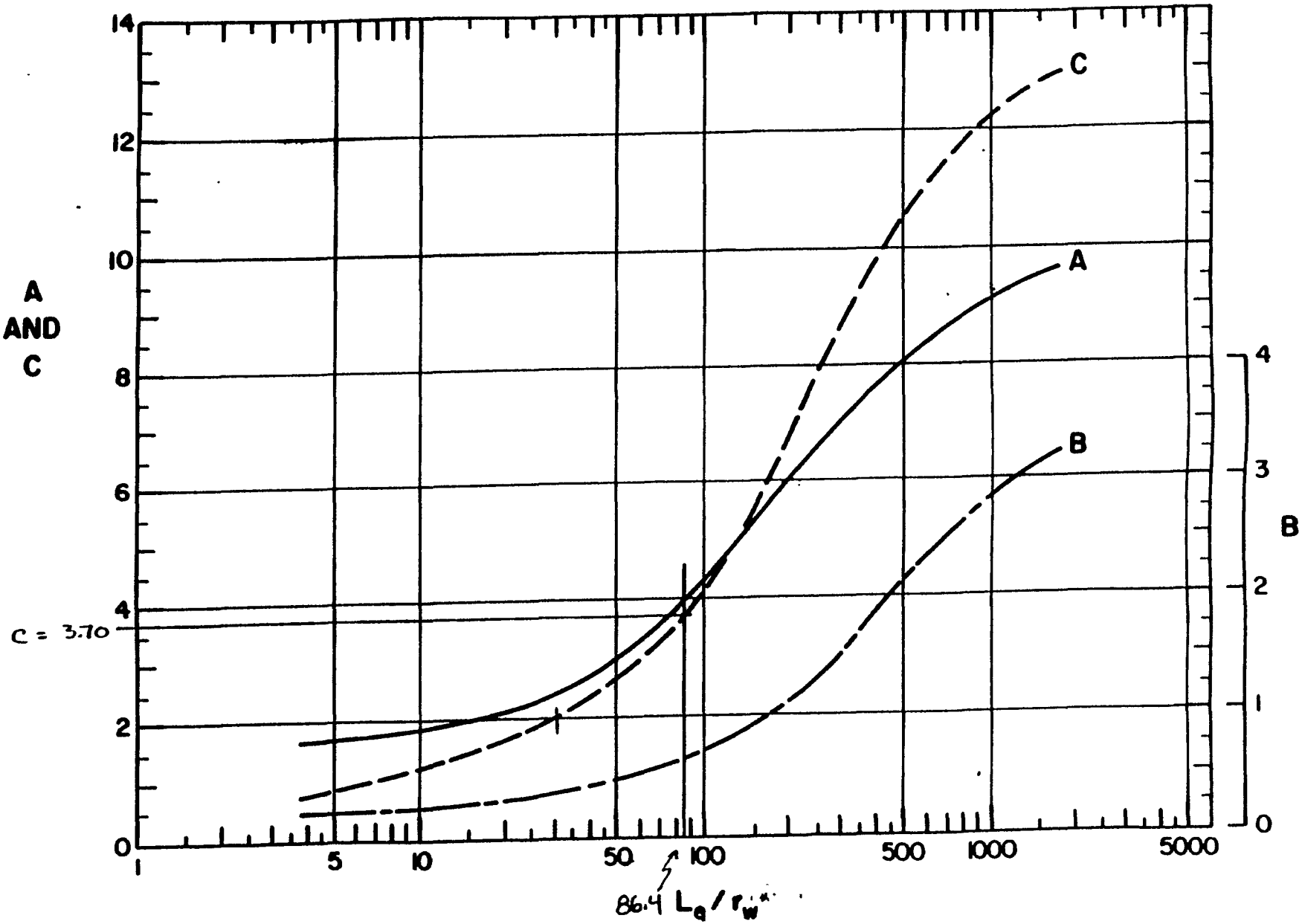
$L_e/r_w = 14/0.162 = 86.4$

$A =$

$B =$

$C = 3.7$

NUS 1554 REVISED 0285



C-65

AR302409

D = H THEREFORE:

$$\ln R_e/r_w = \left[\frac{1.1}{\ln(L_w/r_w)} + \frac{C}{L_e/r_w}\right]^{-1}$$

$$\ln R_e/r_w = \left[\frac{1.1}{\ln(91.63/0.162)} + \frac{3.7}{(14/0.162)}\right]^{-1}$$

$$\ln R_e/r_w = \left[0.174 + 0.043\right]^{-1}$$

$$\ln R_e/r_w = 4.61$$

$$K = \frac{r_c^2 \ln(R_e/r_w)}{2L_e}\frac{1}{t}\ln Y_0/Y_t$$

$$K = \frac{(0.083)^2 \cdot (4.61)}{2(14.0)}\left(\frac{1}{0.2}\right)\cdot\ln\left(\frac{7.58}{2.38}\right)$$

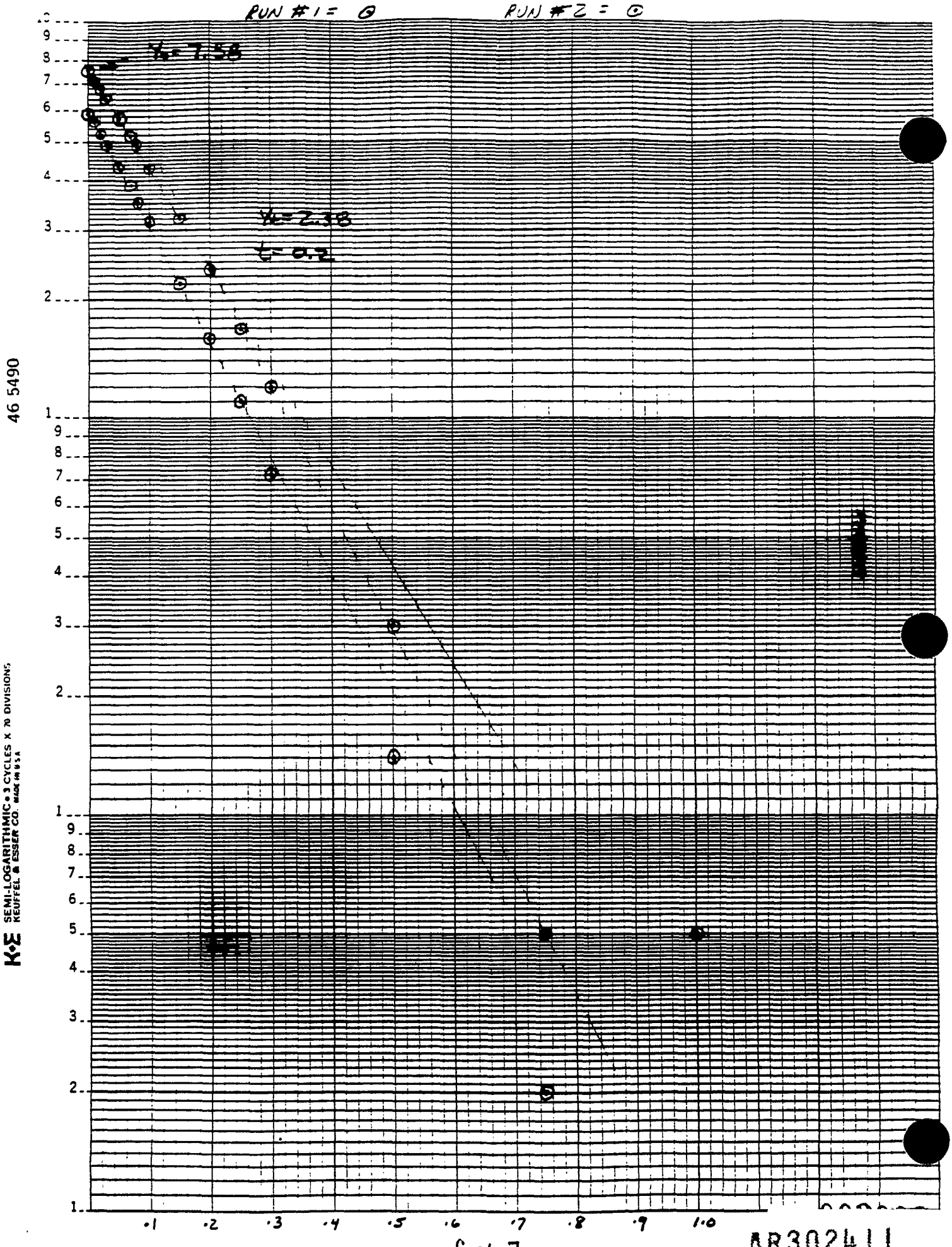
$$K = (1.13\times10^{-3})(5.0)(1.16)$$

$$K = 6.55\times10^{-3}\ \text{ft/min.}$$

$$K = 3.33\times10^{-3}\ \text{cm/sec}$$

$$T = K\cdot D = (6.55\times10^{-3}\ \text{ft/min.})(110'-90') = 0.131\ \text{ft}^2/\text{min.}$$

$$= 1411\ \text{gpd/ft}$$


RUN #1 = ⊙
RUN #2 = ⊙
Yo = 7.58
Yo = 2.38
t = 0.2
46 5490
K+E SEMI-LOGARITHMIC • 3 CYCLES X 70 DIVISIONS
KEUFFEL & ESSER CO. MADE IN U.S.A.
·1 ·2 ·3 ·4 ·5 ·6 ·7 ·8 ·9 1·0

AR302411

NUS CORPORATION
A Halliburton Company

SITE NAME DRAKE CHEMICAL
WELL MEASURED MW-M 112
PUMPING WELL

COMPUTED ____ CHECKED ____
PROJECT NO ____
PAGE ____ OF ____

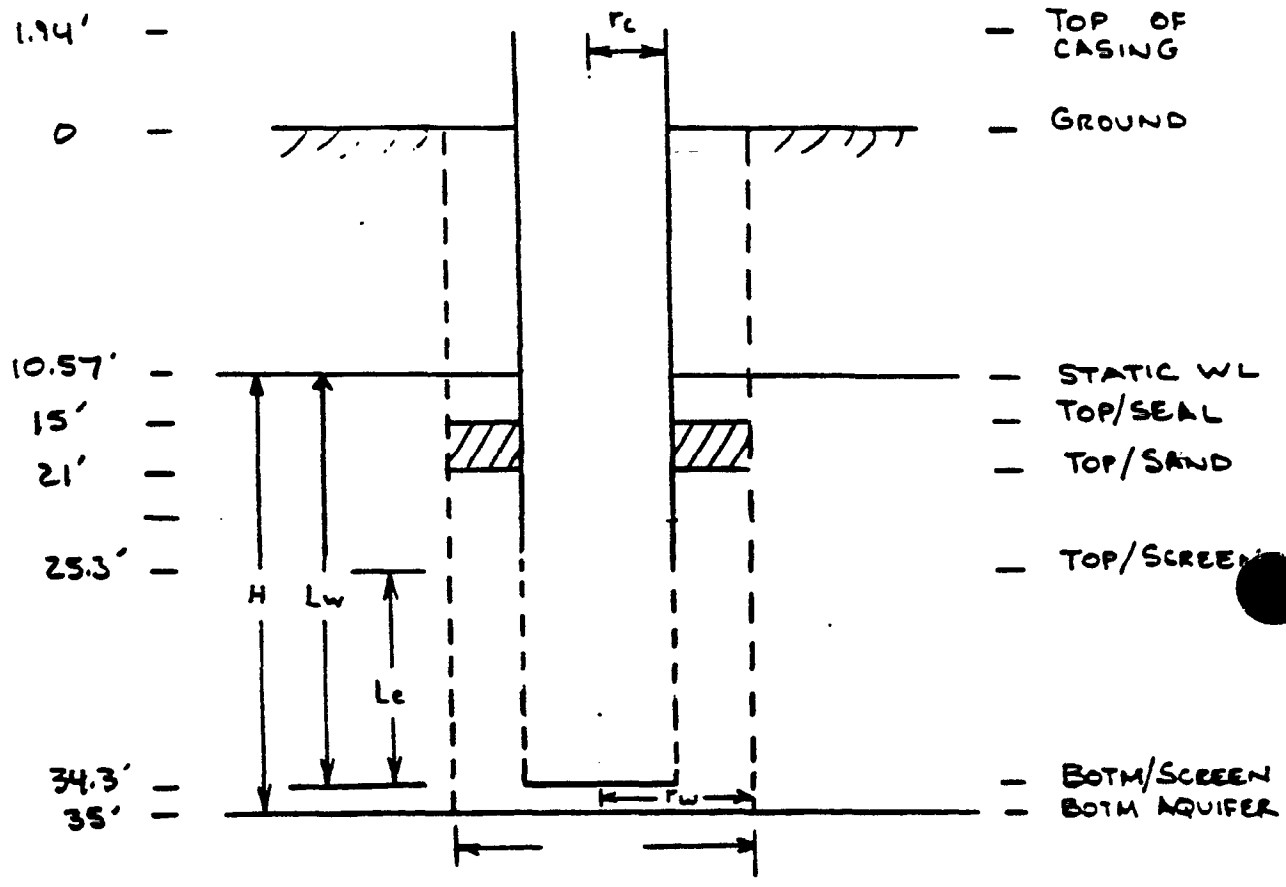
- DISTANCE FROM PUMPING WELL (ft) (r) ____ - PUMPING RATE (gpm) (Q) ____
- STATIC H_2O LEVEL (ft) (t_0) ____ - PUMP SETTING FEET BELOW MONITORING POINT ____
- TIME PUMPING START OR STOP (t_0) ____ - MONITORING POINT ____
- ELEVATION OF MONITORING POINT (ft above MSL) ____

DATE	TIME	(t) MIN SINCE PUMP START OR STOP	WATER LEVEL MEASUREMENTS			(s) DD or RECOV. (ft)	REMARKS
			HELD	CUT	DTW	RUN #1	RUN #2
1-6-87		0.0000	0'			5.93	6.50
		0.1000				4.45	4.89
		0.2000				3.53	3.87
		0.3000				2.85	3.11
		0.4167				2.22	2.41
		0.5000				1.87	2.02
		0.5833				1.58	1.69
		0.6667				1.34	1.43
		0.8333				.97	1.02
		0.9167				.83	.87
		1.0000				.71	.75
		1.5000				.46	.33
		2.0000				.15	.17
		2.5000				.09	.10
		3.0000				.05	.07
		3.5000				.03	.01
		4.0000				.01	

CLIENT EPA - DRAKE CHEM	FILE NO 620Y	BY RDB	PAGE 1 OF
SUBJECT. SLUG TEST CALC MW-M112		CHECKED BY JS	DATE 2-18-88

CALCULATIONS: (BOUWER & RICE)

DEPTH (FT.) WELL CONSTRUCTION



$H = 35 - 10.57' = 24.43'$

$L_w = 34.3 - 10.57' = 23.73'$

$L_e = 34.3 - 25.3' = 9.0'$

$r_c = 0.083'$

$r_w = 0.42'$

$L_e/r_w = 9/0.42 = 21.43$

$A = 2.17$

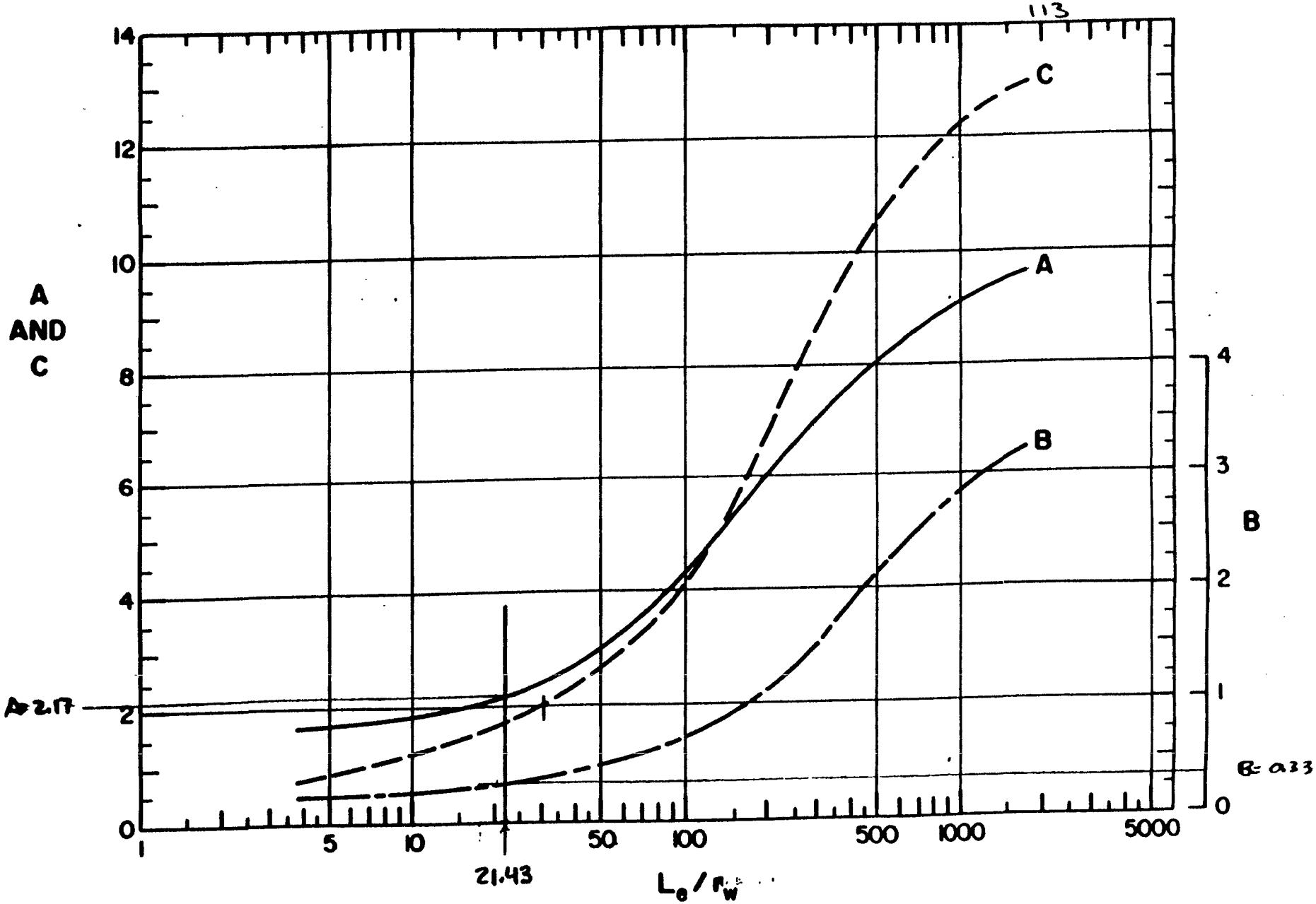
$B = 0.33$

$C =$

NUS 1984 REVISED 0285

AR302413

102 .7
103 122
104 124
112
113



C-70

AR302414

CLIENT. EPA · DRAKE CHEM	FILE NO. 620Y	BY. RDB	PAGE 3 OF
SUBJECT SLUG TEST CALC'S. MW-M 112		CHECKED BY JS	DATE

$$\ln R_e/r_w = \left[\frac{1.1}{\ln(L_w/r_w)} + \frac{A + B\ln[(H-L_w)/r_w]}{L_e/r_w}\right]^{-1}$$

$$\ln R_e/r_w = \left[\frac{1.1}{\ln(23.73/0.42)} + \frac{2.17 + (0.33)\ln[(24.43-23.73)/0.42]}{21.43}\right]^{-1}$$

$$\ln R_e/r_w = \left[0.273 + 0.109\right]^{-1}$$

$$\ln R_e/r_w = 2.62$$

$$K = \frac{r_c^2 \ln(R_e/r_w)}{2L_e} \cdot \frac{1}{t} \ln Y_0/Y_t$$

$$K = \frac{(0.083)^2(2.62)}{2(9.0)} \cdot \frac{1}{0.7} \ln\left(\frac{5.4}{1.3}\right)$$

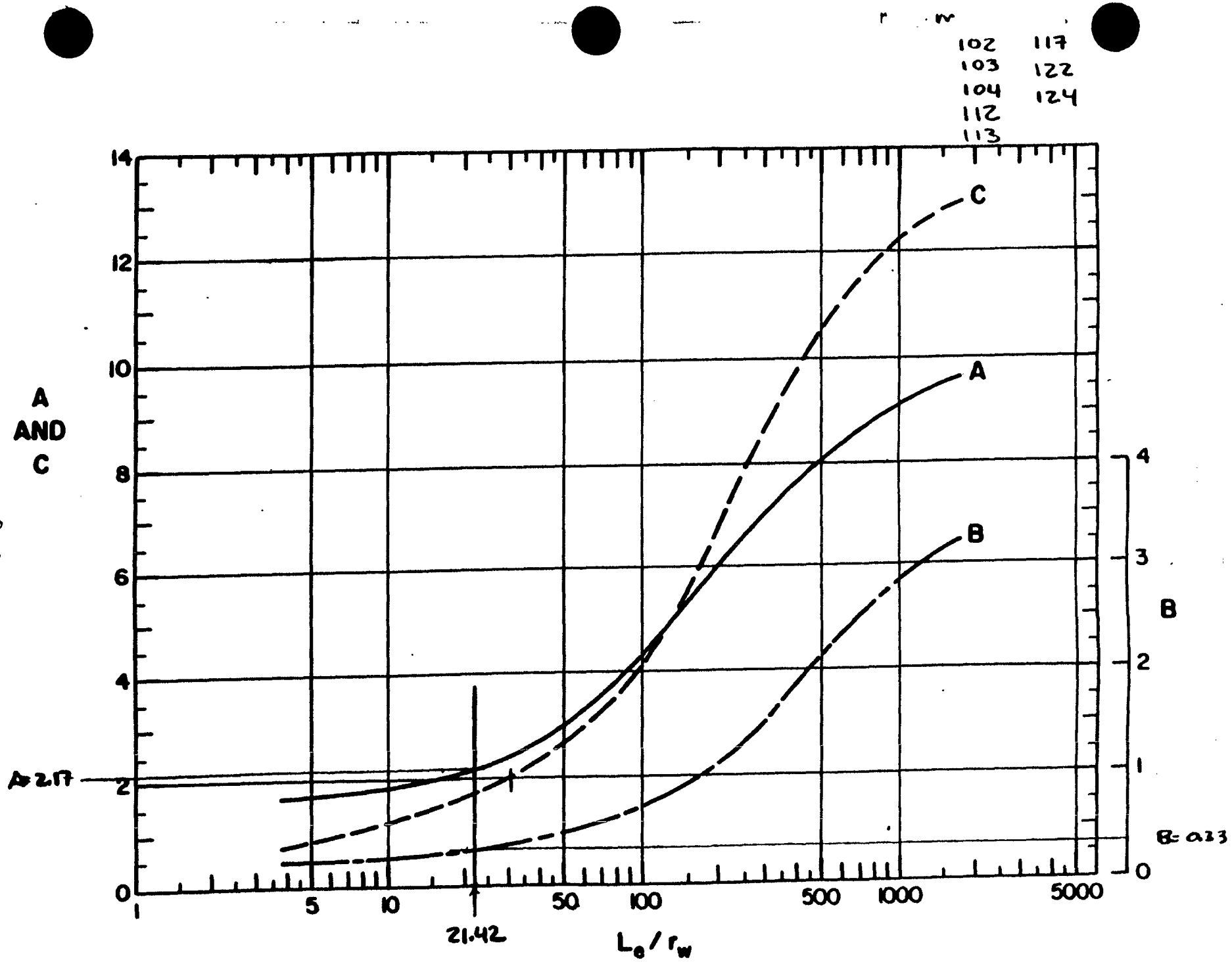
$$K = (1.00\times10^{-3})(1.43)(1.42)$$

$$K = 2.03\times10^{-3} \text{ ft/min.}$$

$$K = 1.03\times10^{-3} \text{ cm/sec.}$$

$$T = K\cdot D = (2.03\times10^{-3} \text{ ft/min.})(24.43 \text{ ft}) = 4.96\times10^{-2} \text{ ft}^2/\text{min.}$$

534 gpd/ft.


102
103
104
112
113
117
122
124
A AND C
B
C
A
B
A=2.17
B=0.33
21.42
L_e / r_w
0
2
4
6
8
10
12
14
1
5
10
50
100
500
1000
5000
0
1
2
3
4

AR302416

NUS CORPORATION
A Halliburton Company

SITE NAME DRAKE CHEM
WELL MEASURED MW-M113 Runs #1-#3
PUMPING WELL

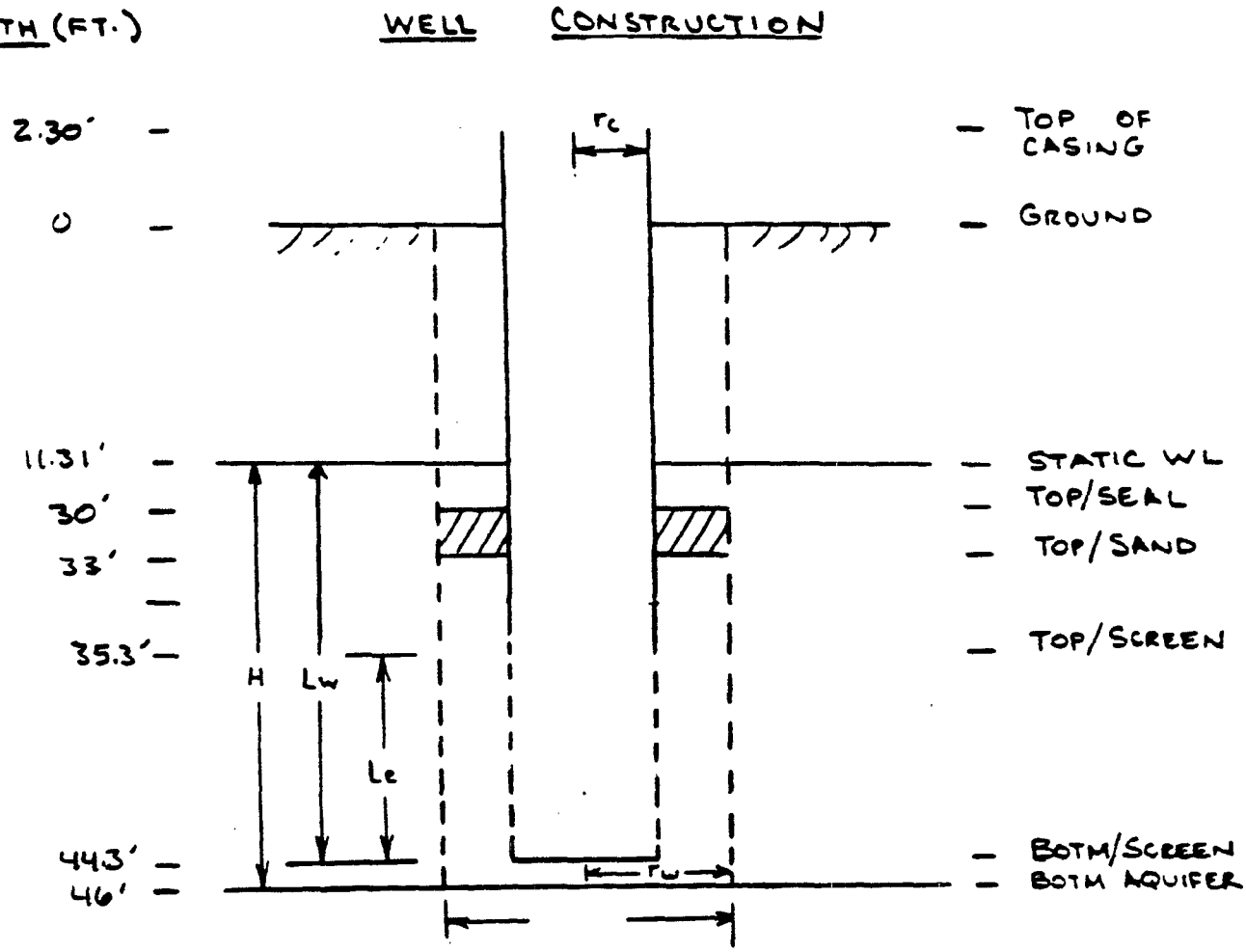
COMPUTED ____ CHECKED ____
PROJECT NO 6207
PAGE 4 OF

- DISTANCE FROM PUMPING WELL (ft) (r) ____
- PUMPING RATE (gpm) (Q) ____
- STATIC H_2O LEVEL (ft) (s_0) ____
- PUMP SETTING FEET BELOW MONITORING POINT ____
- TIME PUMPING START OR STOP (t_0) ____
- MONITORING POINT ____
- ELEVATION OF MONITORING POINT (ft above MSL) ____

DATE	TIME	(t) MIN SINCE PUMP START OR STOP	WATER LEVEL MEASUREMENTS			(s) DD or RECOV. (ft)	REMARKS
			HELD	~~CUT~~ Run #1	~~DTW~~ Run #2	Run #3	Run #4 SLUG TEST DATA
		0		—	-0.60		—
		.003		-0.05	-0.47		-0.91
		.007		-0.04	-0.34		-0.69
		.010		-0.09	-0.17		-0.60
		.013		-0.11	-0.10		-0.46
		.017		-0.13	-0.03		-0.40
		.020		-0.14	—		-0.22
		.023		-0.15	—		-0.12
		.027		-0.15	—		-0.04
		.030		-0.14	—		0
		.033		-0.13	—		
		.050		0	—		
		.067			—	-0.19	
		.083			-0.20	-0.13	
		.100			-0.15	-0.03	
		.167			-0.03		
		.133			0		
		.150					
		.167					
		.183					
		.200					
		.233					
		.250					
		.300					
		.350					
		.400					

CLIENT	FILE NO	BY	PAGE 1 OF
EPA - DRAKE CHEM	620Y	RDB	
SUBJECT SLUG TEST CALC MW-M113		CHECKED BY JS	DATE 2-18-88

CALCULATIONS: (BOUWER & RICE)



$H = 46 - 11.31' = 34.69'$

$L_w = 44.3 - 11.31' = 32.99'$

$L_e = 44.3 - 35.3' = 9.0'$

$r_c = 0.083'$

$r_w = 0.42'$

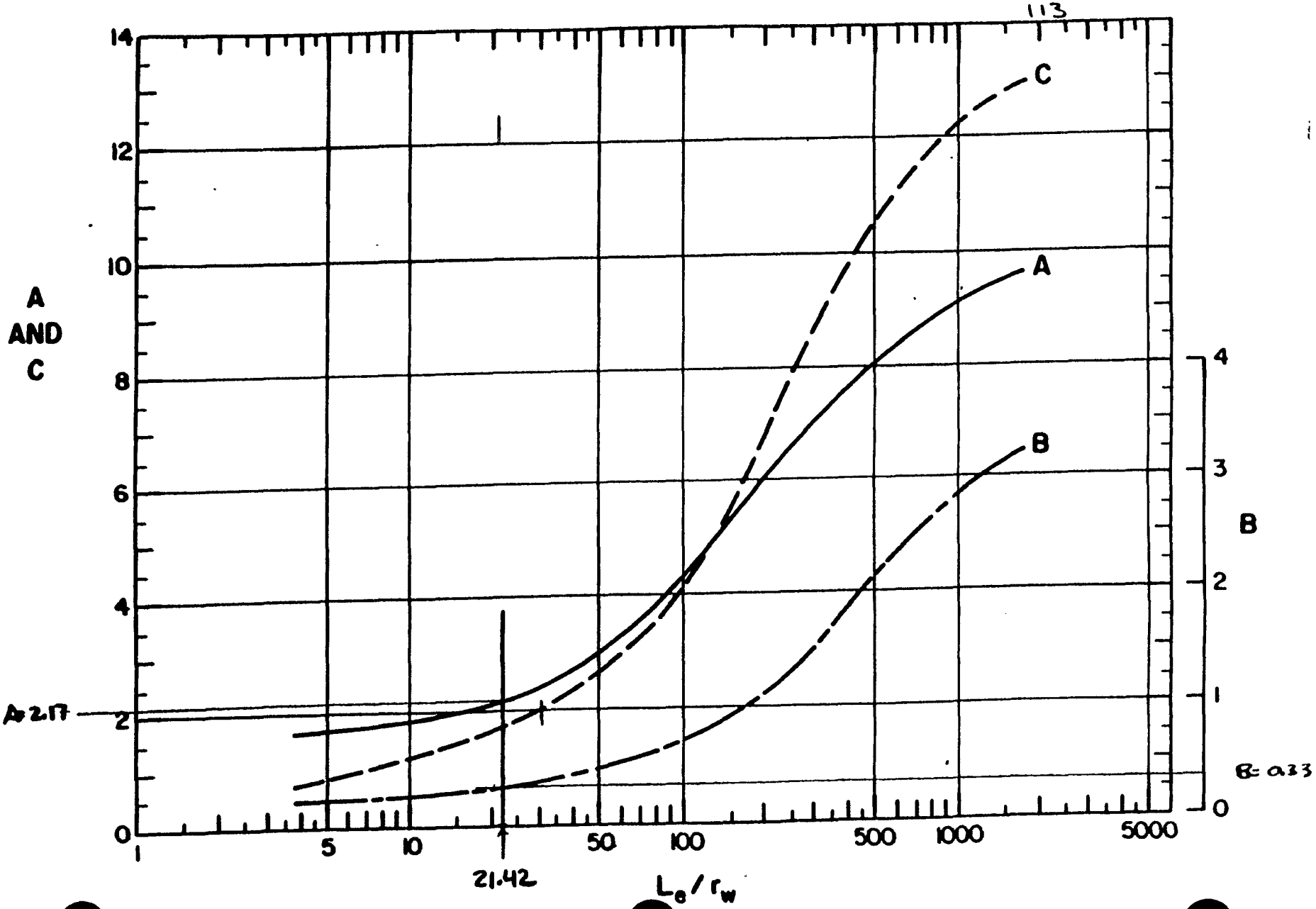
$L_e/r_w = 9/0.42' = 21.43'$

$A = 2.17$

$B = 0.33$

$C =$

102 117
103 122
104 124
112
113



C-75

AR302419

CLIENT. EPA · DRAKE CHEM	FILE NO. 620Y	BY. RDB	PAGE 3 OF
SUBJECT. SLUG TEST CALC'S. MW-M 113		CHECKED BY JS	DATE 2-23-88

$$\ln R_e/r_w = \left[\frac{1.1}{\ln(L_w/r_w)} + \frac{A + B\ln[(H-L_w)/r_w]}{L_e/r_w}\right]^{-1}$$

$$\ln R_e/r_w = \left[\frac{1.1}{\ln(32.99/0.42)} + \frac{2.17 + (0.33)\ln[(34.69-32.99)/0.42]}{21.43}\right]^{-1}$$

$$\ln R_e/r_w = \left[0.252 + 0.123\right]^{-1}$$

$$\ln R_e/r_w = 2.67$$

$$K = \frac{r_c^2 \ln(R_e/r_w)}{2L_e} \cdot \frac{1}{t} \ln Y_0/Y_t$$

$$K = \frac{(0.083)^2(2.67)}{2(9.0)} \cdot \frac{1}{0.01} \ln\left(\frac{1.1}{0.59}\right)$$

$$K = (1.02\times10^{-3})(100)(0.623)$$

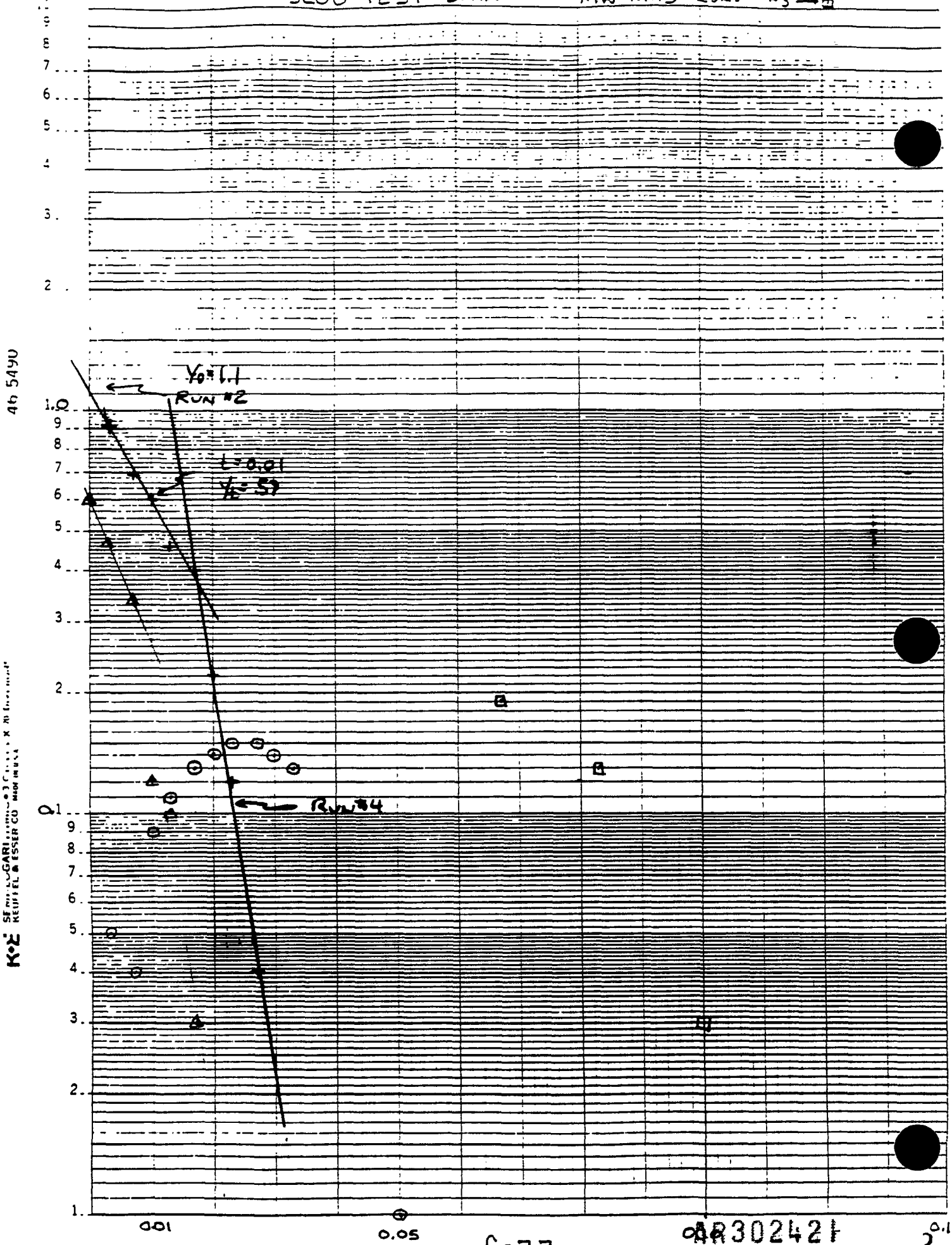
$$K = 6.36\times10^{-2}\ \text{ft/min.}$$

$$K = 3.23\times10^{-2}\ \text{cm/sec.}$$

$$T = K\cdot D = (6.36\times10^{-2}\ \text{ft/min.})(34.69') = 2.21\ \text{ft}^2/\text{min.}$$

23,804 gpd/ft

SLUG TEST DATA MW-M113 RUNS #3 → ⊡



AR302421

INUS CORPORATION
A Halliburton Company

SITE NAME DRAKE CHEM
WELL MEASURED MW-M114
PUMPING WELL

COMPUTED ____ CHECKED ____
PROJECT NO 6209Y
PAGE 4 OF

• DISTANCE FROM PUMPING WELL (ft) (r) ____ • PUMPING RATE (gpm) (Q) SLUG TEST

• STATIC H_2O LEVEL (ft X t_0) 13.62' top of riser • PUMP SETTING FEET BELOW MONITORING POINT ____

• TIME PUMPING START OR STOP (t_0) ____ • MONITORING POINT top of riser pipe

• ELEVATION OF MONITORING POINT (ft above MSL) ____

DATE	TIME 14:45	(t) MIN SINCE PUMP START OR STOP	WATER LEVEL MEASUREMENTS HELD	CUT	DTW Rvn=1	(s) DD or RECOV. (ft) Rvn=2	REMARKS
HS-88	0.0				2.36	4.27	
	0.05				2.21	4.16	
	0.10				2.11	3.99	
	0.15				2.01	3.83	
	0.20				1.93	3.73	
	0.25				1.85	3.57	
	0.30				1.79	3.45	
	0.50				1.55	3.04	
	0.75				1.30	2.59	
	1.0				1.11	2.23	
	1.25				0.94	1.94	
	1.5				0.81	1.69	
	1.75				0.69	1.47	
	2.0				0.60	1.29	
	2.5				0.44	1.01	
	3.0				0.33	0.80	
	3.5				0.25	0.64	
	4.0				0.18	0.53	
	4.5				0.14	0.43	
	5.0				0.09	0.36	
	5.5				0.06	0.30	
	6.0				0.03	0.26	
	6.5				0.01	0.22	
	7.0					0.19	
	7.5					0.17	
	8.0					0.15	
	8.5					0.13	
	9.0					0.12	
	9.5					0.10	
	10.0					0.09	

AR302422

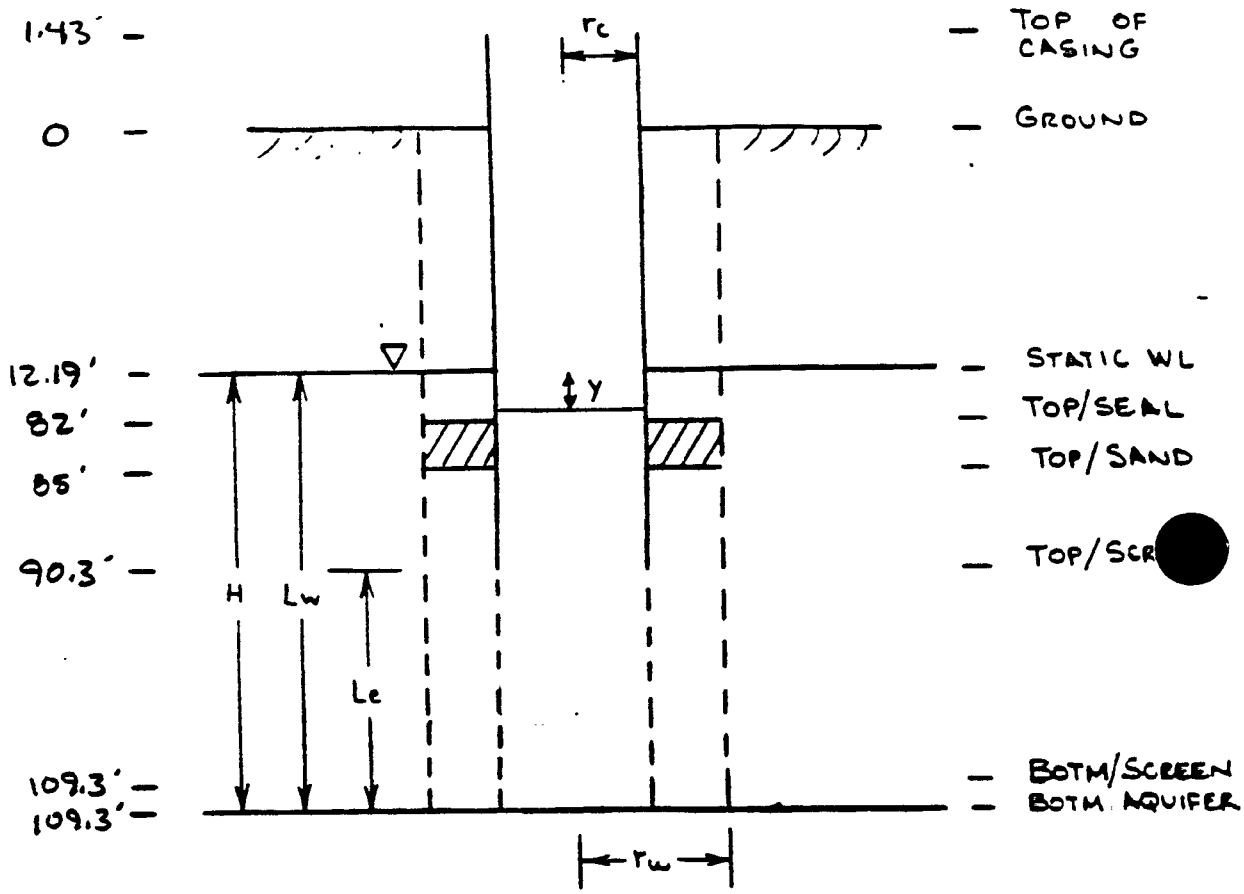
NUS CORPORATION AND SUBSIDIARIES

STANDARD CALCULATION SHEET

CLIENT	FILE NO	BY	PAGE 1 OF
EPA - DRAKE CHEM	620Y	RDB	
SUBJECT SLUG TEST CALC. MW-M 114		CHECKED BY JS	DATE 2-18-88

CALCULATIONS: (BOUWER & RICE)

DEPTH (FT.) WELL CONSTRUCTION



$H = 109.3' - 12.19' = 97.11'$

$L_w = 109.3' - 12.19' = 97.11'$

$L_e = 109.3 - 90.3' = 19'$

$r_c = 0.083'$

$r_w = 0.162'$

$L_e/r_w = 19'/0.162' = 117.3$

A =

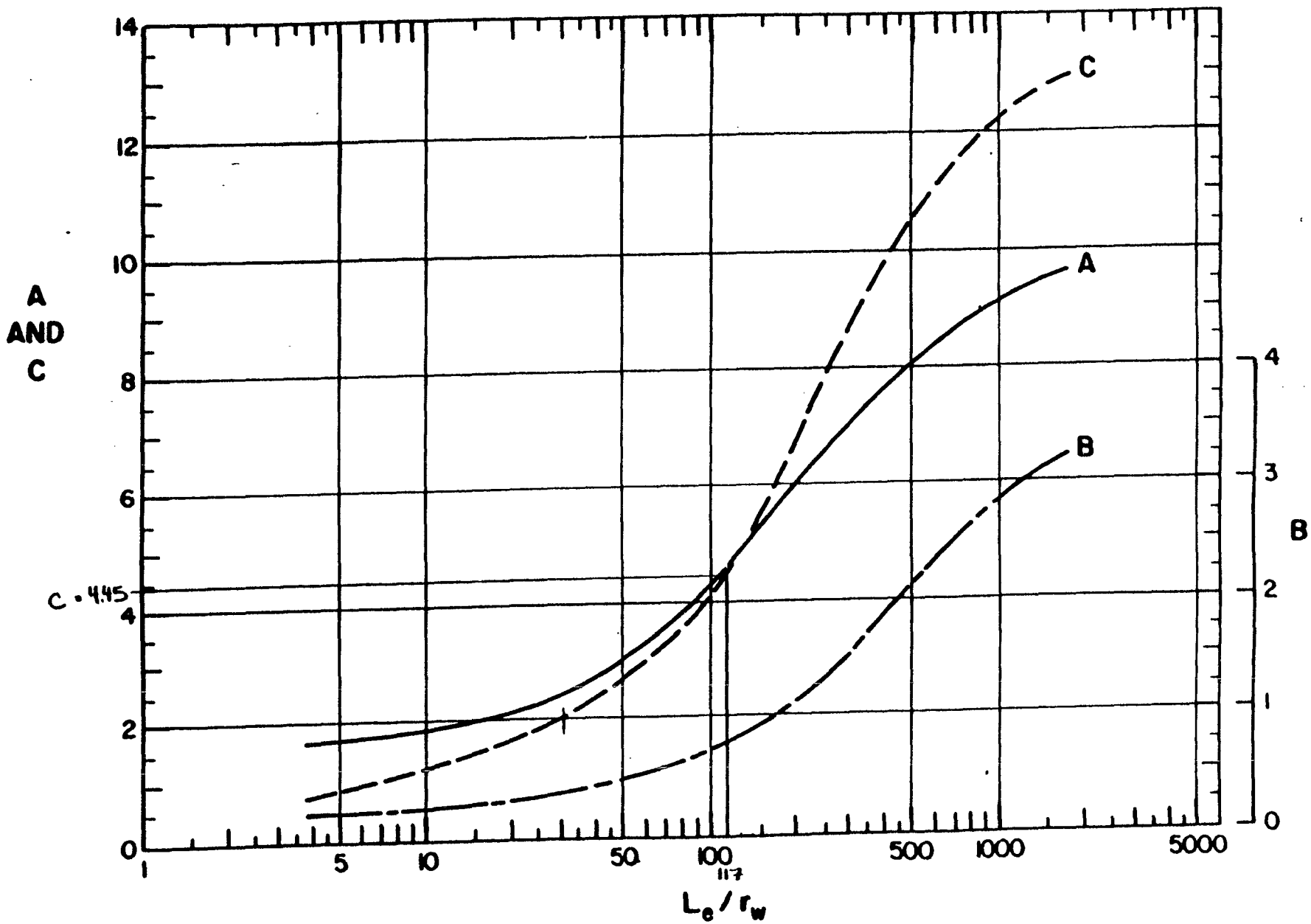
B =

C = 4.45

AR302423

NUS 1554 REVISED 0285

107
114
120



C-80

AR302424

D = H THEREFORE:

$$\ln R_e/r_w = \left[\frac{1.1}{\ln(L_w/r_w)} + \frac{C}{L_e/r_w}\right]^{-1}$$

$$\ln R_e/r_w = \left[\frac{1.1}{\ln(97.11/0.162)} + \frac{4.45}{(19/0.162)}\right]^{-1}$$

$$\ln R_e/r_w = \left[0.172 + 0.038\right]^{-1}$$

$$\ln R_e/r_w = 4.76$$

$$K = \frac{r_c^2 \ln(R_e/r_w)}{2L_e}\frac{1}{t}\ln Y_0/Y_t$$

$$K = \frac{(0.083)^2 \cdot (4.76)}{2(19)}\left(\frac{1}{2.0}\right)\cdot\ln\left(\frac{2.1}{0.6}\right)$$

$$K = (8.63\times10^{-4})(0.5)(1.25)$$

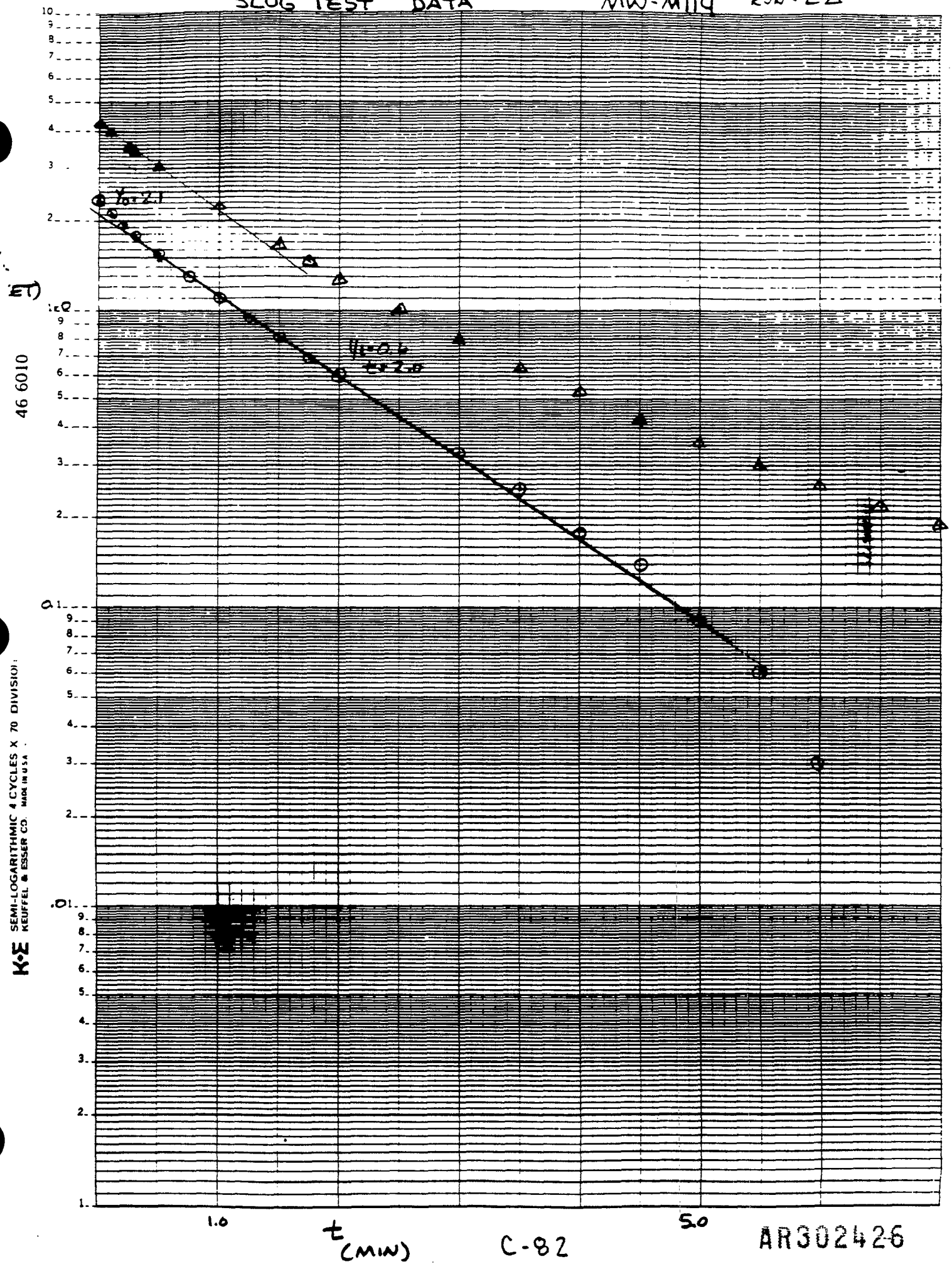
$$K = 5.39\times10^{-4}\ \text{ft/min.}$$

$$K = 2.74\times10^{-4}\ \text{cm/sec.}$$

$$T = K\cdot D = (5.39\times10^{-4}\ \text{ft/min})(109'-46') = 3.40\times10^{-2}\ \text{ft}^2/\text{min}$$

$$= 366\ \text{gpd/ft}$$

SLUG TEST DATA MW-M114 RUN #2 △



C-82

AR302426

CORPORATION
A Halliburton Company

SITE NAME DRAKE CHEMICAL
WELL MEASURED MW-M115
PUMPING WELL

COMPUTED ____ CHECKED ____
PROJECT NO 620Y
PAGE 1 OF 1

- DISTANCE FROM PUMPING WELL (ft) (r) ____
- PUMPING RATE (gpm) (Q) ____
- STATIC H_2O LEVEL (ft) (s_o) ____
- PUMP SETTING FEET BELOW MONITORING POINT ____
- TIME PUMPING START OR STOP (t_o) ____
- MONITORING POINT ____
- ELEVATION OF MONITORING POINT (ft above MSL) ____

DATE	TIME	(t) MIN SINCE PUMP START OR STOP	WATER LEVEL MEASUREMENTS			(s) DD or RECOV. (ft)	REMARKS
			HELD	CUT	DTW RUN #1	RUN #2	RUN #3
1-6-88		0.0000			2.29	2.86	3.02
		0.0099			2.48	2.27	3.00
		0.0200			2.39	1.97	2.22
		0.0300			1.72	1.77	1.58
		0.0500			.77	.55	.74
		0.0666			.37	.32	.38
		0.0833			.18	.22	.20
		0.1000			.10	.18	.12
		0.1166			.08	.17	.09
		0.1333			.07	.16	.08
		0.1500			.06	.16	.07
		0.2000			.05	.14	.06
		0.2333			.04	.14	.05
		0.2500			.04		.05
		0.3000			.04		.05

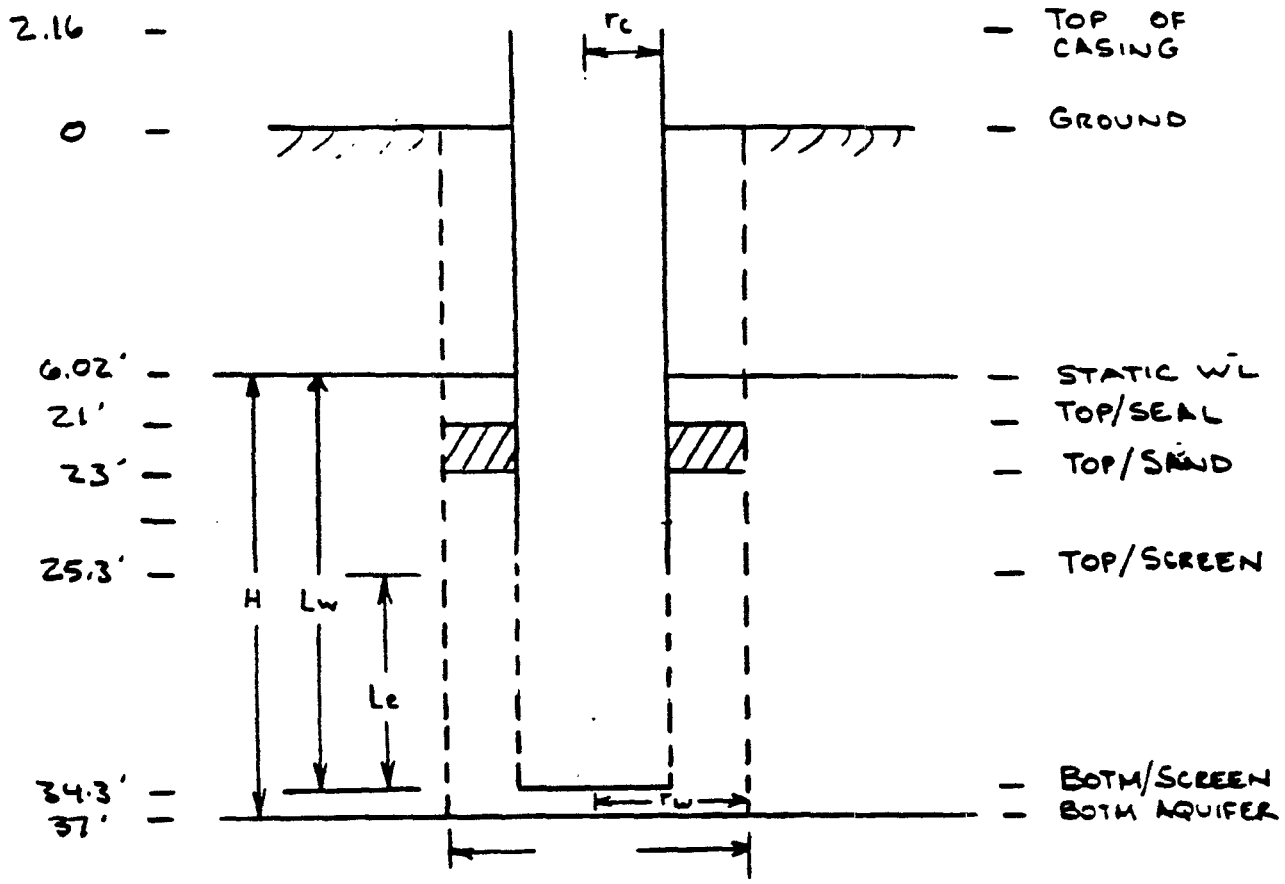
C-83

AR302427

CLIENT EPA - DRAKE CHEM	FILE NO 620Y	BY RDB	PAGE 1 OF
SUBJECT SLUG TEST CALC MW-M115		CHECKED BY MLM 3/1/88	DATE 2-18-88

CALCULATIONS: (BOUWER & RICE)

DEPTH (FT.) WELL CONSTRUCTION



$H = 37' - 6.02' = 30.98'$

$L_w = 34.3' - 6.02' = 28.28'$

$L_e = 34.3' - 25.3' = 9.0'$

$r_c = 0.083'$

$r_w = 0.42'$

$L_e/r_w = 9/.42 = 21.43$

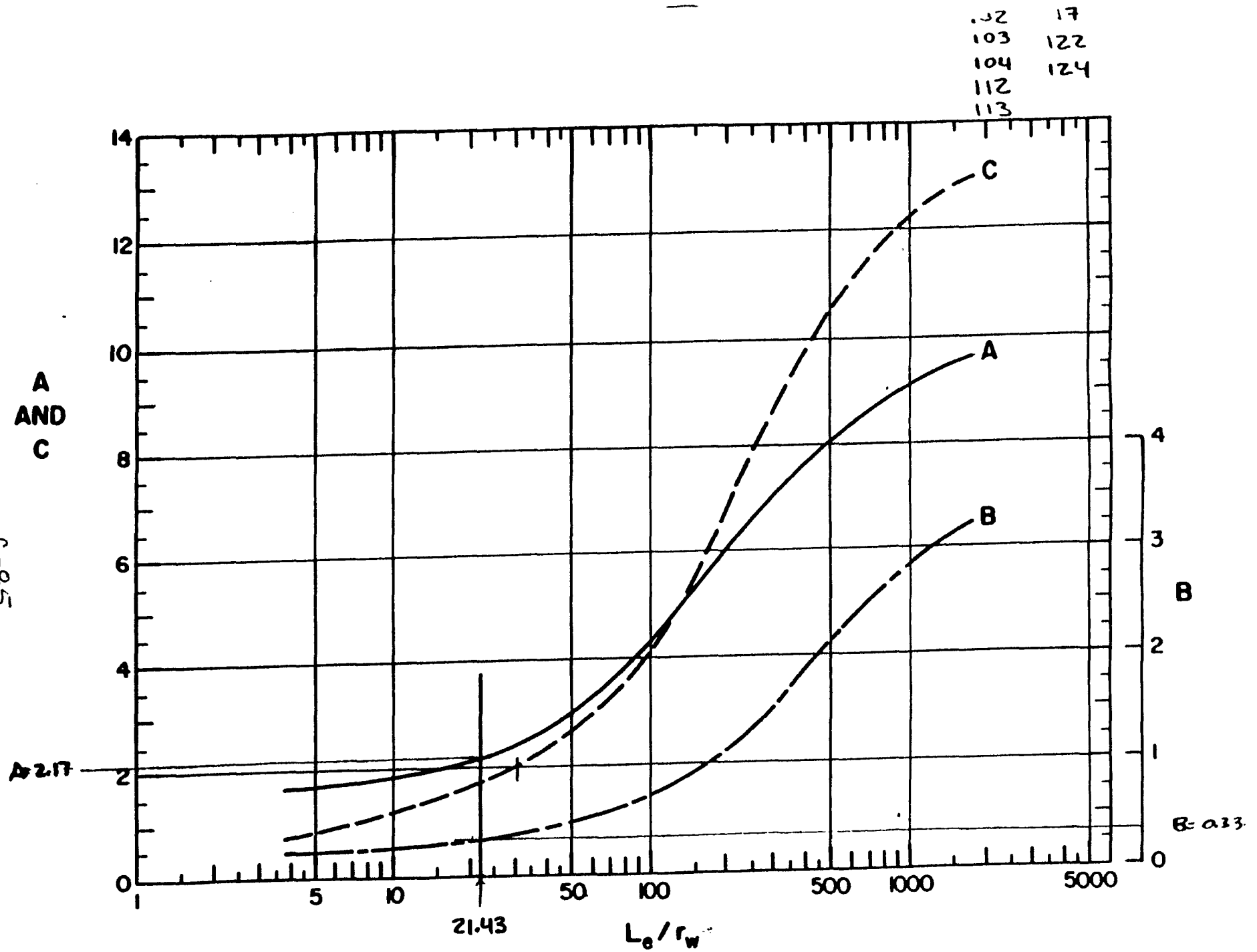
$A = 2.17$

$B = 0.33$

$C =$

NUS 1554 REVISED 0285

AR302428


.02 17
103 122
104 124
112
113
A AND C
B
C
A
B
A=2.17
B=0.33
21.43
L_e / r_w
0
2
4
6
8
10
12
14
1
5
10
50
100
500
1000
5000
0
1
2
3
4

AR302429

NUS CORPORATION AND SUBSIDIARIES			STANDARD CALCULATION SHEET
CLIENT: EPA · DRAKE CHEM	FILE NO.: 620Y	BY: RBB	PAGE 3 OF
SUBJECT: SLUG TEST CALC'S. MW-M115		CHECKED BY:	DATE

$$\ln R_e/r_w = \left[\frac{1.1}{\ln(L_w/r_w)} + \frac{A + B\ln[(H-L_w)/r_w]}{L_e/r_w}\right]^{-1}$$

$$\ln R_e/r_w = \left[\frac{1.1}{\ln(28.28/0.42)} + \frac{2.17 + (0.33)\ln[(30.98-28.28)/0.42]}{21.43}\right]^{-1}$$

$$\ln R_e/r_w = \left[0.261 + 0.130\right]^{-1}$$

$$\ln R_e/r_w = 2.56$$

$$K = \frac{r_c^2 \ln(R_e/r_w)}{2L_e} \cdot \frac{1}{t} \ln Y_0/Y_t$$

$$K = \frac{(0.083)^2(2.56)}{2(9.0)} \cdot \frac{1}{0.05} \ln\left(\frac{4.35}{0.75}\right)$$

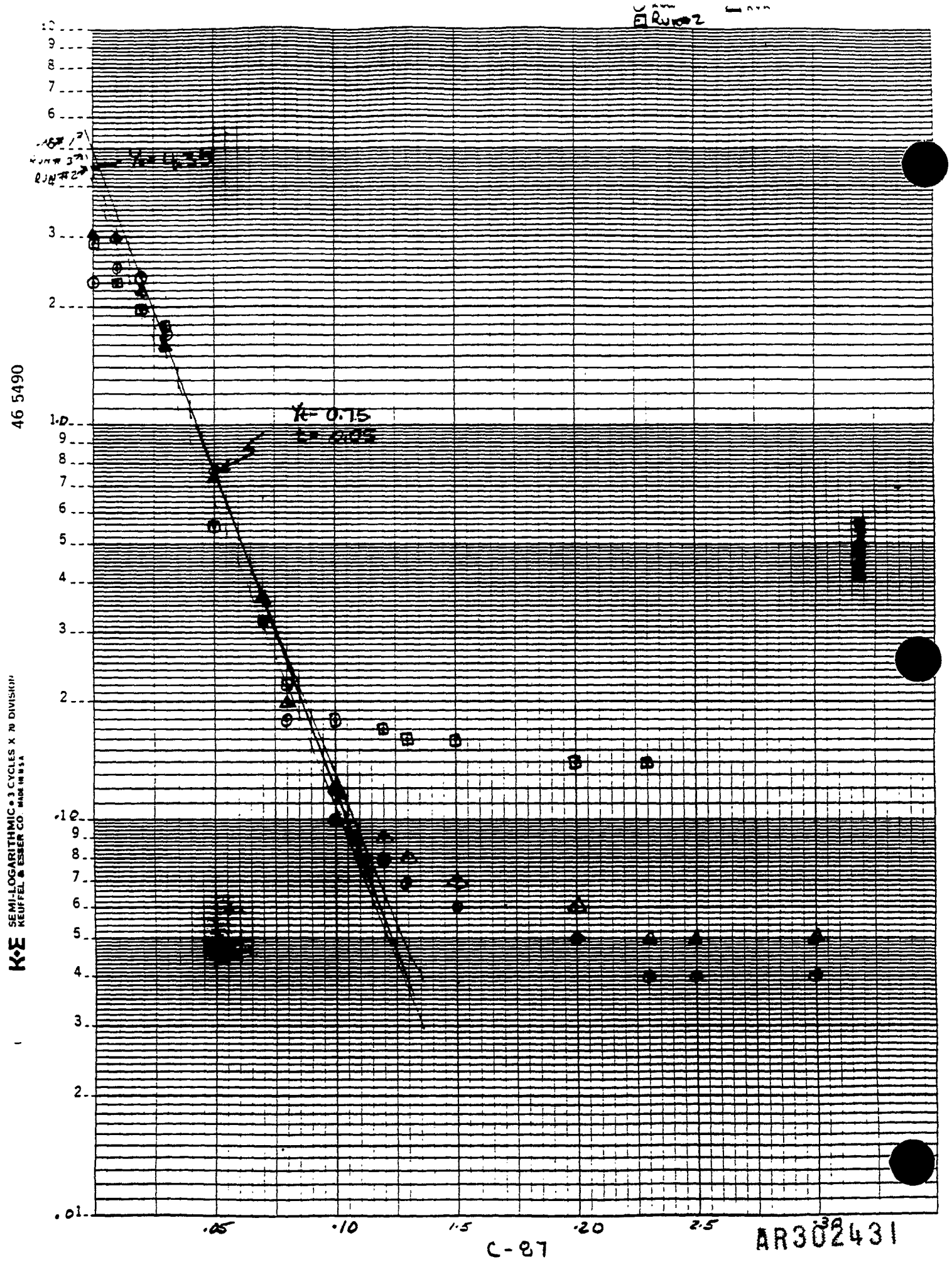
$$K = (9.80\times10^{-4})(20)(1.76)$$

$$K = 3.45\times10^{-2}\ \text{ft/min.}$$

$$K = 1.75\times10^{-2}\ \text{cm/sec.}$$

$$T = K\cdot D = (3.45\times10^{-2}\ \text{ft/min})(30.98\ \text{ft}) = 1.07\ \text{ft}^2/\text{min.}$$

$$= 11{,}512\ \text{gpd/ft}$$


RUN#2
RUN#3
RUN#2
Yt= 0.75
t= 0.05
46 5490
K+E SEMI-LOGARITHMIC • 3 CYCLES X 70 DIVISIONS
KEUFFEL & ESSER CO. MADE IN U.S.A.
.05
.10
1.5
.20
2.5

AR302431

NUS CORPORATION
A Halliburton Company

SITE NAME DRAKE CHEM
WELL MEASURED MW-M116 RUNS 1-2
PUMPING WELL

COMPUTED ____ CHECKED ____
PROJECT NO ____
PAGE ____ OF ____

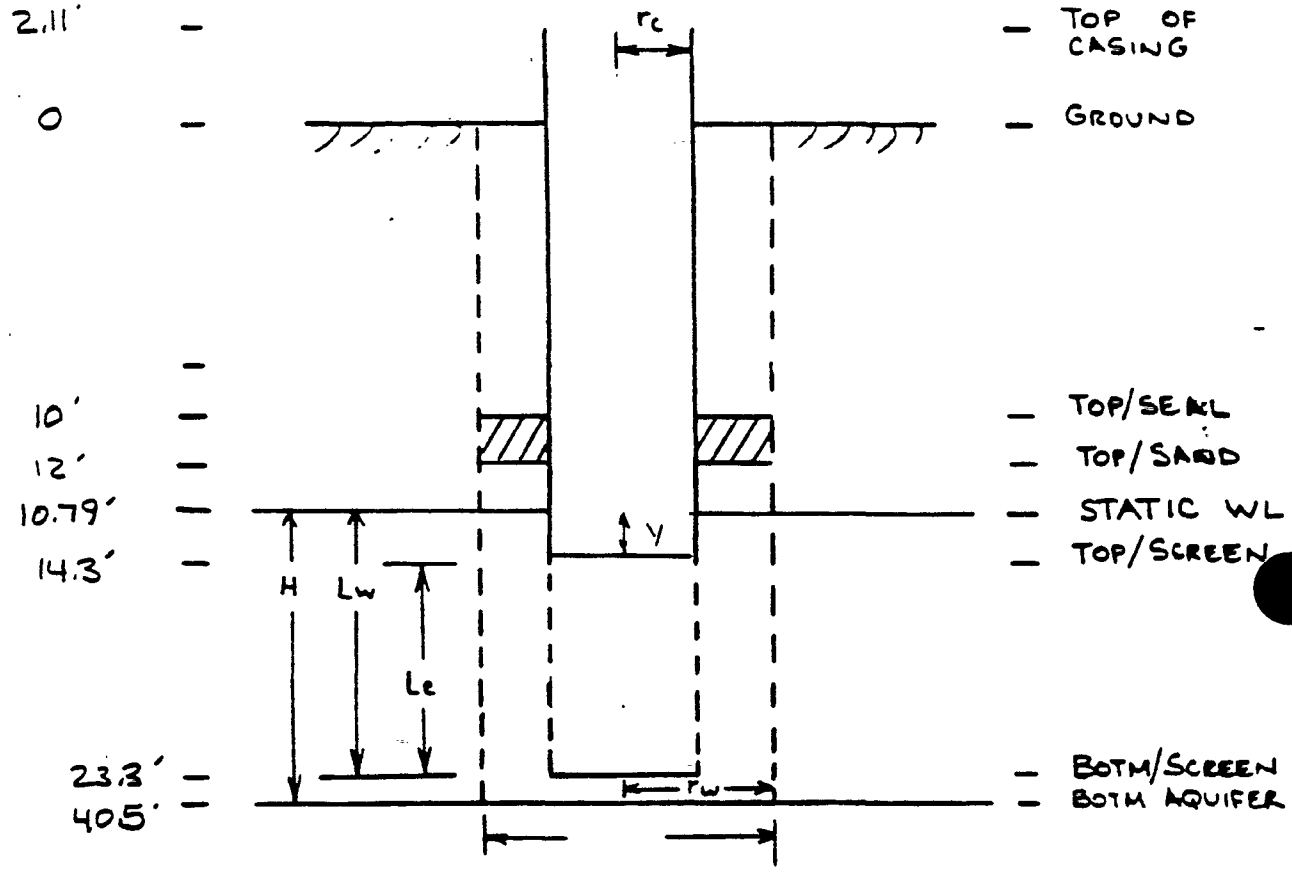
- DISTANCE FROM PUMPING WELL (ft) (r) ____ • PUMPING RATE (gpm) (Q) ____
- STATIC H_2O LEVEL (ft X t_0) 12.9' Top of riser • PUMP SETTING FEET BELOW MONITORING POINT ____
- TIME PUMPING START OR STOP (t_0) ____ • MONITORING POINT ____
- ELEVATION OF MONITORING POINT (ft above MSL) ____

DATE	TIME	(t) MIN SINCE PUMP START OR STOP	WATER LEVEL MEASUREMENTS			(s) DD or RECOV. (ft)	REMARKS
			HELD	CUT	DTW Run #2	Run #1	
1-5-88	1631	0			-5.29	-5.08	
		0.01			-5.09	-4.87	
		0.02			-4.96	-4.74	
		0.03			-4.83	-4.61	
		0.05			-4.64	-4.40	
		0.067			-4.52	-4.25	
		0.083			-4.41	-4.14	
		0.100			-4.32	-4.03	
		0.150			-4.04	-3.77	
		0.200			-3.82	-3.54	
		0.250			-3.63	-3.35	
		0.300			-3.45	-3.17	
		0.333			-3.35	-3.06	
		0.417			-3.10	-2.82	
		0.500			-2.88	-2.60	
		0.58			-2.68	-2.40	
		0.67			-2.50	-2.22	
		0.75			-2.32	-2.06	
		1.00			-1.88	-1.65	
		1.25			-1.52	-1.34	
		1.50			-1.23	-1.10	
		1.75			-0.98	-0.92	
		2.00			-0.78	-0.78	
		2.50			-0.49		
		3.00			-0.29		
		3.50			-0.17		
		4.00			-0.10		
		4.50			-0.04		
		5.00			-0.02		
		5.50			-0.01		
		6.00			000		
		6.50					

CLIENT EPA DRAKE CHEM	FILE NO 620Y	BY RDB	PAGE 1 OF
SUBJECT SLUG TEST CALC. MW-M 116		CHECKED BY	DATE 3/30/88

CALCULATIONS: (BOUWER & RICE)

DEPTH (FT.) WELL CONSTRUCTION



$H = 40.5' - 10.79' = 29.71'$

$L_w = 23.3 - 10.79' = 12.51'$

$L_e = 23.3 - 14.3' = 9.0'$

$r_c = 0.083'$

$r_w = 0.42'$

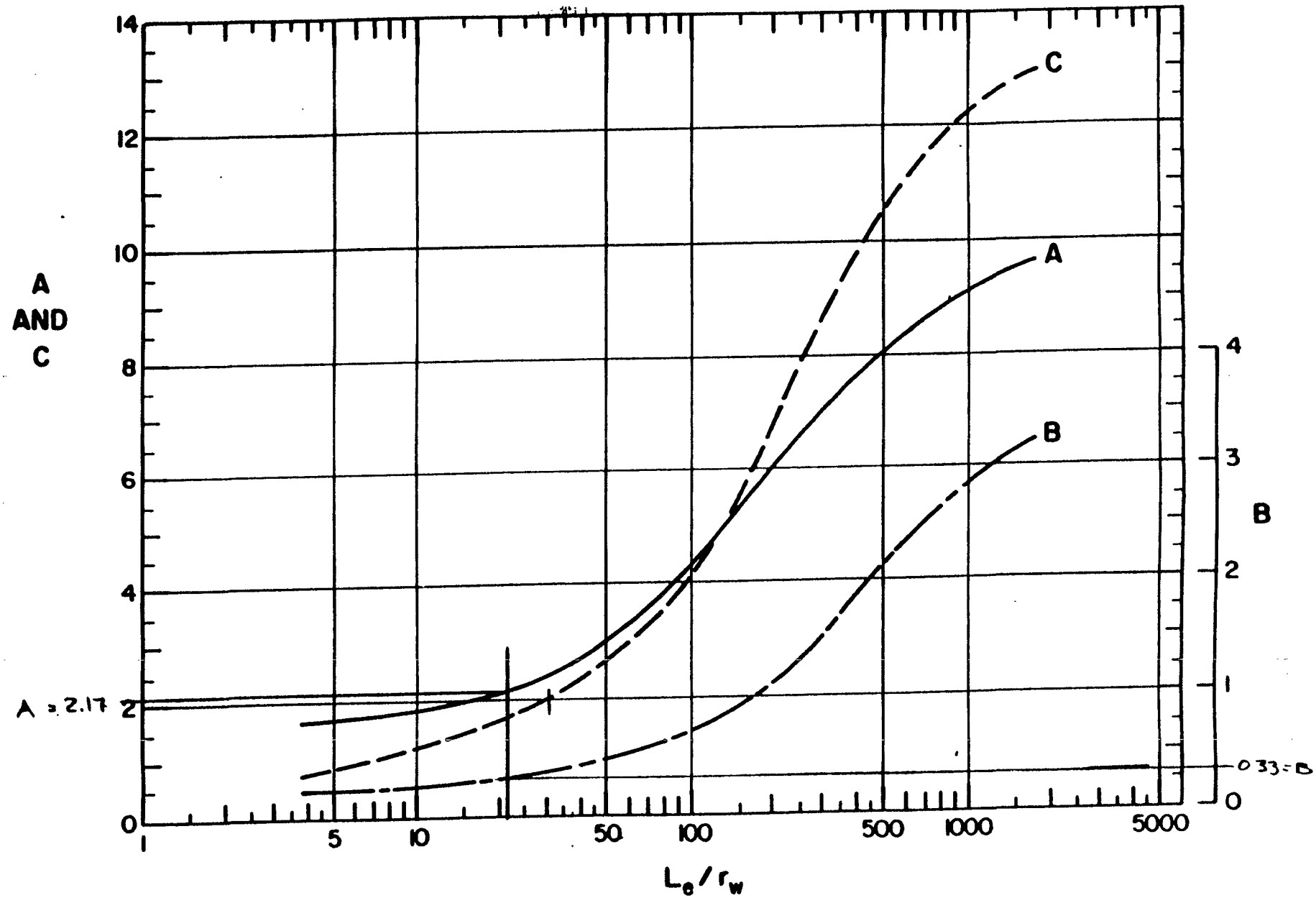
$L_e/r_w = 9'/0.42' = 21.43$

$A = 2.17$

$B = 0.33$

$C =$

MW-M116



C-90

AR302434

CLIENT: EPA · DRAKE CHEM	FILE NO.: 620Y	BY: RDB	PAGE 3 OF
SUBJECT: SLUG TEST CALC'S. MW-M 116		CHECKED BY:	DATE: 2-23-8[illegible]

$$\ln R_e/r_w = \left[\frac{1.1}{\ln(L_w/r_w)} + \frac{A + B\ln[(H-L_w)/r_w]}{L_e/r_w}\right]^{-1}$$

$$\ln R_e/r_w = \left[\frac{1.1}{\ln(12.51/0.42)} + \frac{2.17 + (.33)\ln[(29.71-12.51)/0.42]}{21.43}\right]^{-1}$$

$$\ln R_e/r_w = \left[0.324 + 0.158\right]^{-1}$$

$$\ln R_e/r_w = 2.08$$

$$K = \frac{r_c^2 \ln(R_e/r_w)}{2L_e} \cdot \frac{1}{t} \ln Y_0/Y_t$$

$$K = \frac{(.083)^2(2.08)}{2(9.0)} \cdot \frac{1}{2.5} \ln\left(\frac{4.6}{0.49}\right)$$

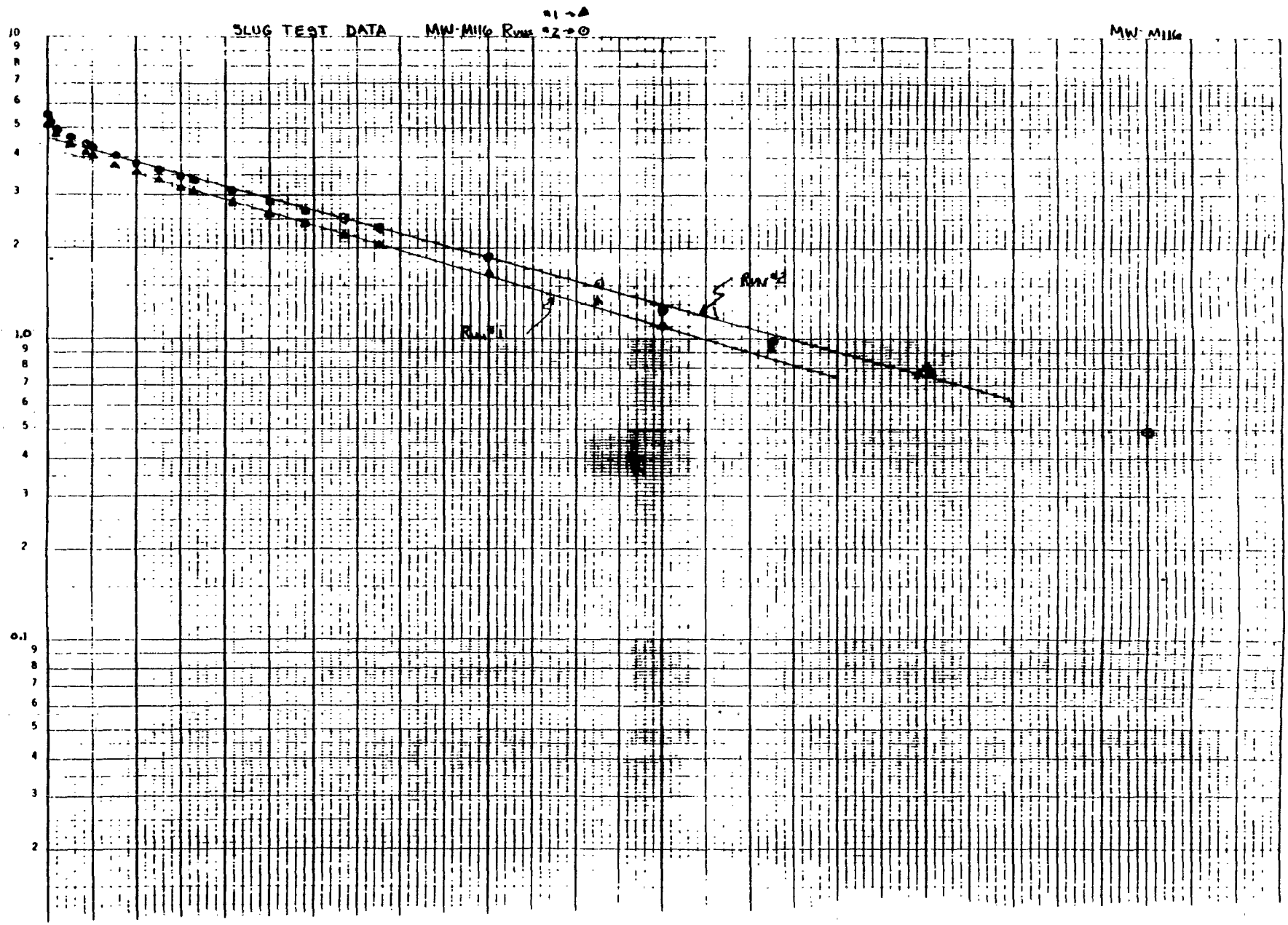
$$K = (7.96\times10^{-4})(0.4)(2.24)$$

$$K = 7.13\times10^{-4} \text{ ft/min.}$$

$$K = 3.62\times10^{-4} \text{ cm/sec.}$$

$$T = K\cdot D = (7.13\times10^{-4}\text{ ft/min})(29.71\text{ ft}) = 2.12\times10^{-2}\text{ ft}^2/\text{min}$$

$$= 228 \text{ gpd/ft}$$

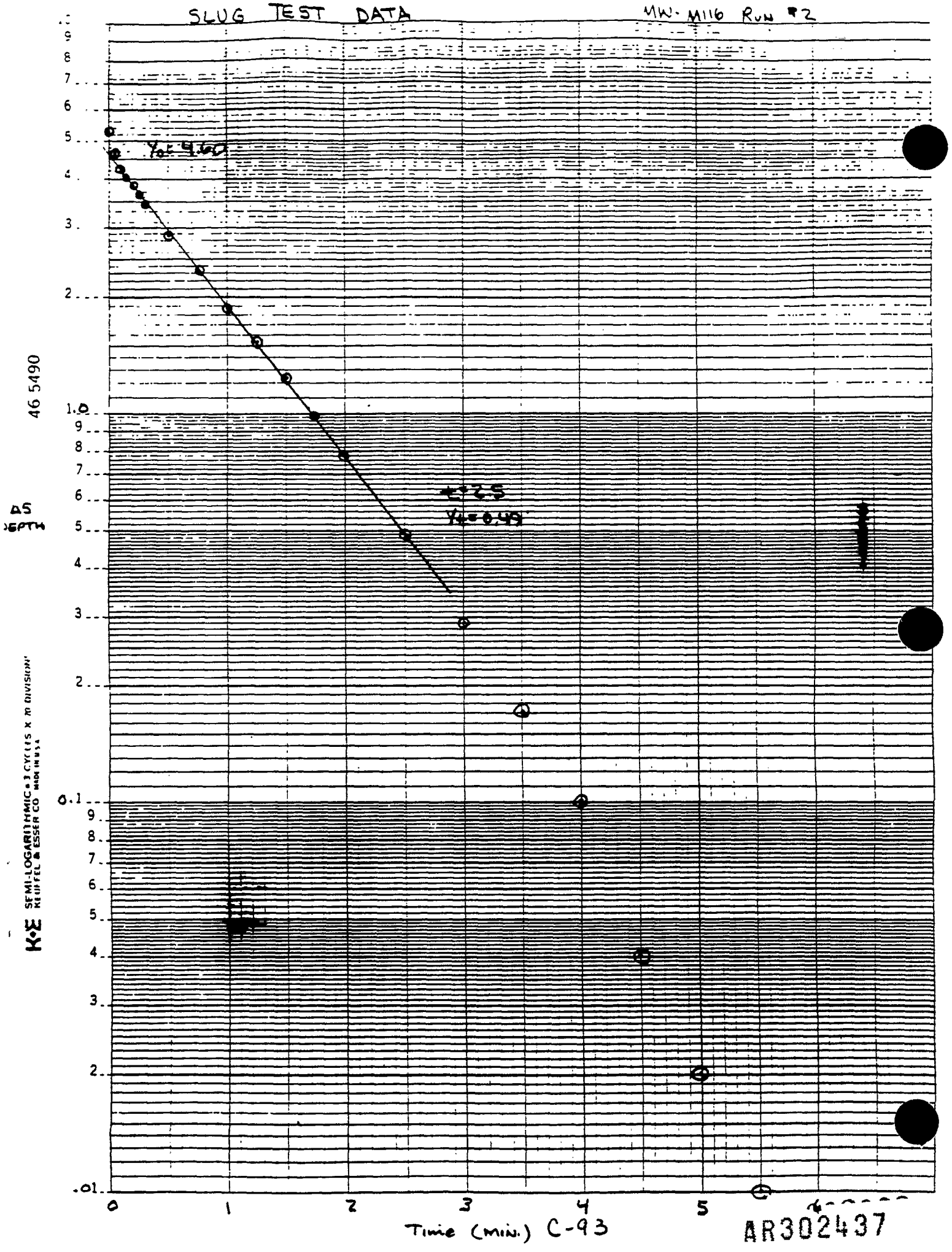


46 5490

C-92

K&E SEMI-LOGARITHMIC 3 CYCLES X 5 DIVISIONS
KEUFFEL & ESSER CO. MADE IN U.S.A.

AR302436



C-93

AR302437

NUS CORPORATION
A Halliburton Company

SITE NAME DRAKE CHEM
WELL MEASURED MW-M117 Runs #1 + 2
PUMPING WELL

COMPUTED ____ CHECKED ____
PROJECT NO ____
PAGE ____ OF

- DISTANCE FROM PUMPING WELL (ft) (r) ____ - PUMPING RATE (gpm) (Q) ____
- STATIC H_2O LEVEL (ft) (t_0) 13.04' Top of riser - PUMP SETTING FEET BELOW MONITORING POINT ____
- TIME PUMPING START OR STOP (t_0) ____ - MONITORING POINT ____
- ELEVATION OF MONITORING POINT (ft above MSL) ____

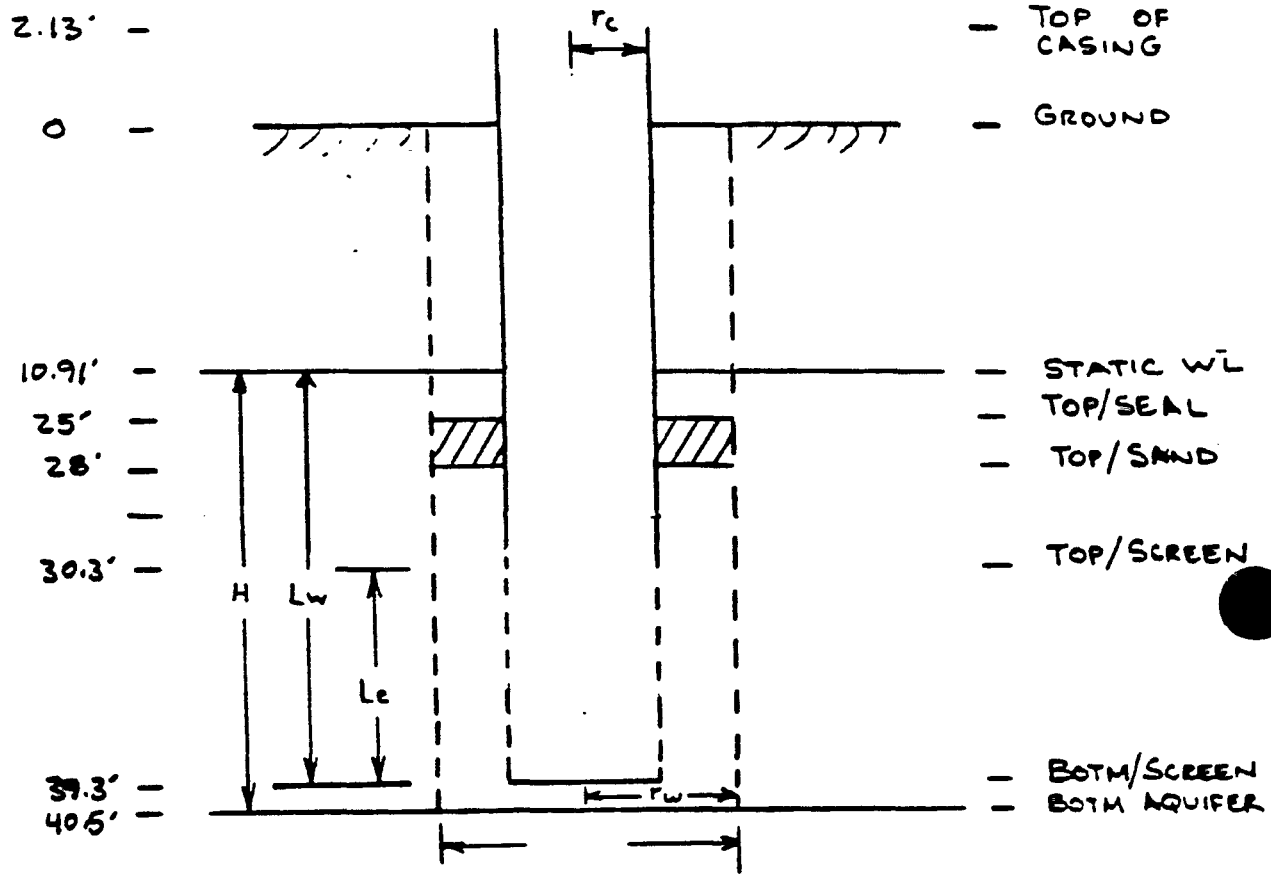
DATE	TIME 1700	(t) MIN SINCE PUMP START OR STOP	WATER LEVEL MEASUREMENTS HELD	CUT	DTW Run #1	(s) DD or RECOV. (ft) Run #2	REMARKS
1-5-87	0.0				-4.09	-3.97	
	0.003				-3.85	-3.78	
	0.007				-3.67	-3.53	
	0.010				-3.50	-3.35	
	0.013				-3.36	-3.19	
	0.020				-3.10	-2.99	
	0.023				-2.97	-2.81	
	0.027				-2.87	-2.66	
	0.030				-2.72	-2.59	
	0.033				-2.66	-2.62	
	0.050				-2.20	-2.03	
	0.067				-1.83	-1.67	
	0.083				-1.52	-1.38	
	0.100				-1.27	-1.14	
	0.117				-1.05	-0.94	
	0.133				-0.87	-0.77	
	0.150				-0.72	-0.64	
	0.167				-0.60	-0.53	
	0.183				-0.51	-0.44	
	0.200				-0.42	-0.37	
	0.250				-0.24	-0.21	
	0.300				-0.15	-0.13	
	0.317				-0.13	-0.11	
	0.333				-0.11	-0.10	
	0.417				-0.06	-0.05	
	0.500				-0.03	-0.03	
	0.667				-0.02	-0.02	
	0.750				-0.01	-0.01	

AR302438

CLIENT EPA - DRAKE CHEM	FILE NO 620Y	BY RDB	PAGE 1 OF
SUBJECT. SLUG TEST CALC MW-M117		CHECKED BY MLM 3/9/88	DATE 2-18-88

CALCULATIONS: (BOUWER & RICE)

DEPTH (FT.) WELL CONSTRUCTION



$H = 40.5 - 10.91' = 29.59'$

$L_w = 39.3 - 10.91' = 28.39'$

$L_e = 39.3 - 30.3' = 9.0'$

$r_c = 0.083'$

$r_w = 0.42'$

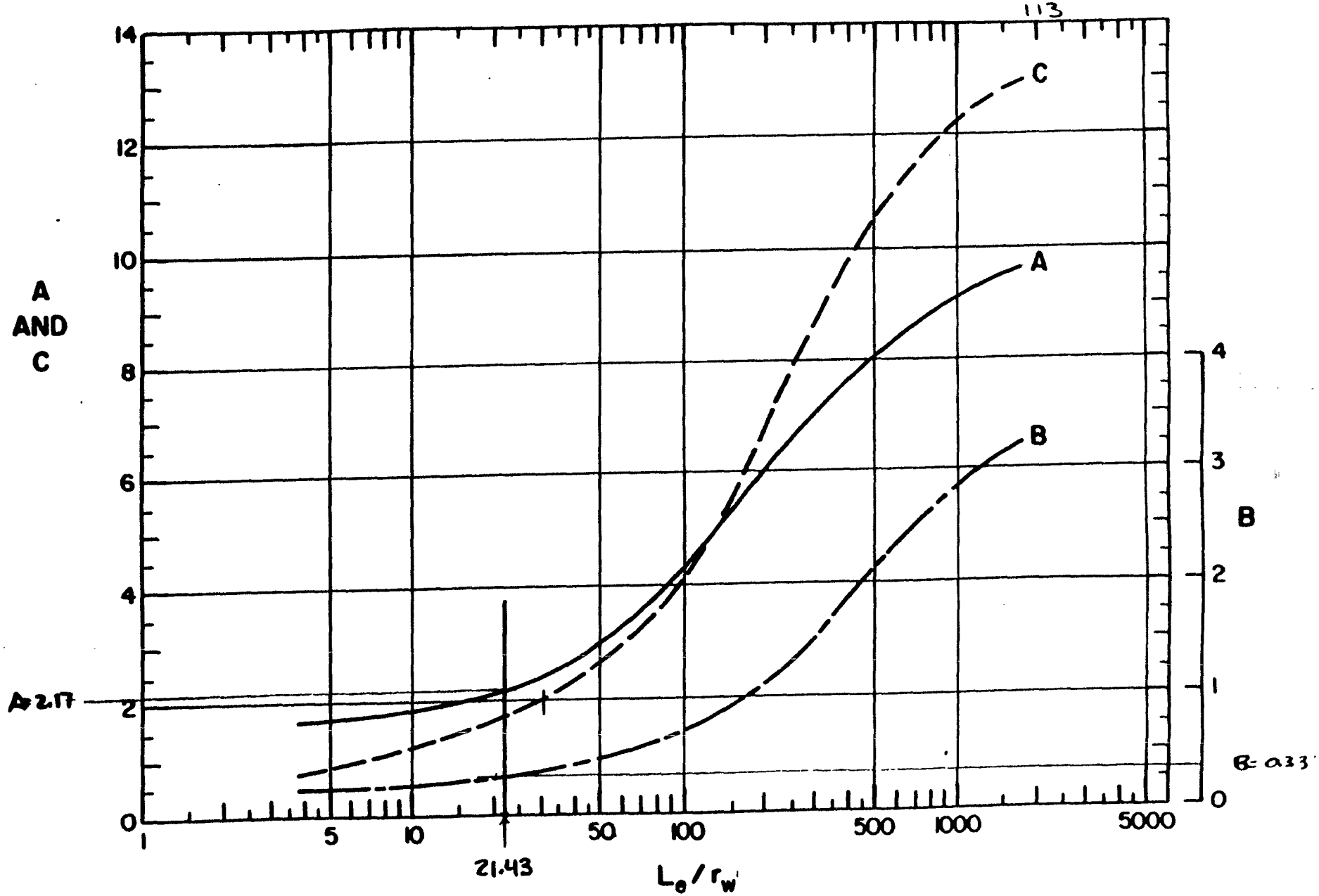
$L_e/r_w = 9.0/0.42 = 21.43$

$A = 2.17$

$B = 0.33$

$C =$

102
103
104
112
113
117
122
124



C-96

AR302440

CLIENT	FILE NO.	BY:	PAGE 3 OF
EPA · DRAKE CHEM	620Y	RDB	
SUBJECT: SLUG TEST CALC'S. MW-M117		CHECKED BY:	DATE

$$\ln R_e/r_w = \left[\frac{1.1}{\ln(L_w/r_w)} + \frac{A + B\ln[(H-L_w)/r_w]}{L_e/r_w}\right]^{-1}$$

$$\ln R_e/r_w = \left[\frac{1.1}{\ln(28.39/0.42)} + \frac{2.17 + (0.33)\ln[(29.59-28.39)/0.42]}{21.43}\right]^{-1}$$

$$\ln R_e/r_w = \left[0.261 + 0.117\right]^{-1}$$

$$\ln R_e/r_w = 2.65$$

$$K = \frac{r_c^2 \ln(R_e/r_w)}{2L_e} \cdot \frac{1}{t} \ln Y_0/Y_t$$

$$K = \frac{(0.083)^2(2.65)}{2(9.0)} \cdot \frac{1}{0.2} \ln\left(\frac{3.80}{0.42}\right)$$

$$K = (1.01\times10^{-3})(5.0)(2.20)$$

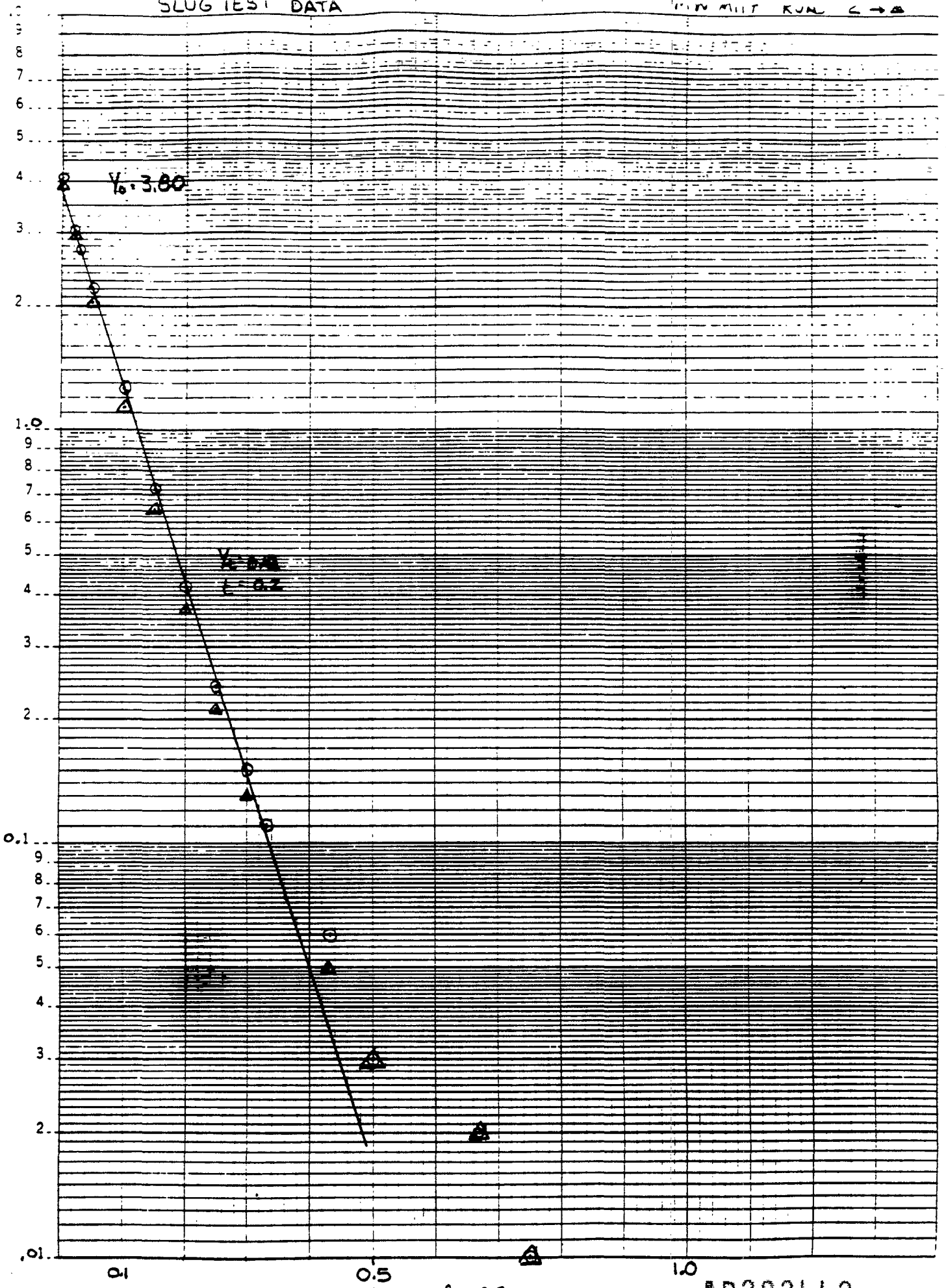
$$K = 1.11\times10^{-2}\ \text{ft/min.}$$

$$K = 9.64\times10^{-3}\ \text{cm/sec}$$

$$T = K\cdot D = (1.11\times10^{-2}\ \text{ft/min})(29.59\ \text{ft}) = 0.328\ \text{ft}^2/\text{min}$$

$$= 3533\ \text{gpd/ft}$$

SLUG TEST DATA



46 5490

K+E LOGARITHMIC 3 CYCLES X 5 DECADES
KEUFFEL & ESSER CO. MADE IN U.S.A.

C-98

NUS CORPORATION
A Halliburton Company

SITE NAME DRAKE CHEMICAL
WELL MEASURED MW-M118 RUN #2+2
PUMPING WELL

COMPUTED ____ CHECKED ____
PROJECT NO ____
PAGE ____ OF

- DISTANCE FROM PUMPING WELL (ft) (r) ____ - PUMPING RATE (gpm) (Q) ____
- STATIC H_2O LEVEL (ft) (s_o) 15.88' TOR - PUMP SETTING FEET BELOW MONITORING POINT ____
- TIME PUMPING START OR STOP (t_o) ____ - MONITORING POINT Top of riser pipe
- ELEVATION OF MONITORING POINT (ft above MSL) 555.47'

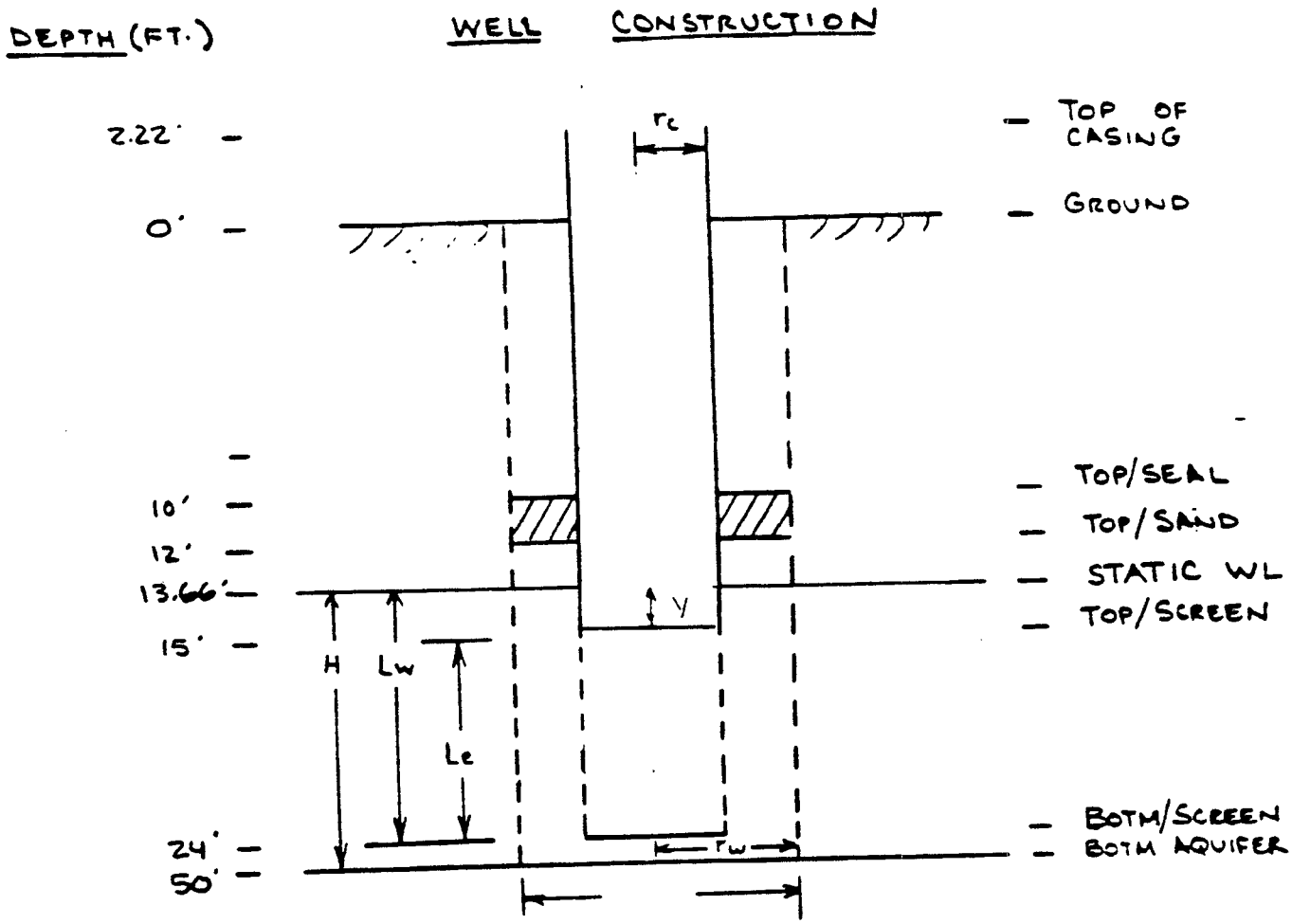
DATE	TIME	(t) MIN. SINCE PUMP START OR STOP	WATER LEVEL MEASUREMENTS			(s) DD or RECOV. (ft.)	REMARKS
			HELD	CUT	DTW Run #1	Run #2	
1-5-88	1150		0.0000		2.29	2.44	
			0.0033		2.33	2.32	
			0.0066		2.16	2.22	
			0.0099		2.14	2.14	
			0.0133		2.05	2.09	
			0.0166		2.00	2.03	
			0.0200		1.92	1.96	
			0.0233		1.86	1.86	
			0.0266		1.80	1.80	
			0.0300		1.74	1.74	
			0.0333		1.68	1.68	
			0.0500		1.39	1.36	
			0.0666		1.17	1.14	
			0.0833		1.00	.97	
			0.1000		0.88	.85	
			0.1166		0.77	.74	
			0.1333		0.69	.65	
			0.1500		0.62	.58	
			0.1666		0.56	.51	
			0.1833		0.50	.46	
			0.2000		0.46	.42	
			0.2166		0.42	.38	
			0.2333		0.38	.34	
			0.2500		0.35	.32	
			0.2666		0.32	.28	
			0.2833		0.29	.26	
			0.3000		0.26	.23	
			0.3166		0.24	.22	
			0.3333		0.22	.19	
			0.4167		0.15	.12	
			0.5000		0.10	.09	
			0.5833		0.07	.05	
			0.6667		0.05	.04	
			0.7500		0.04	.03	
			0.8333		0.03	.02	
			1.0000		0.02	.01	
			1.5000		0.01	.00	

C-99

AR302443

CLIENT EPA DRAKE CHEM	FILE NO 620Y	BY RDB	PAGE 1 OF
SUBJECT SLUG TEST CALC. MW-M 118		CHECKED BY	DATE 2-18-88

CALCULATIONS: (BOUWER & RICE)



$H = 50' - 13.66' = 36.34'$

$L_w = 24' - 13.66' = 10.34'$

$L_e = 24' - 15' = 9.0'$

$r_c = 0.083'$

$r_w = 0.25'$

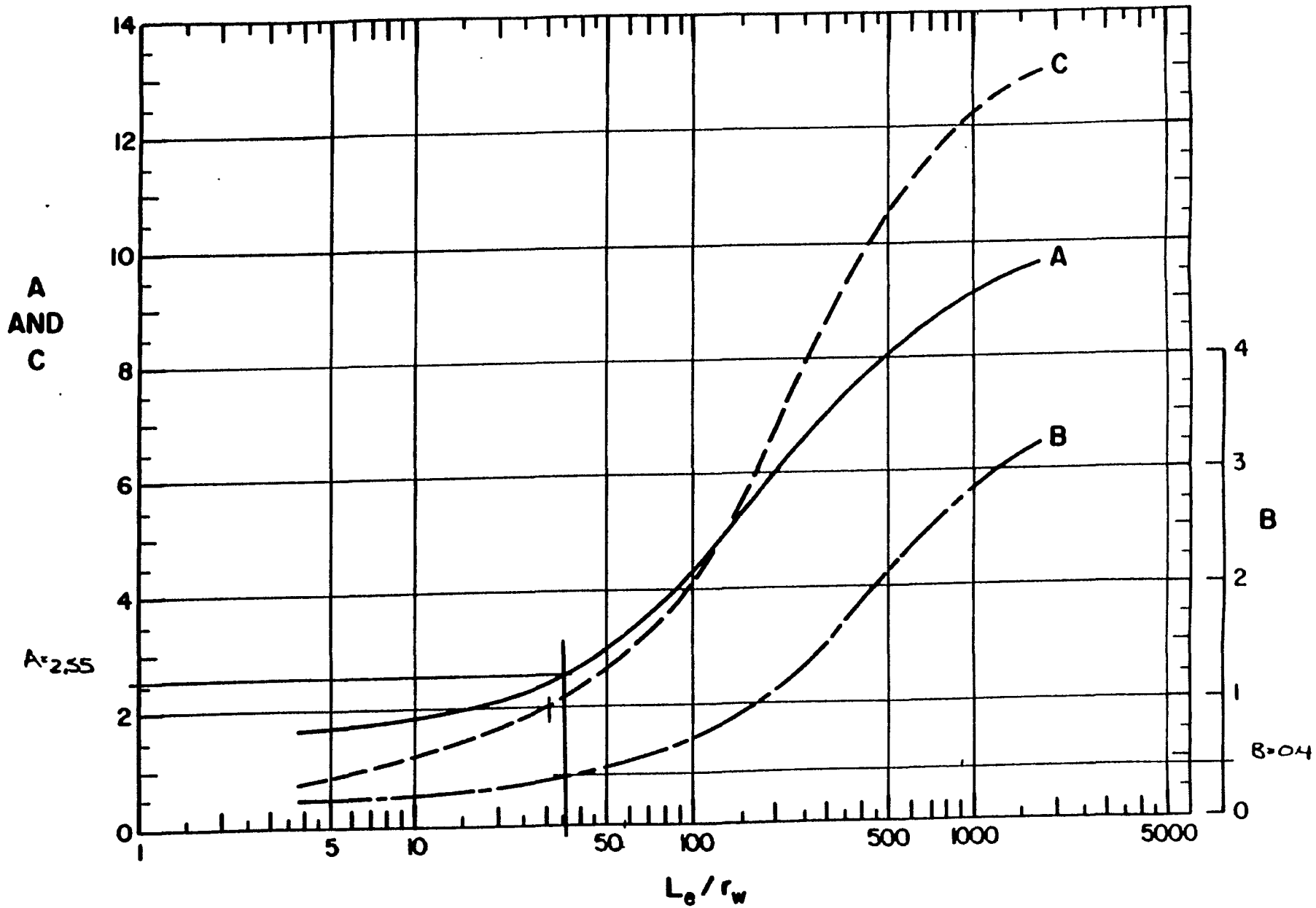
$L_e/r_w = 9.0/0.25 = 36$

$A = 2.55$

$B = 0.40$

$C =$

MW .MIIC



C-101

AR302445

CLIENT	FILE NO.	BY	PAGE 3 OF
EPA · DRAKE CHEM	620Y	RDB	
SUBJECT: SLUG TEST CALC'S, MW-M 118		CHECKED BY	DATE: 3/30/88

$$\ln R_e/r_w = \left[\frac{1.1}{\ln(L_w/r_w)} + \frac{A + B\ln[(H-L_w)/r_w]}{L_e/r_w}\right]^{-1}$$

$$\ln R_e/r_w = \left[\frac{1.1}{\ln(10.34/0.25)} + \frac{2.55 + (0.40)\ln[(36.34-10.34)/0.25]}{36}\right]^{-1}$$

$$\ln R_e/r_w = \left[0.300 + 0.122\right]^{-1}$$

$$\ln R_e/r_w = 2.37$$

$$K = \frac{r_c^2 \ln(R_e/r_w)}{2L_e} \cdot \frac{1}{t} \ln Y_0/Y_t$$

$$K = \frac{(0.083)^2(2.37)}{2(9.0)} \cdot \frac{1}{0.2} \ln\left(\frac{1.57}{0.46}\right)$$

$$K = (9.07 \times 10^{-4})(5.0)(1.23)$$

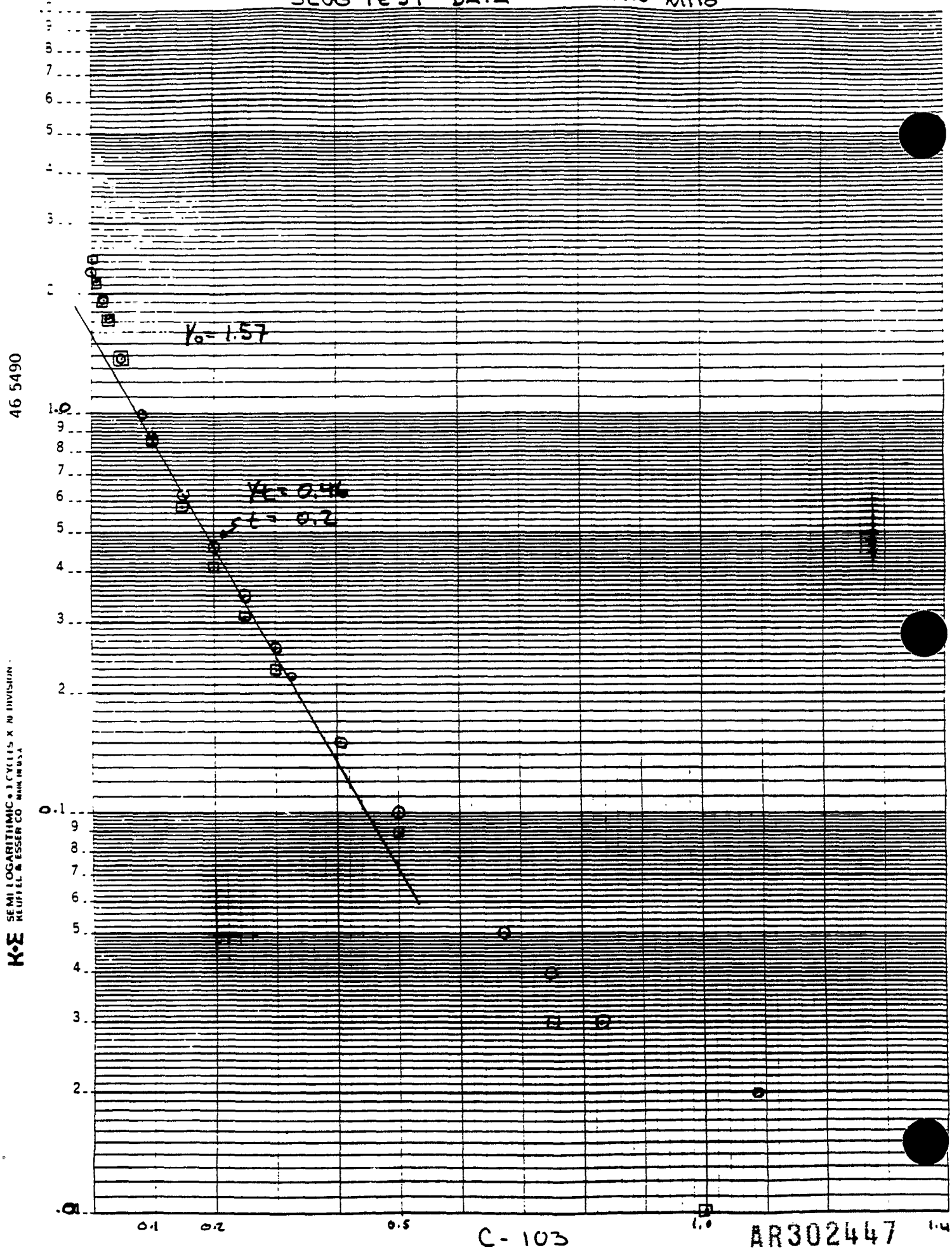
$$K = 5.58 \times 10^{-3}\ \text{ft/min.}$$

$$K = 2.84 \times 10^{-3}\ \text{cm/sec}$$

$$T = K \cdot D = (5.58 \times 10^{-3}\ \text{ft/min})(36.34) = 0.203\ \text{ft}^2/\text{min}$$

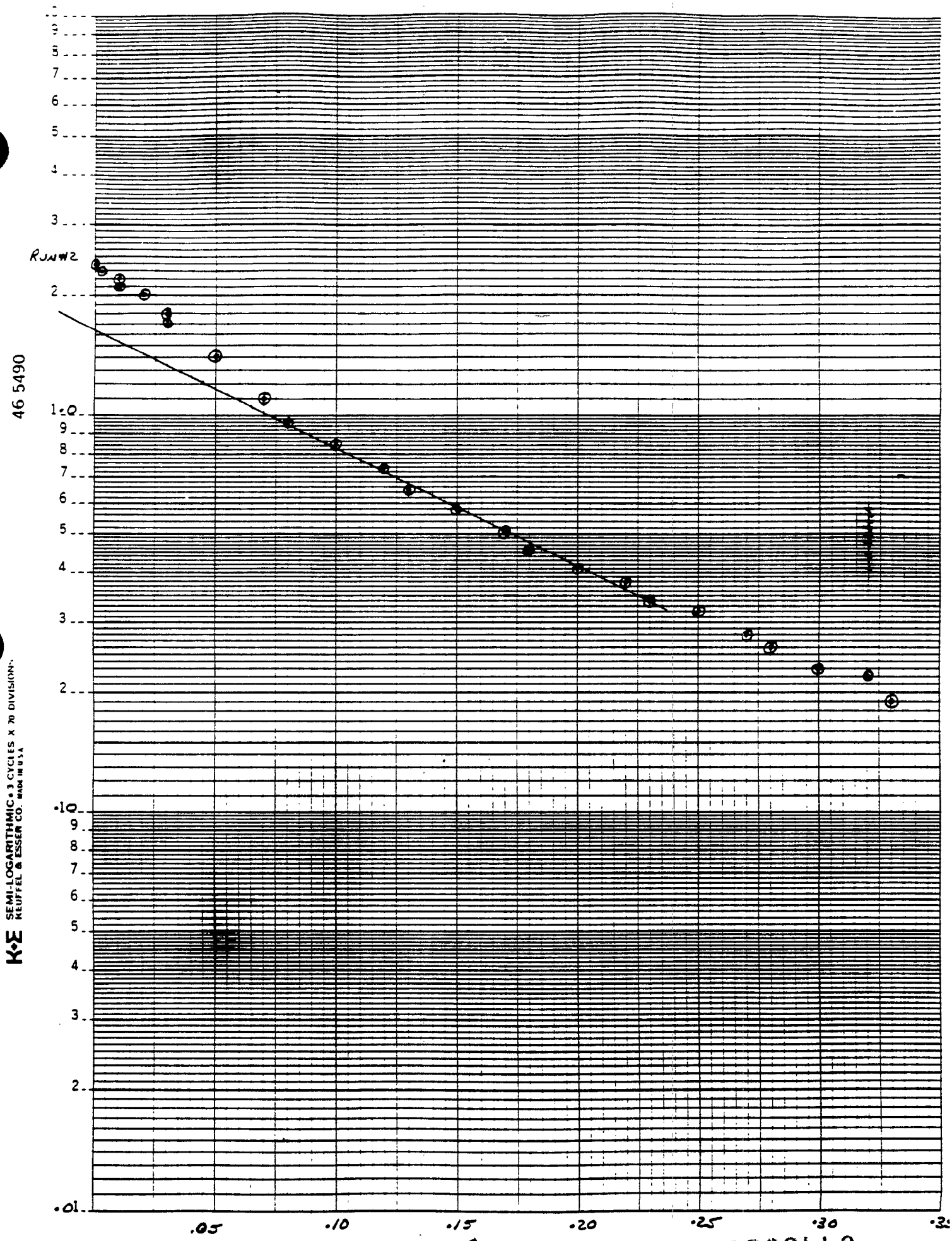
$$= 2187\ \text{gpd/ft}$$

SLUG TEST DATA MW-M118 Run #2



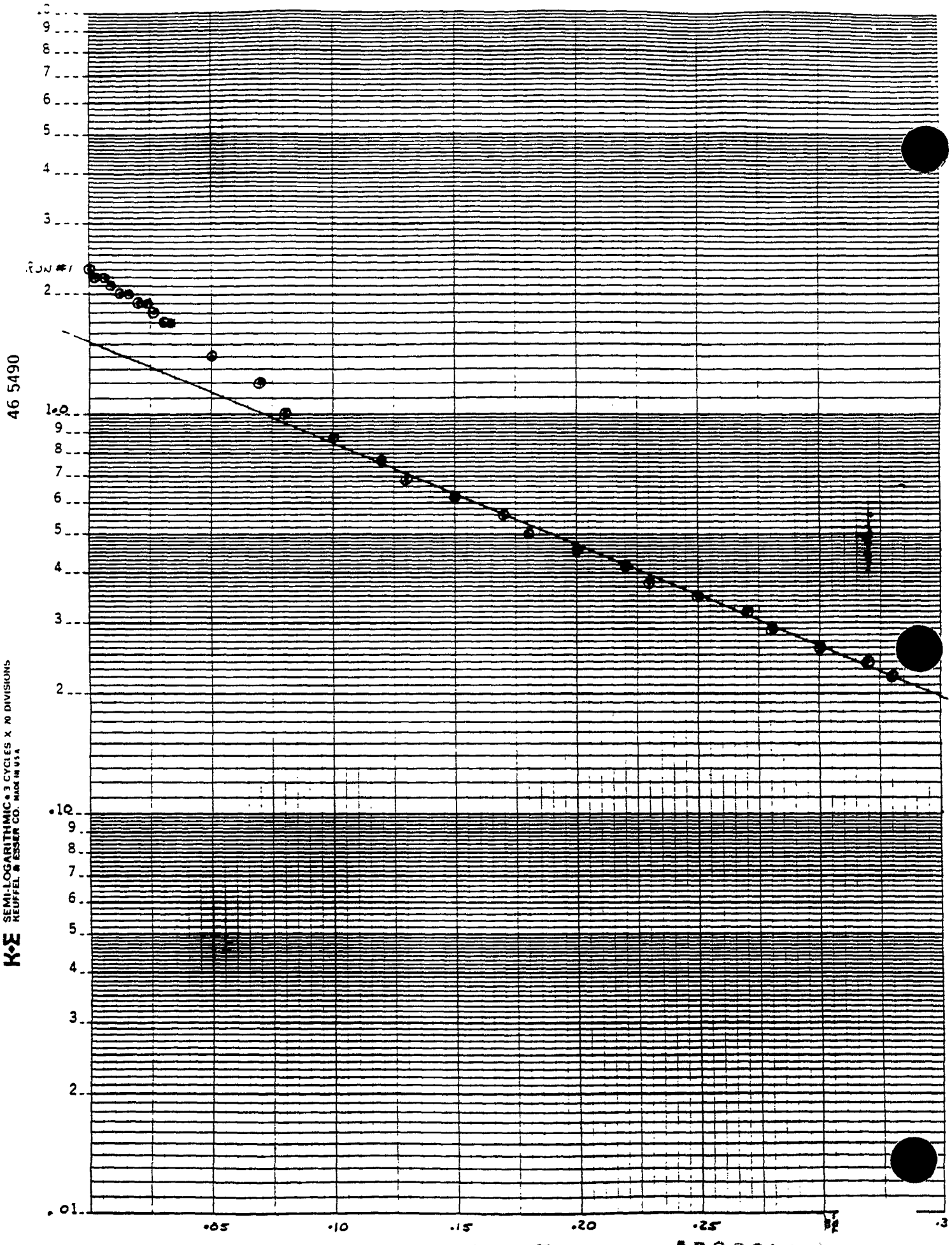
C-103

AR302447



C-104

AR302448



C-105

AR302449

NUS CORPORATION
A Halliburton Company

SITE NAME DRAKE CHEM
WELL MEASURED MW-M119
PUMPING WELL

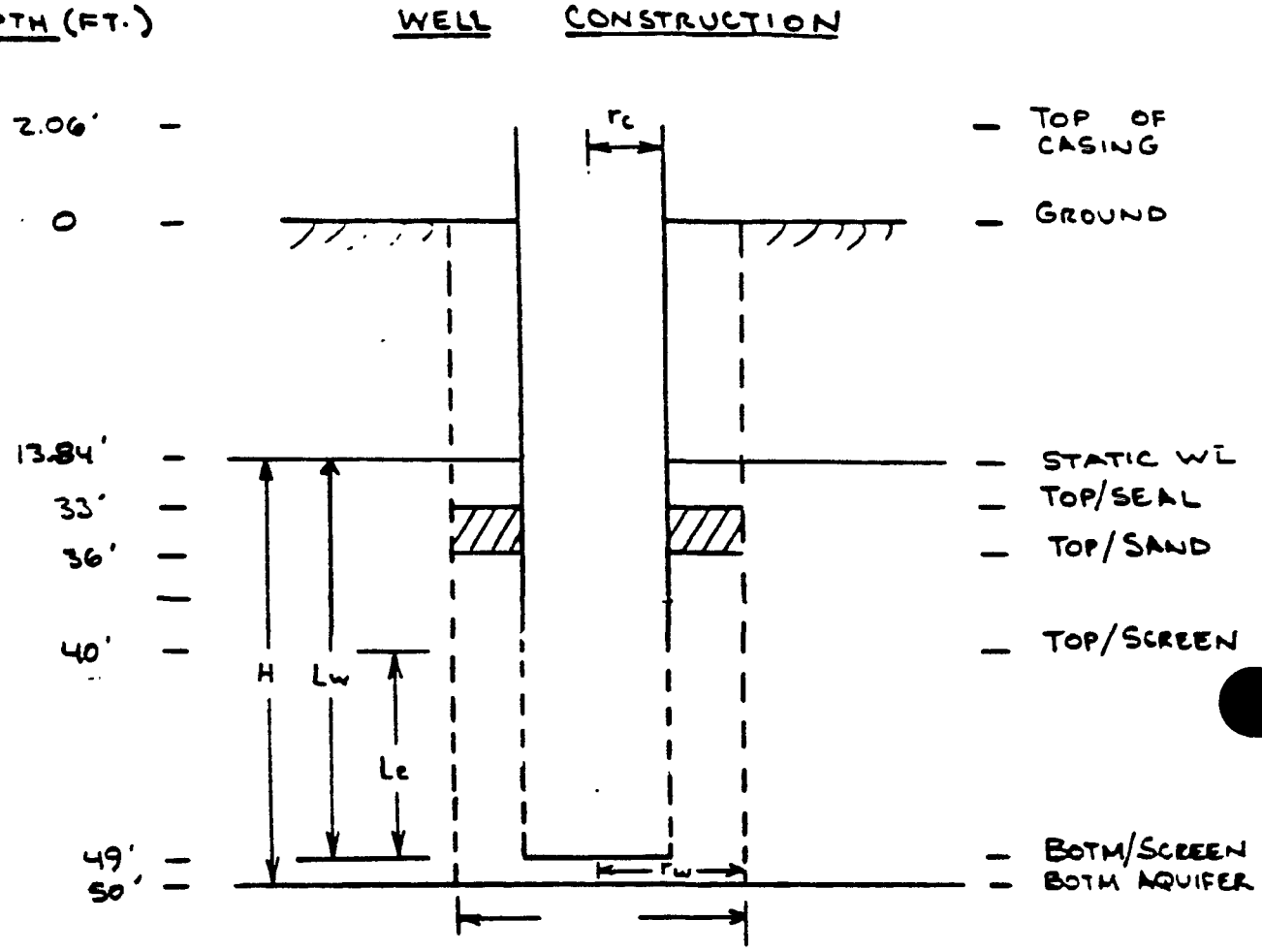
COMPUTED ____ CHECKED ____
PROJECT NO. 620Y
PAGE ____ OF ____

- DISTANCE FROM PUMPING WELL (ft.) (r) ____ - PUMPING RATE (gpm) (Q) ____
- STATIC H_2O LEVEL (ft.) (s_0) ____ - PUMP SETTING FEET BELOW MONITORING POINT ____
- TIME PUMPING START OR STOP (t_0) ____ - MONITORING POINT ____
- ELEVATION OF MONITORING POINT (ft. above MSL) ____

DATE	TIME	(t) MIN. SINCE PUMP START OR STOP	WATER LEVEL MEASUREMENTS			(s) DD or RECOV. (ft.)	REMARKS
			HELD	CUT Run#1	DTW Run#2	Run#3	
1-5-87	0930	0.00		-2.04	-3.12	-5.24	
		0.01		-1.85	-2.89	-4.80	
		0.02		-1.75	-2.67	-4.46	
		0.03		-1.62	-2.47	-4.10	
		0.05		-1.39	-2.10	-3.42	
		0.10		-0.91	-1.34	-2.11	
		0.15		-0.56	-0.79	-1.20	
		0.20		-0.32	-0.42	-0.62	
		0.25		-0.16	-0.20	-0.28	
		0.30		-0.09	-0.10	-0.13	
		0.42		-0.04	-0.05	-0.10	
		0.50		-0.04	-0.04	-0.09	
		0.75		-0.02	-0.02	-0.06	
		1.00		-0.02	-0.01	-0.05	
		1.50		-0.01	-0.01	-0.03	
		2.00				-0.02	
		2.50				-0.02	
		3.00				-0.02	

CLIENT	FILE NO	BY	PAGE 1 OF
EPA - DRAKE CHEM	620Y	RDB	
SUBJECT: SLUG TEST CALC MW-M119		CHECKED BY MLM 3/16/88	DATE 2-18-88

CALCULATIONS: (BOUWER & RICE)



$H = 50' - 13.84' = 36.16'$

$L_w = 49' - 13.84' = 35.16'$

$L_e = 49' - 40' = 9.0'$

$r_c = 0.083'$

$r_w = 0.42$

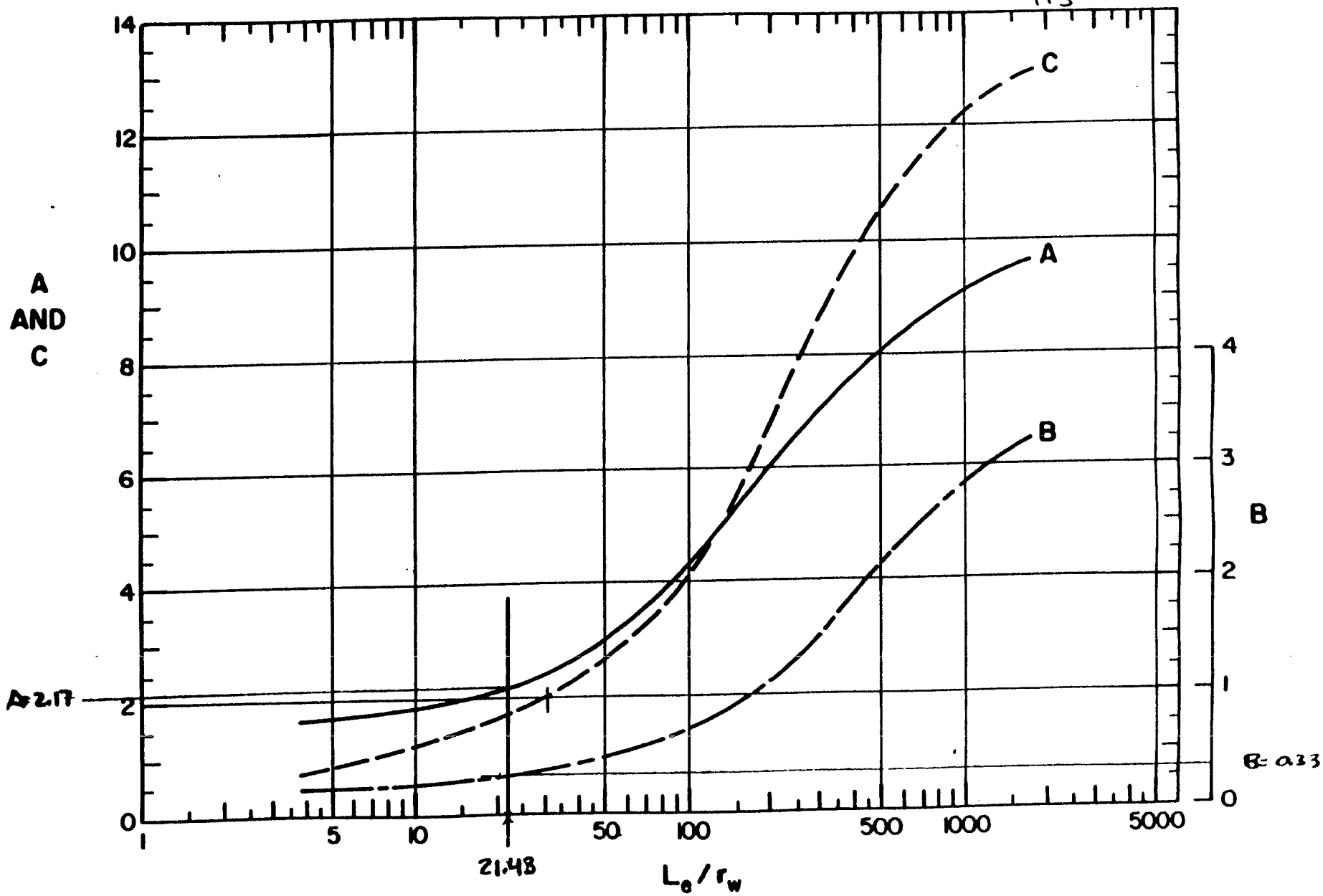
$L_e/r_w = 9.0/0.42 = 21.43$

$A = 2.17$

$B = 0.33$

$C =$

N- 11 15
102 117
103 122
104 124
112 119
113



C-108

AR302452

CLIENT	FILE NO.	BY	PAGE 3 OF
EPA · DRAKE CHEM	620Y	RDB	
SUBJECT		CHECKED BY	DATE
SLUG TEST CALC'S. MW-M119			2-24-88

$$\ln R_e/r_w = \left[\frac{1.1}{\ln(L_w/r_w)} + \frac{A + B\ln[(H-L_w)/r_w]}{L_e/r_w}\right]^{-1}$$

$$\ln R_e/r_w = \left[\frac{1.1}{\ln(35.16/0.42)} + \frac{2.17 + (0.33)\ln[(36.16-35.16)/0.42]}{21.43}\right]^{-1}$$

$$\ln R_e/r_w = \left[0.248 + 0.115\right]^{-1}$$

$$\ln R_e/r_w = 2.76$$

$$K = \frac{r_c^2 \ln(R_e/r_w)}{2L_e} \cdot \frac{1}{t} \ln Y_0/Y_t$$

$$K = \frac{(0.083)^2(2.76)}{2(9.0)} \cdot \frac{1}{0.2} \ln\left(\frac{3.12}{0.42}\right)$$

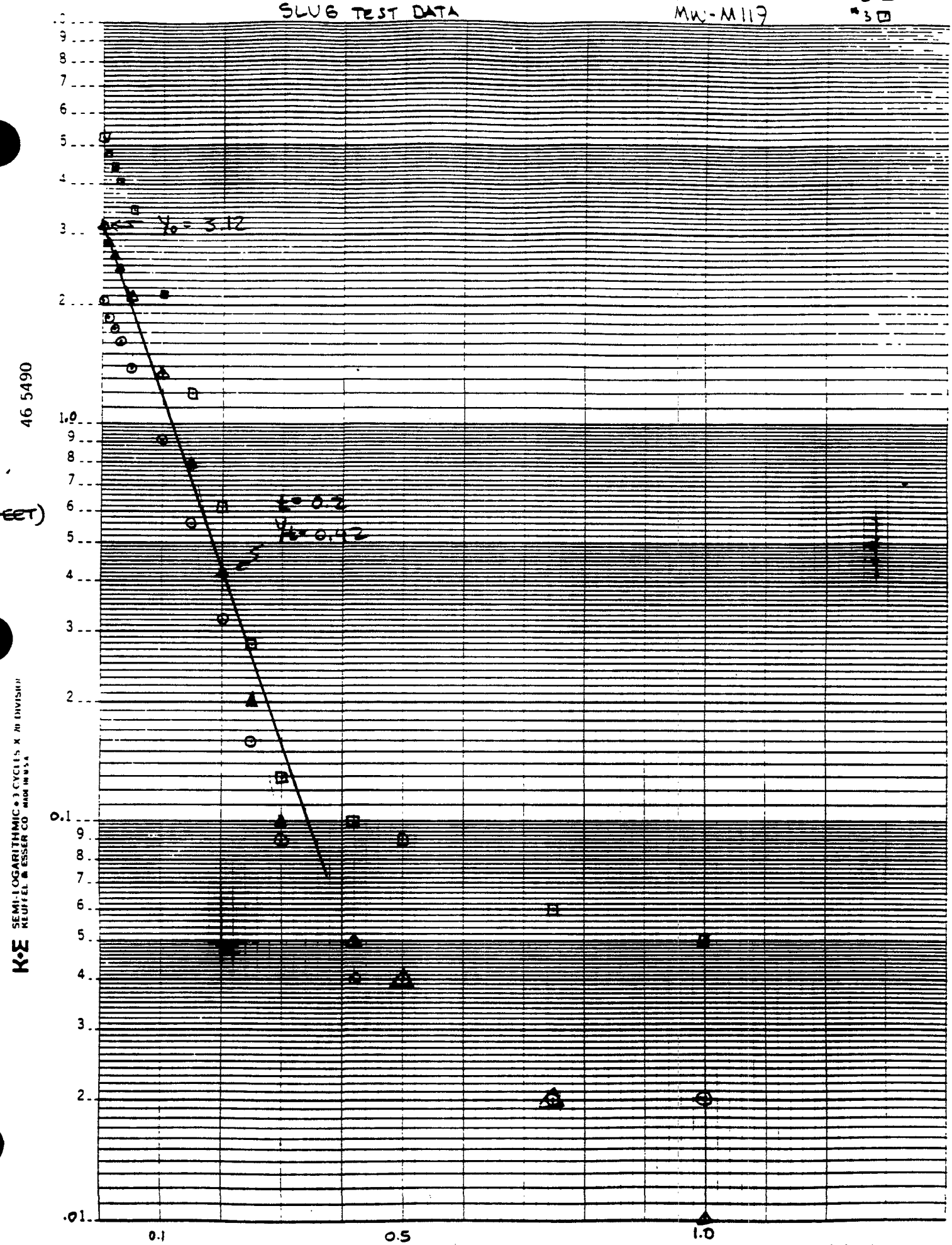
$$K = (1.06\times10^{-3})(5.0)(2.00)$$

$$K = 1.06\times10^{-2}\ \text{ft/min.}$$

$$K = 5.38\times10^{-3}\ \text{cm/sec.}$$

$$T = K\cdot D = (1.06\times10^{-2}\ \text{ft/min})(36.16) = 0.383\ \text{ft}^2/\text{min.}$$
$$= 4125\ \text{gpd/ft}$$

SLUG TEST DATA MW-M117 #3



C-110

AR302454

NUS CORPORATION
A Halliburton Company

SITE NAME: DRAKE CHEMICAL
WELL MEASURED: MW-M120 RUN #1
PUMPING WELL:

COMPUTED: CHECKED:
PROJECT NO: 620 Y
PAGE: OF

- DISTANCE FROM PUMPING WELL (ft) (r):
- PUMPING RATE (gpm) (Q):
- STATIC H_2O LEVEL (ft) (s_o): 16.01 Top of riser
- PUMP SETTING FEET BELOW MONITORING POINT:
- TIME PUMPING START OR STOP (t_o):
- MONITORING POINT: Top of pvc riser
- ELEVATION OF MONITORING POINT (ft above MSL):

DATE	TIME	(t) MIN SINCE PUMP START OR STOP	WATER LEVEL MEASUREMENTS			(s) DD or RECOV. (ft)	REMARKS	
			HELD	CUT	DTW	Run #1	Run #2	Run #3
1-5-87		0.0000				5.49	4.81	5.50
		0.0033				5.40	4.63	5.41
		0.0066				5.34	4.42	5.35
		0.0099				4.88	4.30	4.89
		0.0133				5.00	4.64	5.01
		0.0166				5.05	4.21	5.06
		0.0200				4.64	4.04	4.65
		0.0233				5.10	4.18	5.11
		0.0266				4.56	3.84	4.57
		0.0300				4.51	3.63	4.52
		0.0333				4.12	3.53	4.13
		0.0500				3.59	3.01	3.60
		0.0666				3.05	2.53	3.06
		0.0833				2.57	2.12	2.58
		0.1000				2.14	1.76	2.15
		0.1166				1.77	1.44	1.78
		0.1333				1.45	1.17	1.46
		0.1500				1.17	0.93	1.18
		0.1666				0.93	0.74	0.94
		0.1833				0.72	0.57	0.73
		0.2000				0.55	0.44	0.56
		0.2166				0.41	0.33	0.42
		0.2333				0.30	0.24	0.31
		0.2500				0.21	0.19	0.22
		0.2666				0.15	0.14	0.16
		0.2833				0.10	0.12	0.11
		0.3000				.07	0.10	0.08
		0.3166				.06	0.09	0.07
		0.3333				.04	0.09	0.05
		0.4167				.05	0.10	0.06
		0.5000				.04	0.08	0.05
		0.5833				.02	0.08	0.03
		0.8333				.01	0.06	0.02
		0.9167				.00	0.05	0.01
		1.00					0.06	
		1.25					0.05	
		1.50					0.04	
		2.0					0.03	

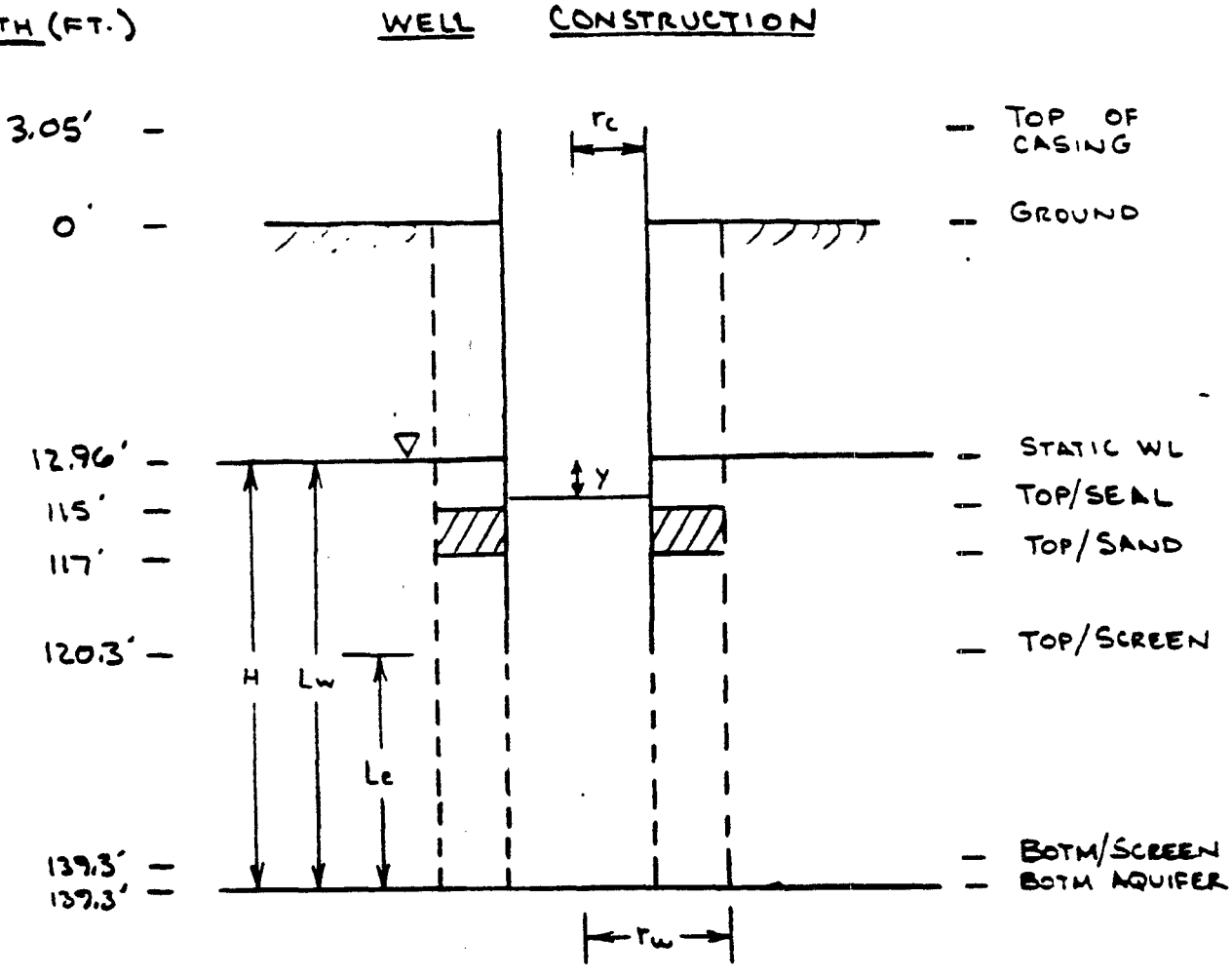
C-111

R302455

NUS CORPORATION AND SUBSIDIARIES — STANDARD CALCULATION SHEET

CLIENT	FILE NO	BY	PAGE 1 OF
EPA - DRAKE CHEM	620 Y	RDB	
SUBJECT SLUG TEST CALC. MW-M120		CHECKED BY MLM 3/10/88	DATE 2-18-88

CALCULATIONS: (BOUWER & RICE)



$H = 139.3' - 12.96' = 126.34'$

$L_w = 139.3' - 12.96' = 126.34'$

$L_e = 139.3 - 120.3' = 19.0'$

$r_c = 0.083'$

$r_w = 0.162'$

$L_e/r_w = 19/.162 = 117.3$

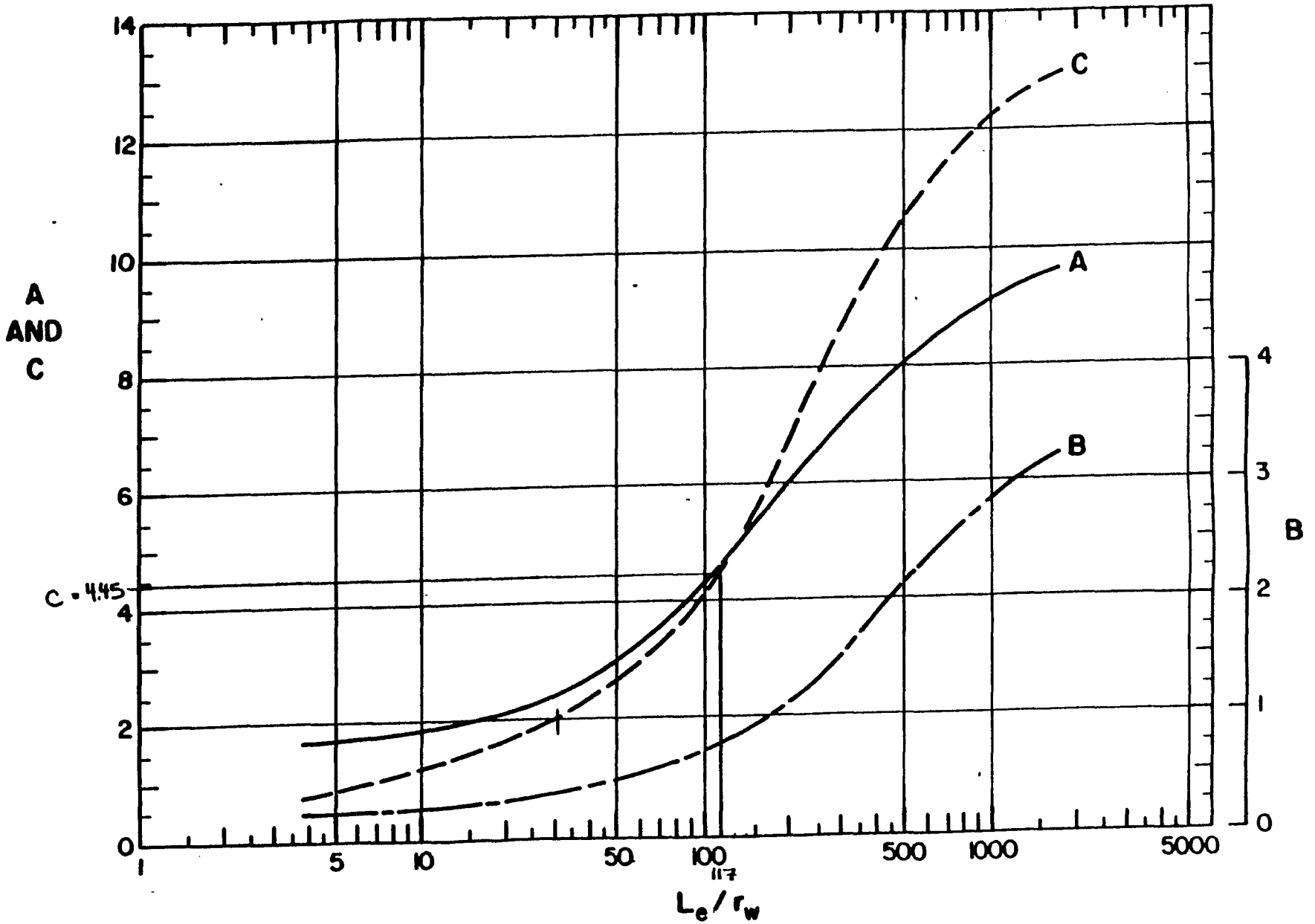
A =

B =

C = 4.45

NUS 1554 REVISED 0285

N.
107
114
120



C-113

AR302457

D = H THEREFORE:

$$\ln R_e/r_w = \left[\frac{1.1}{\ln(L_w/r_w)} + \frac{C}{L_e/r_w}\right]^{-1}$$

$$\ln R_e/r_w = \left[\frac{1.1}{\ln(126.34/0.162)} + \frac{4.45}{(19/0.162)}\right]^{-1}$$

$$\ln R_e/r_w = \left[0.165 + 0.038\right]^{-1}$$

$$\ln R_e/r_w = 4.93$$

$$K = \frac{r_c^2 \ln(R_e/r_w)}{2L_e}\,\frac{1}{t}\,\ln Y_0/Y_t$$

$$K = \frac{(0.083)^2\cdot(4.93)}{2(19)}\left(\frac{1}{0.15}\right)\cdot\ln\left(\frac{5.50}{0.93}\right)$$

$$K = (8.94\times10^{-4})(6.67)(1.78)$$

$$K = 1.06\times10^{-2}\ \text{ft/min.}$$

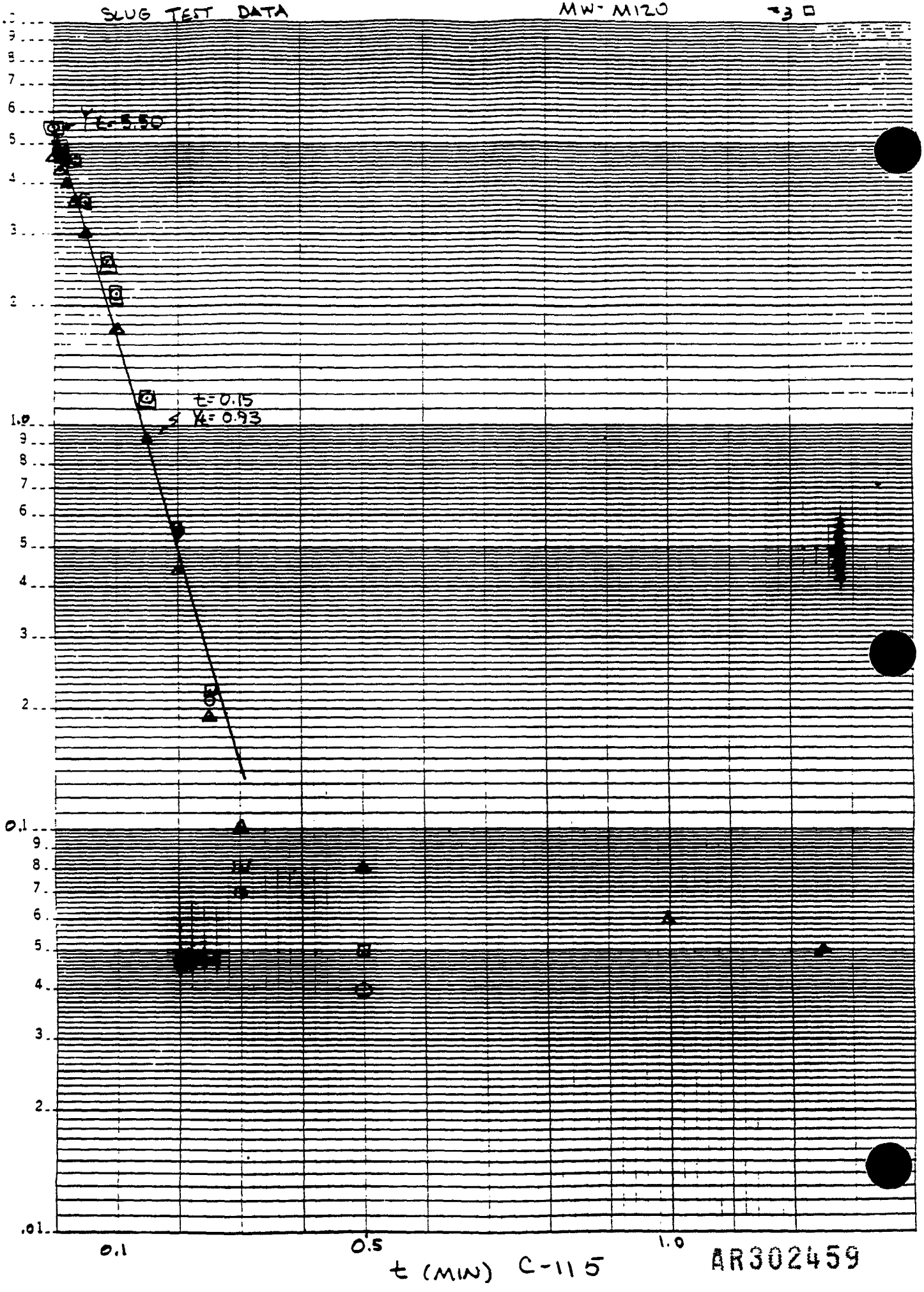
$$K = 5.38\times10^{-3}\ \text{cm/sec.}$$

$$T = K\cdot D = (1.06\times10^{-2}\ \text{ft/min})(139-55) = 0.890\ \text{ft}^2/\text{min}$$

$$= 9506\ \text{gpd/ft}$$

SLUG TEST DATA

MW-M120



46 5490

K+E SEMI-LOGARITHMIC 3 CYCLES X 70 DIVISIONS KEUFFEL & ESSER CO. MADE IN U.S.A.

C-115

AR302459

NUS CORPORATION
A Halliburton Company

SITE NAME DRAKE CHEM
WELL MEASURED MW-M122 Runs #1-#3
PUMPING WELL

COMPUTED ____ CHECKED ____
PROJECT NO 620Y
PAGE ____ OF

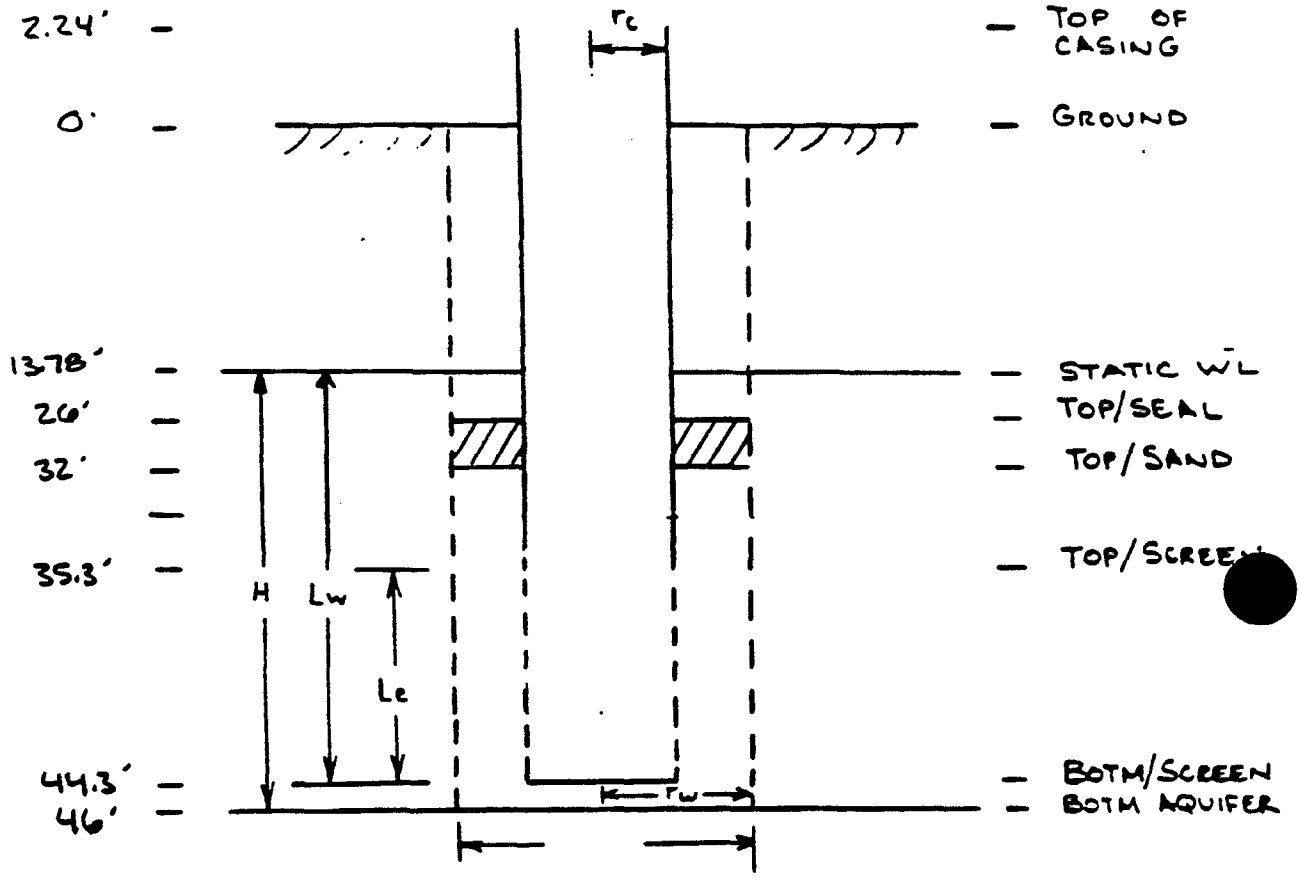
- DISTANCE FROM PUMPING WELL (ft) (r) ____ - PUMPING RATE (gpm) (Q) ____
- STATIC H_2O LEVEL (ft X t_0) 16.02' (Top of riser) - PUMP SETTING FEET BELOW MONITORING POINT ____
- TIME PUMPING START OR STOP (t_0) ____ - MONITORING POINT ____
- ELEVATION OF MONITORING POINT (ft above MSL) ____

DATE	TIME	(t) MIN. SINCE PUMP START OR STOP	WATER LEVEL MEASUREMENTS			(s) DD or RECOV. (ft)	REMARKS
			HELD	CUT Run #1	DTW Run #2	Run #3	
1-6-88	10:38	0		-1.58	-1.89	-1.67	
		0.003		-1.28	-1.49	-1.68	
		0.007		-0.95	-1.88	-1.65	
		0.010		-0.86	-1.93	-1.99	
		0.013		-0.64	-1.65	-1.98	
		0.017		-0.52	-1.42	-1.81	
		0.020		-0.30	-1.14	-1.67	
		0.023		-0.30	-0.96	-1.38	
		0.027		-0.13	-0.73	-1.17	
		0.030		0	-0.54	-1.01	
		0.033			-0.45	-0.75	
		0.050			—	-0.09	
		0.067			—	—	
		0.083			—	—	
		0.100			0.05	0.02	
		0.150			0	0	

CLIENT	FILE NO	BY	PAGE 1 OF
EPA · DRAKE CHEM	620Y	RDB	
SUBJECT SLUG TEST CALC MW-M122		CHECKED BY mcm 3/10/88	DATE 2-18-88

CALCULATIONS: (BOUWER & RICE)

DEPTH (FT.) WELL CONSTRUCTION



$H = 46' - 13.78' = 32.22'$

$L_w = 44.3' - 13.78' = 30.52'$

$L_e = 44.3 - 35.3' = 9.0'$

$r_c = 0.083'$

$r_w = 0.42'$

$L_e/r_w = 9'/0.42' = 21.43'$

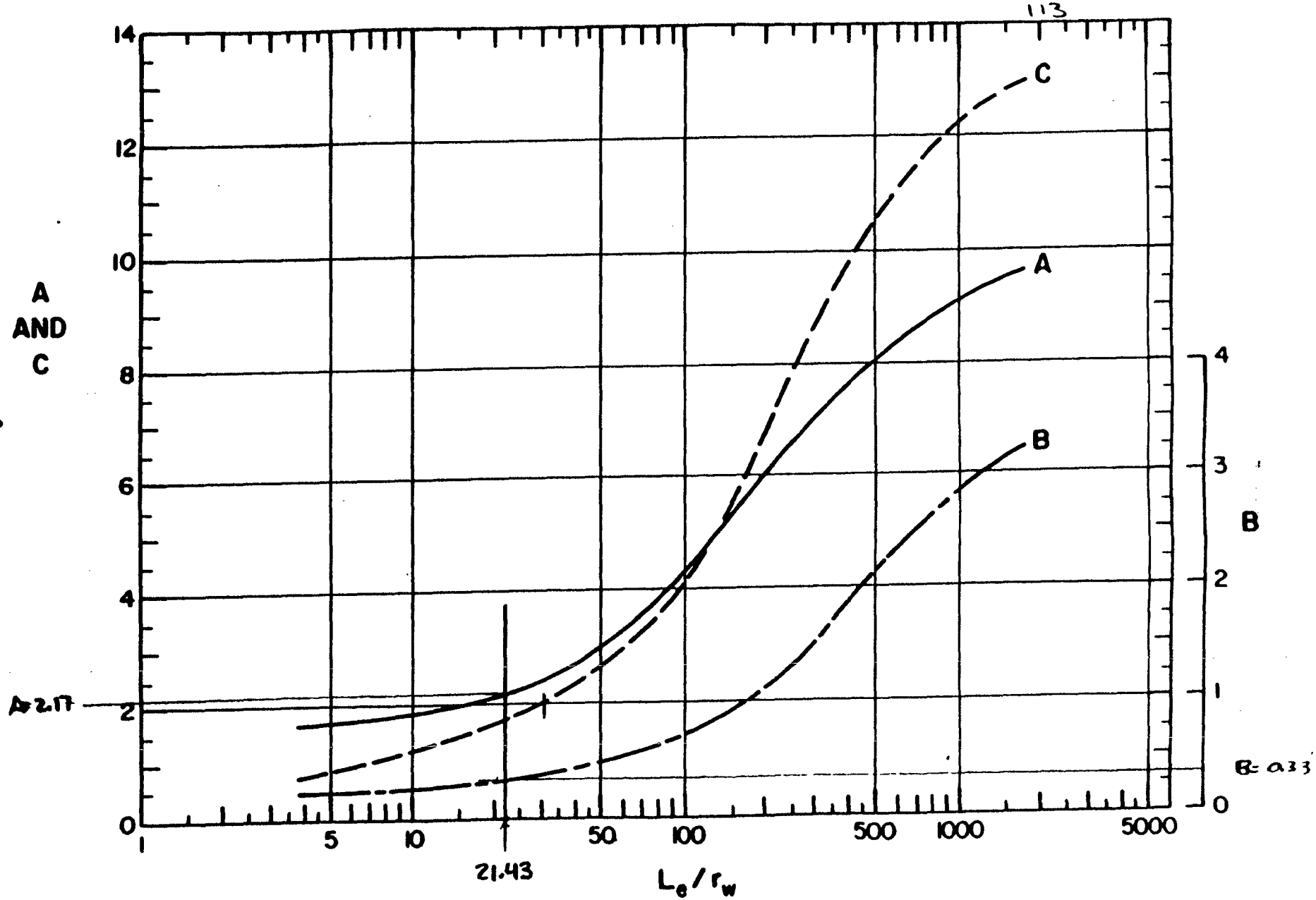
$A = 2.17$

$B = 0.33$

$C =$

NUS 1554 REVISED 0285

102 117
103 122
104 124
112
113



AR302462

$$\ln R_e/r_w = \left[\frac{1.1}{\ln(L_w/r_w)} + \frac{A + B\ln[(H-L_w)/r_w]}{L_e/r_w}\right]^{-1}$$

$$\ln R_e/r_w = \left[\frac{1.1}{\ln(30.52/0.42)} + \frac{2.17 + (0.33)\ln[(32.22-30.52)/0.42]}{21.43}\right]^{-1}$$

$$\ln R_e/r_w = \left[0.257 + 0.123\right]^{-1}$$

$$\ln R_e/r_w = 2.63$$

$$K = \frac{r_c^2 \ln(R_e/r_w)}{2L_e} \cdot \frac{1}{t} \ln Y_0/Y_t$$

$$K = \frac{(0.083)^2(2.63)}{2(9.0)} \cdot \frac{1}{0.023} \ln\left(\frac{1.58}{0.3}\right)$$

$$K = (1.01\times10^{-3})(43.48)(1.66)$$

$$K = 7.29\times10^{-2}\ \text{ft/min.}$$

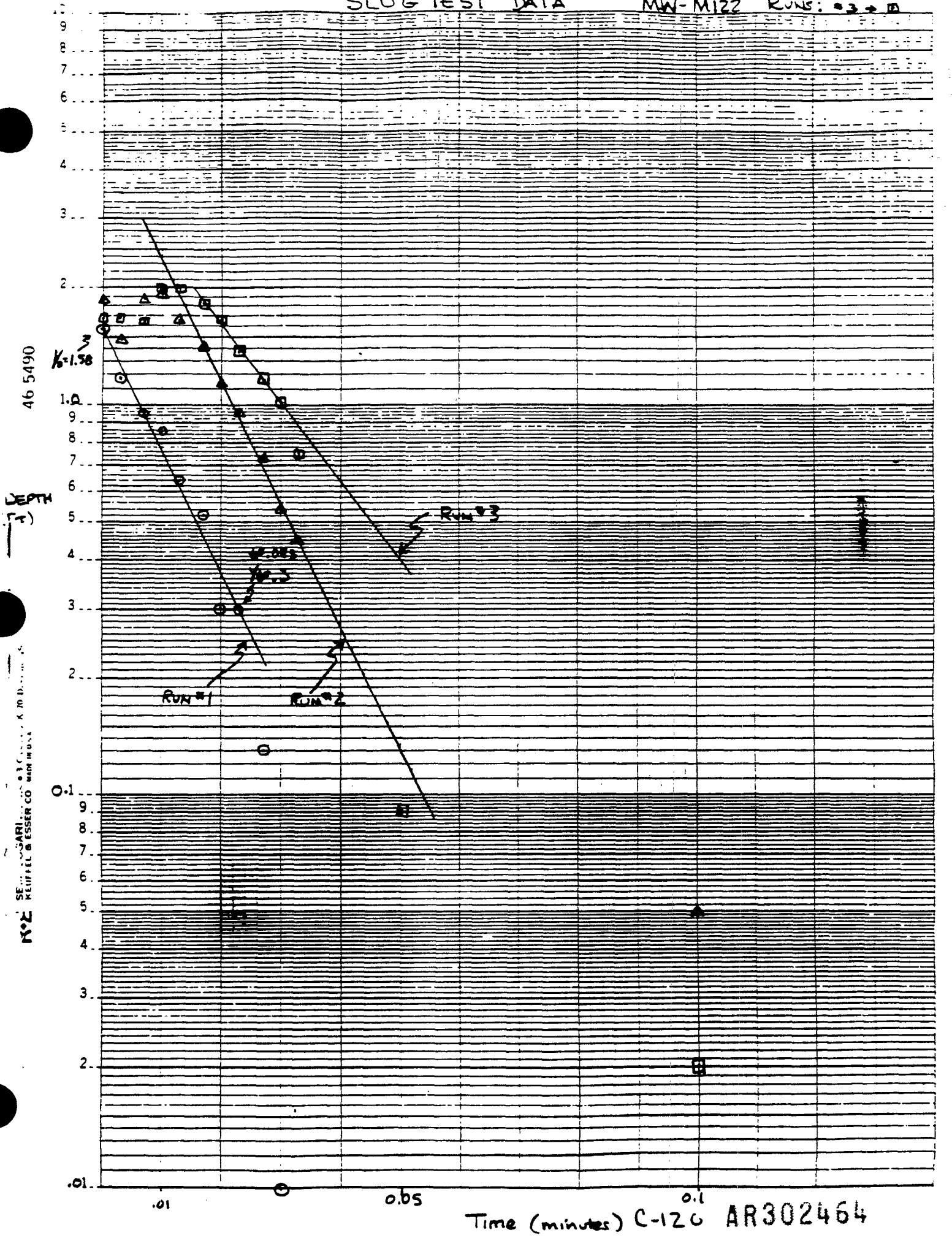
$$K = 3.70\times10^{-2}\ \text{cm/sec}$$

$$T = K\cdot D = (7.29\times10^{-2}\ \text{ft/min})(32.22\ \text{ft}) = 2.35\ \text{ft}^2/\text{min.}$$

$$= 25312\ \text{gpd/ft}$$

NUS 155A REVISED 0285

SLUG TEST DATA MW-M122 RUNS: ▪2 → △ ▪3 → ⊡



C-120 AR302464

NUS CORPORATION
A Halliburton Company

SITE NAME DRAKE CHEM
WELL MEASURED MW-M123 Runs #1+#2
PUMPING WELL

COMPUTED ____ CHECKED ____
PROJECT NO 620Y
PAGE ____ OF

- DISTANCE FROM PUMPING WELL (ft) (r) ____ - PUMPING RATE (gpm) (Q) ____
- STATIC H_2O LEVEL (ft) (t_0) 15.75' (Top of riser) - PUMP SETTING FEET BELOW MONITORING POINT
- TIME PUMPING START OR STOP (t_0) ____ - MONITORING POINT Top of PVC riser
- ELEVATION OF MONITORING POINT (ft above MSL) ____

DATE	TIME	(t) MIN SINCE PUMP START OR STOP	WATER LEVEL MEASUREMENTS			(s) DD or RECOV. (ft)	REMARKS
			HELD	CUT	DTW Run #1	Run #2	SLUG TEST DATA
1-6-88	10:15	0			-7.51	-7.80	
		0.003			-7.40	-7.75	
		.007			-7.32	-7.73	
		.010			-7.24	-7.71	
		.013			-7.20	-7.57	
		.017			-7.09	-7.48	
		.020			-7.13	-7.45	
		.030			-6.84	-7.24	
		.050			-6.51	-6.88	
		.083			-5.91	-6.30	
		0.100			-5.63	-6.02	
		.150			-4.86	-5.24	
		.200			-4.18	-4.55	
		.250			-3.58	-3.92	
		.300			-3.03	-3.36	
		.333			-2.71	-3.01	
		.417			-2.00	-2.27	
		.500			-1.45	-1.66	
		.583			-1.03	-1.19	
		.667			-0.71	-0.84	
		.750			-0.48	-0.57	
		.833			-0.33	-0.38	
		.917			-0.22	-0.26	
		1.000			-0.15	-0.17	
		1.083			-0.11	-0.11	
		1.167			-0.09	-0.08	
		1.250			-0.07	-0.06	
		1.50			-0.06	-0.04	
		1.75			-0.04	-0.03	
		2.00			-0.04	-0.03	
		2.50			-0.04	-0.01	
		3.00			-0.02	-0.01	
		3.50			-0.02	-0.01	
		4.00			-0.02	0.00	
		5.00			-0.01		

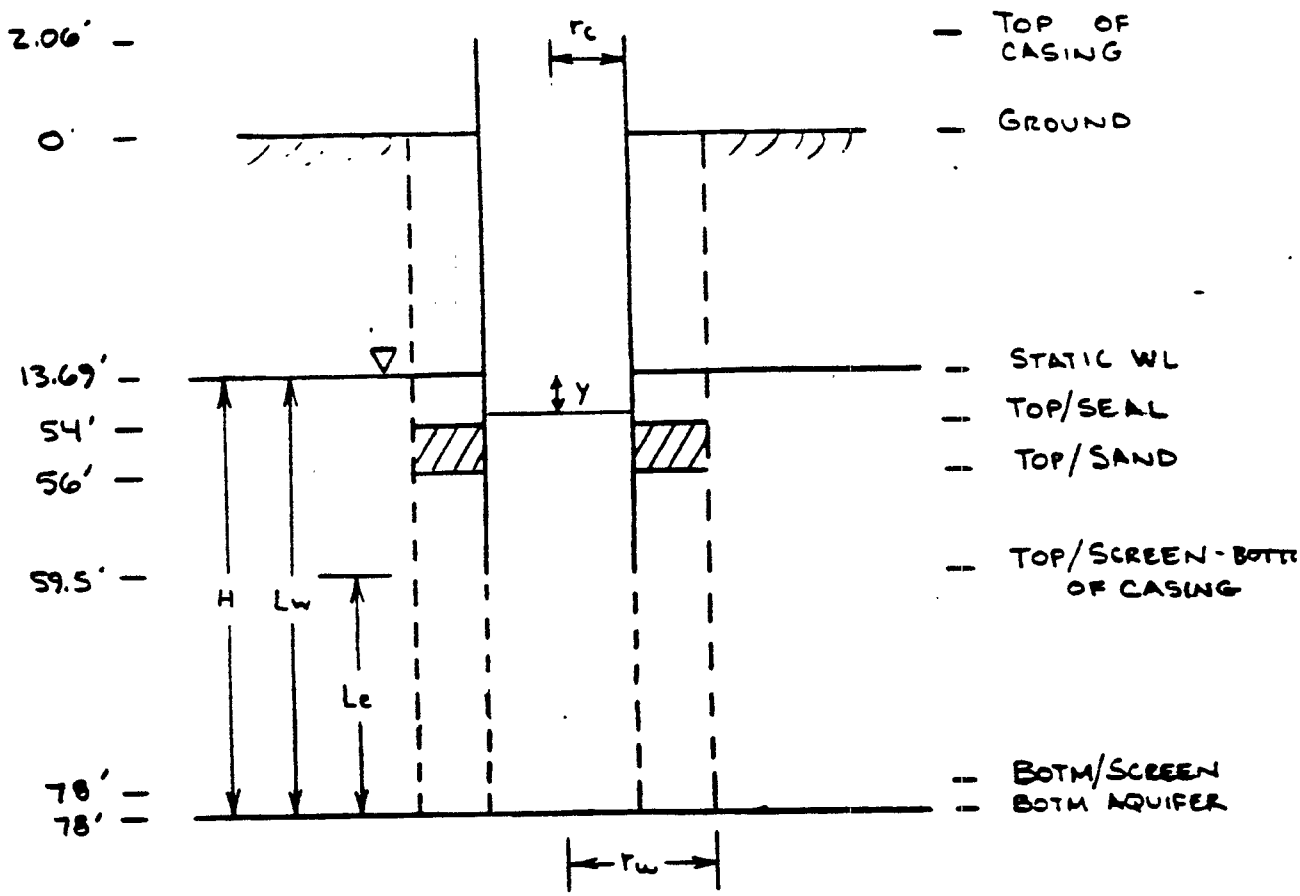
NUS CORPORATION AND SUBSIDIARIES

STANDARD CALCULATION SHEET

CLIENT	FILE NO	BY	PAGE 1 OF
EPA · DRAKE CHEM	620Y	RDB	
SUBJECT SLUG TEST CALC. MW-M123		CHECKED BY MLM 3/10/88	DATE 2-18-88

CALCULATIONS: (BOUWER & RICE)

DEPTH (FT.) WELL CONSTRUCTION



$H = 78' - 13.69' = 64.31'$

$Lw = 78' - 13.69' = 64.31'$

$Le = 78' - 59.5' = 18.5'$

$r_c = 0.083'$

$r_w = 0.162'$

$Le/r_w = 18.5'/0.162' = 114.2$

A =

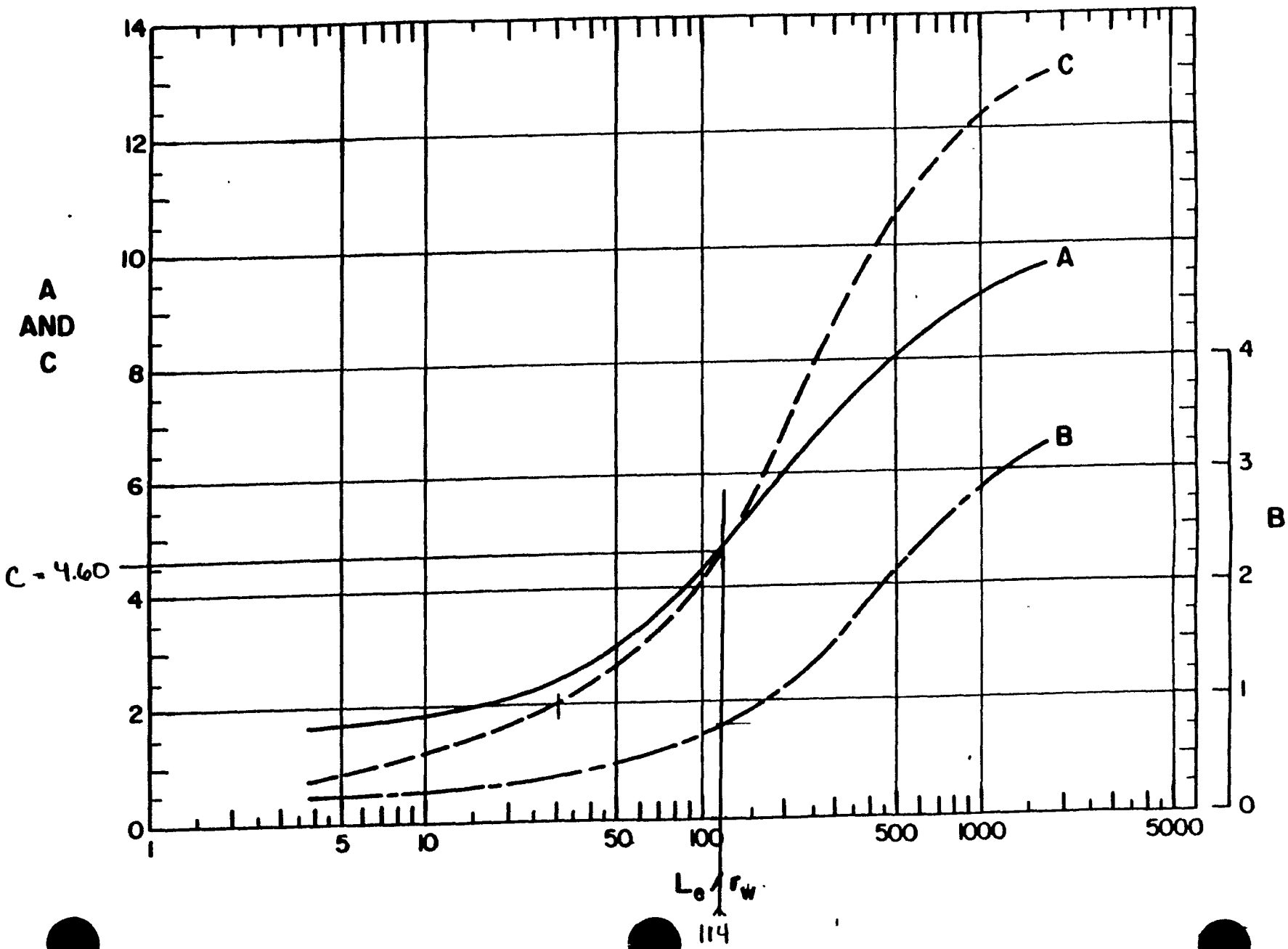
B =

C = 4.60

NUS 1554 REVISED 0285

AR302466

M MI



C-123

AR302467

D = H THEREFORE:

$$\ln R_e/r_w = \left[\frac{1.1}{\ln (L_w/r_w)} + \frac{C}{L_e/r_w}\right]^{-1}$$

$$\ln R_e/r_w = \left[\frac{1.1}{\ln(64.31/0.162)} + \frac{4.60}{114.2}\right]^{-1}$$

$$\ln R_e/r_w = \left[\ 0.184 + 0.040\ \right]^{-1}$$

$$\ln R_e/r_w = 4.46$$

$$K = \frac{r_c^2 \ln (R_e/r_w)}{2L_e} \frac{1}{t} \ln Y_0/Y_t$$

$$K = \frac{(0.083)^2 \cdot (4.46)}{2(18.5)} \left(\frac{1}{0.5}\right) \cdot \ln\left(\frac{7.8}{1.67}\right)$$

$$K = (8.30 \times 10^{-4})(2.0)(1.54)$$

$$K = 2.56 \times 10^{-3}\ \text{ft/min.}$$

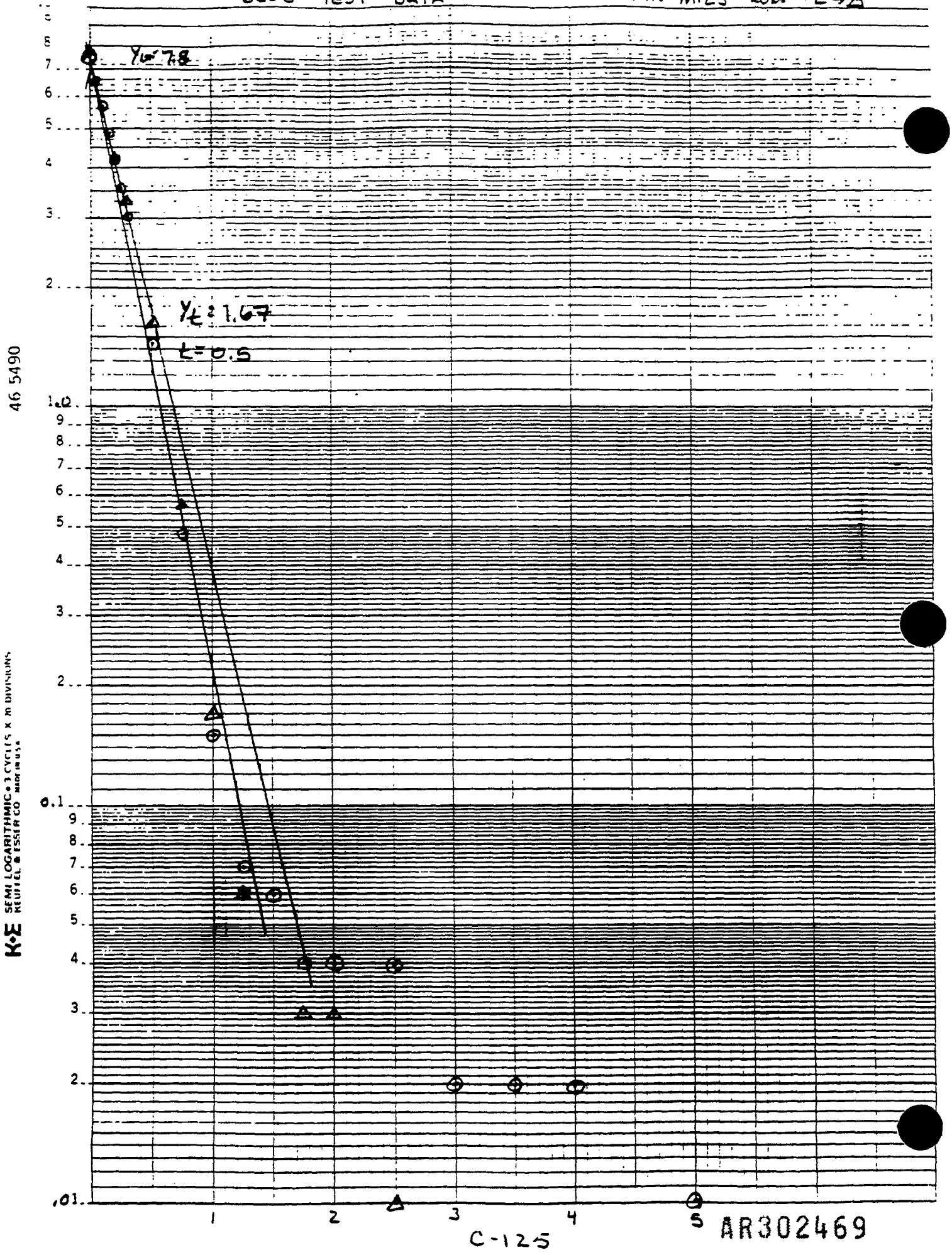
$$K = 1.30 \times 10^{-3}\ \text{cm/sec.}$$

$$T = K \cdot D = (2.56 \times 10^{-3}\ \text{ft/min})(78'\text{-}46') = 8.19 \times 10^{-2}\ \text{ft}^2/\text{min}$$

$$= 882\ \text{gpd/ft}$$

SLUG TEST DATA

MW-M123 Run #2 → △



C-125

AR302469

NUS CORPORATION
A Halliburton Company

SITE NAME DRAKE CHEMICAL
WELL MEASURED MW-M124
PUMPING WELL

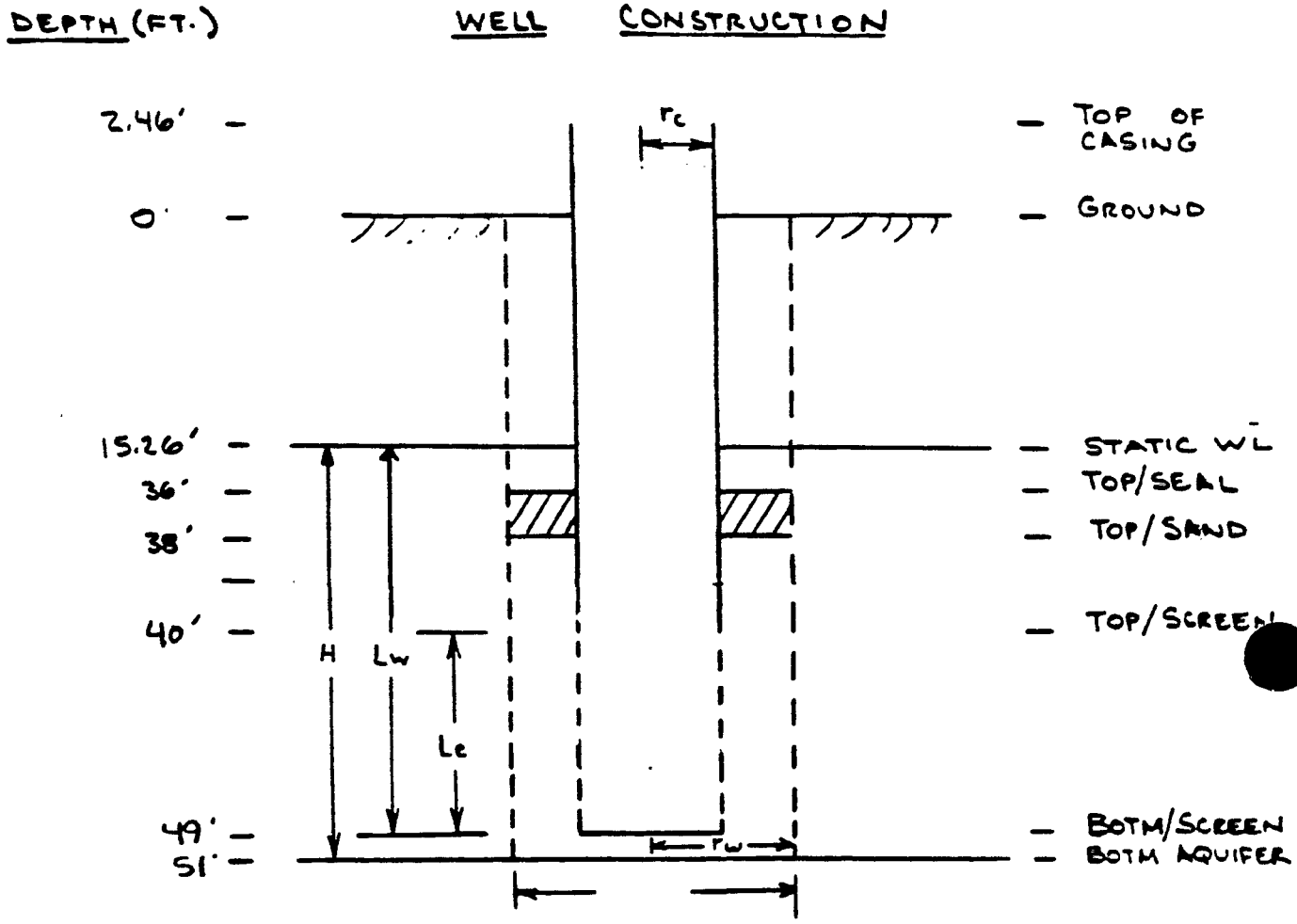
COMPUTED ____ CHECKED ____
PROJECT NO ____
PAGE 1 OF 1

- DISTANCE FROM PUMPING WELL (ft) (r) ____ - PUMPING RATE (gpm) (Q) ____
- STATIC H_2O LEVEL (ft) (s_0) ____ - PUMP SETTING FEET BELOW MONITORING POINT ____
- TIME PUMPING START OR STOP (t_0) ____ - MONITORING POINT ____
- ELEVATION OF MONITORING POINT (ft above MSL) ____

DATE	TIME	(t) MIN SINCE PUMP START OR STOP	WATER LEVEL MEASUREMENTS			(s) DD or RECOV. (ft)	REMARKS
			HELD	CUT	DTW	RUN #1	RUN #2
1-6-88		0.0000				8.63	8.93
		0.0500				8.24	8.49
		0.1000				8.01	8.27
		0.2000				7.57	7.89
		0.3000				7.22	7.59
		0.4167				6.86	7.25
		0.5000				6.62	7.02
		0.5833				6.40	6.82
		0.6667				6.20	6.64
		0.8333				5.82	6.32
		0.9167				5.64	6.18
		1.0000				5.46	6.04
		1.5000				4.46	5.27
		2.0000				3.63	4.59
		2.5000				2.94	3.97
		3.0000				2.34	3.42
		3.5000				1.84	2.93
		4.0000				1.42	2.48
		4.5000				1.07	2.08
		5.0000				.78	1.73
		5.5000				.56	1.41
		6.0000				.38	1.14
		6.5000				.25	.91
		7.0000				.14	.71
		7.5000				.06	.55

CLIENT EPA - DRAKE CHEM	FILE NO 620Y	BY RDB	PAGE 1 OF
SUBJECT SLUG TEST CALC MW-M 124		CHECKED BY MLM 3/10/88	DATE 2-18-88

CALCULATIONS: (BOUWER & RICE)



$H = 51' - 15.26' = 35.74'$

$L_w = 49' - 15.26' = 33.74'$

$L_e = 49' - 40' = 9.0'$

$r_c = 0.083'$

$r_w = 0.42'$

$L_e/r_w = 9/.42 = 21.43'$

$A = 2.17$

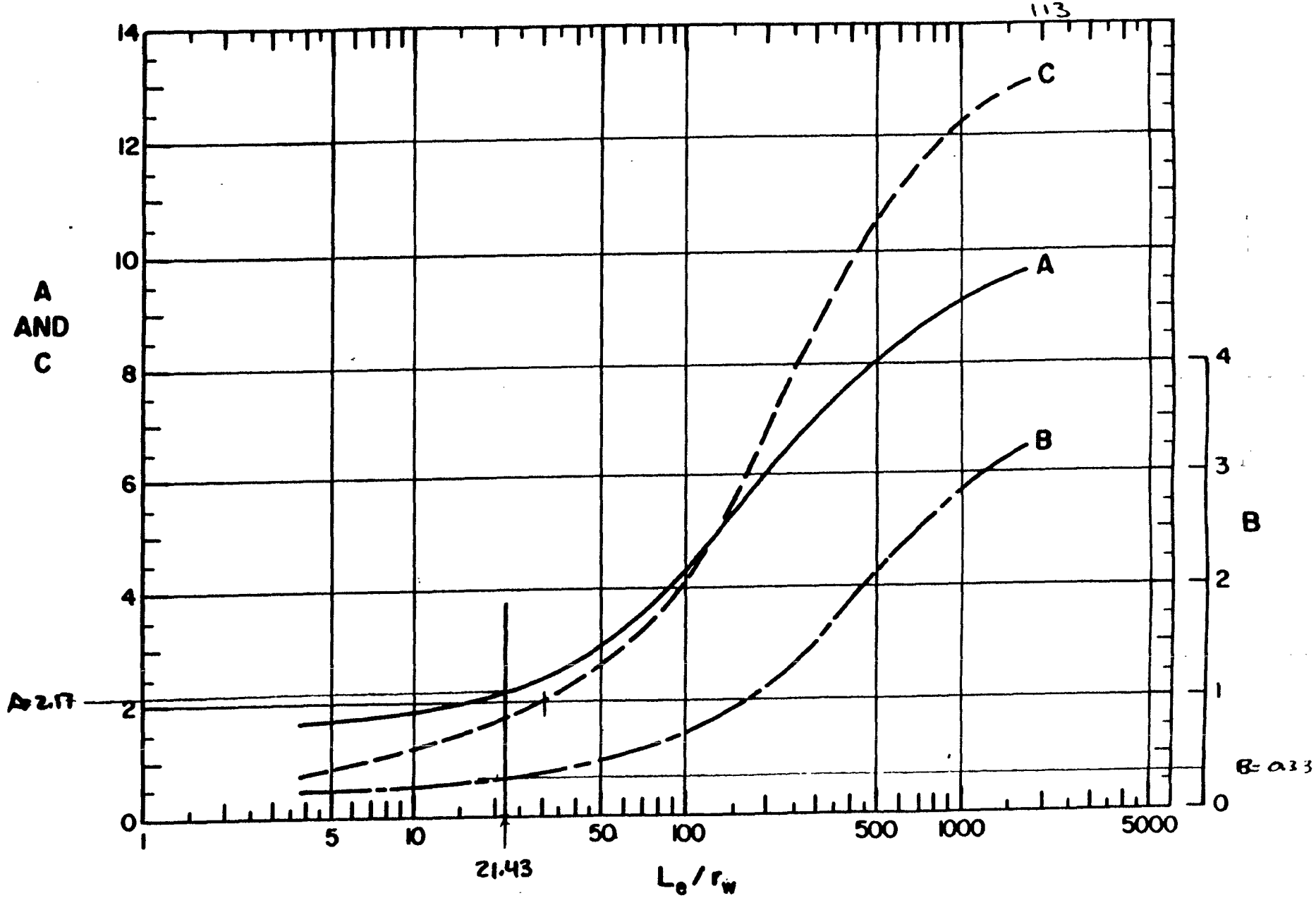
$B = 0.33$

$C =$

NUS 1554 REVISED 0285

AR302471

102 .17
103 122
104 124
112
113



C-128

AR302472

CLIENT	FILE NO.	BY	PAGE 3 OF
EPA · DRAKE CHEM	620Y	RDB	
SUBJECT: SLUG TEST CALC'S. MW-M 124		CHECKED BY	DATE 2-24-88

$$\ln R_e/r_w = \left[\frac{1.1}{\ln(L_w/r_w)} + \frac{A + B\ln[(H-L_w)/r_w]}{L_e/r_w}\right]^{-1}$$

$$\ln R_e/r_w = \left[\frac{1.1}{\ln(33.74/0.42)} + \frac{2.17 + (0.33)\ \ln[(35.74-33.74)/0.42]}{21.43}\right]^{-1}$$

$$\ln R_e/r_w = \left[0.251 + 0.125\right]^{-1}$$

$$\ln R_e/r_w = 2.66$$

$$K = \frac{r_c^2 \ln(R_e/r_w)}{2L_e} \cdot \frac{1}{t} \ln Y_0/Y_t$$

$$K = \frac{(0.083)^2(2.66)}{2(9.0)} \cdot \frac{1}{5.0} \ln\left(\frac{8.63}{0.78}\right)$$

$$K = (1.02\times10^{-3})(0.2)(2.40)$$

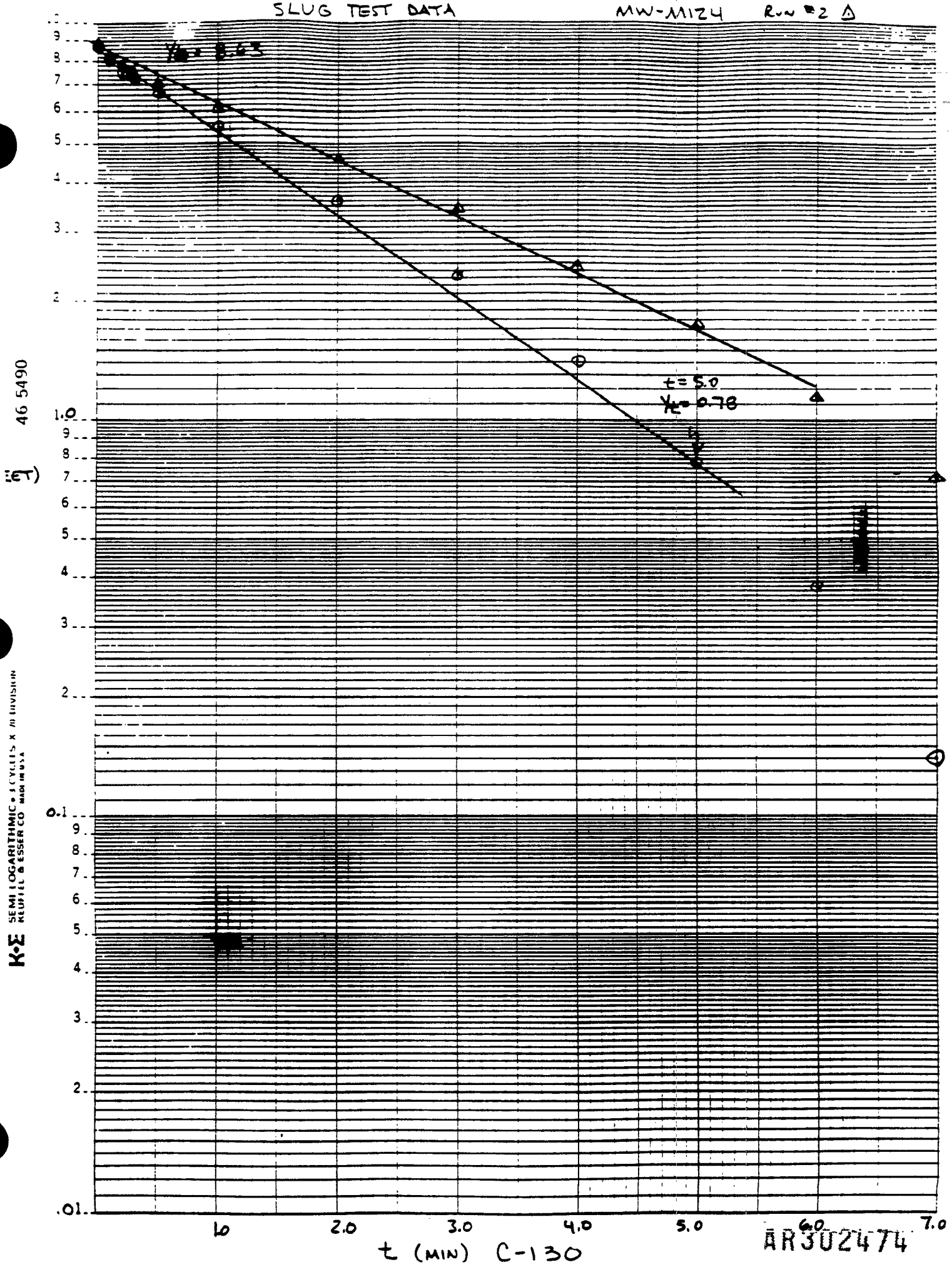
$$K = 4.90\times10^{-4}\ \text{ft/min.}$$

$$K = 2.49\times10^{-4}\ \text{cm/sec.}$$

$$T = K\cdot D = (4.90\times10^{-4}\ \text{ft/min})(35.74')= 1.75\times10^{-2}\ \text{ft}^2/\text{min.}$$

$$= 188\ \text{gpd/ft.}$$

SLUG TEST DATA MW-M12A RUN #2 Δ



C-130

AR302474

NUS CORPORATION
A Halliburton Company

SITE NAME DRAKE CHEM
WELL MEASURED MW-M125 Run #1-2
PUMPING WELL

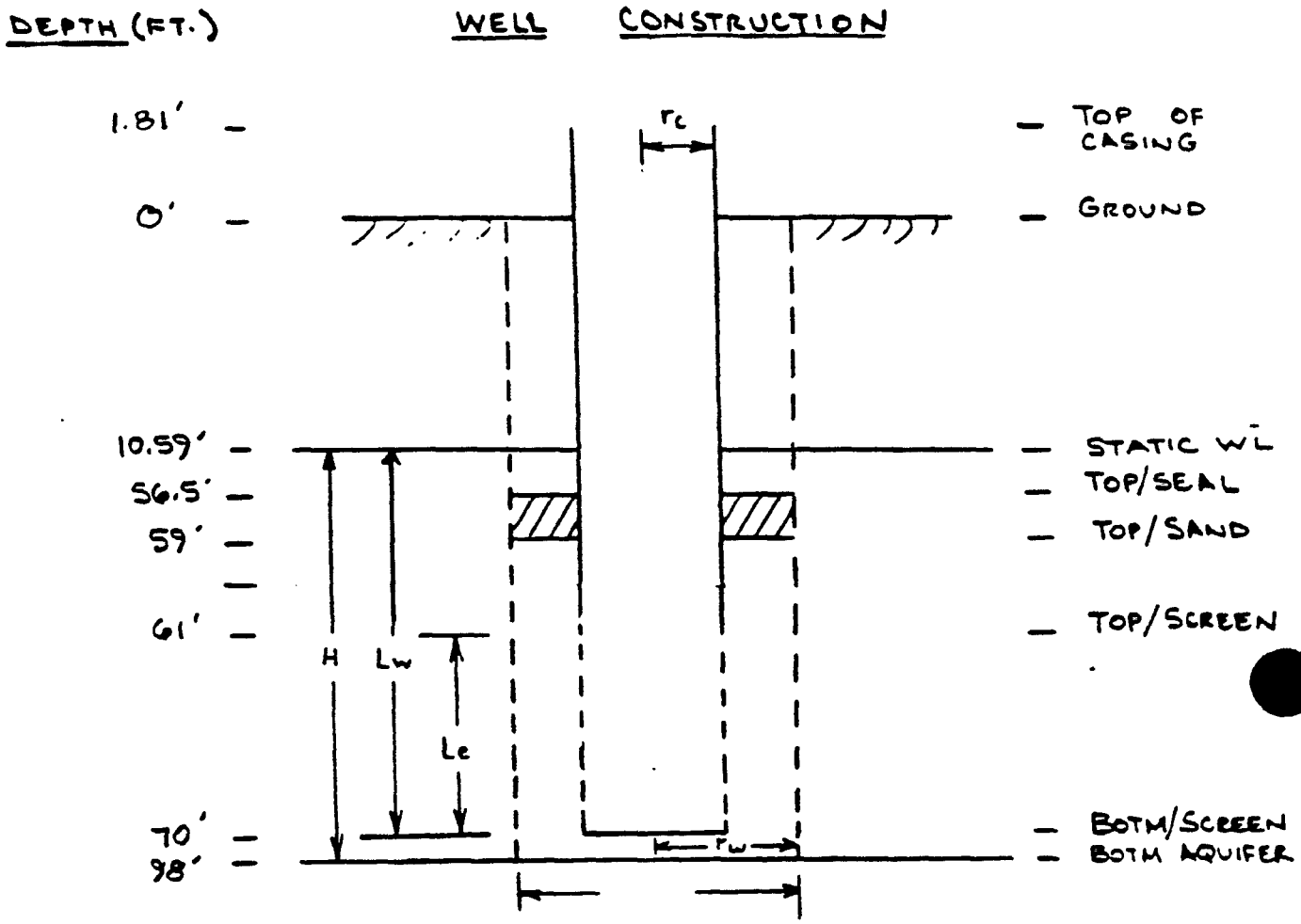
COMPUTED ____ CHECKED ____
PROJECT NO ____
PAGE ____ OF ____

- DISTANCE FROM PUMPING WELL (ft) (r) ____ - PUMPING RATE (gpm) (Q) ____
- STATIC H_2O LEVEL (ft) (s_0) 12.40' Top of riser - PUMP SETTING FEET BELOW MONITORING POINT ____
- TIME PUMPING START OR STOP (t_0) ____ - MONITORING POINT ____
- ELEVATION OF MONITORING POINT (ft above MSL) ____

DATE	TIME 0956	(t) MIN SINCE PUMP START OR STOP	WATER LEVEL MEASUREMENTS HELD	CUT	DTW Run #1	(s) DD or RECOV. (ft) Run #2	REMARKS
1-7-88	0				-6.77	-4.94	
	0.01				-6.69	-4.92	
	0.02				-6.74	-4.90	
	0.05				-6.57	-4.84	
	0.10				-6.41	-4.75	
	0.15				-6.28	-4.66	
	0.20				-6.16	-4.57	
	0.25				-6.05	-4.49	
	0.30				-5.95	-4.42	
	0.50				-5.58	-4.13	
	0.75				-5.17	-3.81	
	1.0				-4.82	-3.51	
	1.25				-4.48	-3.25	
	1.50				-4.19	-3.00	
	1.75				-3.90	-2.78	
	2.0				-3.64	-2.57	
	2.5				-3.16	-2.20	
	3.0				-2.75	-1.88	
	3.5				-2.39	-1.60	
	4.0				-2.07	-1.36	
	4.5					-1.14	
	5.0					-0.95	
	5.5					-0.79	
	6.0					-0.65	
	6.5					-0.53	
	7.0					-0.43	
	7.5					-0.35	
	8.0					-0.27	
	8.5					-0.21	
	9.0					-0.16	
	9.5					-0.10	
	10.0					-0.07	

CLIENT EPA · DRAKE CHEM	FILE NO 620Y	BY RDB	PAGE 1 OF
SUBJECT SLUG TEST CALC MW-M12S		CHECKED BY MLM 3/10/88	DATE 2-18-88

CALCULATIONS: (BOUWER & RICE)



$H = 98' - 10.59' = 87.41'$

$L_w = 70' - 10.59' = 59.41'$

$L_e = 70' - 61' = 9.0$

$r_c = 0.083'$

$r_w = 0.25'$

$L_e/r_w = 9'/.25' = 36$

$A = 2.55$

$B = 0.4$

$C =$

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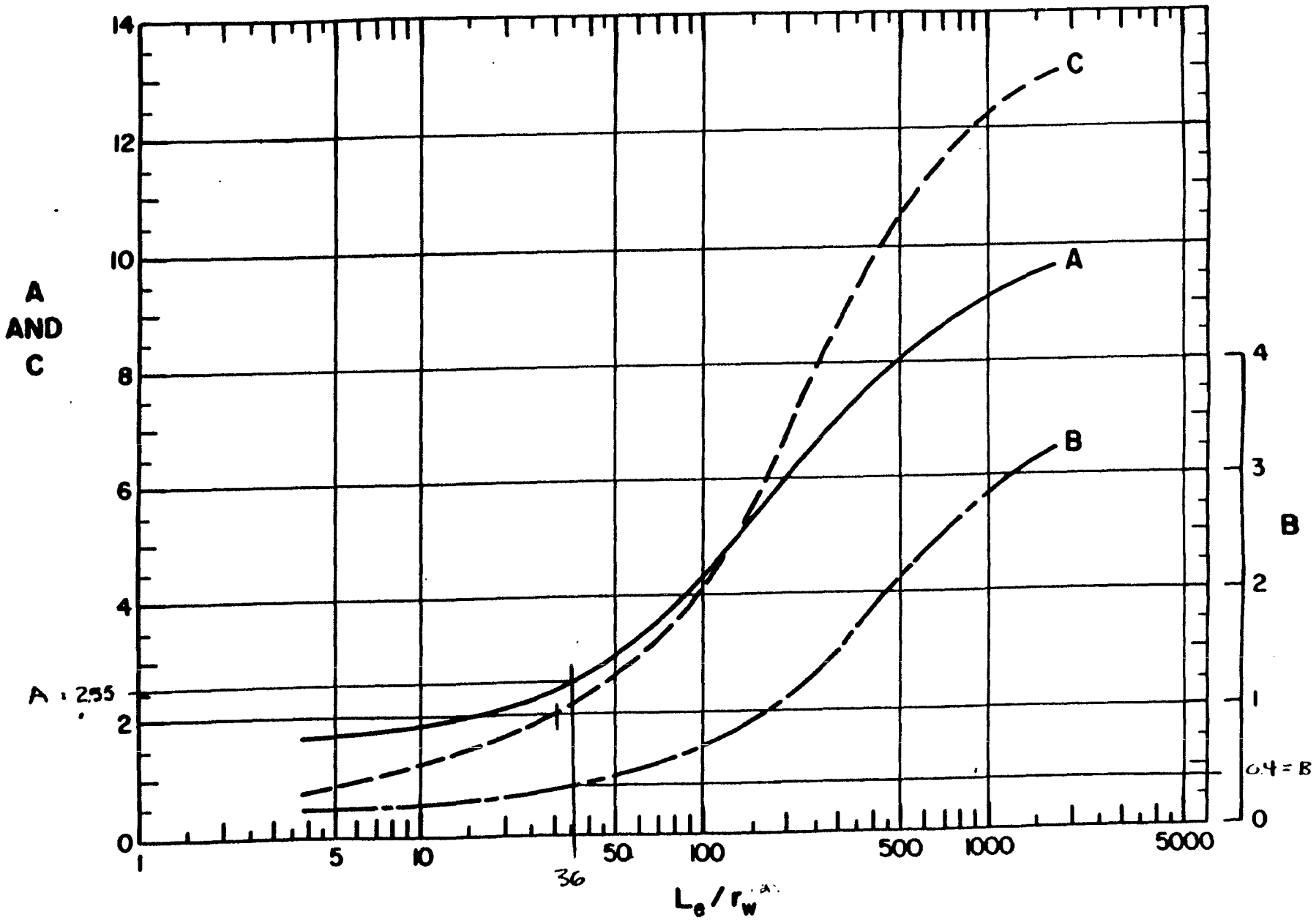
125



C-133

AR302477

CLIENT. EPA · DRAKE CHEM	FILE NO. 620Y	BY. RDB	PAGE 3 OF
SUBJECT. SLUG TEST CALC'S, MW-M125		CHECKED BY.	DATE. 2-24-88

$$\ln R_e/r_w = \left[\frac{1.1}{\ln(L_w/r_w)} + \frac{A + B\ln[(H-L_w)/r_w]}{L_e/r_w}\right]^{-1}$$

$$\ln R_e/r_w = \left[\frac{1.1}{\ln(59.41/0.25)} + \frac{2.55 + (0.4)\ln[(87.41-59.41)/0.25]}{36}\right]^{-1}$$

$$\ln R_e/r_w = \left[0.201 + 0.123\right]^{-1}$$

$$\ln R_e/r_w = 3.09$$

$$K = \frac{r_c^2 \ln(R_e/r_w)}{2L_e} \cdot \frac{1}{t} \ln Y_0/Y_t$$

$$K = \frac{(0.083)^2(3.09)}{2(9.0)} \cdot \frac{1}{5.0} \ln\left(\frac{4.82}{0.95}\right)$$

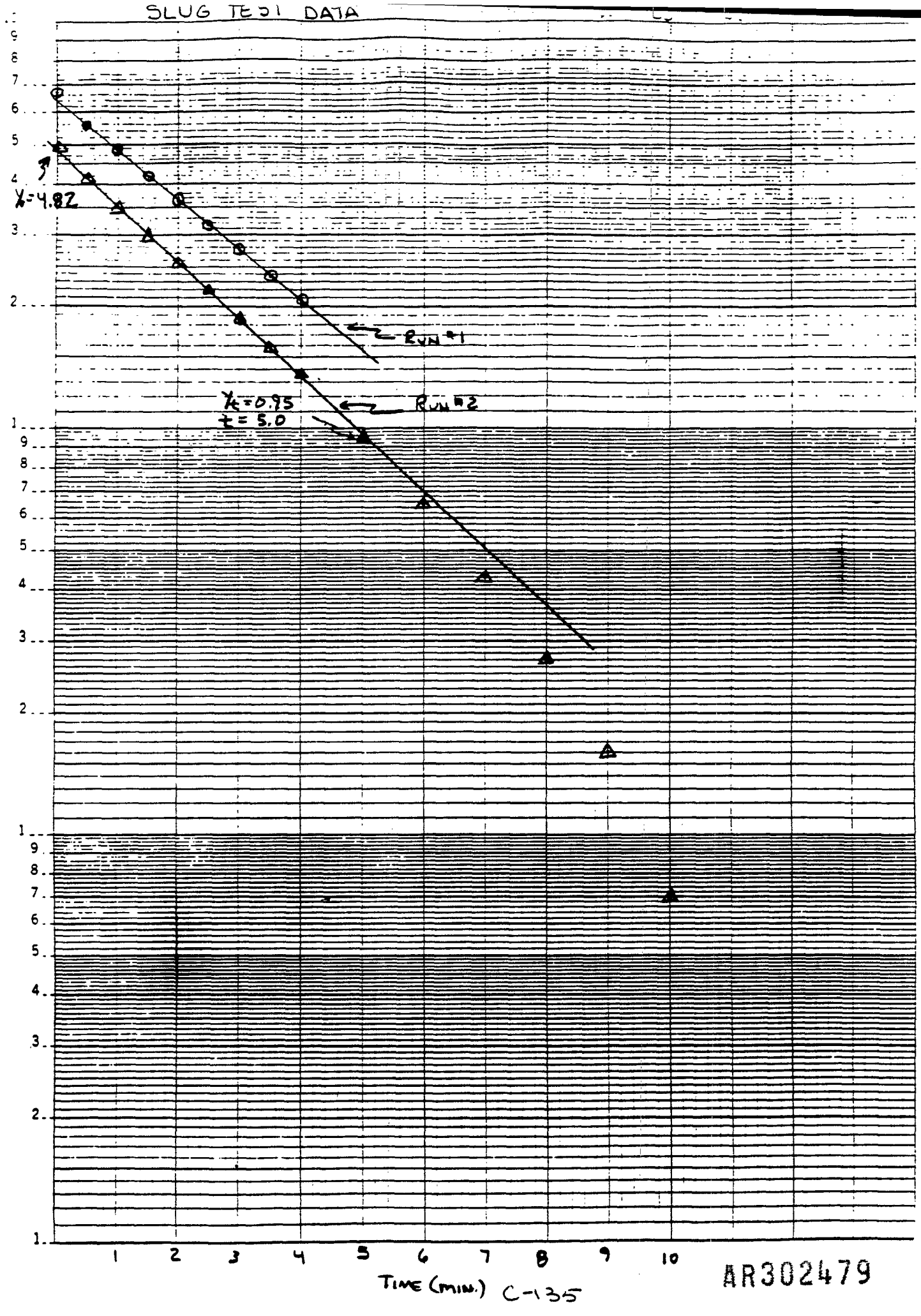
$$K = (1.18 \times 10^{-3})(0.2)(1.62)$$

$$K = 3.82 \times 10^{-4} \text{ ft/min.}$$

$$K = 1.94 \times 10^{-4} \text{ cm/sec}$$

$$T = K \cdot D = (3.82 \times 10^{-4} \text{ ft/min})(87.41) = 3.34 \times 10^{-2} \text{ ft}^2/\text{min.}$$
$$= 360 \text{ gpd/ft}$$

SLUG TEST DATA



C-135

AR302479

APPENDIX D

CONSTRUCTION LOG FORMS

BORING NO MWM 101

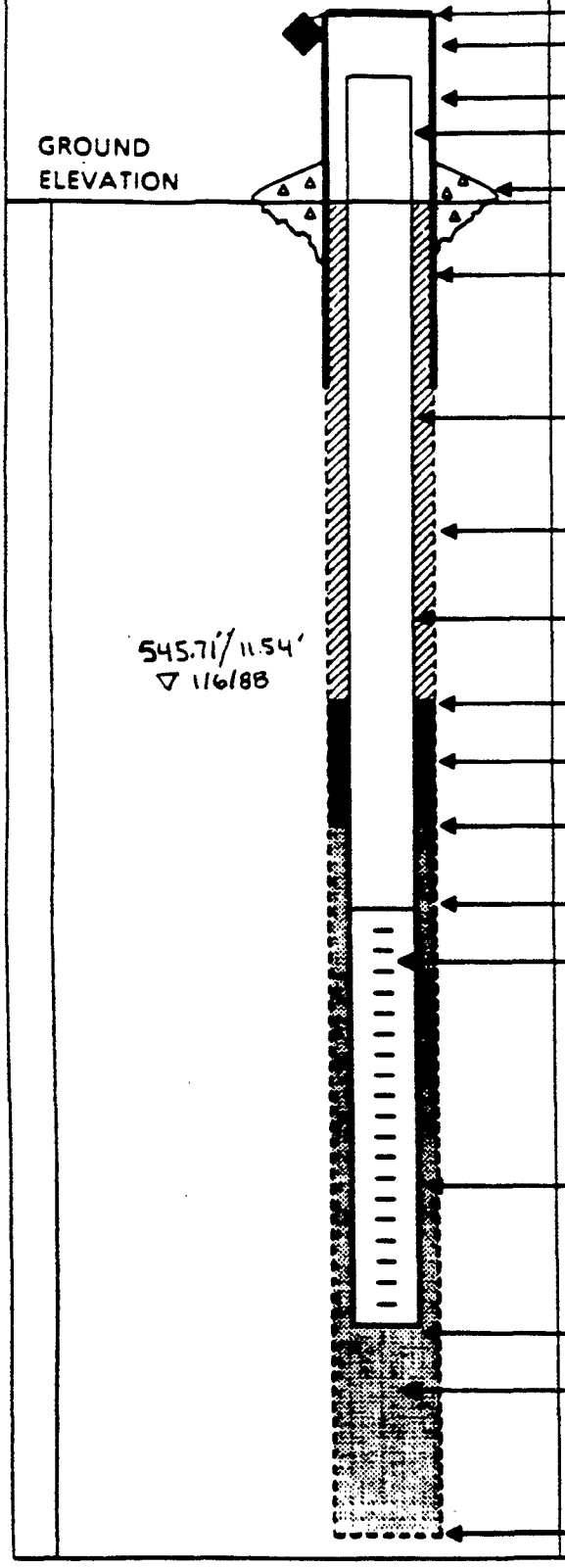
NUS CORPORATION
A Halliburton Company

OVERBURDEN MONITORING WELL SHEET

PROJECT: DRAKE CHEMICAL
PROJECT NO.: 620Y
ELEVATION: 557.25'
FIELD GEOLOGIST: SJ CONTI

LOCATION: LOCK HAVEN, PA.
BORING: MWM 101
DATE: 12-14-87

DRILLER: PENN DRILL
DRILLING METHOD: H. STEM AUGERS
DEVELOPMENT METHOD: AIR



ELEVATION OF TOP OF SURFACE CASING: 557.29'
ELEVATION OF TOP OF RISER PIPE: 557.09'
STICK - UP TOP OF SURFACE CASING: 0.04'
STICK - UP RISER PIPE: -0.16'
TYPE OF SURFACE SEAL: FLUSH MOUNT COVER
I.D. OF SURFACE CASING: NA
TYPE OF SURFACE CASING: CAST IRON FLUSH MOUNT COVER
RISER PIPE I.D.: 2"
TYPE OF RISER PIPE: PVC
BOREHOLE DIAMETER: 10"
TYPE OF BACKFILL: CEMENT/BENTONITE
ELEVATION / DEPTH TOP OF SEAL: 548.25'/9
TYPE OF SEAL: BENTONITE PELLET
DEPTH TOP OF SAND PACK: 545.25'/12
ELEVATION / DEPTH TOP OF SCREEN: 541.75'/15.5'
TYPE OF SCREEN: PVC
SLOT SIZE x LENGTH: 10 SLOT x 9'
I.D. OF SCREEN: 2"
TYPE OF SAND PACK: #430 SAND
ELEVATION / DEPTH BOTTOM OF SCREEN: 532.75'/24.5'
ELEVATION / DEPTH BOTTOM OF SAND PACK: 532.25'/25'
TYPE OF BACKFILL BELOW OBSERVATION WELL:
ELEVATION / DEPTH OF HOLE: 532.25'/25'

AR302481

BORING NO MWM 102

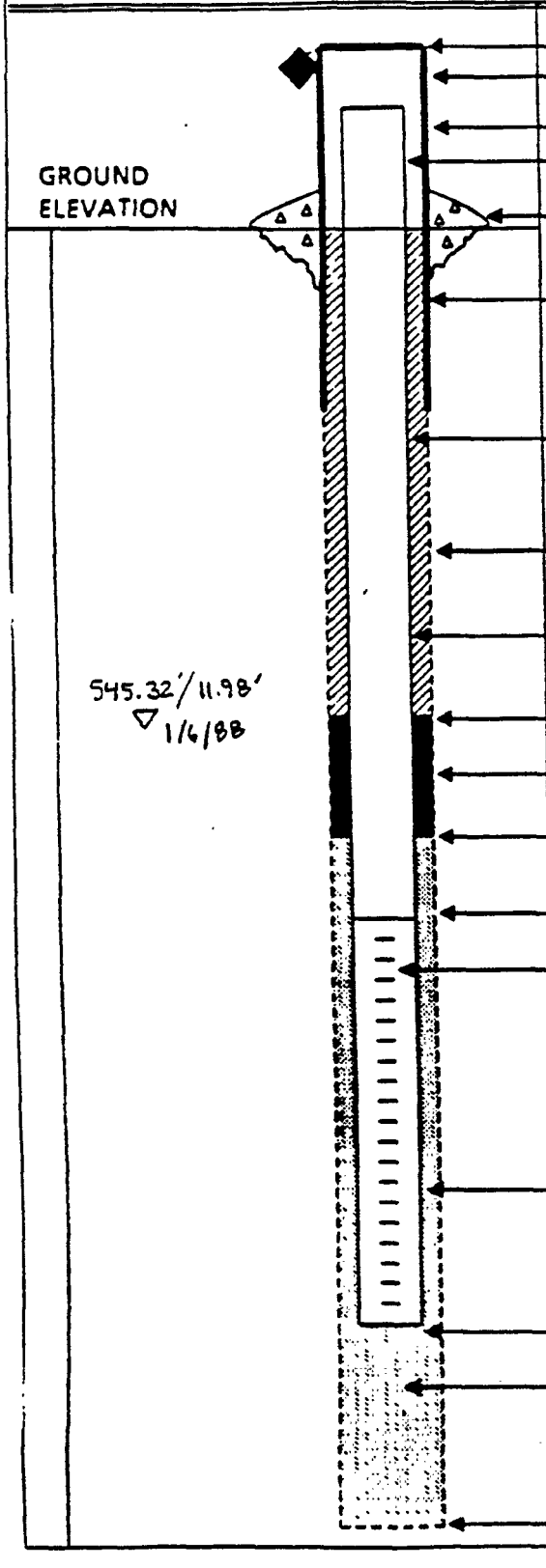
NUS CORPORATION
A Halliburton Company

OVERBURDEN MONITORING WELL SHEET

PROJECT DRAKE CHEMICAL
PROJECT NO. 6207
ELEVATION 557.30'
FIELD GEOLOGIST SJ CONTI

LOCATION LOCK HAVEN, PA
BORING MWM102
DATE 12-14-87

DRILLER PENNA DRILLING
DRILLING METHOD H. STEM AUGERS
DEVELOPMENT METHOD AIR



ELEVATION OF TOP OF SURFACE CASING: 557.28'
ELEVATION OF TOP OF RISER PIPE: 557.10'
STICK - UP TOP OF SURFACE CASING: -0.02' *
STICK - UP RISER PIPE: -0.20' *
TYPE OF SURFACE SEAL: * FLUSH MOUNT COVER
I.D. OF SURFACE CASING: NA
TYPE OF SURFACE CASING: NA
CAST IRON FLUSH MOUNT COVER
RISER PIPE I.D. 2"
TYPE OF RISER PIPE: PVC
BOREHOLE DIAMETER: 10"
TYPE OF BACKFILL: CEMENT/BENTONITE
ELEVATION / DEPTH TOP OF SEAL: 535.30'/22'
TYPE OF SEAL: BENTONITE PELLETS
DEPTH TOP OF SAND PACK: 531.30'/26'
ELEVATION / DEPTH TOP OF SCREEN: 526.80'/30.5'
TYPE OF SCREEN: PVC
SLOT SIZE x LENGTH: 10 SLOT x 9'
I.D. OF SCREEN: 2"
TYPE OF SAND PACK: #430 SAND
ELEVATION / DEPTH BOTTOM OF SCREEN: 517.80'/39.5'
ELEVATION / DERTH BOTTOM OF SAND PACK: 516.30'/41'
TYPE OF BACKFILL BELOW OBSERVATION WELL:
ELEVATION / DEPTH OF HOLE: 516.30'/41'

AR302482

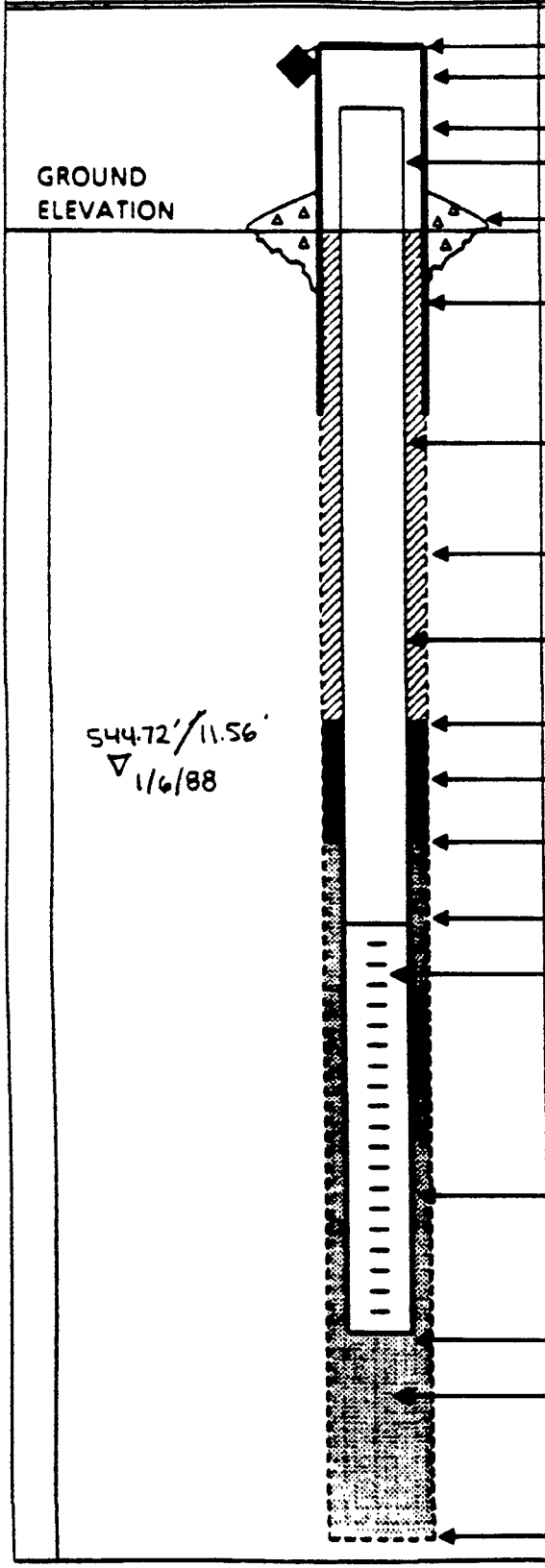
NUS CORPORATION
A Halliburton Company

OVERBURDEN MONITORING WELL SHEET

PROJECT: DRAKE CHEMICAL
PROJECT NO.: 620Y
ELEVATION: 556.28'
FIELD GEOLOGIST: SJ CONTI

LOCATION: LOCK HAVEN, PA
BORING: MWM103
DATE: 10-15-87

DRILLER: PENN DRILL
DRILLING METHOD: H. STEM AUGERS
DEVELOPMENT METHOD: AIR



ELEVATION OF TOP OF SURFACE CASING: 556.37'
ELEVATION OF TOP OF RISER PIPE: 556.06'
STICK-UP TOP OF SURFACE CASING: +0.09'
STICK-UP RISER PIPE: -0.22'
TYPE OF SURFACE SEAL: FLUSH MOUNT COVER
I.D. OF SURFACE CASING: —
TYPE OF SURFACE CASING: CAST IRON FLUSH MOUNT
RISER PIPE I.D.: 2"
TYPE OF RISER PIPE: PVC
BOREHOLE DIAMETER: 10"
TYPE OF BACKFILL: CEMENT/BENTONITE
ELEVATION / DEPTH TOP OF SEAL: 547.28'/9
TYPE OF SEAL: BENTONITE PELLETS
DEPTH TOP OF SAND PACK: 544.28'/12
ELEVATION / DEPTH TOP OF SCREEN: 539.78'/16.5
TYPE OF SCREEN: PVC
SLOT SIZE x LENGTH: 10SL x 9'
I.D. OF SCREEN: 2"
TYPE OF SAND PACK: #430 SAND
ELEVATION / DEPTH BOTTOM OF SCREEN: 530.78'/25.5
ELEVATION / DEPTH BOTTOM OF SAND PACK: 530.28'/26'
TYPE OF BACKFILL BELOW OBSERVATION WELL:
ELEVATION / DEPTH OF HOLE: 530.28'/26'

AR302483

BORING NO MWM 104

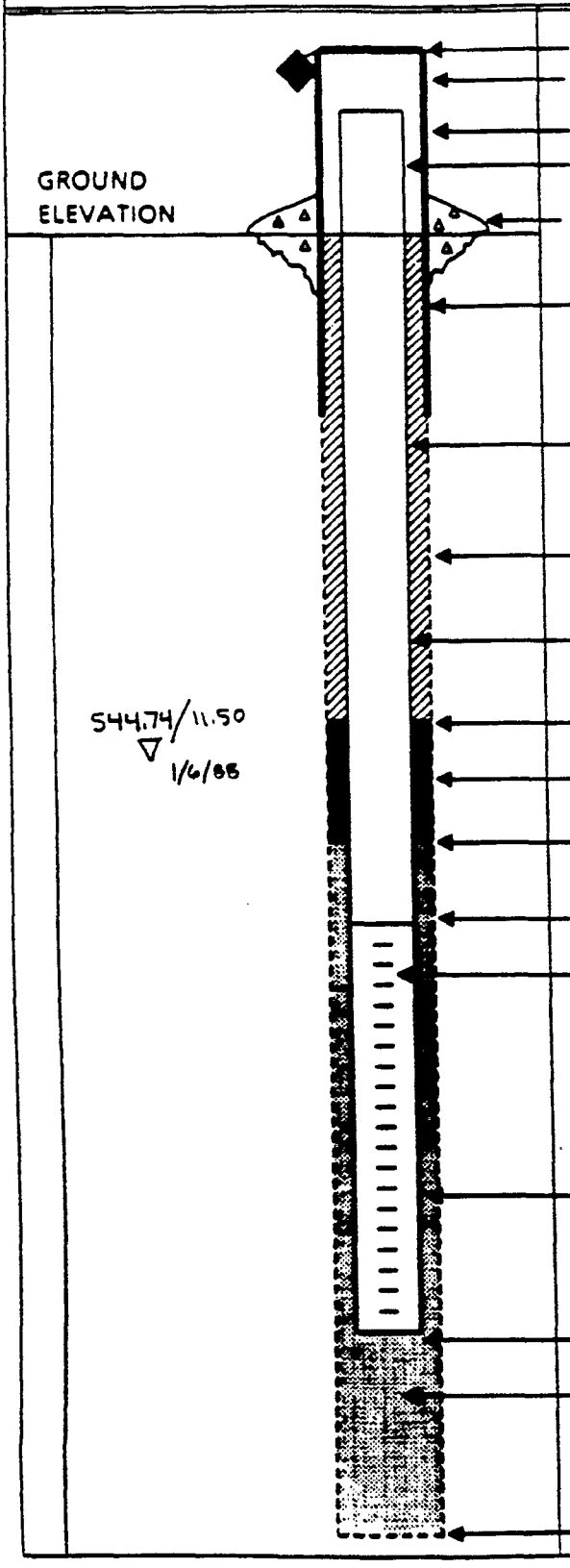
NUS CORPORATION
A Halliburton Company

OVERBURDEN MONITORING WELL SHEET

PROJECT DRAKE CHEMICAL
PROJECT NO. 620Y
ELEVATION 556.24'
FIELD GEOLOGIST SJ CONTI

LOCATION LOCK HAVEN, PA
BORING MWM104
DATE 12-15-87

DRILLER PENN DRILL
DRILLING METHOD H STEM AUGER
DEVELOPMENT METHOD AIR



ELEVATION OF TOP OF SURFACE CASING: 556.34'
ELEVATION OF TOP OF RISER PIPE: 556.01'
STICK - UP TOP OF SURFACE CASING: 0.10'
STICK - UP RISER PIPE: -0.23'
TYPE OF SURFACE SEAL: FLUSH MOUNT COVERS
I.D. OF SURFACE CASING: NA
TYPE OF SURFACE CASING: CAST IRON FLUSH MOUNT
RISER PIPE I.D. 2"
TYPE OF RISER PIPE: PVC
BOREHOLE DIAMETER: 10"
TYPE OF BACKFILL: CEMENT / BENTONITE
ELEVATION / DEPTH TOP OF SEAL: 532.24'/24'
TYPE OF SEAL: BENTONITE PELLET
DEPTH TOP OF SAND PACK: 529.24'/27'
ELEVATION / DEPTH TOP OF SCREEN: 524.74'/31.5'
TYPE OF SCREEN: PVC
SLOT SIZE x LENGTH: 10 SL x 9'
I.D. OF SCREEN: 2"
TYPE OF SAND PACK: #430 SAND
ELEVATION / DEPTH BOTTOM OF SCREEN: 515.74'/40.5'
ELEVATION / DEPTH BOTTOM OF SAND PACK: 515.24'/41'
TYPE OF BACKFILL BELOW OBSERVATION WELL:
ELEVATION / DEPTH OF HOLE: 515.24'/41'

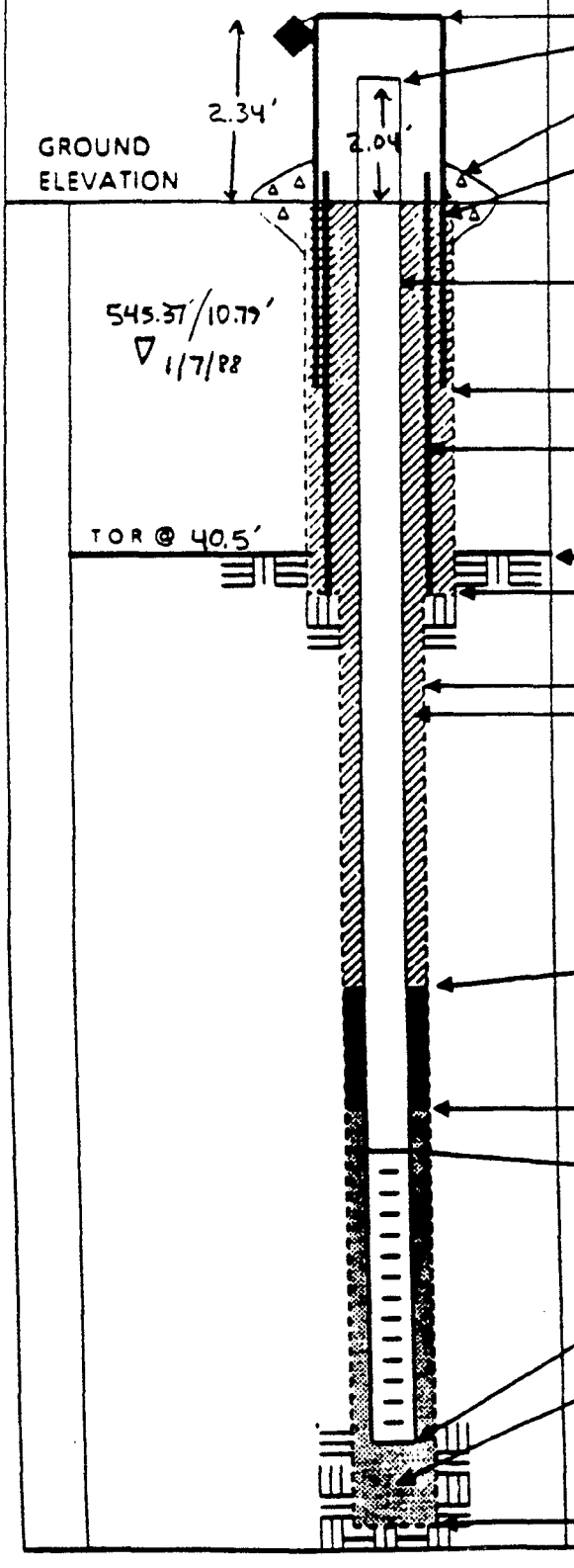
AR302484

NUS CORPORATION

BEDROCK MONITORING WELL SHEET

PROJECT: DRAKE CHEM
PROJECT NO.: 620Y
ELEVATION: 556.16'
FIELD GEOLOGIST: R BETHEL
LOCATION: LOCK HAVEN, PA
BORING: MW-M105
DATE: 12-7-87

DRILLER: B. GOLLIHUE
DRILLING METHOD: HOLLOW STEM AUGER/ CONVENTIONAL CORING
DEVELOPMENT METHOD: AIR SURGE



ELEVATION OF TOP OF SURFACE CASING: 558.50'
ELEVATION OF TOP OF RISER PIPE: 558.20'

TYPE OF SURFACE SEAL: CEMENT

I.D. OF SURFACE CASING: 6"
TYPE OF SURFACE CASING: BLACK STEEL

RISER PIPE I.D: 2"
TYPE OF RISER PIPE: SCHEDULE 40 PVC

BOREHOLE DIAMETER: 10"

PERM. CASING I.D.: 4"
TYPE OF CASING & BACKFILL: SCHEDULE 40 PVC
CEMENT / BENTONITE SLURRY

ELEVATION / DEPTH TOP OF BEDROCK: 515.66'/40.5'
ELEVATION / DEPTH BOTTOM OF CASING: 501.16'/55'

BOREHOLE DIA. BELOW CASING: 3 7/8"
TYPE OF BACKFILL: CEMENT / BENTONITE SLURRY

NOTES:

ELEVATION / DEPTH TOP OF SEAL: 492.16'/64'
TYPE OF SEAL: PUMPED BENTONITE SLUG W/ TREMIE TUBE (BENT. + POTABLE WATER)

ELEVATION / DEPTH TOP OF SAND PACK: 477.16'/79'

ELEVATION/DEPTH TOP OF SCREEN: 469.66'/86.5
TYPE OF SCREEN: SCHEDULE 40 SLOTTED PVC
SLOT SIZE x LENGTH: 10 SLOT x 19'
ID OF SCREEN: 2"
TYPE OF SAND PACK: SILICA SAND #430
ELEVATION / DEPTH BOTTOM OF SCREEN: 450.66'/105.5

ELEVATION / DEPTH BOTTOM OF SAND PACK: 449.96'/106.2
TYPE OF BACKFILL BELOW OBSERVATION WELL: SILICA SAND #430

ELEVATION / DEPTH OF HOLE: 449.96'/106.2

AR302485

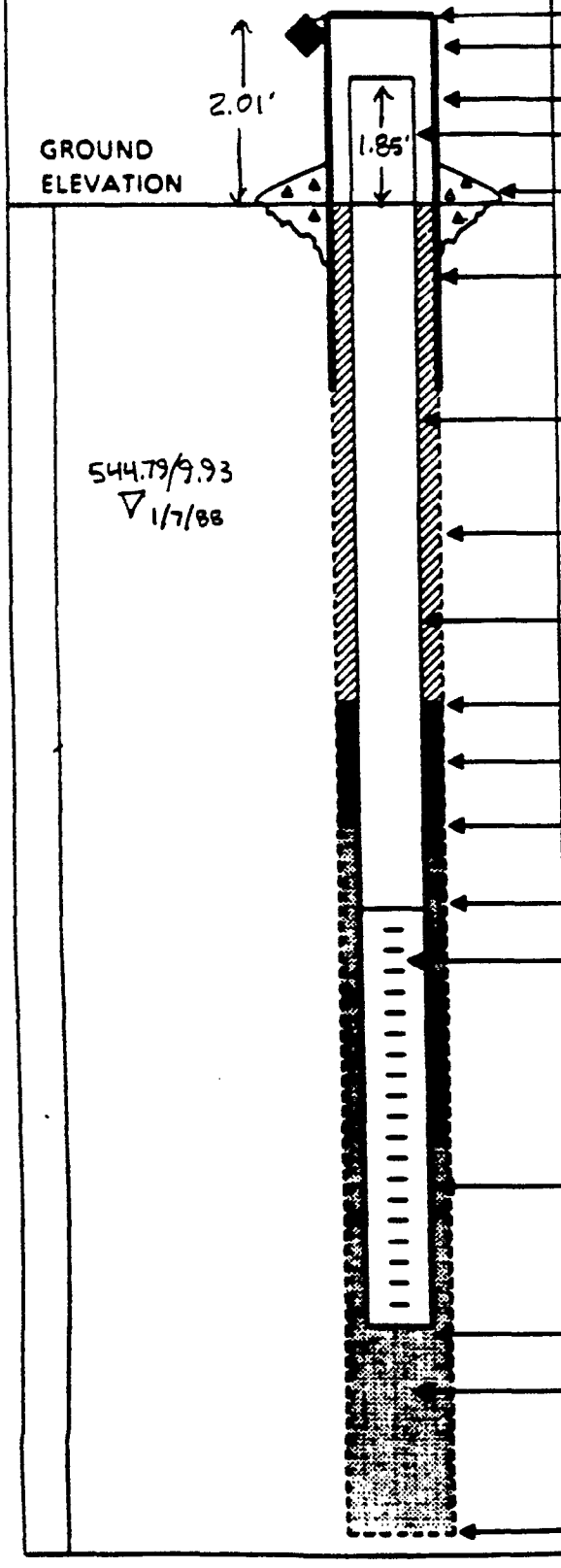
NUS CORPORATION
A Halliburton Company

OVERBURDEN MONITORING WELL SHEET

PROJECT DRAKE CHEM
PROJECT NO. 620Y
ELEVATION 554.72'
FIELD GEOLOGIST - R BETHEL

LOCATION LOCK HAVEN, PA
BORING MW-M106
DATE 11/24/87

DRILLER E DYE PENN DR.
DRILLING METHOD DRIVE AND
DEVELOPMENT METHOD AIR SURGE



ELEVATION OF TOP OF SURFACE CASING: 556.73'
ELEVATION OF TOP OF RISER PIPE: 556.57'
STICK - UP TOP OF SURFACE CASING: 2.01'
STICK - UP RISER PIPE: 1.85'
TYPE OF SURFACE SEAL: CEMENT
I.D. OF SURFACE CASING: 6"
TYPE OF SURFACE CASING: BLACK STEEL
RISER PIPE I.D. 2"
TYPE OF RISER PIPE: PVC
BOREHOLE DIAMETER: 6"
TYPE OF BACKFILL: BENTONITE / CEMENT GROUT
ELEVATION / DEPTH TOP OF SEAL: 544.72'/10'
TYPE OF SEAL: BENTONITE PELLETS
DEPTH TOP OF SAND PACK: 542.72/12'
ELEVATION / DEPTH TOP OF SCREEN: 541.72'/13'
TYPE OF SCREEN: PVC
SLOT SIZE x LENGTH: 10 SLOT x 9'
I.D OF SCREEN: 2"
TYPE OF SAND PACK: OTTOWA 430
ELEVATION / DEPTH BOTTOM OF SCREEN: 532.72'/22'
ELEVATION / DEPTH BOTTOM OF SAND PACK: 534.72/20'
TYPE OF BACKFILL BELOW OBSERVATION WELL: HOLE BACKFILLED W/ NATURAL SAND UP TO 20' (RUNNING SANDS
ELEVATION / DEPTH OF HOLE: 529.22'/25.5'

AR302486

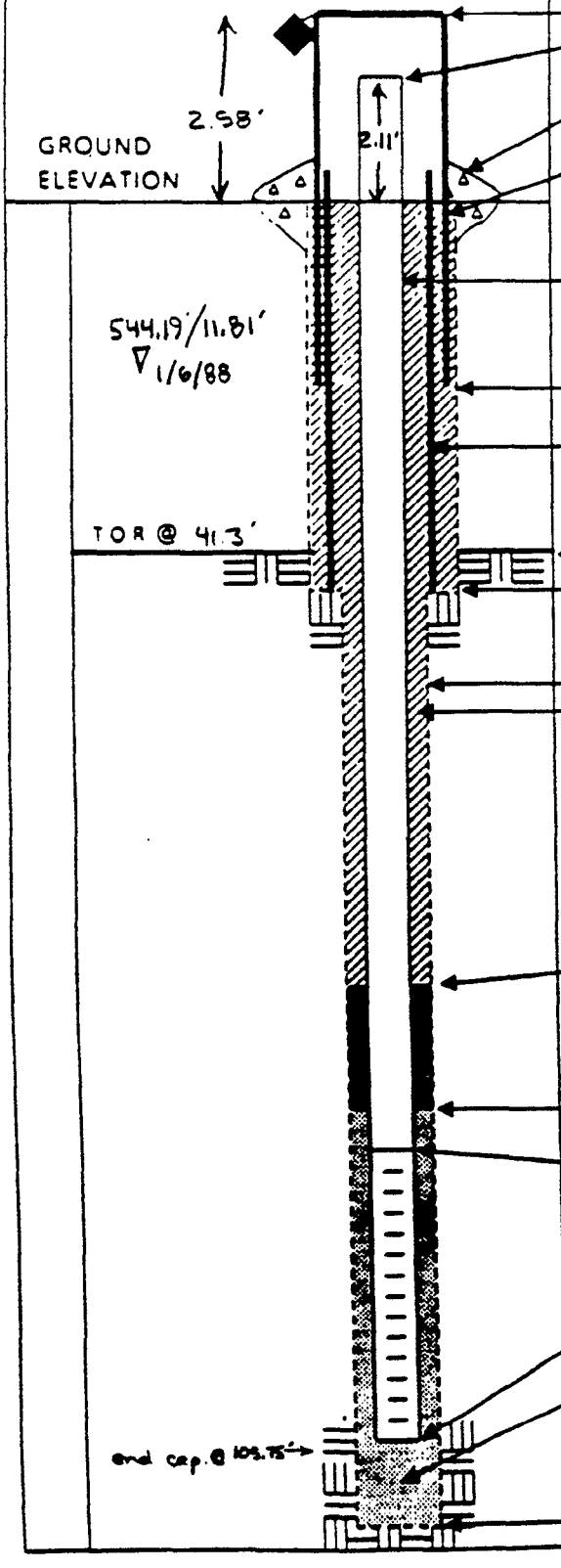
NUS CORPORATION

BEDROCK MONITORING WELL SHEET

PROJECT: DRAKE CHEM
PROJECT NO.: 6720Y
ELEVATION: 556.00'
FIELD GEOLOGIST: R. BETHEL

LOCATION: LOCK HAVEN PA
BORING: MW-M107
DATE: 12-4-87

DRILLER: B. GOLLHUE
DRILLING METHOD: HOLLOW STEM AUGER CONVENTIONAL CORING
DEVELOPMENT METHOD: AIR SURGE



ELEVATION OF TOP OF SURFACE CASING: 558.58'
ELEVATION OF TOP OF RISER PIPE: 558.11'

TYPE OF SURFACE SEAL: CEMENT

I.D. OF SURFACE CASING: 6"
TYPE OF SURFACE CASING: BLACK STEEL

RISER PIPE I.D: 2"
TYPE OF RISER PIPE: SCHED. 40 PVC

BOREHOLE DIAMETER: 10"

PERM. CASING I.D.: 4"
TYPE OF CASING & BACKFILL: SCHED. 40 PVC CEMENT/BENTONITE SLURRY

ELEVATION / DEPTH TOP OF BEDROCK: 514.70'/41.3'
ELEVATION / DEPTH BOTTOM OF CASING: 516.00'/40'

BOREHOLE DIA. BELOW CASING: 3 7/8"
TYPE OF BACKFILL: CEMENT/BENTONITE SLURRY

NOTES:

ELEVATION / DEPTH TOP OF SEAL: 482.00'/-74'
TYPE OF SEAL: PUMPED BENTONITE SLUG W/ TREMIE TUBE (BENT. + POTABLE WATER)

ELEVATION / DEPTH TOP OF SAND PACK: 479.00'/77'

ELEVATION/DEPTH TOP OF SCREEN: 470.00'/86'
TYPE OF SCREEN: SCHED. 40 SLOTTED PVC
SLOT SIZE x LENGTH: 10 SLOT x 19FT.
ID OF SCREEN: 2"
TYPE OF SAND PACK: SILICA SAND #430

ELEVATION / DEPTH BOTTOM OF SCREEN: 451.00'/105'

ELEVATION / DEPTH BOTTOM OF SAND PACK: 450.00'/106'
TYPE OF BACKFILL BELOW OBSERVATION WELL: HOLE CAVED IN TO 106' W/ NATURAL BEDROCK MATERIAL

ELEVATION / DEPTH OF HOLE: 448.00'/108'

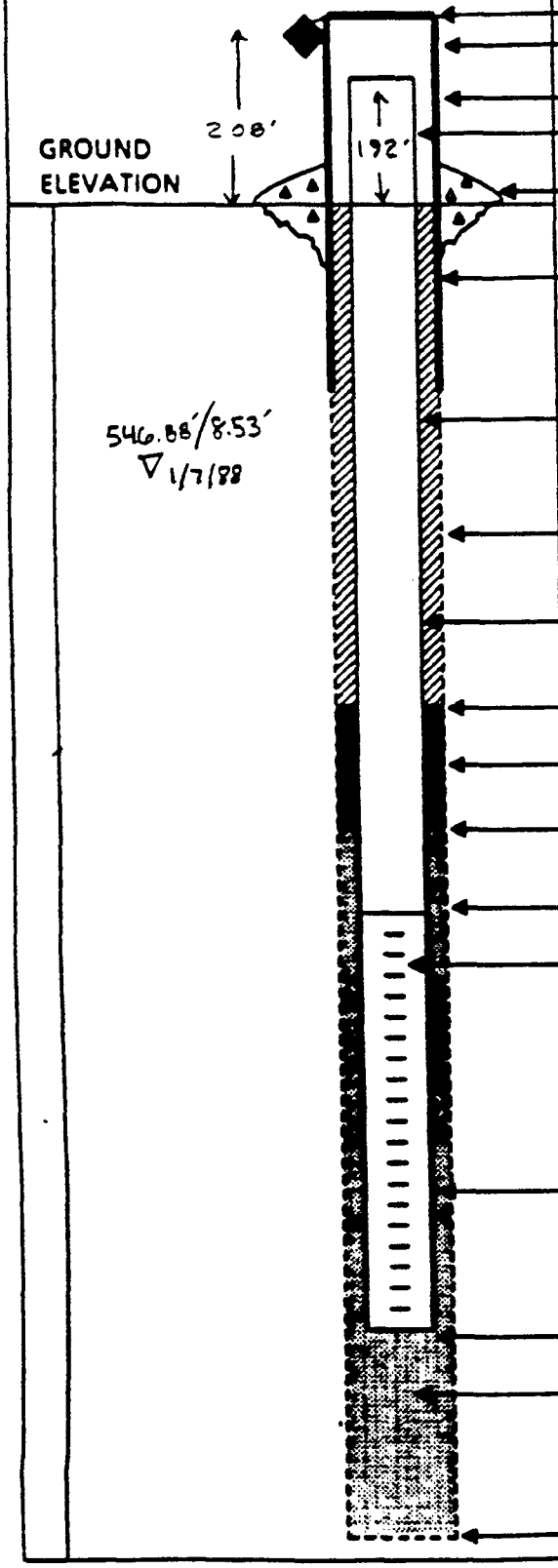
NUS CORPORATION
A Halliburton Company

OVERBURDEN MONITORING WELL SHEET

PROJECT: DRAKE CHEM
PROJECT NO.: 620Y
ELEVATION: 555.41'
FIELD GEOLOGIST: R. BETHEL

LOCATION: LOCK HAVEN PA
BORING: SB-32 / MW-M108
DATE: 11/20/87

DRILLER: E. DYE, PENN CREEK
DRILLING METHOD: DRIVE + WASH
DEVELOPMENT METHOD: AIR SURGE



ELEVATION OF TOP OF SURFACE CASING: 557.49'
ELEVATION OF TOP OF RISER PIPE: 557.33'
STICK - UP TOP OF SURFACE CASING: 2.08'
STICK - UP RISER PIPE: 1.92'
TYPE OF SURFACE SEAL: CEMENT
I.D. OF SURFACE CASING: 6"
TYPE OF SURFACE CASING: STEEL
RISER PIPE I.D. 2"
TYPE OF RISER PIPE: SCHED. 40 PVC
BOREHOLE DIAMETER: 6"
TYPE OF BACKFILL: BENT./CEMENT GROUT
ELEVATION / DEPTH TOP OF SEAL: 548.71'/6'
TYPE OF SEAL: BENTONITE PELLETS
DEPTH TOP OF SAND PACK: 546.61'/8.9'
ELEVATION / DEPTH TOP OF SCREEN: 545.41'/10'
TYPE OF SCREEN: SCHED. 40 PVC
SLOT SIZE x LENGTH: 10 SLOT x 9'
I.D. OF SCREEN: 2"
TYPE OF SAND PACK: OTTOWA 430
ELEVATION / DEPTH BOTTOM OF SCREEN: 536.41'/19'
ELEVATION / DEPTH BOTTOM OF SAND PACK: 534.41'/21'
TYPE OF BACKFILL BELOW OBSERVATION WELL: HOLE COLLAPSED W/ OVERBURDEN MAT.
ELEVATION / DEPTH OF HOLE: 532.41'/23'

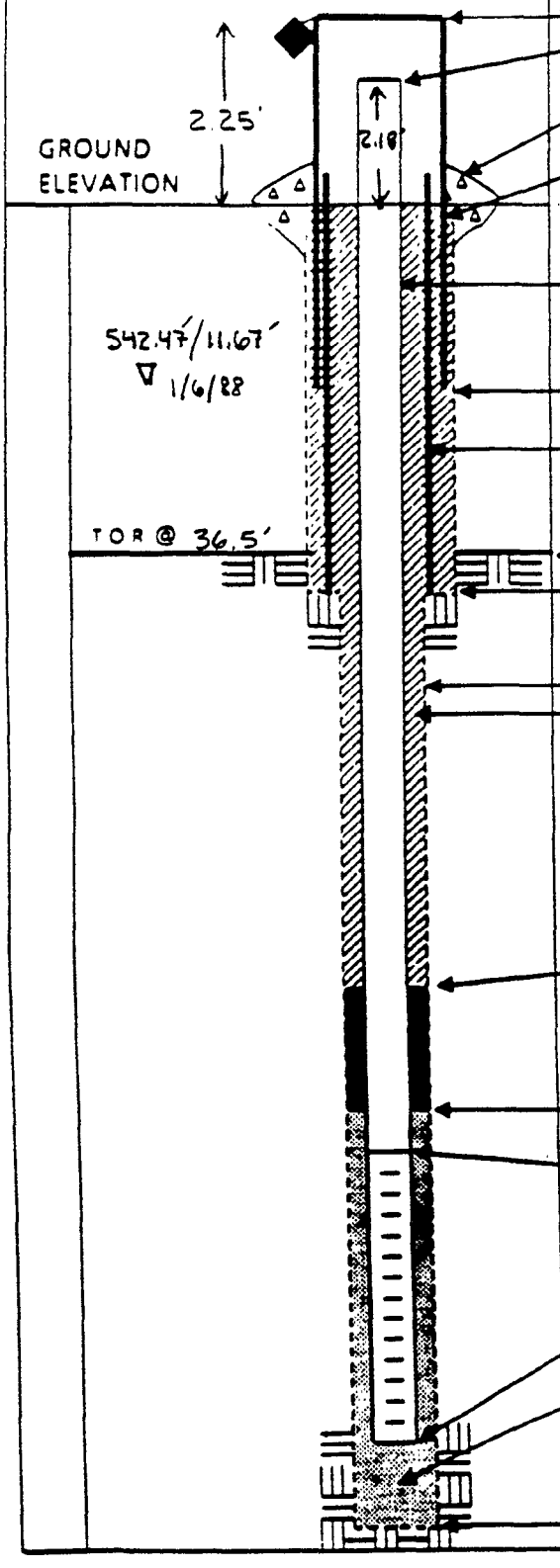
NUS CORPORATION

BEDROCK MONITORING WELL SHEET

PROJECT DRAKE CHEMICAL
PROJECT NO. 6207
ELEVATION 554.14'
FIELD GEOLOGIST M.L. MENBEL

LOCATION LOCK HAVEN, PA.
BORING MW-M109
DATE 11-16-87

DRILLER B GOLLIHUE
DRILLING METHOD HOLLOW STEM/NX CORING
DEVELOPMENT METHOD AIR SURGE



ELEVATION OF TOP OF SURFACE CASING: 556.39'
ELEVATION OF TOP OF RISER PIPE: 556.32'

TYPE OF SURFACE SEAL: CEMENT

I.D. OF SURFACE CASING: 6"
TYPE OF SURFACE CASING: BLACK STEEL

RISER PIPE I.D 2"
TYPE OF RISER PIPE: SCHEDULE 40 PVC

BOREHOLE DIAMETER: 10"

PERM. CASING I.D. 4"
TYPE OF CASING & BACKFILL: SCHEDULE 40 PVC CEMENT/BENTONITE SLURRY

ELEVATION / DEPTH TOP OF BEDROCK: 517.64'/36.5'
ELEVATION / DEPTH BOTTOM OF CASING: 514.14'/40'

BOREHOLE DIA. BELOW CASING: 3 7/8"
TYPE OF BACKFILL: CEMENT/BENTONITE SLURRY

NOTES:

ELEVATION / DEPTH TOP OF SEAL: 474.14'/80'
TYPE OF SEAL: BENTONITE PELLETS

ELEVATION / DEPTH TOP OF SAND PACK: 468.14'/86'

ELEVATION/DEPTH TOP OF SCREEN: 464.84'/89.3
TYPE OF SCREEN: SCHEDULE 40 SLOTTED
SLOT SIZE x LENGTH: 10 SLOT X 14
ID OF SCREEN: 2"
TYPE OF SAND PACK: SILICA SAND #430

ELEVATION / DEPTH BOTTOM OF SCREEN: 450.84'/103.3

ELEVATION / DEPTH BOTTOM OF SAND PACK: 450.14'/104'
TYPE OF BACKFILL BELOW OBSERVATION WELL:

ELEVATION / DEPTH OF HOLE: 450.14'/104'

NUS CORPORATION
A Halliburton Company

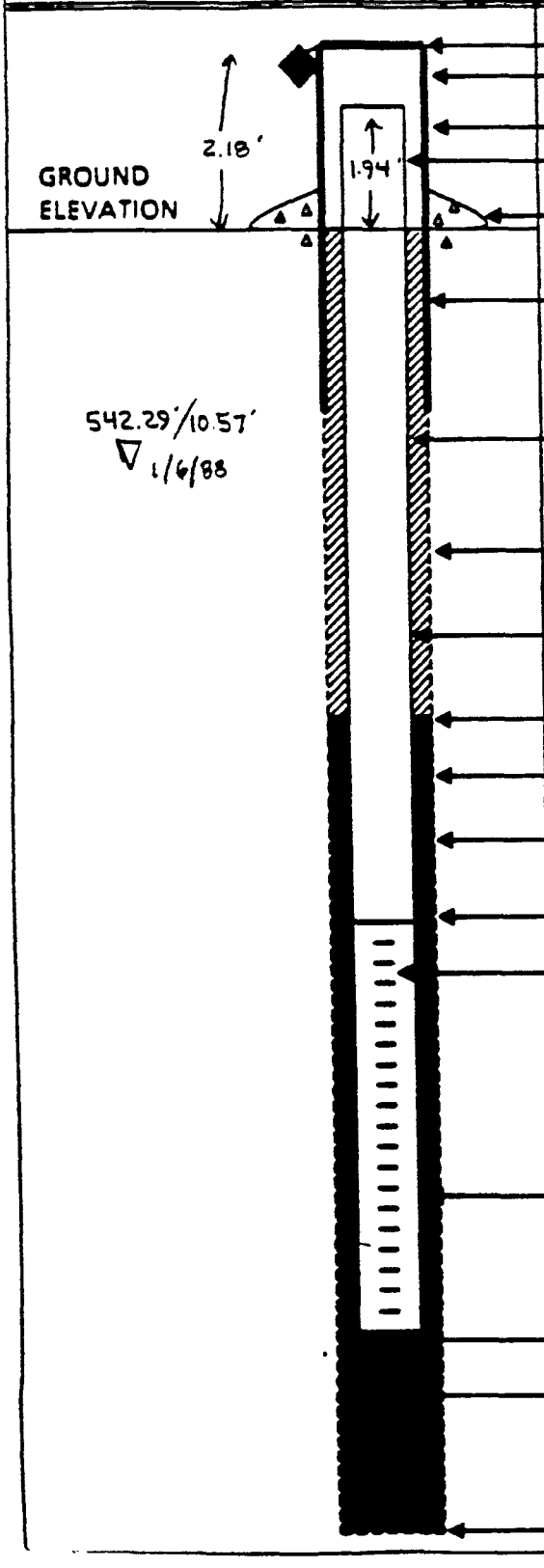
BORING NO MW-M12

OVERBURDEN MONITORING WELL SHEET

PROJECT DRAKE CHEMICAL
PROJECT NO. 620Y
ELEVATION 552.86'
FIELD GEOLOGIST M. L. MENGEL

LOCATION LOCK HAVEN, PA
BORING MW-M12
DATE 11-17-87

DRILLER B. GOLLINGE
DRILLING METHOD ROTARY
DEVELOPMENT METHOD AIR SURGE



ELEVATION OF TOP OF SURFACE CASING: 555.04'
ELEVATION OF TOP OF RISER PIPE: 554.80'
STICK-UP TOP OF SURFACE CASING: 2.18'
STICK-UP RISER PIPE: 1.94'
TYPE OF SURFACE SEAL: CEMENT / BENTONITE SLURRY
I.D. OF SURFACE CASING: 6"
TYPE OF SURFACE CASING: BLACK STEEL
RISER PIPE I.D. 2"
TYPE OF RISER PIPE: SCHEDULE 40 PVC
BOREHOLE DIAMETER: 10"
TYPE OF BACKFILL: CEMENT / BENTONITE SLURRY
ELEVATION / DEPTH TOP OF SEAL: 537.86'/15.0'
TYPE OF SEAL: BENTONITE PELLETS
DEPTH TOP OF SAND PACK: 531.86'/21.0'
ELEVATION / DEPTH TOP OF SCREEN: 527.56'/25.3'
TYPE OF SCREEN: SCHEDULE 40 SLOTTED
SLOT SIZE x LENGTH: 10 SLOT x 9'
I.D. OF SCREEN: 2"
TYPE OF SAND PACK: SILICA SAND #430
ELEVATION / DEPTH BOTTOM OF SCREEN: 518.56'/34.3
ELEVATION / DEPTH BOTTOM OF SAND PACK: 517.36'
TYPE OF BACKFILL BELOW OBSERVATION WELL: SILICA SAND #430
ELEVATION / DEPTH OF HOLE: 517.36'/35.5

AR302490

NUS CORPORATION
A Halliburton Company

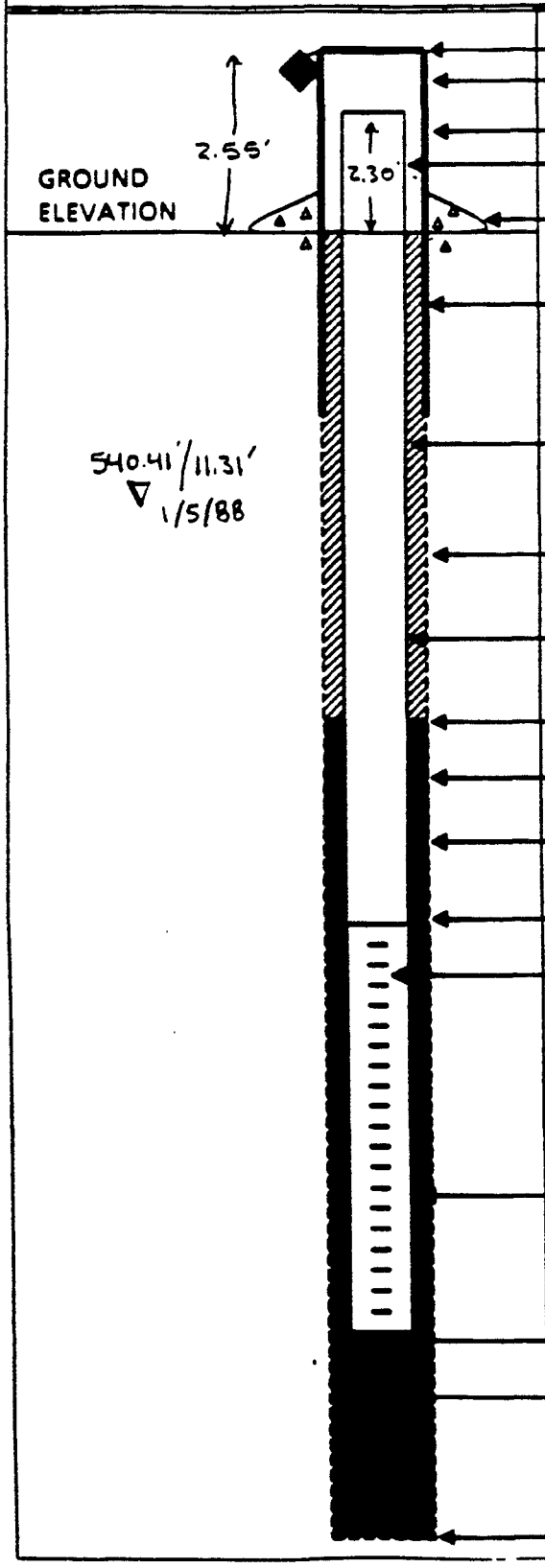
BORING NO MW-M-3

OVERBURDEN MONITORING WELL SHEET

PROJECT DRAKE CHEMICAL
PROJECT NO. 620 Y
ELEVATION 551.72'
FIELD GEOLOGIST M.L. MENGEL

LOCATION LOCK HAVEN, PA.
BORING MW-M113
DATE 11-20-87

DRILLER B. GOLLINGE
DRILLING METHOD ROTARY
DEVELOPMENT METHOD AIR SURGE



ELEVATION OF TOP OF SURFACE CASING: 554.27'
ELEVATION OF TOP OF RISER PIPE: 554.02'
STICK - UP TOP OF SURFACE CASING: 2.55'
STICK - UP RISER PIPE: 2.30
TYPE OF SURFACE SEAL: CEMENT / BENTONITE SLURRY
I.D. OF SURFACE CASING: 6"
TYPE OF SURFACE CASING: BLACK STEEL
RISER PIPE I.D. 2"
TYPE OF RISER PIPE: SCHEDULE 40 PVC
BOREHOLE DIAMETER: 10"
TYPE OF BACKFILL: CEMENT / BENTONITE SLURRY
ELEVATION / DEPTH TOP OF SEAL: 521.72' / 30.0'
TYPE OF SEAL: BENTONITE PELLETS
DEPTH TOP OF SAND PACK: 518.72' / 33.0'
ELEVATION / DEPTH TOP OF SCREEN: 516.42' / 35.3'
TYPE OF SCREEN: SCHEDULE 40 SLOTTED
SLOT SIZE x LENGTH: 10 SLOT x 9'
I.D. OF SCREEN: 2"
TYPE OF SAND PACK: SILICA SAND #430
ELEVATION / DEPTH BOTTOM OF SCREEN: 507.42' / 44.3
ELEVATION / DEPTH BOTTOM OF SAND PACK: 505.22' / 46.5
TYPE OF BACKFILL BELOW OBSERVATION WELL: SILICA SAND #480
ELEVATION / DEPTH OF HOLE: 505.22' / 46.5

AR302491

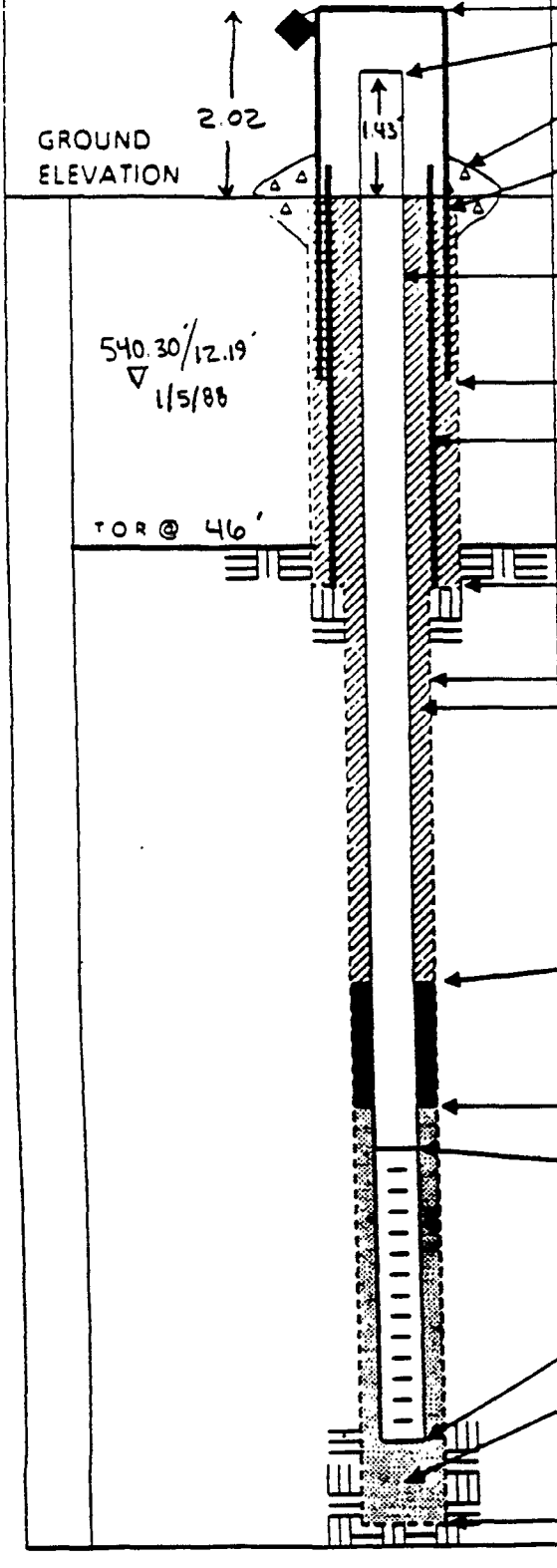
NUS CORPORATION

BEDROCK
MONITORING WELL SHEET

PROJECT Drake Chemical
PROJECT NO. 620 Y
ELEVATION 552.49'
FIELD GEOLOGIST M.L. Menbel

LOCATION Lock Haven PA
BORING MW-M114
DATE 11-20-87

DRILLER S. Gollihue
DRILLING METHOD Hollow Stem
DEVELOPMENT METHOD Air Surge



ELEVATION OF TOP OF SURFACE CASING: 554.51'
ELEVATION OF TOP OF RISER PIPE: 553.92'

TYPE OF SURFACE SEAL: Cement

I.D. OF SURFACE CASING: 6"
TYPE OF SURFACE CASING: Black Steel

RISER PIPE I.D: 2"
TYPE OF RISER PIPE: Schedule 40 PVC

BOREHOLE DIAMETER: 10"

PERM. CASING I.D. 4"
TYPE OF CASING & BACKFILL: Schedule 40 PVC
Cement/Bentonite Slurry

ELEVATION / DEPTH TOP OF BEDROCK: 506.49'/46'
ELEVATION / DEPTH BOTTOM OF CASING: 502.49'/50'

BOREHOLE DIA. BELOW CASING: 3 7/8"
TYPE OF BACKFILL: Cement/Bentonite Slurry

NOTES:

ELEVATION / DEPTH TOP OF SEAL: 470.49'/82'
TYPE OF SEAL: Bentonite Pellets

ELEVATION / DEPTH TOP OF SAND PACK: 467.49'/85'

ELEVATION/DEPTH TOP OF SCREEN: 462.19'/90.3'
TYPE OF SCREEN: Schedule 40 Slotted
SLOT SIZE x LENGTH: 10 Slot X 19'
ID OF SCREEN: 2"
TYPE OF SAND PACK: Silica Sand #430
ELEVATION / DEPTH BOTTOM OF SCREEN: 443.19'/109.3

ELEVATION / DEPTH BOTTOM OF SAND PACK: 441.49'/111'
TYPE OF BACKFILL BELOW OBSERVATION WELL:

ELEVATION / DEPTH OF HOLE: 441.49'/111'

D-12

AR302492

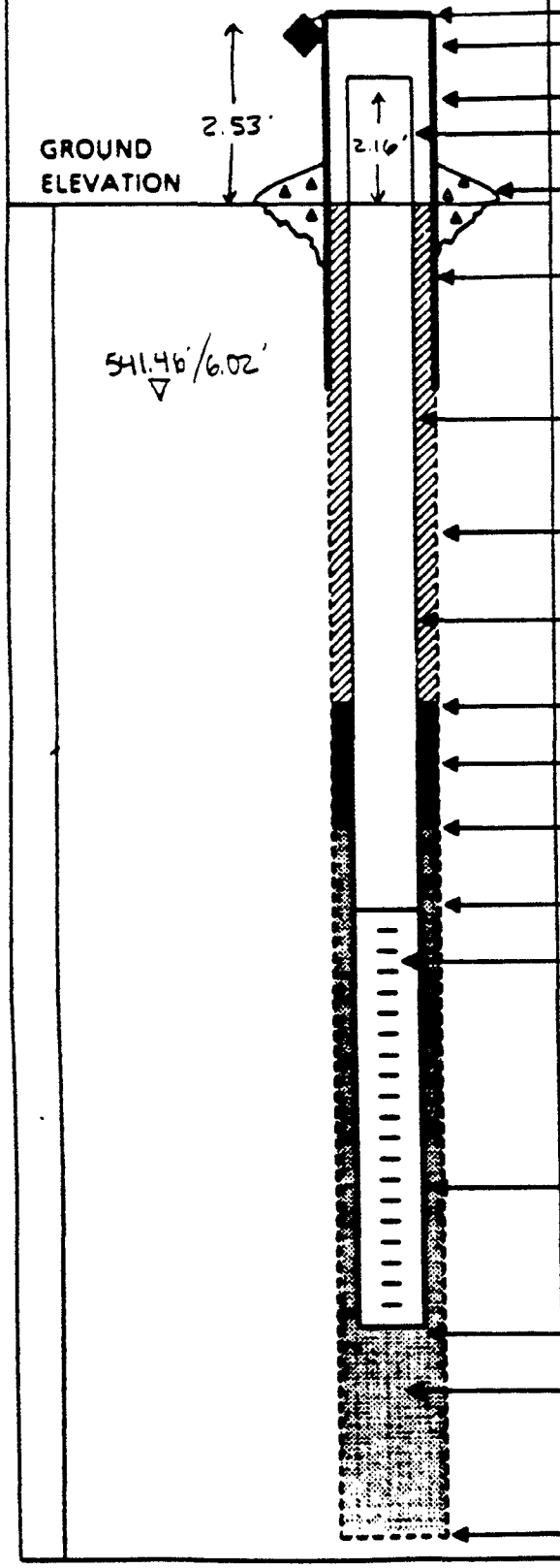
NUS CORPORATION
A Halliburton Company

OVERBURDEN MONITORING WELL SHEET

PROJECT: DRAKE CHEMICAL
PROJECT NO.: 620 Y
ELEVATION: 547.48'
FIELD GEOLOGIST: M.L. MENGEL

LOCATION: LOCK HAVEN, PA
BORING: MW-M115
DATE: 11-21-87

DRILLER: B. GOODHUE
DRILLING METHOD: ROTARY
DEVELOPMENT METHOD: AIR SURGE



ELEVATION OF TOP OF SURFACE CASING: 550.01'
ELEVATION OF TOP OF RISER PIPE: 549.64'
STICK-UP TOP OF SURFACE CASING: 2.53'
STICK-UP RISER PIPE: 2.16'
TYPE OF SURFACE SEAL: BENTONITE / CEMENT SLURRY
I.D. OF SURFACE CASING: 6"
TYPE OF SURFACE CASING: BLACK STEEL
RISER PIPE I.D. 2"
TYPE OF RISER PIPE: SCHEDULE 40 PVC
BOREHOLE DIAMETER: 10"
TYPE OF BACKFILL: CEMENT / BENTONITE SLURRY
ELEVATION / DEPTH TOP OF SEAL: 526.48' /21.0'
TYPE OF SEAL: BENTONITE PELLETS
DEPTH TOP OF SAND PACK: 524.48'/23.0'
ELEVATION / DEPTH TOP OF SCREEN: 522.18' /25.3'
TYPE OF SCREEN: SCHEDULE 40 SLOTTED
SLOT SIZE x LENGTH: 10 SLOT x 9.'
I.D. OF SCREEN: 2"
TYPE OF SAND PACK: SILICA SAND #430
ELEVATION / DEPTH BOTTOM OF SCREEN: 513.18' /34.3'
ELEVATION / DEPTH BOTTOM OF SAND PACK: 510.48' /37.0'
TYPE OF BACKFILL BELOW OBSERVATION WELL: SILICA SAND # 430
ELEVATION / DEPTH OF HOLE: 510.48' /37.0'

NUS CORPORATION
A Halliburton Company

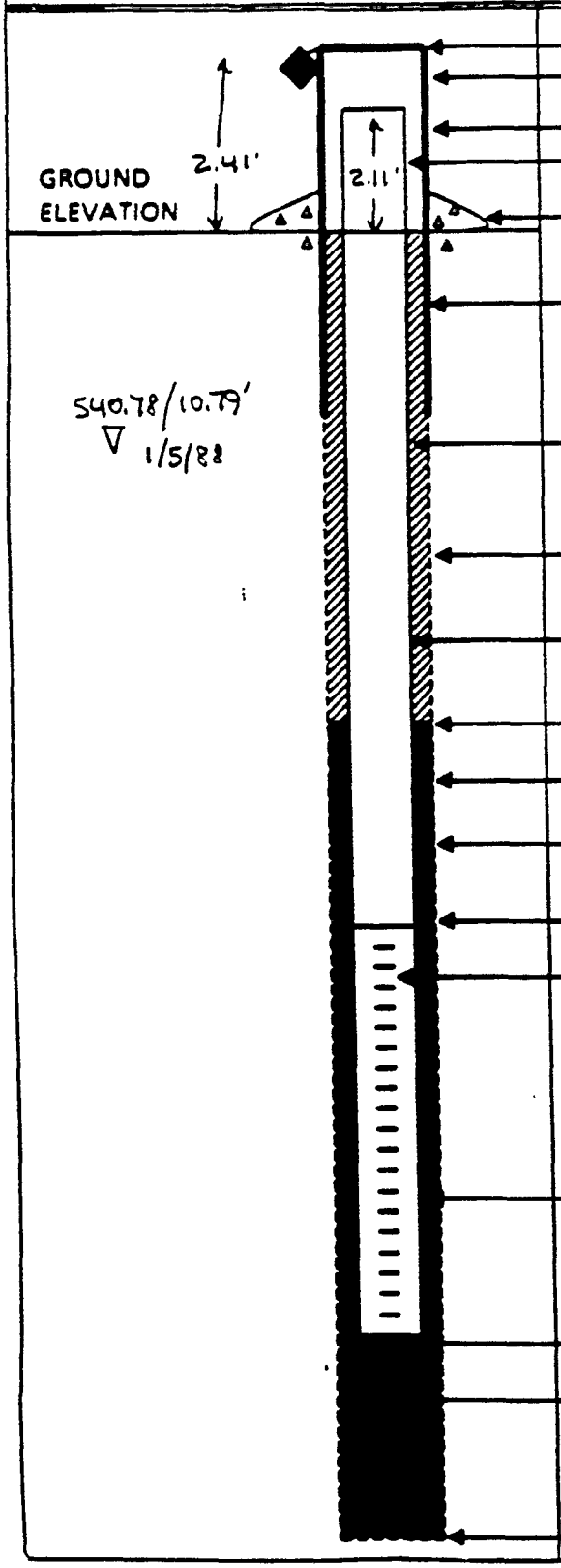
BORING NO MW-M116

OVERBURDEN MONITORING WELL SHEET

PROJECT DRAKE CHEMICAL
PROJECT NO. 620 Y
ELEVATION 551.57
FIELD GEOLOGIST M.L. MENGEL

LOCATION LOCK HAVEN, PA.
BORING MW-M116
DATE 11-21-87

DRILLER B GOLLINGE
DRILLING METHOD ROTARY
DEVELOPMENT METHOD AIR SURGE



ELEVATION OF TOP OF SURFACE CASING: 553.98'
ELEVATION OF TOP OF RISER PIPE: 553.68'
STICK - UP TOP OF SURFACE CASING: 2.41'
STICK - UP RISER PIPE: 2.11'
TYPE OF SURFACE SEAL: CEMENT / BENTONITE SLURRY
I.D. OF SURFACE CASING: 6"
TYPE OF SURFACE CASING: BLACK STEEL
RISER PIPE I.D. 2"
TYPE OF RISER PIPE: SCHEDULE 40 PVC
BOREHOLE DIAMETER: 10"
TYPE OF BACKFILL: CEMENT / BENTONITE SLURRY
ELEVATION / DEPTH TOP OF SEAL: 541.57' /10.0'
TYPE OF SEAL: BENTONITE PELLETS
DEPTH TOP OF SAND PACK: 539.57'/12.0'
ELEVATION / DEPTH TOP OF SCREEN: 537.27'/14.3'
TYPE OF SCREEN: SCHEDULE 40
SLOT SIZE x LENGTH: 10 SLOT x 9'
I.D. OF SCREEN: 2"
TYPE OF SAND PACK: SILICA SAND #430
ELEVATION / DEPTH BOTTOM OF SCREEN: 528.27'/23.3
ELEVATION / DEPTH BOTTOM OF SAND PACK: 526.57'/25.0
TYPE OF BACKFILL BELOW OBSERVATION WELL: SILICA SAND #430
ELEVATION / DEPTH OF HOLE: 526.57'/25.0

AR302494

NUS CORPORATION
A Halliburton Company

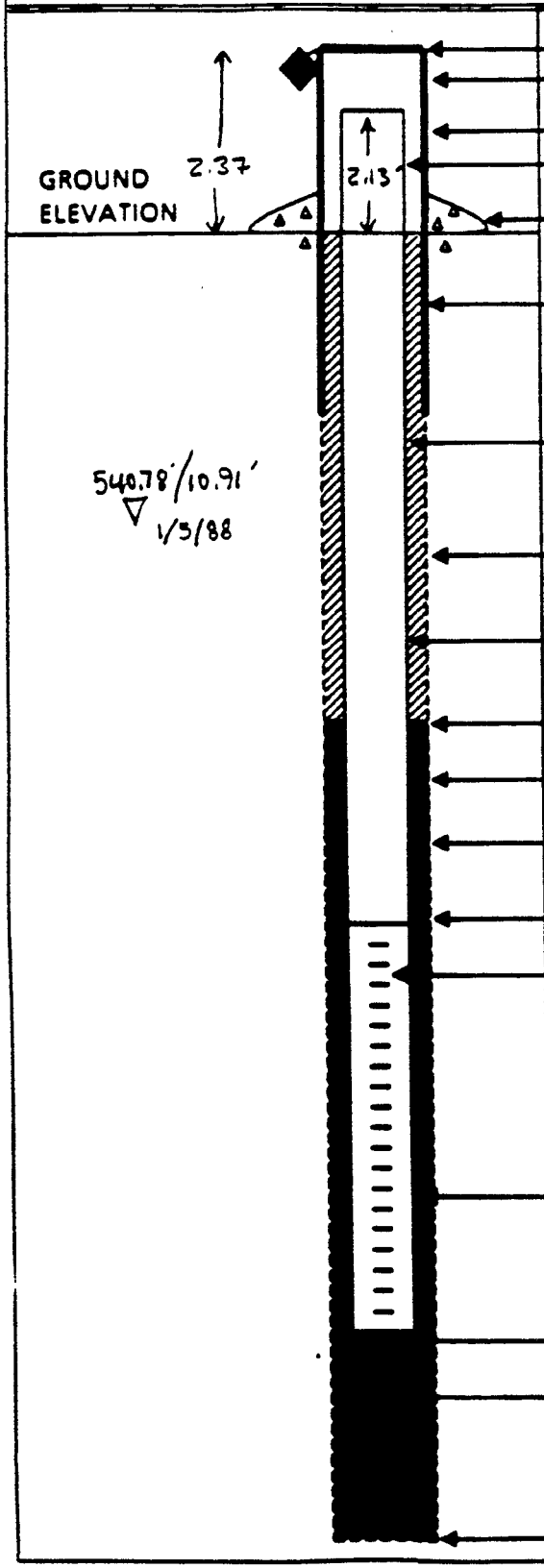
BORING NO MW-M117

OVERBURDEN
MONITORING WELL SHEET

PROJECT DRAKE CHEMICAL
PROJECT NO. 620Y
ELEVATION 551.69'
FIELD GEOLOGIST M L MENGEL

LOCATION LOCK HAVEN, PA
BORING MW-M117
DATE 11-21-87

DRILLER B. GOLLINGE
DRILLING METHOD ROTARY
DEVELOPMENT METHOD AIR SURGE



ELEVATION OF TOP OF SURFACE CASING: 554.06'
ELEVATION OF TOP OF RISER PIPE: 553.82'
STICK - UP TOP OF SURFACE CASING: 2.37'
STICK - UP RISER PIPE: 2.13'
TYPE OF SURFACE SEAL: CEMENT / BENTONITE SLURRY
I.D. OF SURFACE CASING: 6"
TYPE OF SURFACE CASING: BLACK STEEL
RISER PIPE I.D. 2"
TYPE OF RISER PIPE: SCHEDULE 40 PVC
BOREHOLE DIAMETER: 10"
TYPE OF BACKFILL: CEMENT / BENTONITE SLURRY
ELEVATION / DEPTH TOP OF SEAL: 526.69' /25.0'
TYPE OF SEAL: BENTONITE PELLETS
DEPTH TOP OF SAND PACK: 523.69' /28.0'
ELEVATION / DEPTH TOP OF SCREEN: 512.39' /30.3
TYPE OF SCREEN: SCHEDULE 40 SLOTTED
SLOT SIZE x LENGTH: 10 SLOT x 9'
I.D. OF SCREEN: 2"
TYPE OF SAND PACK: SILICA SAND #430
ELEVATION / DEPTH BOTTOM OF SCREEN: 512.39' /39.3'
ELEVATION / DEPTH BOTTOM OF SAND PACK: 510.69' /41'
TYPE OF BACKFILL BELOW OBSERVATION WELL: SILICA SAND #430
ELEVATION / DEPTH OF HOLE: D-14 510.69' /41'

AR302495

NUS CORPORATION
A Halliburton Company

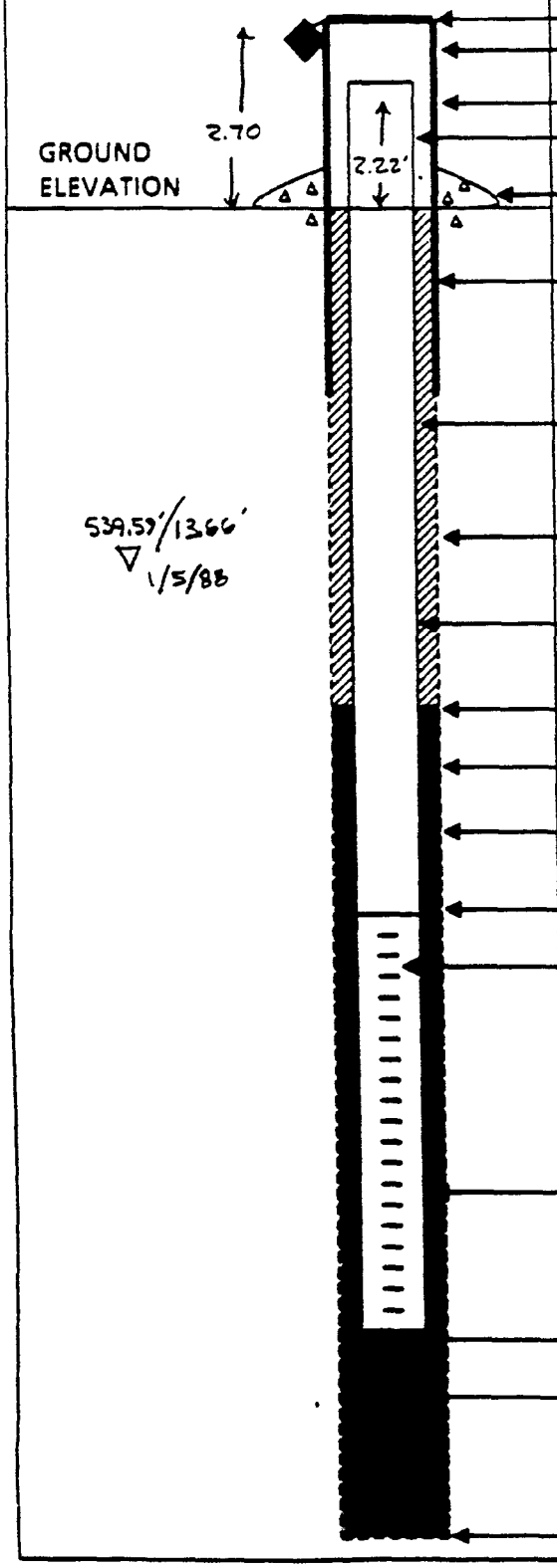
BORING NO MW-MI18

OVERBURDEN MONITORING WELL SHEET

PROJECT DRAKE CHEM
PROJECT NO. 6720Y
ELEVATION 553.25'
FIELD GEOLOGIST R BETHEL

LOCATION LOCK HAVEN, PA
BORING MW-MI18
DATE 12-16-87

DRILLER E DYE
DRILLING METHOD SOLID STEM AUGER
DEVELOPMENT METHOD AIR SURGE



ELEVATION OF TOP OF SURFACE CASING: 555.95'
ELEVATION OF TOP OF RISER PIPE: 555.47'
STICK - UP TOP OF SURFACE CASING: 2.70'
STICK - UP RISER PIPE: 2.22'
TYPE OF SURFACE SEAL: CEMENT
I.D. OF SURFACE CASING: 6"
TYPE OF SURFACE CASING: BLACK STEEL
RISER PIPE I.D. 2"
TYPE OF RISER PIPE: SCHED 40 PVC
BOREHOLE DIAMETER: 6"
TYPE OF BACKFILL: CEMENT / BENTONITE
ELEVATION / DEPTH TOP OF SEAL: 543.25'/10'
TYPE OF SEAL: BENTONITE PELLETS
DEPTH TOP OF SAND PACK: 541.25'/12'
ELEVATION / DEPTH TOP OF SCREEN: 538.25'/15'
TYPE OF SCREEN: SLOTTED PVC, SCHED 40
SLOT SIZE x LENGTH: 10 SLOT x 9'
I.D. OF SCREEN: 2"
TYPE OF SAND PACK: #430 SAND
ELEVATION / DEPTH BOTTOM OF SCREEN: 529.25'/24'
ELEVATION / DEPTH BOTTOM OF SAND PACK: 528.25'/25'
TYPE OF BACKFILL BELOW OBSERVATION WELL: #430 SAND
ELEVATION / DEPTH OF HOLE: 528.25'/25'

AR302496

NUS CORPORATION
A Halliburton Company

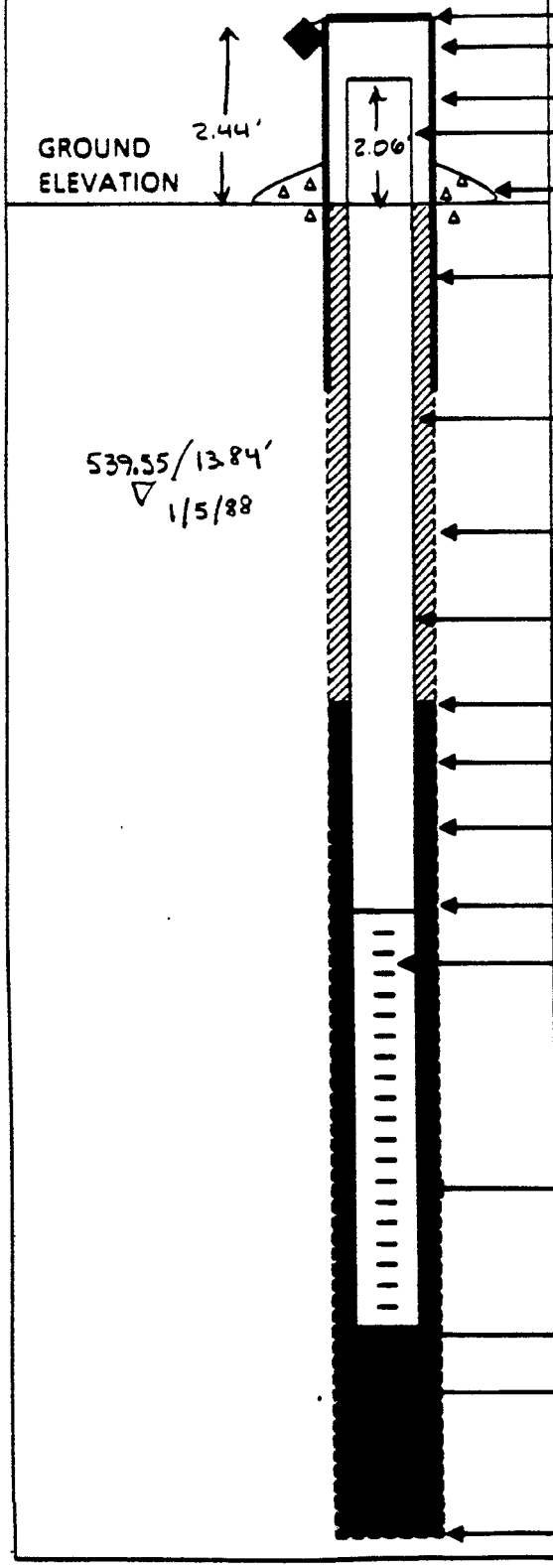
BORING NO MW-M119

OVERBURDEN MONITORING WELL SHEET

PROJECT DRAKE CHEM
PROJECT NO. 6204
ELEVATION 553.39'
FIELD GEOLOGIST R BETHEL

LOCATION LOCK HAVEN, PA
BORING MW-M119
DATE 12-16-87

DRILLER E DYE
DRILLING METHOD HOLLOW STEM AUGER
DEVELOPMENT METHOD AIR SURGE



ELEVATION OF TOP OF SURFACE CASING: 555.83'
ELEVATION OF TOP OF RISER PIPE: 555.45'
STICK - UP TOP OF SURFACE CASING: 2.44'
STICK - UP RISER PIPE: 2.06'
TYPE OF SURFACE SEAL: CEMENT
I.D. OF SURFACE CASING: 6"
TYPE OF SURFACE CASING: BLACK STEEL
RISER PIPE I.D. 2"
TYPE OF RISER PIPE: SCHED 40 PVC
BOREHOLE DIAMETER: 10"
TYPE OF BACKFILL: CEMENT / BENTONITE
ELEVATION / DEPTH TOP OF SEAL: 520.39'/33'
TYPE OF SEAL: BENTONITE PELLETS
DEPTH TOP OF SAND PACK: 517.39'/36'
ELEVATION / DEPTH TOP OF SCREEN: 513.39'/40'
TYPE OF SCREEN: SLOTTED PVC, SCHED. 40
SLOT SIZE x LENGTH: 10 SLOT x 9'
I.D. OF SCREEN: 2"
TYPE OF SAND PACK: #430 SAND
ELEVATION / DEPTH BOTTOM OF SCREEN: 504.39'/49'
ELEVATION / DEPTH BOTTOM OF SAND PACK: 503.39'/50'
TYPE OF BACKFILL BELOW OBSERVATION WELL: #430 SAND
ELEVATION / DEPTH OF HOLE: 503.39'/50'

AR302497

BORING NO. MW-M120

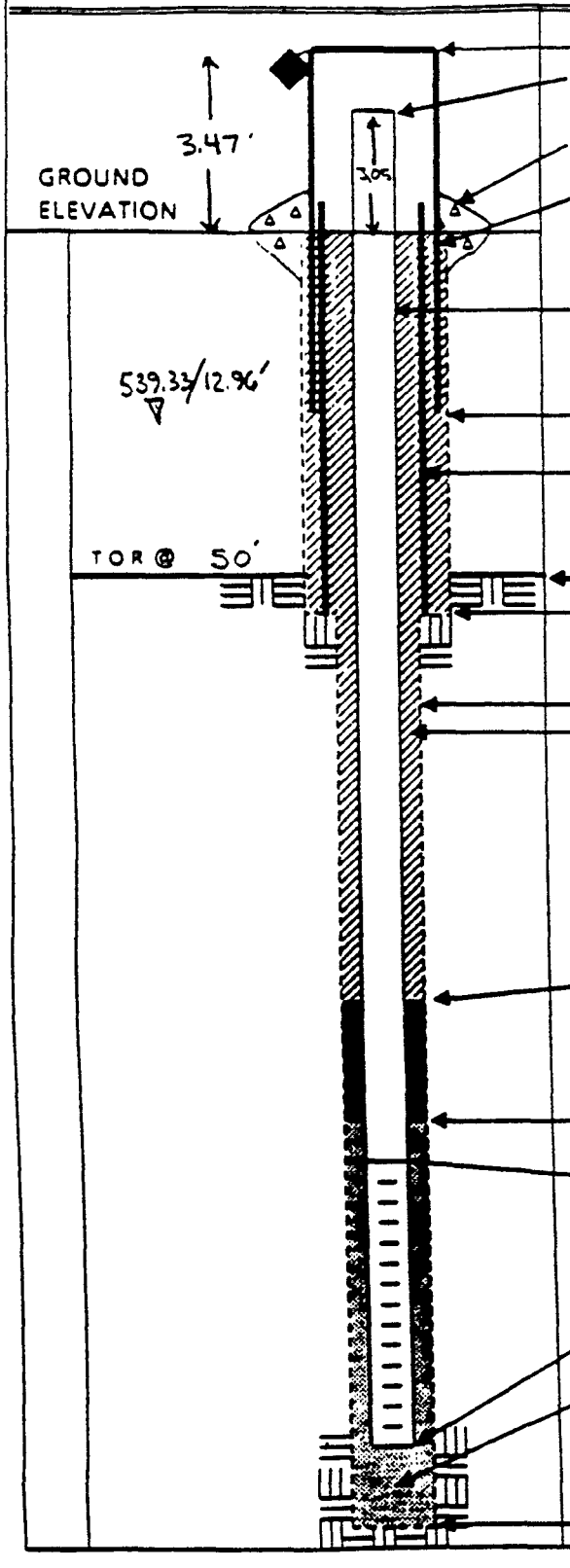
NUS CORPORATION

BEDROCK
MONITORING WELL SHEET

PROJECT: DRAKE
PROJECT NO.: 620 Y
ELEVATION: 552.29'
FIELD GEOLOGIST: R BETHEL

LOCATION: LOCK HAVEN, PA
BORING: MW-M120
DATE: 12-15-87

DRILLER: E DYE
DRILLING METHOD: HOLLOW STEM
DEVELOPMENT METHOD: AIR SURGE



ELEVATION OF TOP OF SURFACE CASING: 555.76'
ELEVATION OF TOP OF RISER PIPE: 555.34'

TYPE OF SURFACE SEAL: CEMENT

I.D. OF SURFACE CASING: 6"
TYPE OF SURFACE CASING: BLACK STEEL

RISER PIPE I.D: 2"
TYPE OF RISER PIPE: SCHEDULE 40 PVC

BOREHOLE DIAMETER: 10"

PERM. CASING I.D. 4"
TYPE OF CASING & BACKFILL: CEMENT / BENTONITE SLURRY

ELEVATION / DEPTH TOP OF BEDROCK: 502.29'/50'
ELEVATION / DEPTH BOTTOM OF CASING: 436.29'/116'

BOREHOLE DIA. BELOW CASING: 3 7/8"
TYPE OF BACKFILL: CEMENT / BENTONITE SLURRY

NOTES:

ELEVATION / DEPTH TOP OF SEAL: 437.29'/115'
TYPE OF SEAL: BENTONITE PELLETS

ELEVATION / DEPTH TOP OF SAND PACK: 435.29'/117'

ELEVATION/DEPTH TOP OF SCREEN: 431.99'/120.3
TYPE OF SCREEN: SCHEDULE 40 SLOTTED
SLOT SIZE x LENGTH: 10 SLOT x 19'
ID OF SCREEN: 2"
TYPE OF SAND PACK: SILICA SAND #430
ELEVATION / DEPTH BOTTOM OF SCREEN: 412.99'/139.3

ELEVATION / DEPTH BOTTOM OF SAND PACK: 412.29'/140'
TYPE OF BACKFILL BELOW OBSERVATION WELL:

ELEVATION / DEPTH OF HOLE: 412.29'/140'

D-17

AR302498

NUS CORPORATION
A Halliburton Company

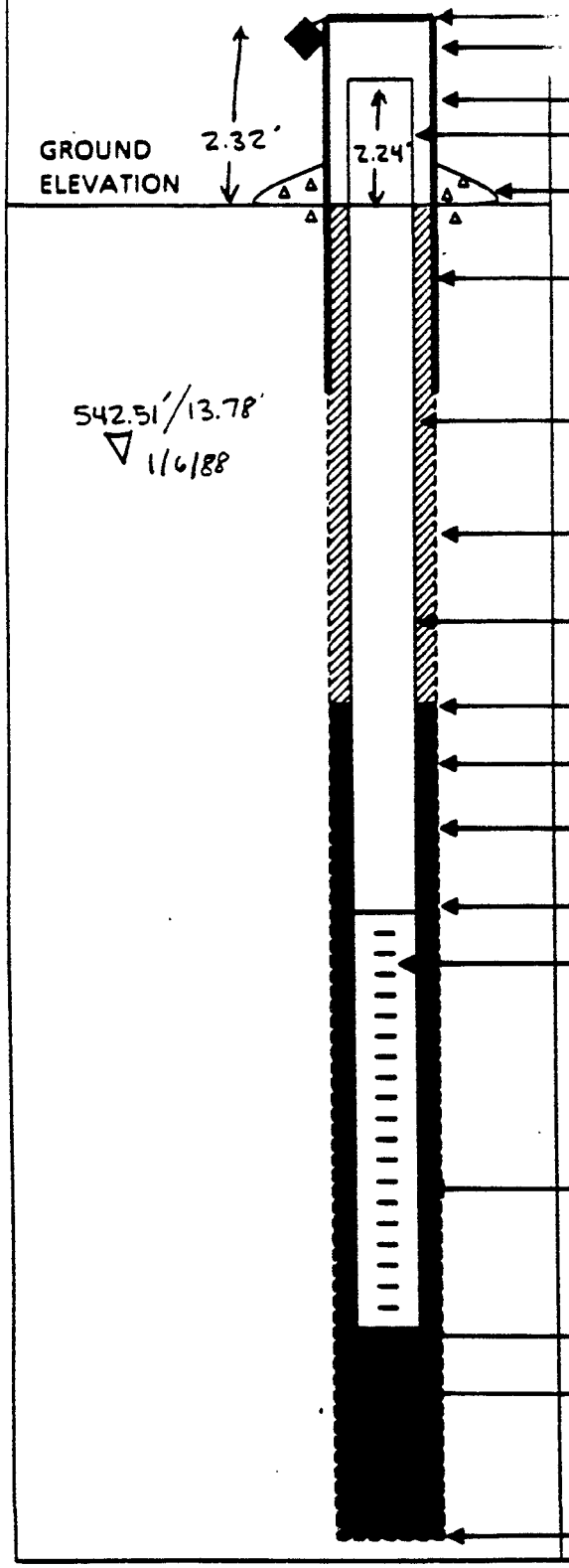
BORING NO MW-M122

OVERBURDEN MONITORING WELL SHEET

PROJECT DRAKE CHEMICAL
PROJECT NO. 620 Y
ELEVATION 556.29'
FIELD GEOLOGIST R BETHEL

LOCATION LOCK HAVEN, PA.
BORING MW-M122
DATE 11-25-87

DRILLER B. GOLLINUE
DRILLING METHOD SOLID AND HOLLOW STEM
DEVELOPMENT METHOD AIR SURGE



ELEVATION OF TOP OF SURFACE CASING: 558.61'
ELEVATION OF TOP OF RISER PIPE: 558.53'

STICK - UP TOP OF SURFACE CASING: 2.32'
STICK - UP RISER PIPE: 2.24'

TYPE OF SURFACE SEAL: CEMENT

I.D. OF SURFACE CASING: 6"
TYPE OF SURFACE CASING: BLACK STEEL

RISER PIPE I.D. 2"
TYPE OF RISER PIPE: SCHEDULE 40 PVC

BOREHOLE DIAMETER: 10"

TYPE OF BACKFILL: CEMENT / BENTONITE SLURRY

ELEVATION / DEPTH TOP OF SEAL: 530.29' /26'

TYPE OF SEAL: BENTONITE PELLETS

DEPTH TOP OF SAND PACK: 524.29' /32'

ELEVATION / DEPTH TOP OF SCREEN: 520.99' /35.3'

TYPE OF SCREEN: SCHEDULE 40 SLOTTED

SLOT SIZE x LENGTH: 10 SLOT X 9'

I.D. OF SCREEN: 2"

TYPE OF SAND PACK: SILICA SAND #430

ELEVATION / DEPTH BOTTOM OF SCREEN: 511.99' /443'

ELEVATION / DEPTH BOTTOM OF SAND PACK: 509.29' /47'

TYPE OF BACKFILL BELOW OBSERVATION WELL: HOLE COLLAPSED TO 48', ADDED BENTONITE PELLETS TO 47'.

ELEVATION / DEPTH OF HOLE: 505.29' /51'

AR302499

NUS CORPORATION

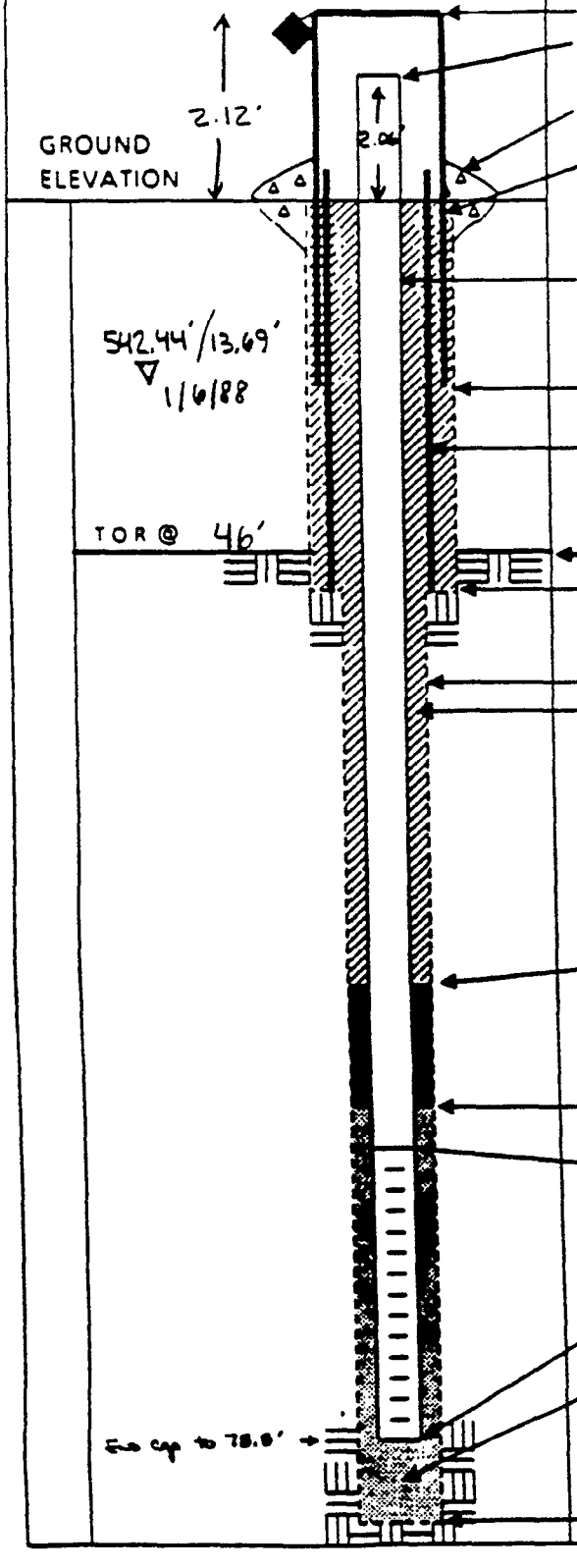
BORING NO MW-M123

BEDROCK
MONITORING WELL SHEET

PROJECT DRAKE CHEM
PROJECT NO. 6207
ELEVATION 556.13'
FIELD GEOLOGIST R. BETHEL

LOCATION LOCK HAVEN, PA
BORING MW-M123
DATE 11-30-87

DRILLER B GOLLHOFER
DRILLING METHOD HOLLOW STEM CONVENTIONAL
DEVELOPMENT METHOD AIR SURGE



ELEVATION OF TOP OF SURFACE CASING 558.25'
ELEVATION OF TOP OF RISER PIPE: 558.19'

TYPE OF SURFACE SEAL: CEMENT

I.D. OF SURFACE CASING: 6"
TYPE OF SURFACE CASING: BLACK STEEL

RISER PIPE I.D 2"
TYPE OF RISER PIPE: SCHED. 40 PVC

BOREHOLE DIAMETER: 10"

PERM. CASING I.D. 4"
TYPE OF CASING & BACKFILL: SCHED 40 PVC CEMENT/BENTONITE SLURRY

ELEVATION / DEPTH TOP OF BEDROCK: 510.13'/46'
ELEVATION / DEPTH BOTTOM OF CASING: 496.63'/59.5'

BOREHOLE DIA. BELOW CASING: 3 7/8"
TYPE OF BACKFILL: CEMENT/BENTONITE SLURRY

NOTES:

ELEVATION / DEPTH TOP OF SEAL: 502.13'/54'
TYPE OF SEAL: BENTONITE PELLETS

ELEVATION / DEPTH TOP OF SAND PACK: 500.13'/56'

ELEVATION/DEPTH TOP OF SCREEN: 497.13'/59'
TYPE OF SCREEN: SCHED. 40 SLOTTED PVC
SLOT SIZE x LENGTH: 10 SLOT x 19'
ID OF SCREEN: 2"
TYPE OF SAND PACK: SILICA SAND #430

ELEVATION / DEPTH BOTTOM OF SCREEN: 478.13'/78'

ELEVATION / DEPTH BOTTOM OF SAND PACK: 477.33'/78.8'
TYPE OF BACKFILL BELOW OBSERVATION WELL: HOLE CAVED IN WITH NATURAL MATERIAL TO 78.8'

ELEVATION / DEPTH OF HOLE: 476.13'/80'

AR302500

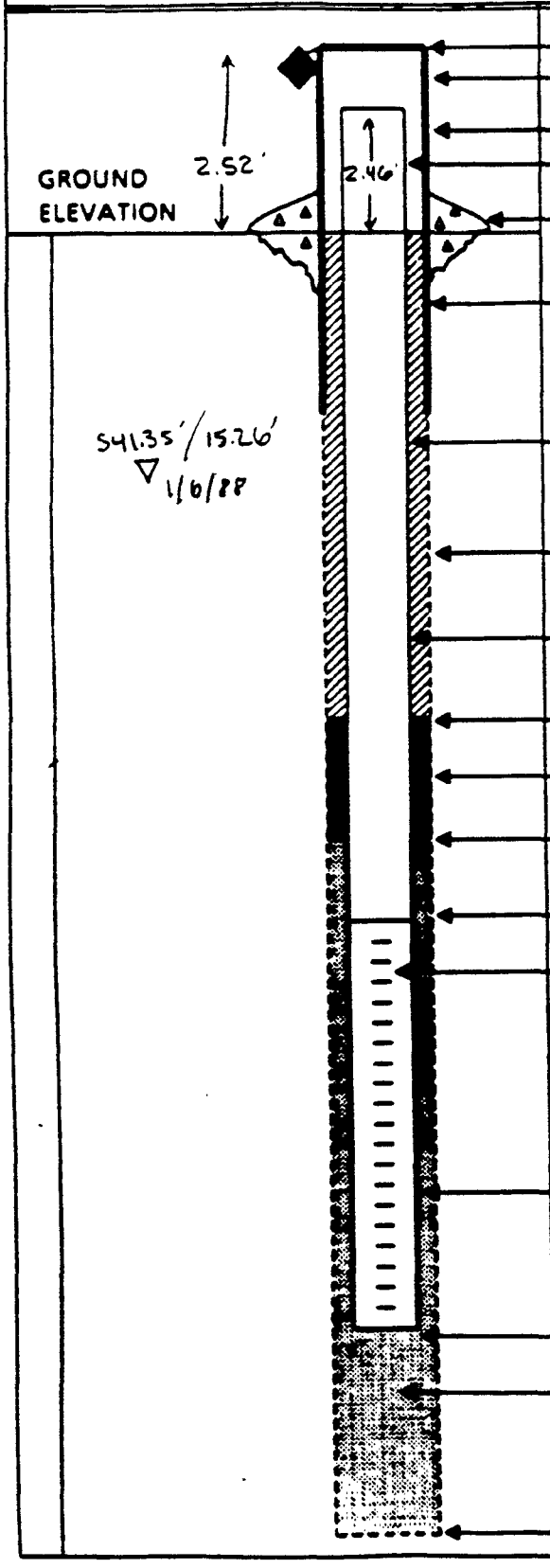
NUS CORPORATION
A Halliburton Company

OVERBURDEN MONITORING WELL SHEET

PROJECT: DRAKE
PROJECT NO.: 620Y
ELEVATION: 556.61'
FIELD GEOLOGIST: R BETHEL

LOCATION: LOCK HAVEN, PA
BORING: MW-M124
DATE: 11/30/87

DRILLER: B GOLLINGE
DRILLING METHOD: HOLLOW STEM
DEVELOPMENT METHOD: AIR SURGE



ELEVATION OF TOP OF SURFACE CASING: 559.13'
ELEVATION OF TOP OF RISER PIPE: 559.07'
STICK - UP TOP OF SURFACE CASING: 2.52'
STICK - UP RISER PIPE: 2.46'
TYPE OF SURFACE SEAL: CEMENT
I.D. OF SURFACE CASING: 6"
TYPE OF SURFACE CASING: BLACK STEEL
RISER PIPE I.D. 2"
TYPE OF RISER PIPE: SCHEDULE 40 PVC
BOREHOLE DIAMETER: 10"
TYPE OF BACKFILL: CEMENT/ BENTONITE SLURRY
ELEVATION / DEPTH TOP OF SEAL: 520.61'/36'
TYPE OF SEAL: BENTONITE PELLETS
DEPTH TOP OF SAND PACK: 518.61'/38'
ELEVATION / DEPTH TOP OF SCREEN: 516.61'/40'
TYPE OF SCREEN: SCHEDULE 40 PVC
SLOT SIZE x LENGTH: 10 SLOT x 9'
I.D OF SCREEN: 2"
TYPE OF SAND PACK: #430 (U.S Sieve 10 to 6 MESH)
ELEVATION / DEPTH BOTTOM OF SCREEN: 507.61'/49'
ELEVATION / DEPTH BOTTOM OF SAND PACK: 505.61'/51'
TYPE OF BACKFILL BELOW OBSERVATION WELL: SAND PACK
ELEVATION / DEPTH OF HOLE: 505.61'/51'

AR302501

NUS CORPORATION
A Halliburton Company

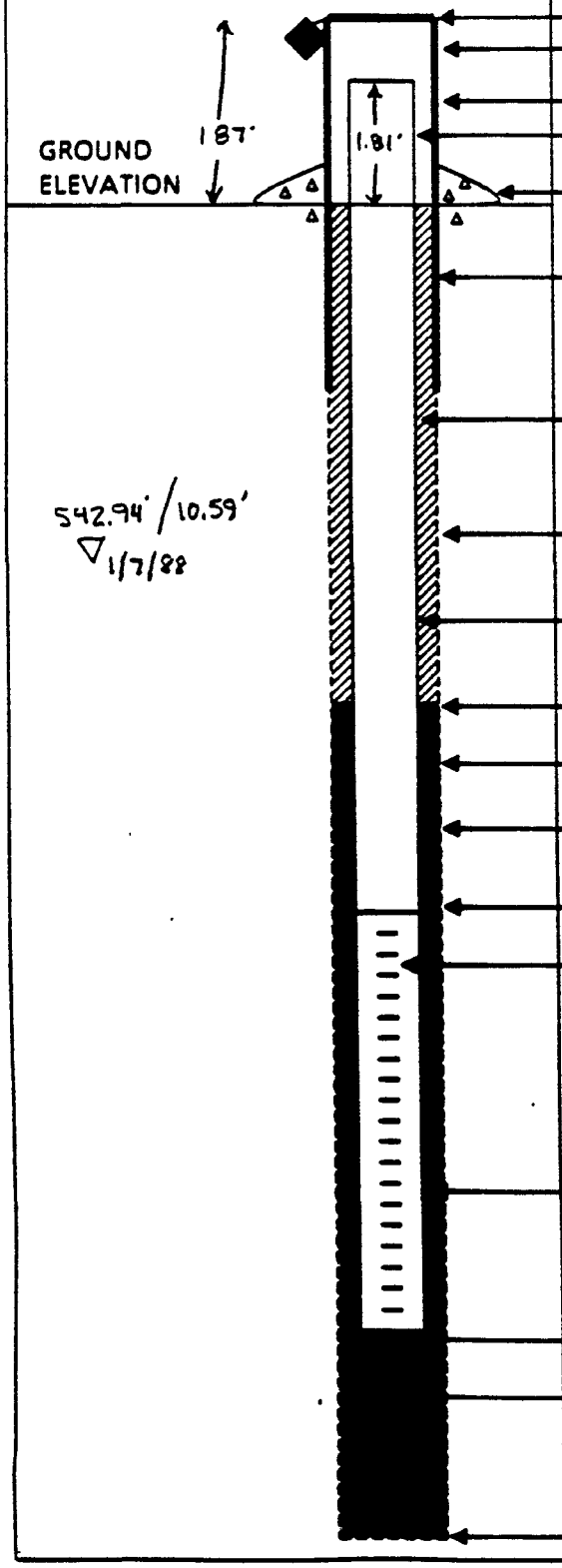
BORING NO MW-M12S

OVERBURDEN MONITORING WELL SHEET

PROJECT DRAKE CHEM
PROJECT NO. 620Y
ELEVATION 553.53'
FIELD GEOLOGIST R BETHEL

LOCATION LOCK HAVEN, PA
BORING MW-M12S
DATE 12-10-87

DRILLER R. GOLLINUE
DRILLING METHOD HOLLOW STEM
DEVELOPMENT METHOD AIR SURGE



ELEVATION OF TOP OF SURFACE CASING: 555.40'
ELEVATION OF TOP OF RISER PIPE: 555.34'
STICK - UP TOP OF SURFACE CASING: 1.87'
STICK - UP RISER PIPE: 1.81'
TYPE OF SURFACE SEAL: CEMENT
I.D. OF SURFACE CASING: 6"
TYPE OF SURFACE CASING: BLACK STEEL
RISER PIPE I.D. 2"
TYPE OF RISER PIPE: PVC SCHED 40
BOREHOLE DIAMETER: 6"
TYPE OF BACKFILL: CEMENT / BENTONITE
ELEVATION / DEPTH TOP OF SEAL: 497.03' / 56.5'
TYPE OF SEAL: BENTONITE PELLETS
DEPTH TOP OF SAND PACK: 494.53' / 59'
ELEVATION / DEPTH TOP OF SCREEN: 492.53' / 61'
TYPE OF SCREEN: SCHED. 40 SLOTTED PVC
SLOT SIZE x LENGTH: 10 SLOT x 9'
I.D. OF SCREEN: 2"
TYPE OF SAND PACK: SILICA SAND #430
ELEVATION / DEPTH BOTTOM OF SCREEN: 483.53' / 70'
ELEVATION / DEPTH BOTTOM OF SAND PACK: 482.93' / 70.6'
TYPE OF BACKFILL BELOW OBSERVATION WELL: COLLAPSE OF NATURAL MATERIAL
ELEVATION / DEPTH OF HOLE: 454.53' / 99'

AR302502

APPENDIX E

FIELD CHANGE REQUESTS (FCRs)

FILE COPY
FILE NO. 1.6

Figure 15-1

EBASCO SERVICES INCORPORATED
FIELD CHANGE REQUEST
-TYPICAL-

123-3L31	42365 5203	6204-TASK 03
EPA Work Assignment No.	EBASCO Work Charge Number	Field Charge No. RB 11/9/87

FCR ~~2~~ 1

To FIELD INVESTIGATION TEAM Location PITTSBURGH Date 11/3/87

Description:
Taken from FSAP Section 3.3.1, p. 40. "Samples will be obtained from the backhoe bucket. The sample shall be collected from the center of the bucket and placed in sample containers using a decontaminated stainless steel trowel or spatula."

Reason For Change:
1) Safety - potential for injury during personnel proximity to backhoe bucket
2) Expediency - more time efficient to fill sample containers and simultaneously allow the backhoe operator to continue with the test pit excavation
3) Convenience - easier for sampler to obtain the samples.

Recommended Disposition:
The selected interval for sample collection as determined by the field geologist shall be obtained with the backhoe bucket. The contents will then be placed on the ground surface a safe distance from the test pit and the backhoe on the side away from the excavation pile. The sample shall be collected from the center of the sample pile and placed in sample containers using a decontaminated stainless steel trowel or spatula.

Richard D Bethel 11/3/87
Field Operations Leader (Signature) Date

Disposition:

Site Manager Date

Distribution: Regional Manager
Quality Assurance Manager
Site Manager
Field Operations Leader
Others as required

AR302504

Figure 15-1

EBASCO SERVICES INCORPORATED
FIELD CHANGE REQUEST
-TYPICAL-

123-3631	4236.55203	6204-TASK03
EPA Work Assignment No.	EBASCO Work Charge Number	Field Charge No.

FCR ~~1~~ 2 RB 11/9/87

To FIELD INVESTIGATION TEAM Location PITTSBURGH Date 11/5/87

Description:
Sample location #8 (See FSAP Fig 3-2, p.39), Sample location #11, Sample locations 1, 3, 4, 5, 10, 13, 22, 28, 34, 40, and 51.

Reason For Change:
Sample location #8 is located within the covered material placed on site from the leachate stream during earlier remedial
Location #11 can be relocated away from the waste pond inlet interfering with the integrity of the grid.
Locations 1, 3, 4, 5, 10, 13, 22, 28, 34, 40, and 51 are located proximal to buried utility pipelines (i.e. water, sewer, and/or gas lines)

Recommended Disposition:
Abort location #8 and add location #11 to current soil sample grid.
Relocate #1, 3, 4, 5, 10, 13, 22, 28, 34, 40, and 51 grid points to adjacent areas away from the the buried utility pipelines.

Richard O Barth 11/5/87
Field Operations Leader (Signature) Date

Disposition:

Site Manager Date

Distribution: Regional Manager
Quality Assurance Manager
Site Manager
Field Operations Leader

Others as required

FILE COPY
1.6

Figure 15-1

EBASCO SERVICES INCORPORATED
FIELD CHANGE REQUEST
-TYPICAL-

123-3L31	4236.55203	6204-TASK 3
EPA Work Assignment No.	EBASCO Work Charge Number	Field Charge No.

FCR RB 11/5

To FIELD INVESTIGATION TEAM Location PITTSBURGH Date 11/5/87

Description:
~~Obtain~~ Obtain samples from locations #11 & 15 as indicated on Figure 3-2 FSAP

Reason For Change:
Locations are deemed accessible with skid type rig. Previously it was felt they were not accessible.

Recommended Disposition:
Obtain sampling equipment (bottles) and laboratory spaces for the 1 additional samples. Solicit drillers opinion regarding best means of obtaining the sample.

Richard D Beckel 11/10/87
Field Operations Leader (Signature) Date

Disposition:
Agree, Implement

Site Manager D. M. [illegible] Date 29 Dec 87

Distribution: Regional Manager
Quality Assurance Manager
Site Manager
Field Operations Leader

Others as required

Figure 15-1

EBASCO SERVICES INCORPORATED
FIELD CHANGE REQUEST
-TYPICAL-

123-3L31	4236.55203	620Y - TASK 03
EPA Work Assignment No.	EBASCO Work Charge Number	Field Charge No.

FCR ~~3~~ 4

To FIELD INVESTIGATION TEAM Location PGH Date 11/9/87

Description:
Modify FSAP Table 2-2 RE: collection of CEC ~~&~~ ~~&~~ TOC & Oil & Grease from test pit soil samples

Reason For Change:
Characterize the retardation capacity of the clay confining layer. The clay confining layer was discovered during ~~the~~ test pit excavations during week of 02Nov87. See Field NB #3, pages 27 & 28.

Recommended Disposition:
Obtain samples for CEC, TOC & oil & grease from ~ three (3) clay layer samples and delete same samples from corresponding test pit soil samples. No Net Change in the # samples submitted for analysis.

Richard D Bethel 11/9/87
Field Operations Leader (Signature) Date

Disposition:
Agree, Implement

Site Manager D. M. [illegible] Date 29 Dec 87

Distribution: Regional Manager
Quality Assurance Manager
Site Manager
Field Operations Leader

Others as required

FILE

Figure 15-1

EBASCO SERVICES INCORPORATED
FIELD CHANGE REQUEST
-TYPICAL-

EPA Work Assignment No.	EBASCO Work Charge Number	Field Charge No.
123-3L31	4236.552	620 TASK 03

FCR 5

To FIELD INVESTIGATION TEAM Location PGH Date 11/6/87

Description:
PAGE 52 SECTION 4.1 GC Screening states that "VOLATILE ORGANICS & Phenolics will BE ANALYZED USING THE EPA laboratory trailers HNU-301 GC"
SECTION 4.2 SAMPLING METHODS STATES "SAMPLES WILL BE SENT TO CLP, REM III RASPANS SAS FOR CAR INFORMATION BASED ON GC RESULTS AND NO SEC COSTS DIRECTION

Reason For Change:
GC EQUIPMENT IS NOT AVAILABLE AND/OR NOT FUNCTIONING PROPERLY therefore SAMPLES SENT TO CLP AND REM III RAS AND SAS LABS ARE NOT SENT FOR ANALYSIS BASED ON GC SCREENING RESULTS SINCE NO RESULTS ARE GIVEN WITHIN 48 HR turn around time from GC MOBILE LAB HOLDING TIMES WILL BE EXCEEDED FOR SAMPLES IF DETERMINATION IS BASED SOLELY ON the MOBILE LAB.

Recommended Disposition:
1 SAMPLES WILL BE SENT TO CLP & Rem III RAS AND SAS LABS Per test + Pit BASED UPON VISUAL CONTAMINATION AND HNU READINGS from SOIL PILES AT THE TEST PITS OR HEADSPACE OF SAMPLE JAR WITH THE HNU PHENOLS WILL Be collected AT 3 depths from each test pit AND ALL 3 WILL BE SENT for laboratory ANALYSIS

Richard D Bethel 11/6/87
Field Operations Leader (Signature) Date

Disposition: Agree, Implement (discussed on 06 Nov 87)

Site Manager D.M. [illegible] Date 28 Dec 87

Distribution: Regional Manager
Quality Assurance Manager
Site Manager
Field Operations Leader
Others as required

E-5

AR302508

Figure 15-1

EBASCO SERVICES INCORPORATED
FIELD CHANGE REQUEST
-TYPICAL-

123-3L31	423655203	620Y -TASK 3
EPA Work Assignment No.	EBASCO Work Charge Number	Field Charge No.

FCR 6

To FIELD INVESTIGATION TEAM Location PITTSBURGH Date 11/9/87

Description:
Location of proposed monitoring wells, taken from FSAP, Fig 3-3, p 45.

Reason For Change:
Problems obtaining permission for land access to drill and install monitoring wells.

Recommended Disposition:
As per EPA (Roy Snyrock) relocate MW-M101, M102 approx. 300' to E onto PennDOT land, MW-M103, 104 approx. 100' to W onto Penn DOT prop., MW-M109 approx. 300' to E onto Centre Twp. prop., MW-M112 approx. 300' to E onto Centre Twp. Prop.

Richard D Bethel 11/9/87
Field Operations Leader (Signature) Date

Disposition: Agree Implement ~~(D. Smith, R. Bethel, R. Schrock~~
~~relayed this on or about 09 Nov 87)~~ DS 11/9/87

Site Manager D. M. Smith Date

Distribution: Regional Manager
Quality Assurance Manager
Site Manager
Field Operations Leader
Others as required

FILE 16

Figure 15-1

ERASCO SERVICES INCORPORATED
FIELD CHANGE REQUEST
-TYPICAL-

123-3L31	423655203	620Y-TASK 3
EPA Work Assignment No.	ERASCO Work Charge Number	Field Charge No.

FCR 7

To Field Investigation Team Location Pittsburgh Date 11/12

Description:
Taken from FSAP, p 38 Refraction seismic techniques (FT404, Section 5.2) will be used only if the buried stream channel cannot be delineated from the EM survey results. Seismic refraction will be used as a backup to the EM method." p. 40 "the location [MW-M125] will be determined using geophysical techniques"

Reason For Change:
Due to results of synthetic refraction results it was determined that the impedance values of the fractured and weathered surface of the shale bedrock would be very close to those of the overlying overburden material. Thus seismic data may not work to locate buried channel and the cost (~$10,000) can be better [illegible]

Recommended Disposition:
Drill soil borings near the existing well E-3 downgradient toward Bald Eagle Creek to refusal [illegible] surface. Convert the soil boring which locates the buried channel into monitoring well MW-M125. This has been given verbal approval as per Ray Shrick (EPA) and Dave MacIntyre.

Richard D Bethel 11/12/87
Field Operations Leader (Signature) Date

Disposition:
Agree Implement (Discussed 11/12 Nov 87)

Site Manager D. M. [illegible] Date 28 Dec 87

Distribution: Regional Manager
Quality Assurance Manager
Site Manager
Field Operations Leader
Others as required

AR302510

Figure 15-1

ERASCO SERVICES INCORPORATED
FIELD CHANGE REQUEST
-TYPICAL-

123-3631	552	6204 TASK 03
EPA Work Assignment No.	ERASCO Work Charge Number	Field Charge No.

FCR 8

To FIELD INVESTIGATION TEAM Location PGH Date 11/12/87

Description:
Page 40 FSAP Sect 3.31 Test Pits STATES THAT" the SAMPLER WILL - MONITOR the CONTENTS of the backhoe with an HNU or OVA meter

Reason For Change:
IN WEATHER BELOW 45°F OR HIGH HUMIDITY the HNU Manufacturer STATES that the HNU will not function properly due to the photoionization bulb condensating therefore deterring carbon Atoms from ionizing therefore incorrect Readings if any are given.

Recommended Disposition:
DURING LEVEL B OPERATIONS there is NO need to MONITOR SINCE BREATHING AIRS SUPPLIED for HEALTH AND SAFETY ~~PURPOSES~~ However for selection OF SAMPLES TO Be sent for ANALYSIS will Be brought back to AN AREA > 45°F AND A HEADSPACE READING TAKEN FOR Determination OF LABORATORY ANALYSIS

Richard D Beth 11/12/87
Field Operations Leader (Signature) Date

Disposition: Agree, Implement

Site Manager D. M. [illegible] Date 28 Dec 87

Distribution: Regional Manager
Quality Assurance Manager
Site Manager
Field Operations Leader

Others as required

Figure 15-1

EBASCO SERVICES INCORPORATED
FIELD CHANGE REQUEST
-TYPICAL-

EPA Work Assignment No.	EBASCO Work Charge Number	Field Charge No.
123-3L31	423655203	620Y-TASK03

FCR 9

To Field Investigation Team Location Pittsburgh Date 11/12/87

Description:
No procedure is described for handling and obtaining core sample during drilling of bedrock.

Reason For Change:
FT 7.03 is not listed in the FOP

Recommended Disposition:
Obtain a copy of appropriate FT Guideline for handling and obtaining rock core sample during drilling operation from field auditor and use this procedure during drilling operations as per modifications.

Richard D Bethel 11/12/87
Field Operations Leader (Signature) Date

Disposition: Agree, Implement

Site Manager D.M. [illegible] Date 28 Dec 87

Distribution: Regional Manager
Quality Assurance Manager
Site Manager
Field Operations Leader
Others as required

Figure 15-1

EBASCO SERVICES INCORPORATED
FIELD CHANGE REQUEST
-TYPICAL-

123-3L31 — EPA Work Assignment No.

423655203 — EBASCO Work Charge Number

Field Charge No. FCR 10

To Field Investigation Team Location Pittsburgh Date 11/18/87

Description: NA

Reason For Change: No procedure for photographs

Recommended Disposition: Each person shall record the photographs according to the roll number, and exposure number in their individual field note book.

Richard G Bothell — 11/18/87
Field Operations Leader (Signature) — Date

Disposition: Agree

Site Manager — Date 28 Dec 87

Distribution: Regional Manager
Quality Assurance Manager
Site Manager
Field Operations Leader

Others as required

FILE COPY
76

Figure 15-1

EBASCO SERVICES INCORPORATED
FIELD CHANGE REQUEST
-TYPICAL-

123-3L31	423655203	620Y03
EPA Work Assignment No.	EBASCO Work Charge Number	Field Charge No.

FCR 11

To Field Investigation Team Location Pittsburgh Date 11/18/87

Description:
Section 3.3.1 requires that sample collections handled w/ proper care However, field personnel did not change gloves during each sampling activity.

Reason For Change:
It is impractical to change gloves while collecting samples from the same test pit. The samples are collected w/ decontaminated trowels or spoons, etc and the gloves have minimal, if any, contact w/ the sample. Dirty gloves will be wiped clean using paper towels, etc.

Recommended Disposition:
The same gloves shall be used while collecting samples from each test pit. A new pair of gloves will be used for each test pit, or the same gloves may be reused if they can be effectively cleaned.

Richard D. Bethel 11/18/87
Field Operations Leader (Signature) Date

Disposition: Agree Based On Auditors Comment

Site Manager D. M. [illegible] Date 28 Dec 87

Distribution: Regional Manager
Quality Assurance Manager
Site Manager
Field Operations Leader
Others as required

AR302514

FILE COPY
FILE NO. 76

Figure 15-1

EBASCO SERVICES INCORPORATED
FIELD CHANGE REQUEST
-TYPICAL-

123-3L31	423655203	620Y-TASK03
EPA Work Assignment No.	EBASCO Work Charge Number	Field Change No. FCR # 12

To FIELD INVESTIGATION TEAM Location PITTSBURGH Date 11/30/87

Description:
Refer to FSAP, FIG. 3-3 Monitoring well MW-M123 is a shallow bedrock well and according to Fig 3-4 is to be left as an open borehole well in bedrock.

Reason For Change:
The borehole is highly fractured in bedrock from 60-70', and collapsed twice after reaming the hole.

Recommended Disposition:
The determined interval for monitoring is from 60-80' and to assure monitoring of this interval a 20' screen (60-80') and 62' of riser pipe (2" PVC Sched.40) be installed along w/ a gravel pack up to the 4" casing (58') followed by 2' of bentonite and then grout inside the 4" casing.

Michael D Bethel 11/30/87
Field Operations Leader (Signature) Date

Disposition: Agree

Site Manager D. M. [illegible] Date 28 Dec 87

Distribution: Regional Manager
Quality Assurance Manager
Site Manager
Field Operations Leader

Others as required

AR302515

FILE COPY
FILE NO. 76

Figure 15-1

EBASCO SERVICES INCORPORATED
FIELD CHANGE REQUEST
-TYPICAL-

123-3L31	423655203	620Y - TASK 03
EPA Work Assignment No.	EBASCO Work Charge Number	Field Charge No.

FCR # 13

To FIELD INVESTIGATION TEAM Location PITTSBURGH Date 12/2/87

Description:
Refer to FSAP, p. 47: Overburden Wells... "Two soil samples from each well cluster location... and analyzed for TOC and CEC."

Reason For Change:
As per D. Smith Project Manager

Recommended Disposition:
One sample shall be collected for CLP analysis for oil + grease, TOC and CEC from each of the following wells: MW-M102, M104, M106, M107, M109, M112, M113, M115, M117, M119, and M122

Richard D Bethel 12/2/87
Field Operations Leader (Signature) Date

Disposition:
Agree

Site Manager D. M. [illegible] Date 28 Dec 87

Distribution: Regional Manager
Quality Assurance Manager
Site Manager
Field Operations Leader
Others as required

AR302516

FILE NO. 16

Figure 15-1

EBASCO SERVICES INCORPORATED
FIELD CHANGE REQUEST
-TYPICAL-

123-3L31	423655203	6204 - Task 03
EPA Work Assignment No.	EBASCO Work Charge Number	Field Charge No.

FCR #14

To Field Investigation Team Location Pittsburgh Date 12/8/87

Description:
See FSAP Appendix B ASTM 1586 Item 7.5 (Sampling of Soils) and FT602 Borehole and Sample Logging

Reason For Change:
There is no procedure for numbering system for soil samples collected only for lithologic description which are not sent for CLP analyses

Recommended Disposition:
RS 12/8
Core barrel samples collected for lithologic description and not for CLP analyses shall be numbered as S-1, S-2, etc. in succession with drilling and will be noted on the soil boring log. rock samples collected for lithologic description will be numbered C-1, C-2 etc. in succession with the core run for each well and shall be noted on the boring log

Richard D. Bottel 12/8/87
Field Operations Leader (Signature) Date

Disposition: DS 28 Dec 87 / Agree

Site Manager D. M. [illegible] Date 28 Dec 87

Distribution: Regional Manager
Quality Assurance Manager
Site Manager
Field Operations Leader
Others as required

AR302517

FILE NO. 15

Figure 15-1

EBASCO SERVICES INCORPORATED
FIELD CHANGE REQUEST
-TYPICAL-

123-3131 552	4236 552	62CY -ASKC
EPA Work Assignment No.	EBASCO Work Charge Number	Field Charge No.

FCR #15

To FIELD CREW Location Lockhaven, PA Date 12/14/87

Description:
USE Vacuum SYSTEM TO OBTAIN SAMPLES FROM MONITORING wells inaccessible by the use of a BAILER

Reason For Change:
Some MONITORING wells are not accessible by the use of a bailer

Recommended Disposition:
Use vacuum system to obtain samples except for VOA analysis which will be collected from PE tubing

Richard D Bell 12/14/87
Field Operations Leader (Signature) Date

Disposition:

Site Manager Anwen Roffman for Dennis Smith. DMS 12/14/87 Date

Distribution: Regional Manager
Quality Assurance Manager
Site Manager
Field Operations Leader

Others as required

AR302518

FILE COPY

Figure 15-1

EBASCO SERVICES INCORPORATED
FIELD CHANGE REQUEST
-TYPICAL-

123-3131	552	620 TASK C
EPA Work Assignment No.	EBASCO Work Charge Number	Field Change No. FCR 16

To FIELD CREW Location Lockhaven, PA Date 12-28-87

Description:
Securing sample bottles by the use of tape around lid of the sample bottle

Reason For Change:
- Possible contamination from TAPE INTO SAMPLE Bottle
- Cooler is CUSTODY Sealed

Recommended Disposition:
OMIT THE USE OF TAPING LIDS

Richard D. Bethel 12-29-87
Field Operations Leader (Signature) Date

Disposition:
Agree, Implement

D.M. [signature] 29 Dec 87
Site Manager Date

Distribution: Regional Manager
Quality Assurance Manager
Site Manager
Field Operations Leader
Others as required

FILE COPY
DOC NO. 13

Figure 15-1

ERASCO SERVICES INCORPORATED
FIELD CHANGE REQUEST
-TYPICAL-

EPA Work Assignment No.	ERASCO Work Charge Number	Field Charge No.
123-3631	552	60% Task 03

FCR 17

To Field Crew Location Lockhaven PA Date 12-28-87

Description:
Sample description for monitoring wells is MW

Reason For Change:
Sample # requires no more than 12 characters

Recommended Disposition:
Change Sample description for monitoring wells to M

Richard D Bethel 12-29-87
Field Operations Leader (Signature) Date

Disposition:
Agree, Implement

D. M. [illegible] 29 Dec 87
Site Manager Date

Distribution: Regional Manager
Quality Assurance Manager
Site Manager
Field Operations Leader

Others as required

Figure 15-1

EBASCO SERVICES INCORPORATED
FIELD CHANGE REQUEST
-TYPICAL-

163-3L31	4-23655203	6Z0Y - TASK 03
EPA Work Assignment No.	EBASCO Work Charge Number	Field Charge No.

FCR 18

To FIELD INVESTIGATION TEAM Location PITTSBURGH, PA Date 12-28-87

Description:
A PORTION OF FTG-7.04 IS USED IN APPENDIX A OF THE FOP BUT IS NOT MENTIONED IN THE FSAP UNDER SECTION 2.3.

Reason For Change:
TO LIST ALL FTG'S OR PARTS THEREOF SO THAT FOP CONFORMS TO REM III REQUIREMENTS.

Recommended Disposition:
FTG-7.04 SHOULD BE INCLUDED AS PART OF THE LIST OF FTG'S USED TO CONDUCT ON SITE ACTIVITIES AT THE BRALE CHEMICAL SITE. HOWEVER ONLY THE PORTION OF FTG-7.04 OUTLINED IN APPENDIX A OF THE FOP SHOULD BE INCORPORATED INTO SITE ACTIVITIES.

Richard D. [illegible] 12-29-87
Field Operations Leader (Signature) Date

Disposition:
Agree. As the FOP is not scheduled for revision at this time, the change will be documented by this FCR only (RS)

D.M. [illegible] 29 Dec 87
Site Manager Date

Distribution: Regional Manager
Quality Assurance Manager
Site Manager
Field Operations Leader

Others as required

AR302521

FILE COPY
FILE No. 7.6

Figure 15-1

EBASCO SERVICES INCORPORATED
FIELD CHANGE REQUEST
-TYPICAL-

123-3131	423655203	6284 - TASK 03
EPA Work Assignment No.	EBASCO Work Charge Number	Field Charge No.

FCR 19

To FIELD INVESTIGATION TEAM Location PITTSBURGH, PA Date 12-29-87

Description:
SAMPLES WHICH HAVE BEEN COLLECTED ALONG WITH PERTINENT INFORMATION (LOCATION, SAMPLE NUMBER, REQUIRED ANALYSIS, ETC) IS NOT ALL RECORDED IN WEEKLY SUMMARY REPORTS.

Reason For Change:
IN ADDITION TO WEEKLY FIELD SUMMARY REPORT AN EPA SAMPLE SHIPPING LOG FORM IS SENT TO EBASCO WHICH CONTAINS SAMPLE INFORMATION (LOCATION, SAMPLE NUMBER, ANALYSIS, ETC.)

Recommended Disposition:
DO NOT REPORT THIS INFORMATION ON THE WEEKLY FIELD SUMMARY REPORT SINCE IT IS ALREADY BEING RECORDED ON EPA SAMPLE SHIPPING LOGS.

Richard D Bethell 12-29-87
Field Operations Leader (Signature) Date

Disposition:
Agree

D.M. Smith 29 Dec 87
Site Manager Date

Distribution: Regional Manager
Quality Assurance Manager
Site Manager
Field Operations Leader
Others as required

AR302522

FILE COPY
FILE NO. 16

Figure 15-1

EBASCO SERVICES INCORPORATED
FIELD CHANGE REQUEST
-TYPICAL-

123-3L31	423055203	620Y-TASK 09
EPA Work Assignment No.	EBASCO Work Charge Number	Field Charge No.

FCR 20

To File: Drake 620Y Location Pitt, PA Date 03 May 88

Description: Resample 6 monitoring wells & obtain analysis for BOD5, COD & TOC. This data will be used to determine the biotreatability of groundwater

Reason For Change: Additional data need identified during the remedial alternative screening process

Recommended Disposition: Recommend additional sampling & analysis

Richard D Berkel 5/3/88
Field Operations Leader (Signature) Date

Disposition:

Recommend As Stated.

D. M. [illegible] 03 MAY 88
Site Manager Date

Distribution: Regional Manager
Quality Assurance Manager
Site Manager
Field Operations Leader

Others as required

APPENDIX F

MODELING COMPUTATIONS

NUS CORPORATION AND SUBSIDIARIES			STANDARD CALCULATION SHEET
CLIENT: Ebasco	FILE NO.: 6201	BY: DMS	PAGE 1 OF 1
SUBJECT: Retardation Factors - Drake		CHECKED BY:	DATE: 07 JUNE 88

$$R_d = 1 + \left(\frac{K_d \rho_b}{p}\right)$$

K_d = partition coefficient ml/g
ρ_b = bulk density (g/ml) 1.7
p = porosity (fraction) 0.3

- 1,2 Dichloroethane $1 + \left(\frac{0.3\,ml}{g} \cdot \frac{1.7\,g}{ml} \frac{1}{0.3}\right) = 2.7$
- Chlorobenzene $1 + \left(\frac{1.6\,ml}{g} \frac{1.7\,g}{ml} \frac{1}{0.3}\right) = 9.1$
- Fenac $1 + \left(\frac{4.0\,ml}{g} \frac{1.7\,g}{ml} \frac{1}{0.3}\right) = 22.7$
- Cr $1 + \left(\frac{37.0\,ml}{g} \frac{1.7\,g}{ml} \frac{1}{0.3}\right) = 211$
- Cd $1 + \left(\frac{6.3\,ml}{g} \frac{1.7\,g}{ml} \frac{1}{0.3}\right) = 36$

Summary

A) Physico/Chemico Parameters For Fenac

1) S = 200 mg/l (Virschuren)

2) Log_{10} Kow = 3.54 (Hubbard/Leo's Factor)

3) Koc :

$$Log\ Koc = -0.557 \log S + 4.277$$

$$S = \frac{200\ mg}{l} \frac{1\ mole}{240{,}000\ mg^*} \times \frac{10^6\ \mu mole}{mole} = \frac{833\ \mu mole}{l}$$

$$Log\ Koc = -0.557 \log (848) + 4.277 = 2.646$$

Koc = 442

4) BCF :

$$Log\ BCF = 0.76\ Log\ Kow - 0.23$$

$$Log\ BCF = 0.76\ (3.54) - 0.23 = 2.460$$

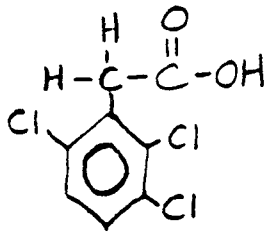
BCF = 289

*

Atom	AW	#	MW
[redacted]	12	8	96
	1	5	5
	16	2	32
	35.5	3	106.5
			~240 g/mole

AR302526

CLIENT: Ebasco	FILE NO.: 620Y	BY: R. Hebbard	PAGE 1 OF 3
SUBJECT: FENAC		CHECKED BY: JMS	DATE:



$$f_{C_6H_5} = 1.90 = 1.90$$

$$f_C^{\phi} = 0.20 = 0.20$$

$$2f_H = 2(0.23) = 0.46$$

$$f_{CO_2H}^{IR.} = -1.03 = -1.03$$

$$F_b = (2-1)(-0.12) = -0.12$$

$$f_{Cl}^{\phi} = 3(0.94) = 2.82$$

$$f_H^{\phi} = 3(-0.23) = -0.69$$

$$\boxed{3.54}$$

MW Fenac =

8C	=>	8(12.011)	=	96.088
3Cl	=>	3(35.453)	=	106.359
5H	=>	5(1.0079)	=	5.0395
2O	=>	2(15.999)	=	31.998
				239.4845

S in μmol/L :

$$\frac{200\ \text{mg}}{\text{L}} \left| \frac{1000\ \mu\text{g}}{\text{mg}} \right| \frac{1\ \mu\text{mol}}{239.4845\ \mu\text{g}} = 835.13\ \mu\text{mol/L}$$

2.2 $\log_{10} K_{ow} = \dfrac{\log_{10} 835.13 - 7.26}{-1.37} = \boxed{3.17}$ ($r^2 = 0.903$)

2.3 $\log_{10} K_{ow} = \dfrac{\log_{10} 200 - 4.184}{-0.922} = 2.04$ ($r^2 = 0.74$)

2.4 $\log_{10} K_{ow} = \dfrac{\log_{10} 835.13 - 7.46}{-1.49} = \boxed{3.05}$ ($r^2 = 0.97$)

AR302529

"Not"
Revision
Forthcoming

SUMMARY OF SOURCE CHARACTERIZATION STATISTICS
BASED ON DRAKE CHEMICAL SITE SOIL/SLUDGE SAMPLING & ANALYSSIS
UNITS: UG/KG(ppb)

41 TEST PITS 5 PITS WITH BORING C SAMPLE
1 FULL BORING
N=130-138

REV. 0.0, 20MAY88

1,2-DICHLOROBENZENE
ETHANE

STRATIFIED SAMPLING GRID
3 STRATA: A, ~~0-2 FT.~~ 0-4 ft 3 SECTORS: I, TP 1,2,3,4,5,6,7,9,10,11,12,13,14,8-15,16,17
B, ~~2-7 FT.~~ 4-8 ft II, TP 20,21,24,25,26,30,31,32,33,37,38
C, ~~10-12 FT.~~ 8-12.5 ft III, TP 22,27,28,34,39,40,44,45,46,47,48,49,50,51

RESULTS GENERATED ON NTHITAO

DESCRIPTION	n	MEAN	MEDIAN	TMEAN	STDEV	SEMEAN	MAX	MIN	Q3	Q1
DCA.IA	16	10.65	7.57	9.52	8.34	2.09	34.22	3	16.97	3.93
DCA.IB	15	51.2	25.1	39.7	64.2	16.6	240	3.7	76.5	20.6
DCA.IC	16	34.7	20.2	25.2	49.7	12.4	190	4	30.2	6.4
DCA.IIA	9	8.22	5.75	8.22	5.51	1.84	18.15	3	13.75	4.25
DCA.IIB	15	20.1	22	25.1	20.9	5.4	80	7.3	36.5	10.8
DCA.IIC	12	29.8	19.1	22.8	33.9	9.8	127	2.4	41.1	8.4
DCA.IIIA	14	10.39	6.66	9.04	8.67	2.32	33.63	3.4	17.2	4.66
DCA.IIIB	13	35.1	6.6	24.2	57.7	16	180	2.5	52.5	4
DCA.IIIC	14	23.7	9.5	13.5	42.5	11.4	166.6	2.3	18.7	5.3
DCA.LEVEL A	39	10	6.85	9.03	7.70	1.25	34.22	3	15.54	4.7
DCA.LEVEL B	43	38.3	21.3	30.9	50.7	7.7	240	2.5	36.5	9.6
DCA.LEVEL C	42	29.6	15.8	23	42.5	6.6	190	2.3	29.4	6.6
SECTOR I	47	31.8	17.8	24.2	48.6	7.1	240	3	20.2	6.3
SECTOR II	36	23.7	15.3	19.7	25	4.2	127	2.4	33.5	7.1
SECTOR III	41	22.8	8.1	15.5	41.4	6.5	180	2.3	17	4.5
SITE WIDE	124	26.4	13.8	19.7	40.5	3.6	240	2.3	25.7	5.7

SUMMARY OF POOLED VARIANCE BIVARIATE T-TESTS

IA vs IB: P=0.0188
IB vs IC: P=0.43
IA vs IC: P=0.046
IIA vs IIB: P=0.0118
IIA vs IIC: P=0.076
IIB vs IIC: P=0.08
IIIA vs IIIC: P=0.26
IIIA vs IIIB: P=0.13
IIIB vs IIIC: P=0.56

IC vs IIC: P=0.77
IIC vs IIIC: P=0.52
IIC vs IIIC: P=0.69

STR-A vs STR-B: P=0.00090
STR-A vs STR-C: P=0.00508
STR-B vs STR-C: P=0.39

SECT-I vs SECT-II: P=0.36
SECT-I vs SECT-III: P=0.36
SECT-II vs SECT-III: P=0.91

IA vs IIA: P=0.94
IA vs IIIA: P=0.93
IIA vs IIIA: P=0.51
IB vs IIB: P=0.19
IB vs [illegible] P=0.49
IIB v[illegible]=0.66

NOTES
HISTOGRAM INDICATES DATA IS LOGNORMAL
APPEARS STRATA-A IS SIGNIFICANTLY DIFF(LOWER) THAN B & C
DATA APPEARS RELATIVELY CONSISTENT

0= SIGNIFICANT @ ALPHA=0.05

L-7

AR302530

DRAKE CHEMICAL PHASE III RI
JOB No. 620Y/552

FOR EBASCO/USEPA REGION III
BY: dos

SUMMARY OF SOURCE CHARACTERIZATION STATISTICS
BASED ON LEVEL II ANALYSES OF SITE SOIL/SLUDGE SAMPLING
UNITS: UG/KG(ppb)

41 TEST PITS 5 PITS WITH BORING C SAMPLE
1 FULL BORING
N=134

REV. 1.0, 21MAY88

CHLOROBENZENE ONLY

STRATIFIED SAMPLING GRID
3 STRATA: A, 0-4 FT. 3 SECTORS: I, TP 1,2,3,4,5,6,7,9,10,11,12,13,14,B-15,16,17
B, 4-9 FT. II, TP 20,21,24,25,26,30,31,32,33,37,38
C, 9-12. FT. III, TP 22,27,28,34,39,40,44,45,46,47,48,49,50,51

RESULTS GENERATED ON MINITAB

DESCRIPTION	n	MEAN	MEDIAN	TMEAN	STDEV	SEMEAN	MAX	MIN	Q3	Q1
C1-I,A	11	33.3	20.9	31.7	23.2	7	80.3	1	53.2	17.9
C2-I,B	13	443	42	113	1236	343	4534	4	206	8
C3-I,C	14	267	34	124	586	157	2243	5	312	13
C4-II,A	8	53.3	27.4	53.3	77.9	27.5	241	7.9	51.7	9.6
C6-II,C	12	249	21	49	734	212	2574	5	54	7
C7-II,B	14	1444	134	237	5341	1428	20176	5	397	23
C8-III,A	12	31.2	26.5	29.5	23.2	6.7	76.5	3	47.9	13.1
C9-III,B	11	52.4	14.7	39.4	72.7	21.9	210	3.9	76	12.3
C10-III,C	11	15.3	12.6	14.7	11.2	3.4	33.4	1.9	27.5	6.2
C11-A STRATA	31	37.7	27.4	31.2	43.4	7.8	241	1	51.7	11.1
C12-B STRATA	30	773	41	137	3317	530	20176	4	213	13
C13-C STRATA	37	106	19	52	549	90	2574	2	51	7
C14-SECTOR I	30	260	35	91	802	130	4534	1	146	12
C15-SECTOR II	34	777	33	122	3459	593	20176	5	204	13
C16-SECTOR III	34	32.9	17.9	24.3	45.3	7.8	2210	1.9	32.7	9.6
C18-SITE-WIDE	106	353	28	71	2021	196	20176	1	74	11

RESULTS OF HYPO. TEST:Ho=Hi
TWO SAMPLE T-TEST, ALPHA=0.05, POOLED VARIANCE, N-2 df

I,A vs I,B: P=0.20 I,B vs II,B: P=0.410
I,B vs I,C: P=0.63 I,C vs II,C: P=0.930
II,A vs II,B: P=0.41 II,A vs III,A: P=0.390
II,B vs II,C: P=0.30 II,B vs III,B: P=0.320
III,A vs III,B: P=0.39 II,C vs III,C: P=0.300
III,A vs III,C: P=0.051
III,B vs III,C: P=0.11 I vs II: P=0.37
I,A vs II,A: P=0.480 I, vs III: P=0.10
II, vs III: P=0.21

ASTR. vs BSTR.: P=0.22
BSTR. vs CSTR.: P=0.29
ASTR. vs CSTR.: P=0.14 * NOT REVISED

SUMMARY
NO STATISTICALLY SIGNIFICANT DIFF. ANY ADJOINING STRATA OR SECTOR
MEDIAN PRESENTS A CONSISTENT MEASURE OF CENTRAL TENDANCY
DATA APPEARS SKEWED (R), SEE HISTOGRAM, APPEARS LOGNORMAL

F-8

AR302561

Drake Chemical RI - Phase III
Job 6207 / 552

For Ebasco / Region III EPA
by dms

SUMMARY OF SOURCE CHARACTERIZATION STATISTICS
BASED ON DRAKE CHEMICAL SITE SOIL/SLUDGE SAMPLING & ANALYSIS
UNITS: UG/KG(ppb)

41 TEST PITS 5 PITS WITH BORING C SAMPLE
1 FULL BORING
0-40 PIXED BASE LOG SAMPLES

REV. 0.0, 04JUNE88

FENAC ONLY

STRATIFIED SAMPLING GRID

3 STRATA: A, 0-4 FT. — 3 SECTORS: I, TP 1,2,3,4,5,6,7,9,10,11,12,13,14,8-15,16,17
B, 4-8 FT. — II, TP 20,21,24,25,26,30,31,32,33,37,38
C, 8-12.5 FT. — III, TP 22,27,28,34,35,40,44,45,46,47,48,49,50,51

RESULTS GENERATED ON MINITAB

DESCRIPTION	N	n	MEAN	MEDIAN	TMEAN	STDEV	SEMEAN	MAX	MIN	Q3	Q1
FEN.IA	2	2	256	256	256	345	244	500	12	0	0
FEN.IB	8	7	2600	800	2600	3526	1333	8200	25	7000	320
FEN.IC	7	6	740	220	740	1021	417	2600	6	1625	107
FEN.IIA	1	1	1900	1900	1900	0	0	1900	1900	0	0
FEN.IIB	8	4	2545	1365	2545	3046	1523	7000	430	5750	520
FEN.IIC	7	4	407	310	407	563	281	1300	20	1075	76
FEN.IIIA	0										
FEN.IIIB	7	3	1027	37	1027	1709	987	3000	25	3000	25
FEN.IIIC	8	7	1033	300	1033	1742	650	4000	4	1500	21
FEN.I,ALL	17	15	1500	500	1201	2621	677	8200	6	1400	140
FEN.II,ALL	16	9	1559	2162	1559	2162	721	7000	20	1950	310
FEN.III,ALL	15	10	1031	219	600	1634	.517	4000	4	1075	22
FEN.A,ALL	3	3	804	500	804	900	566	1900	12	1900	12
FEN.B,ALL	23	14	2291	805	1908	2907	793	8200	25	4000	234
FEN.C,ALL	22	17	804	270	591	1254	304	4000	4	1300	37
FEN.SITE,ALL	48	34	1416	465	1085	2200	377	8200	4	1600	54

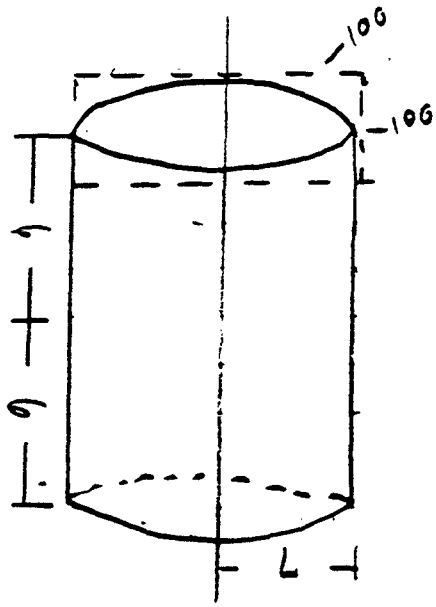
RESULTS OF POOLED T TESTS
Ho=Hi
FEN.I,ALL vs FEN.II,ALL; P=0.98
FEN.I,ALL vs FEN.III,ALL; P=0.56
FEN.II,ALL vs FEN.III,ALL; P=0.55
FEN.A,ALL vs FEN.B,ALL; P=0.41
FEN.A,ALL vs FEN.C,ALL; P=1.0
FEN.B,ALL vs FEN.C,ALL; P=0.07

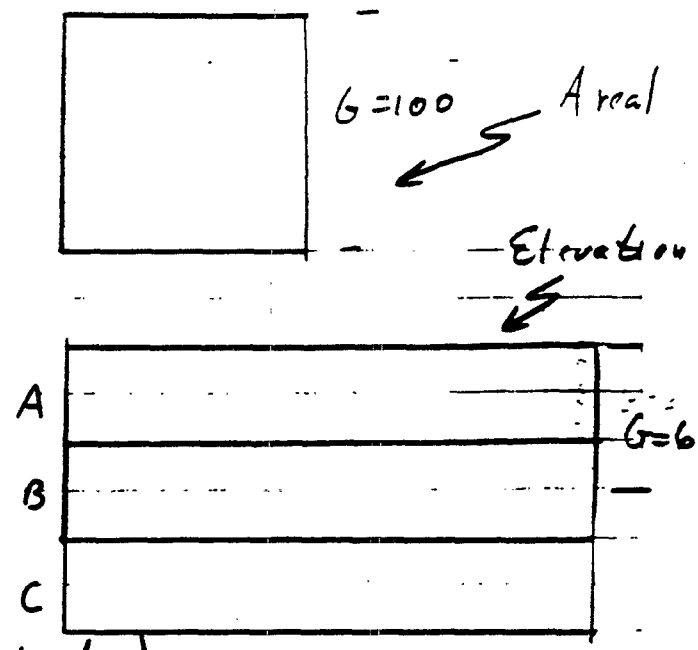
SUMMARY:
NO SIGNIFICANT DIFF. (alpha=0.05) ANY SECTOR OR STRATA
HISTOGRAM APPEARS LOGNORMAL
ASSUMED LACK OF POWER (SMALL n) PRECLUDED INTER-CELL TESTS

AR302532

NUS CORPORATION AND SUBSIDIARIES	STANDARD CALCULATION SHEET

CLIENT: Ebasco	FILE NO.: 520	BY: DMS	PAGE 1 OF
SUBJECT: Soils Data / Hot Spot		CHECKED BY:	DATE: 10 Jun 88





S = 1.0 For a circle (cylinder)

① Size Hot Spot Likely to Hit:

	B	G	S	L/G	Likely Circle Diameter
a) Areal	0.05	100	1	0.6	L=60, Area 11,310 ft²
	0.10	100	1	0.52	L=52, Area 8,500 ft²
	0.2	100	1	0.5	L=50, Area 7854 ft²
b) Elev.	0.05	6	1	0.6	L=3.6, Area 41 ft²
	0.10	6	1	0.52	L=3.1, Area = 31 ft²
	0.2	6	1	0.5	L=3.0, Area = 28 ft²

AR302533

NUS 166A REVISED 0286

NUS CORPORATION AND SUBSIDIARIES			STANDARD CALCULATION SHEET
CLIENT: Ebasco	FILE NO.: 620Y	BY: DMS	PAGE 2 OF
SUBJECT: Soils Data		CHECKED BY:	DATE: 10 June

c) Combining, What Volume Likely to Hit

Area Elev

0.95 x 0.95 = 0.9, 90% chance Hitting 11,310 ft² x 6 ft = 67,860

0.9 x 0.95 = 0.856; 86% chance Hitting 8,500 ft² x 6 ft = 51,000

0.8 x 0.95 = 0.76; 76% Chance Hitting 7854 ft² x 6 ft = 47,124

544,191 ft² = Area 1 Area of Site including Gorham Prop

e 12.5 ft = depth of water table : 6802388 ft³ = volume S

Then . 67860/6802388 ≈ 1.0% of site e 90%

. 51000/6802388 0.75% of Site e 86%

. 47124/680238 0.7% of site e 76%

10% chance were missed on ~~even~~ volume greater 1.0% of the total

14% "

NUS CORPORATION AND SUBSIDIARIES			STANDARD CALCULATION SHEET
CLIENT: Ebasco	FILE NO.: 620 Y	BY: DMS	PAGE 3 OF
SUBJECT: Soils Data		CHECKED BY:	DATE: 10 June

II Pr Not Hitting a Hot Spot

B	G	S	Pg
0.02	100	1	1.0

(L=100) (100X100XL) = 60,000

Assume Site Q = 6802388 ft³ and the elevation (i.e. strata) measurement is 95% (L=3.0)

e L=6 ft ; A= 1133731 ft²

Then (0.98)(0.95) = 0.931 or 93.1% chance of finding a hot spot that is

60,000 ft³ / 6802388 ft³ = 0.88% → ≈1.0%

This checks well with 10% chance were missed a volume greater than 1.0% of the total site volume

AR302535

NUS 1ESA REVISED 0285

THIS THIS SPREADSHEET PROVIDES COMPUTATION FOR THE FOLLOWING: REV.1.0/23MAY88

THIS THIS SPREADSHEET PROVIDES COMPUTATION FOR THE FOLLOWING: REV.1.0/23MAY88

1) 1) LOG Koc=aLOGI+b (ORICS) NOTE: Log Koc MUST BE MANUALLY TRANSFORMED TO Koc
2) 2)Kd=Koc * foc, (ORGANICS)
3) 3)LEACH FRACTION/YR.=CM/YR /POROSITY //CM[1+(GM/CC * Kd/POROSITY)]
4) 4)MASS OF CHEMICAL IN THE SOILS=UG/KG * G/CC * .001KG/G * CC(VOL) * FRACTION OF SITE AFFECTED
5) 5)MANUAL MASS TO GROUNDWATER=MASS IN SOIL(EQ. 4) * LEACH FRACTION(EQ. 3)
6) 6)ADJUSTED MASS TO GROUNDWATER
7) 7)EXPONENTIAL DECAY LEACHING

EQ.1	EQ.1	DESCRIPTION	SLOPE	I VAR.	CONST.	LOG Koc	Koc (DIMLESS)	COMMENT
A	A	CHLOROBENZENE	0.79	690	-1.71	0.5326907	3.41	Kow=690(HADEY, etal., 1982)REG.EQ.(JOHNSON, etal., 1985)
B	B	CHLOROBENZENE	-0.55	400	3.64	2.1613690	145	S=400mg/l(HADEY etal, 1982), REG.EQ.(KENAGA, 1980)
C	C	CHLOROBENZENE	-0.557	4335.5	4.227	2.2011691	158.9	S=4335.5uM/l(HADEY etal, 1982),REG.EQ.(EQ. 4-7, LYMAN, 1981)
D	D	CHLOROBENZENE		0		ERR	330	Koc FROM (HADEY,etal, 1982)

EQ.2	EQ.2	DESCRIPTION	Koc	foc	Kd	COMMENT
A	A	CHLOROBENZENE	3.41	0.01	0.0341	
B	B	CHLOROBENZENE	145	0.01	1.45	
C	C	CHLOROBENZENE	158.9	0.01	1.589	
D	D	CHLOROBENZENE	330	0.01	3.3	

EQ.3	EQ.3	DESCRIPTION	INFIL. CM/YR.	POROSITY V/V	W.DEPTH CM	DENSITY G/CC	Kd ML/G	LCH.FRCT. /YR.	COMMENT
A	A	CASEA CHLOROBENZENE	40.64	0.4	381	1.7	0.0341	0.232911	Kd BASED ON Koc=3.41 (EQ.2-A)
B	B	CASEB CHLOROBENZENE	40.64	0.4	381	1.7	1.45	0.037230	Kd BASED ON Koc=145 (EQ.2-B)
C	C	CASEC CHLOROBENZENE	40.64	0.4	381	1.7	1.589	0.034394	Kd BASED ON Koc=150 (EQ.2-C)
D	D	CASED CHLOROBENZENE	40.64	0.4	381	1.7	3.3	0.017748	Kd BASED ON Koc=330 (HADEY, etal. 19__)

F-13

AR302536

THIS THIS SPREADSHEET PROVIDES COMPUTATION FOR THE FOLLOWING: REV.1.0/23MAY00

EQ.4	EQ.4	DESCRIPTION	CONC. UG/KG	DENSITY G/CC	CONVERS. KG/G	VOLUME CC	FRACT. OBS/SAMP	MASS KG	COMMENT
A	A	CHLORODENZENE	20	1.7	0.001	1.54E+11	0.02	5.984000	BASED ON MEDIAN CONC.OF 20UG/KG (Q1=11,Q3=74)
B	B		71	1.7	0.001	1.54E+11	0.02	15.17393	BASED ON TRIMMED MEAN (.05) CONC. OF 74 UG/KG
C	C		353	1.7	0.001	1.54E+11	0.02	75.44226	BASED ON MEAN CONC. OF 353 UG/KG (n=2021)
		REVISED DATA							
		BASED ON SECTOR MEANS							
D	D	CHL.BENZ. SECTOR I	260	1.7	0.001	6.35E+10	0.01	22.79204	
E	E	CHL.BENZ.SECTOR II	777	1.7	0.001	7.70E+10	0.06	80.44847	
F	F	CHL.BENZ. SECTOR III	32.9	1.7	0.001	5.14E+10	0.03	2.395471	
		TOTAL MASS 3 SECTORS						113.6359	

EQ.5	EQ.5	DESCRIPTION	MASS KG	LEACH FRACT/YR	ANN.LOAD KG/YR	ANN.LOAD KG/HR	DESCRIPTION
A	A	CHLORODENZENE	5.984000	0.232911	1.393765	0.0001591	CASE A-1
B	B		15.17393	0.232911	3.534191	0.0004034	CASE A-2
C	C		75.44226	0.232911	17.57140	0.0020058	CASE A-3
D	D		5.984000	0.037230	0.222793	0.0000254	CASE B-1
E	E		15.17393	0.037230	0.564940	0.0000644	CASE B-2
F	F		75.44226	0.037230	2.808706	0.0003206	CASE B-3
G	G		5.984000	0.034394	0.205817	0.0000234	CASE C-1
H	H		15.17393	0.034394	0.521895	0.0000595	CASE C-2
I	I		75.44226	0.034394	2.594774	0.0002962	CASE C-3
J	J		5.984000	0.017740	0.106206	0.0000121	CASE D-1
K	K		15.17393	0.017740	0.269310	0.0000307	CASE D-2
L	L		75.44226	0.017740	1.338964	0.0001528	CASE D-3

AR302537

THIS THIS SPREADSHEET PROVIDES COMPUTATION FOR THE FOLLOWING: REV.1.0/23MAY00

EQ 7 EQ 7 FIRST ORDER DECAY ESTIMATE OF LEACHING

A "A GENERAL: N=No exp(-k)(T)
EST k AS FOLLOWS:
ASSUME 1/ANNUAL LEACH RATE= 50% @ MASS LEACHED (J. NB)
THEN 1/0.034394/YR=29.075 YR (EQ. 2-C)
N/No=exp(-k/YR)(29.1YR)
.5=exp(-k/YR)(29.1YR)
0.0238/YR=k

CONSTANTS
No=113.64KG (EQ.4-B,E,F)
k=-0.0238195/YR (EQ.7-A)

B GENERAL: N=No exp(-k)(T)
EST k AS FOLLOWS:
ASSUME 1/ANNUAL LEACH RATE=95% @ MASS LEACHED
THEN 1/0.034394/YR=29.075 YR
N/No=exp(-k/YR)(29.1YR)
.05=exp(-k/YR)(29.1YR)
0.1029461=k

CONSTANTS: No=113.64 KG (EQ. 4-B,E,F)
k=-0.1029461/YR (EQ. 7-B)

DESCRIPTION	No(KG)	k(/YR)	STUDY YEAR	T(YRS)	RESIDUAL N(KG)	ANNUAL LOAD(KG)	% LEACHED	CUM.(KG) LEACHED
	113.64	-0.0238	1	1	110.97	2.67	2.35	2.674064
	110.97	-0.0238	2	1	108.35	2.61	4.65	5.284767
	108.35	-0.0238	3	1	105.80	2.55	6.90	7.837192
	105.80	-0.0238	4	1	103.31	2.49	9.09	10.32768
	103.31	-0.0238	5	1	100.88	2.43	11.23	12.75935
	100.88	-0.0238	6	1	98.51	2.37	13.32	15.13389
	98.51	-0.0238	7	1	96.19	2.32	15.36	17.45253
	96.19	-0.0238	8	1	93.92	2.26	17.35	19.71659
	93.92	-0.0238	9	1	91.71	2.21	19.30	21.92737
	91.71	-0.0238	10	1	89.55	2.16	21.20	24.08611
	89.55	-0.0238	11	1	87.45	2.11	23.05	26.19403
	87.45	-0.0238	12	1	85.39	2.06	24.86	28.25234
	85.39	-0.0238	13	1	83.38	2.01	26.63	30.26220
	83.38	-0.0238	14	1	81.42	1.96	28.36	32.22475
	81.42	-0.0238	15	1	79.50	1.92	30.04	34.14111
	79.50	-0.0238	16	1	77.63	1.87	31.69	36.01238
	77.63	-0.0238	17	1	75.80	1.83	33.30	37.83956
	75.80	-0.0238	18	1	74.02	1.78	34.87	39.62375
	74.02	-0.0238	19	1	72.27	1.74	36.40	41.36595
	72.27	-0.0238	20	1	70.57	1.70	37.90	43.06714
	70.57	-0.0238	21	1	68.91	1.66	39.36	44.72829
	68.91	-0.0238	22	1	67.29	1.62	40.79	46.35034
	67.29	-0.0238	23	1	65.71	1.58	42.18	47.93420
	65.71	-0.0238	24	1	64.16	1.55	43.54	49.48079
	64.16	-0.0238	25	1	62.65	1.51	44.87	50.99097
	62.65	-0.0238	26	1	61.17	1.47	46.17	52.46561
	61.17	-0.0238	27	1	59.73	1.44	47.44	53.90559
	59.73	-0.0238	28	1	58.33	1.41	48.67	55.31157
	58.33	-0.0238	29	1	56.96	1.37	49.88	56.68451
	56.96	-0.0238	30	1	55.61	1.34	51.06	58.02513

CASE	No(KG)	k/YR	STUDY YEAR	T(YRS)	RESIDUAL N(KG)	ANNUAL LOAD(KG)	% LEACHED	CUM.(KG) LEACHED
	113.64	-0.10294	1	1	102.5232	11.11676	9.782440	11.11676
	102.5232	-0.10294	2	1	92.49396	10.02927	18.60791	21.14603
	92.49396	-0.10294	3	1	83.44579	9.048166	26.57005	30.19420
	83.44579	-0.10294	4	1	75.28275	8.163034	33.75329	38.35723
	75.28275	-0.10294	5	1	67.91826	7.364490	40.23383	45.72172
	67.91826	-0.10294	6	1	61.27420	6.644063	46.08042	52.36579
	61.27420	-0.10294	7	1	55.28009	5.994112	51.58007	58.36990
	55.28009	-0.10294	8	1	49.87235	5.407741	56.11373	63.76764
	49.87235	-0.10294	9	1	44.99361	4.878732	60.40680	68.64637
	44.99361	-0.10294	10	1	40.59214	4.401473	64.28005	73.04785
	40.59214	-0.10294	11	1	36.62124	3.970902	67.77433	77.01875
	36.62124	-0.10294	12	1	33.03879	3.582451	70.92679	80.60120
	33.03879	-0.10294	13	1	29.80679	3.231999	73.77086	83.83320
	29.80679	-0.10294	14	1	26.89095	2.915831	76.33671	86.74903
	26.89095	-0.10294	15	1	24.26036	2.630592	78.63155	89.37962
	24.26036	-0.10294	16	1	21.88711	2.373295	80.73995	91.75290
	21.88711	-0.10294	17	1	19.74601	2.141093	82.62406	93.89397
	19.74601	-0.10294	18	1	17.81437	1.931642	84.32305	95.82561
	17.81437	-0.10294	19	1	16.07169	1.742680	85.85736	97.56830
	16.07169	-0.10294	20	1	14.49949	1.572203	87.24085	99.14050
	14.49949	-0.10294	21	1	13.08108	1.418404	88.48901	100.5589
	13.08108	-0.10294	22	1	11.80143	1.279649	89.61506	101.8305
	11.80143	-0.10294	23	1	10.64696	1.154468	90.63896	102.9930
	10.64696	-0.10294	24	1	9.605435	1.041533	91.54748	104.0345
	9.605435	-0.10294	25	1	8.665789	0.939645	92.37434	104.9742
	8.665789	-0.10294	26	1	7.818064	0.847725	93.12032	105.8219
	7.818064	-0.10294	27	1	7.053266	0.764797	93.79332	106.5867
	7.053266	-0.10294	28	1	6.363285	0.689981	94.40040	107.2767
	6.363285	-0.10294	29	1	5.740800	0.622484	94.94825	107.8991
	5.740800	-0.10294	30	1	5.179210	0.561590	95.44744	108.4607

AR302538

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54.31	-0.0238	32	1	53.03	1.28	53.34	60.61245	4.215466	-0.10294	33	1	3.803091	0.412375	96.65338	109.8369
53.03	-0.0238	33	1	51.78	1.25	54.44	61.86061	3.803091	-0.10294	34	1	3.431056	0.372035	96.98076	110.2009
51.78	-0.0238	34	1	50.56	1.22	55.51	63.07940	3.431056	-0.10294	35	1	3.095415	0.335641	97.27612	110.5445
50.56	-0.0238	35	1	49.37	1.19	56.56	64.26950	3.095415	-0.10294	36	1	2.792608	0.302807	97.54250	110.8473
49.37	-0.0238	36	1	48.21	1.16	57.58	65.43158	2.792608	-0.10294	37	1	2.519422	0.273185	97.78297	111.1205
48.21	-0.0238	37	1	47.07	1.13	58.58	66.56631	2.519422	-0.10294	38	1	2.272961	0.246461	97.99985	111.3670
47.07	-0.0238	38	1	45.97	1.11	59.55	67.67434	2.272961	-0.10294	39	1	2.050610	0.222351	98.19552	111.5893
45.97	-0.0238	39	1	44.88	1.08	60.50	68.75628	2.050610	-0.10294	40	1	1.850010	0.200599	98.37204	111.7899
44.88	-0.0238	40	1	43.83	1.06	61.43	69.81275	1.850010	-0.10294	41	1	1.669034	0.180976	98.53129	111.9709
43.83	-0.0238	41	1	42.80	1.03	62.34	70.84436	1.669034	-0.10294	42	1	1.505762	0.163272	98.67497	112.1342
42.80	-0.0238	42	1	41.79	1.01	63.23	71.85169	1.505762	-0.10294	43	1	1.358462	0.147300	98.80459	112.2815
41.79	-0.0238	43	1	40.80	0.98	64.09	72.83530	1.358462	-0.10294	44	1	1.225571	0.132890	98.92153	112.4144
40.80	-0.0238	44	1	39.84	0.96	64.94	73.79577	1.225571	-0.10294	45	1	1.105600	0.119890	99.02703	112.5343
39.84	-0.0238	45	1	38.91	0.94	65.76	74.73362	1.105600	-0.10294	46	1	0.997518	0.108162	99.12221	112.6424
38.91	-0.0238	46	1	37.99	0.92	66.57	75.64940	0.997518	-0.10294	47	1	0.899936	0.097581	99.20808	112.7400
37.99	-0.0238	47	1	37.10	0.89	67.36	76.54363	0.899936	-0.10294	48	1	0.811900	0.088035	99.28535	112.8280
37.10	-0.0238	48	1	36.22	0.87	68.12	77.41680	0.811900	-0.10294	49	1	0.732476	0.079423	99.35544	112.9075
36.22	-0.0238	49	1	35.37	0.85	68.87	78.26943	0.732476	-0.10294	50	1	0.660822	0.071654	99.41849	112.9791
35.37	-0.0238	50	1	34.54	0.83	69.61	79.10198	0.660822	-0.10294	51	1	0.596178	0.064644	99.47537	113.0438
34.54	-0.0238	51	1	33.73	0.81	70.32	79.91494	0.596178	-0.10294	52	1	0.537857	0.058320	99.52670	113.1021
33.73	-0.0238	52	1	32.93	0.79	71.02	80.70876	0.537857	-0.10294	53	1	0.485241	0.052615	99.57300	113.1547
32.93	-0.0238	53	1	32.16	0.78	71.70	81.48390	0.485241	-0.10294	54	1	0.437773	0.047468	99.61477	113.2022
32.16	-0.0238	54	1	31.40	0.76	72.37	82.24079	0.437773	-0.10294	55	1	0.394948	0.042824	99.65245	113.2450
31.40	-0.0238	55	1	30.66	0.74	73.02	82.97987	0.394948	-0.10294	56	1	0.356312	0.038635	99.68645	113.2836
30.66	-0.0238	56	1	29.94	0.72	73.66	83.70155	0.356312	-0.10294	57	1	0.321456	0.034856	99.71742	113.3185
29.94	-0.0238	57	1	29.23	0.70	74.28	84.40624	0.321456	-0.10294	58	1	0.290010	0.031446	99.74479	113.3499
29.23	-0.0238	58	1	28.55	0.69	74.88	85.09435	0.290010	-0.10294	59	1	0.261640	0.028370	99.76976	113.3783
28.55	-0.0238	59	1	27.87	0.67	75.47	85.76625	0.261640	-0.10294	60	1	0.236045	0.025594	99.79220	113.4039
27.87	-0.0238	60	1	27.22	0.66	76.05	86.42235	0.236045	-0.10294	61	1	0.212954	0.023091	99.81260	113.4270
27.22	-0.0238	61	1	26.58	0.64	76.61	87.06300	0.212954	-0.10294	62	1	0.192122	0.020832	99.83093	113.4478
26.58	-0.0238	62	1	25.95	0.63	77.16	87.68857	0.192122	-0.10294	63	1	0.173320	0.018794	99.84747	113.4666
25.95	-0.0238	63	1	25.34	0.61	77.70	88.29942	0.173320	-0.10294	64	1	0.156372	0.016955	99.86239	113.4836
25.34	-0.0238	64	1	24.74	0.60	78.23	88.89588	0.156372	-0.10294	65	1	0.141075	0.015297	99.87585	113.4989
24.74	-0.0238	65	1	24.16	0.58	78.74	89.47831	0.141075	-0.10294	66	1	0.127274	0.013800	99.88800	113.5127
24.16	-0.0238	66	1	23.59	0.57	79.24	90.04703	0.127274	-0.10294	67	1	0.114824	0.012450	99.89895	113.5251
23.59	-0.0238	67	1	23.04	0.56	79.73	90.60236	0.114824	-0.10294	68	1	0.103591	0.011232	99.90884	113.5364
23.04	-0.0238	68	1	22.50	0.54	80.20	91.14462	0.103591	-0.10294	69	1	0.093457	0.010133	99.91775	113.5465
22.50	-0.0238	69	1	21.97	0.53	80.67	91.67412	0.093457	-0.10294	70	1	0.084315	0.009142	99.92580	113.5556
21.97	-0.0238	70	1	21.45	0.52	81.13	92.19116	0.084315	-0.10294	71	1	0.076067	0.008248	99.93306	113.5639
21.45	-0.0238	71	1	20.94	0.50	81.57	92.69602	0.076067	-0.10294	72	1	0.068626	0.007441	99.93961	113.5713
20.94	-0.0238	72	1	20.45	0.49	82.00	93.18900	0.068626	-0.10294	73	1	0.061912	0.006713	99.94551	113.5780
20.45	-0.0238	73	1	19.97	0.48	82.43	93.67038	0.061912	-0.10294	74	1	0.055836	0.006056	99.95084	113.5841
19.97	-0.0238	74	1	19.50	0.47	82.84	94.14042	0.055836	-0.10294	75	1	0.050392	0.005464	99.95565	113.5896
19.50	-0.0238	75	1	19.04	0.46	83.24	94.59940	0.050392	-0.10294	76	1	0.045462	0.004929	99.95999	113.5945

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THIS THIS SPREADSHEET PROVIDES COMPUTATION FOR THE FOLLOWING: REV.1.0/23MAY00

19.04	-0.0230	76	1	18.59	0.45	83.64	95.04750	0.041015	-0.10294	78	1	0.037002	0.004012	99.96743	113.6029
18.59	-0.0230	77	1	18.15	0.44	84.02	95.48521	0.037002	-0.10294	79	1	0.033383	0.003619	99.97062	113.6066
18.15	-0.0230	78	1	17.73	0.43	84.40	95.91254	0.033383	-0.10294	80	1	0.030117	0.003265	99.97349	113.6098
17.73	-0.0230	79	1	17.31	0.42	84.77	96.32981	0.030117	-0.10294	81	1	0.027171	0.002946	99.97609	113.6128
17.31	-0.0230	80	1	16.90	0.41	85.13	96.73726	0.027171	-0.10294	82	1	0.024513	0.002658	99.97842	113.6154
16.90	-0.0230	81	1	16.50	0.40	85.48	97.13512	0.024513	-0.10294	83	1	0.022115	0.002397	99.98053	113.6178
16.50	-0.0230	82	1	16.12	0.39	85.82	97.52361	0.022115	-0.10294	84	1	0.019951	0.002163	99.98244	113.6200
16.12	-0.0230	83	1	15.74	0.38	86.15	97.90296	0.019951	-0.10294	85	1	0.018000	0.001951	99.98416	113.6219
15.74	-0.0230	84	1	15.37	0.37	86.48	98.27338	0.018000	-0.10294	86	1	0.016239	0.001760	99.98570	113.6237
15.37	-0.0230	85	1	15.00	0.36	86.80	98.63500	0.016239	-0.10294	87	1	0.014650	0.001588	99.98710	113.6253
15.00	-0.0230	86	1	14.65	0.35	87.11	98.98826	0.014650	-0.10294	88	1	0.013217	0.001433	99.98836	113.6267
14.65	-0.0230	87	1	14.31	0.34	87.41	99.33314	0.013217	-0.10294	89	1	0.011924	0.001292	99.98950	113.6280
14.31	-0.0230	88	1	13.97	0.34	87.71	99.66989	0.011924	-0.10294	90	1	0.010767	0.001166	99.99053	113.6292
13.97	-0.0230	89	1	13.64	0.33	88.00	99.99872	0.010757	-0.10294	91	1	0.009705	0.001052	99.99145	113.6302
13.64	-0.0230	90	1	13.32	0.32	88.28	100.3198	0.009705	-0.10294	92	1	0.008756	0.000949	99.99229	113.6312
13.32	-0.0230	91	1	13.01	0.31	88.55	100.6333	0.008756	-0.10294	93	1	0.007899	0.000856	99.99304	113.6320
13.01	-0.0230	92	1	12.70	0.31	88.82	100.9394	0.007899	-0.10294	94	1	0.007126	0.000772	99.99372	113.6328
12.70	-0.0230	93	1	12.40	0.30	89.09	101.2384	0.007126	-0.10294	95	1	0.006429	0.000697	99.99434	113.6335
12.40	-0.0230	94	1	12.11	0.29	89.34	101.5301	0.006429	-0.10294	96	1	0.005800	0.000628	99.99489	113.6341
12.11	-0.0230	95	1	11.82	0.29	89.59	101.8153	0.005800	-0.10294	97	1	0.005233	0.000567	99.99539	113.6347
11.82	-0.0230	96	1	11.55	0.28	89.84	102.0937	0.005233	-0.10294	98	1	0.004721	0.000511	99.99584	113.6352
11.55	-0.0230	97	1	11.27	0.27	90.08	102.3654	0.004721	-0.10294	99	1	0.004259	0.000461	99.99625	113.6357
11.27	-0.0230	98	1	11.01	0.27	90.31	102.6308	0.004259	-0.10294	100	1	0.003842	0.000416	99.99661	113.6361
11.01	-0.0230	99	1	10.75	0.26	90.54	102.8900	0.003842	-0.10294	101	1	0.003466	0.000375	99.99694	113.6365
10.75	-0.0230	100	1	10.50	0.25	90.76	103.1434	0.003466	-0.10294	102	1	0.003127	0.000339	99.99724	113.6368
10.50	-0.0230	101	1	10.25	0.25	90.98	103.3901	0.003127	-0.10294	103	1	0.002821	0.000305	99.99751	113.6371

AR302540

THIS THIS SPREADSHEET PROVIDES COMPUTATION FOR THE FOLLOWING: REV.0.0/30MAY00

THIS THIS SPREADSHEET PROVIDES COMPUTATION FOR THE FOLLOWING: REV.0.0/30MAY00

1) 1) LOG Koc=MEOBX*B (UNITCS) NOTE: LOG Koc MUST BE MANUALLY TRANSFORMED TO Koc [redacted]

2) 2)Kd=Koc * foc, (ORGANICS)

3) 3)LEACH FRACTION/YR.=CM/YR /POROSITY //CM(1+(BM/CC * Kd/POROSITY))

4) 4)MASS OF CHEMICAL IN THE SOILS=UG/KG * G/CC * .001KG/G * CC(VOL) * FRACTION OF SITE AFFECTED

5) 5)ANNUAL MASS TO GROUNDWATER=MASS IN SOIL(EQ. 4) * LEACH FRACTION(EQ. 3)

6) 6)ADJUSTED MASS TO GROUNDWATER

7) 7)EXPONENTIAL DECAY LOOKUP FUNCTION

EQ.1	EQ.1	DESCRIPTION	SLOPE	X VAR.	CONST.	LOG Koc	Koc (DIMLESS)	COMMENT
A	A	1,2-DICHLOROETHANE	0.79	30	-1.71	-0.543074	0.286	Kow=30(HADEY etal., 1982) REG.EQ.(JOHNSON, 1985)
B	B	1,2-DICHLOROETHANE	-0.55	86490	3.64	1.4735391	29.754	S=8.69E+3mg/l(HADEY etal, 1982), REG.EQ.(KENAGA, 1980)
C	C	1,2-DICHLOROETHANE	-0.557	87796	4.227	1.4734845	29.750	S=87796uM/l(S=8.69E+3, HADEY, etal., 1982),REG.EQ.(EQ. 4-7, LYMAN,1981)
D	D	1,2-DICHLOROETHANE		0		EAR	14.000	Koc FROM (HADEY,etal, 1982)

EQ.2	EQ.2	DESCRIPTION	Koc	foc	Kd	COMMENT
A	A	1,2-DICHLOROETHANE	0.286348	0.01	0.002863	
B	B	1,2-DICHLOROETHANE	29.75357	0.01	0.297535	
C	C	1,2-DICHLOROETHANE	29.74983	0.01	0.297498	
D	D	1,2-DICHLOROETHANE	14	0.01	0.14	

EQ.3	EQ.3	DESCRIPTION	INFIL. CM/YR.	POROSITY V/V	W.DEPTH CM	DENSITY G/CC	Kd ML/G	LCH.FACT. /YR.	COMMENT
A	A	CASEA 1,2-DCA	40.64	0.4	381	1.7	0.002863	0.263460	Kd BASED ON Koc=0.286 (EQ.2-A)
B	B	CASEB 1,2-DCA	40.64	0.4	381	1.7	0.297535	0.117758	Kd BASED ON Koc=29.754 (EQ.2-B)
C	C	CASEC 1,2-DCA	40.64	0.4	381	1.7	0.297498	0.117766	Kd BASED ON Koc=29.75 (EQ.2-C)
D	D	CASED 1,2-DCA	40.64	0.4	381	1.7	0.14	0.167189	Kd BASED ON Koc=14 (HADEY, etal. 19__)

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THIS THIS SPREADSHEET PROVIDES COMPUTATION FOR THE FOLLOWING: REV.0.0/30MAY00

EQ.4	EQ.4	DESCRIPTION	CONC. UG/KG	DENSITY G/CC	CONVERS. KG/G	VOLUME CC	FRACT. UGS/SAMP	MASS KG	COMMENT
		BASED ON SECTOR MEANS							
A	A	1,2-DCA SECTOR I	31.0	1.7	0.001	6.35E+10	0.98	3.359466	NOTE: SECTORs IA & IIA ARE SIGNIFICANTLY DIFF.
B	B	1,2-DCA SECTOR II	23.7	1.7	0.001	7.70E+10	0.92	2.871904	THESE MAY BE REVISED
C	C	1,2-DCA SECTOR III	22.0	1.7	0.001	5.14E+10	0.93	1.097230	
		TOTAL MASS 3 SECTORS						8.128600	

EQ.5	EQ.5	DESCRIPTION	MASS KG	LEACH FRACT/YR	ANN.LOAD KG/YR	ANN.LOAD KG/HR	DESCRIPTION
A	A	1,2-DCA SECTOR I	3.359466	0.263460	0.885085	0.0001010	CASE C-1 NOTE: LEACH FRACT BASED ON Koc FROM EQ.1,2,3,-C
B	B	1,2-DCA SECTOR II	2.871904	0.263460	0.756632	0.0000863	CASE C-2
C	C	1,2-DCA SECTOR III	1.097230	0.263460	0.499846	0.0000570	CASE C-3
D	D	1,2-DCA SECTOR I	3.359466	0.117750	0.395604	0.0000451	CASE D-1
E	E	1,2-DCA SECTOR II	2.871904	0.117750	0.338190	0.0000386	CASE D-2
F	F	1,2-DCA SECTOR III	1.097230	0.117750	0.223415	0.0000255	CASE D-3
G	G	1,2-DCA SECTOR I	3.359466	0.117766	0.395632	0.0000451	CASE C-1
H	H	1,2-DCA SECTOR II	2.871904	0.117766	0.338214	0.0000386	CASE C-2
I	I	1,2-DCA SECTOR III	1.097230	0.117766	0.223434	0.0000255	CASE C-3
J	J	1,2-DCA SECTOR I	3.359466	0.167109	0.561666	0.0000641	CASE D-1
K	K	1,2-DCA SECTOR II	2.871904	0.167109	0.480151	0.0000548	CASE D-2
L	L	1,2-DCA SECTOR III	1.097230	0.167109	0.317197	0.0000362	CASE D-3

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AR302542

THIS THIS SPREADSHEET PROVIDES COMPUTATION FOR THE FOLLOWING: REV.0.0/30MAY00

EQ 7 EQ 7 FIRST ORDER DECAY ESTIMATE OF LEACHING

A A GENERAL: M=Mo exp(-k)(T)
EST k AS FOLLOWS:
ASSUME 1/ANNUAL LEACH RATE= 50% @ MASS LEACHED (J. MB)
THEN 1/0.117766/YR=8.49 YR (EQ. 2-C)
M/Mo=exp(-k/YR)(8.49 YR)
.5=exp(-k/YR)(8.49 YR)
0.0816920/YR=k

CONSTANTS
Mo=8.1206 KG (EQ.4-A,B,C,)
0.0816920/YR=k EQ. 7-A

B GENERAL: M(ie RESIDUAL)=Mo exp(-k)(T)
EST k AS FOLLOWS:
ASSUME 1/ANNUAL LEACH RATE=95% @ MASS LEACHED
THEN 1/0.117766/YR=8.49 YR (EQ.2-C)
M/Mo=exp(-k/YR)(8.49)
0.05=exp(-k)(8.49)
0.3520542=k

DESCRIPTION	Mo(KG)	k(/YR)	STUDY YEAR	T(YRS)	RESIDUAL M(KG)	ANNUAL LOAD(KG)	% LEACHED	CUM(KG) LEACHED
	8.1206	-0.0016	1	1	7.49	0.6373	7.840	0.637273
	7.49	-0.0016	2	1	6.90	0.5873	15.065	1.224505
	6.90	-0.0016	3	1	6.36	0.5413	21.724	1.765852
	6.36	-0.0016	4	1	5.86	0.4988	27.861	2.264684
	5.86	-0.0016	5	1	5.40	0.4597	33.516	2.724409
	5.40	-0.0016	6	1	4.98	0.4237	38.729	3.148091
	4.98	-0.0016	7	1	4.59	0.3905	43.532	3.538550
	4.59	-0.0016	8	1	4.23	0.3599	47.959	3.898412
	4.23	-0.0016	9	1	3.90	0.3316	52.039	4.230054
	3.90	-0.0016	10	1	3.59	0.3056	55.799	4.535696
	3.59	-0.0016	11	1	3.31	0.2817	59.265	4.817376
	3.31	-0.0016	12	1	3.05	0.2596	62.458	5.076972
	3.05	-0.0016	13	1	2.81	0.2392	65.401	5.316216
	2.81	-0.0016	14	1	2.59	0.2205	68.114	5.536784
	2.59	-0.0016	15	1	2.39	0.2032	70.614	5.739996
	2.39	-0.0016	16	1	2.20	0.1873	72.918	5.927177
	2.20	-0.0016	17	1	2.03	0.1726	75.041	6.099766
	2.03	-0.0016	18	1	1.87	0.1591	76.998	6.258874
	1.87	-0.0016	19	1	1.72	0.1466	78.801	6.405412
	1.72	-0.0016	20	1	1.59	0.1351	80.463	6.540500
	1.59	-0.0016	21	1	1.46	0.1245	81.995	6.665013
	1.46	-0.0016	22	1	1.35	0.1147	83.406	6.779757
	1.35	-0.0016	23	1	1.24	0.1057	84.707	6.885504
	1.24	-0.0016	24	1	1.15	0.0975	85.906	6.982962
	1.15	-0.0016	25	1	1.06	0.0898	87.011	7.072278

CASE	Mo(KG)	k(/YR)	STUDY YEAR	T(YR)	RESIDUAL R(KG)	ANNUAL LOAD(KG)	% LEACHED	CUM.(KG) LEACHED
	8.1206	-0.35285	1	1	5.711001	2.416798	29.73203	2.416798
	5.71	-0.35285	2	1	4.013566	1.698234	50.62813	
	4.01	-0.35285	3	1	2.820251	1.193315	65.30450	
	2.82	-0.35285	4	1	1.981733	0.838518	75.62023	
	1.98	-0.35285	5	1	1.392523	0.589209	82.86083	
	1.39	-0.35285	6	1	0.978498	0.414025	87.96228	
	0.98	-0.35285	7	1	0.687570	0.290927	91.54133	
	0.69	-0.35285	8	1	0.483141	0.204428	94.05627	
	0.48	-0.35285	9	1	0.339493	0.143647	95.82346	
	0.34	-0.35285	10	1	0.238555	0.100938	97.06523	
	0.24	-0.35285	11	1	0.167628	0.070927	97.93779	
	0.17	-0.35285	12	1	0.117788	0.049839	98.55693	
	0.12	-0.35285	13	1	0.082767	0.035021	98.98177	
	0.08	-0.35285	14	1	0.058139	0.024608	99.28451	
	0.06	-0.35285	15	1	0.040867	0.017291	99.49724	
	0.04	-0.35285	16	1	0.028716	0.012150	99.64672	
	0.03	-0.35285	17	1	0.020178	0.008538	99.75175	
	0.02	-0.35285	18	1	0.014179	0.005999	99.82556	
	0.01	-0.35285	19	1	0.009963	0.004215	99.87742	
	0.01	-0.35285	20	1	0.007001	0.002962	99.91387	
	0.01	-0.35285	21	1	0.004919	0.002081	99.93947	
	0.00	-0.35285	22	1	0.003456	0.001462	99.95747	
	0.00	-0.35285	23	1	0.002429	0.001027	99.97011	
	0.00	-0.35285	24	1	0.001706	0.000722	99.97900	
	0.00	-0.35285	25	1	0.001199	0.000507	99.98524	

AR302543

THIS THIS SPREADSHEET PROVIDES COMPUTATION FOR THE FOLLOWING: REV.0.0/30MAY00

1.06	-0.0016	26	1	0.97	0.0820	88.029	7.155554	0.00	-0.35285	26	1	0.000842	0.000356	99.98763
0.97	-0.0016	27	1	0.90	0.0763	88.900	7.251859	0.00	-0.35285	27	1	0.000592	0.000250	99.99271
0.90	-0.0016	28	1	0.83	0.0703	89.833	7.342144	0.00	-0.35285	28	1	0.000416	0.000176	99.99488
0.83	-0.0016	29	1	0.76	0.0648	90.630	7.344938	0.00	-0.35285	29	1	0.000292	0.000123	99.99640
0.76	-0.0016	30	1	0.70	0.0597	91.384	7.428631	0.00	-0.35285	30	1	0.000205	0.000086	99.99747
0.70	-0.0016	31	1	0.65	0.0550	92.041	7.481683	0.00	-0.35285	31	1	0.000144	0.000061	99.99822
0.65	-0.0016	32	1	0.60	0.0507	92.665	7.532401	0.00	-0.35285	32	1	0.000101	0.000042	99.99875
0.60	-0.0016	33	1	0.55	0.0467	93.240	7.579142	0.00	-0.35285	33	1	0.000071	0.000030	99.99912
0.55	-0.0016	34	1	0.51	0.0431	93.770	7.622219	0.00	-0.35285	34	1	0.000050	0.000021	99.99938
0.51	-0.0016	35	1	0.47	0.0397	94.259	7.661910	0.00	-0.35285	35	1	0.000035	0.000014	99.99956
0.47	-0.0016	36	1	0.43	0.0366	94.709	7.698506	0.00	-0.35285	36	1	0.000024	0.000010	99.99969
0.43	-0.0016	37	1	0.40	0.0337	95.124	7.732225	0.00	-0.35285	37	1	0.000017	0.000007	99.99978
0.40	-0.0016	38	1	0.37	0.0311	95.506	7.763300	0.00	-0.35285	38	1	0.000012	0.000005	99.99984
0.37	-0.0016	39	1	0.34	0.0286	95.858	7.791939	0.00	-0.35285	39	1	0.000008	0.000003	99.99989
0.34	-0.0016	40	1	0.31	0.0264	96.183	7.818333	0.00	-0.35285	40	1	0.000006	0.000002	99.99992
0.31	-0.0016	41	1	0.29	0.0243	96.482	7.842657	0.00	-0.35285	41	1	0.000004	0.000001	99.99994
0.29	-0.0016	42	1	0.26	0.0224	96.758	7.865075	0.00	-0.35285	42	1	0.000002	0.000001	99.99996
0.26	-0.0016	43	1	0.24	0.0207	97.012	7.885735	0.00	-0.35285	43	1	0.000002	0.000000	99.99997
0.24	-0.0016	44	1	0.22	0.0190	97.246	7.904775	0.00	-0.35285	44	1	0.000001	0.000000	99.99998
0.22	-0.0016	45	1	0.21	0.0175	97.462	7.922323	0.00	-0.35285	45	1	0.000001	0.000000	99.99998
0.21	-0.0016	46	1	0.19	0.0162	97.661	7.938495	0.00	-0.35285	46	1	0.000000	0.000000	99.99999
0.19	-0.0016	47	1	0.18	0.0149	97.845	7.953399	0.00	-0.35285	47	1	0.000000	0.000000	99.99999
0.18	-0.0016	48	1	0.16	0.0137	98.014	7.967138	0.00	-0.35285	48	1	0.000000	0.000000	99.99999
0.16	-0.0016	49	1	0.15	0.0127	98.169	7.979793	0.00	-0.35285	49	1	0.000000	0.000000	99.99999
0.15	-0.0016	50	1	0.14	0.0117	98.313	7.991459	0.00	-0.35285	50	1	0.000000	0.000000	99.99999
0.14	-0.0016	51	1	0.13	0.0108	98.445	8.002211	0.00	-0.35285	51	1	0.000000	0.000000	99.99999
0.13	-0.0016	52	1	0.12	0.0099	98.567	8.012120	0.00	-0.35285	52	1	0.000000	0.000000	99.99999
0.12	-0.0016	53	1	0.11	0.0091	98.679	8.021252	0.00	-0.35285	53	1	0.000000	0.000000	99.99999
0.11	-0.0016	54	1	0.10	0.0084	98.783	8.029667	0.00	-0.35285	54	1	0.000000	0.000000	99.99999
0.10	-0.0016	55	1	0.09	0.0078	98.878	8.037424	0.00	-0.35285	55	1	0.000000	0.000000	99.99999
0.09	-0.0016	56	1	0.08	0.0071	98.966	8.044572	0.00	-0.35285	56	1	0.000000	0.000000	99.99999
0.08	-0.0016	57	1	0.08	0.0066	99.047	8.051159	0.00	-0.35285	57	1	0.000000	0.000000	99.99999
0.08	-0.0016	58	1	0.07	0.0061	99.122	8.057231	0.00	-0.35285	58	1	0.000000	0.000000	99.99999
0.07	-0.0016	59	1	0.07	0.0056	99.191	8.062826	0.00	-0.35285	59	1	0.000000	0.000000	99.99999
0.07	-0.0016	60	1	0.06	0.0052	99.254	8.067982	0.00	-0.35285	60	1	0.000000	0.000000	99.99999
0.06	-0.0016	61	1	0.06	0.0048	99.313	8.072735	0.00	-0.35285	61	1	0.000000	0.000000	99.99999
0.06	-0.0016	62	1	0.05	0.0044	99.367	8.077115	0.00	-0.35285	62	1	0.000000	0.000000	99.99999
0.05	-0.0016	63	1	0.05	0.0040	99.416	8.081151	0.00	-0.35285	63	1	0.000000	0.000000	99.99999
0.05	-0.0016	64	1	0.04	0.0037	99.462	8.084871	0.00	-0.35285	64	1	0.000000	0.000000	99.99999
0.04	-0.0016	65	1	0.04	0.0034	99.504	8.088299	0.00	-0.35285	65	1	0.000000	0.000000	99.99999
0.04	-0.0016	66	1	0.04	0.0032	99.543	8.091459	0.00	-0.35285	66	1	0.000000	0.000000	99.99999
0.04	-0.0016	67	1	0.03	0.0029	99.579	8.094370	0.00	-0.35285	67	1	0.000000	1.9E-10	99.99999
0.03	-0.0016	68	1	0.03	0.0027	99.612	8.097054	0.00	-0.35285	68	1	0.000000	1.3E-10	99.99999
0.03	-0.0016	69	1	0.03	0.0025	99.642	8.099527	0.00	-0.35285	69	1	2.2E-10	9.2E-11	99.99999
0.03	-0.0016	70	1	0.03	0.0023	99.670	8.101806	0.00	-0.35285	70	1	1.5E-10	6.4E-11	99.99999
0.03	-0.0016	71	1	0.02	0.0021	99.696	8.103907	0.00	-0.35285	71	1	1.1E-10	4.5E-11	99.99999
0.02	-0.0016	72	1	0.02	0.0019	99.720	8.105843	0.00	-0.35285	72	1	7.5E-11	3.2E-11	99.99999
0.02	-0.0016	73	1	0.02	0.0018	99.742	8.107627	0.00	-0.35285	73	1	5.3E-11	2.2E-11	99.99999
0.02	-0.0016	74	1	0.02	0.0016	99.762	8.109271	0.00	-0.35285	74	1	3.7E-11	1.6E-11	100

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0.02	-0.0016	75	1	0.02	0.0015	99.781	0.110784	0.00	-0.35285	75	1	2.6E-11	1.1E-11	100
0.02	-0.0016	76	1	0.02	0.0014	99.798	0.112183	0.00	-0.35285	76	1	1.8E-11	7.8E-12	100
0.02	-0.0016	77	1	0.02	0.0013	99.814	0.113470	0.00	-0.35285	77	1	1.3E-11	5.5E-12	100
0.02	-0.0016	78	1	0.01	0.0012	99.828	0.114656	0.00	-0.35285	78	1	9.1E-12	3.8E-12	100
0.01	-0.0016	79	1	0.01	0.0011	99.842	0.115749	0.00	-0.35285	79	1	6.4E-12	2.7E-12	100

THIS THIS SPREADSHEET PROVIDES COMPUTATION FOR THE FOLLOWING: REV.0.0/30MAY00

0.01	-0.0016	80	1	0.01	0.0010	99.854	0.116757	0.00	-0.35285	80	1	4.5E-12	1.9E-12	100
0.01	-0.0016	81	1	0.01	0.0009	99.866	0.117685	0.00	-0.35285	81	1	3.1E-12	1.3E-12	100
0.01	-0.0016	82	1	0.01	0.0009	99.876	0.118541	0.00	-0.35285	82	1	2.2E-12	9.3E-13	100
0.01	-0.0016	83	1	0.01	0.0008	99.886	0.119329	0.00	-0.35285	83	1	1.6E-12	6.6E-13	100
0.01	-0.0016	84	1	0.01	0.0007	99.895	0.120056	0.00	-0.35285	84	1	1.1E-12	4.6E-13	100
0.01	-0.0016	85	1	0.01	0.0007	99.903	0.120726	0.00	-0.35285	85	1	7.7E-13	3.2E-13	100
0.01	-0.0016	86	1	0.01	0.0006	99.911	0.121343	0.00	-0.35285	86	1	5.4E-13	2.3E-13	100
0.01	-0.0016	87	1	0.01	0.0006	99.918	0.121912	0.00	-0.35285	87	1	3.8E-13	1.6E-13	100
0.01	-0.0016	88	1	0.01	0.0005	99.924	0.122436	0.00	-0.35285	88	1	2.7E-13	1.1E-13	100
0.01	-0.0016	89	1	0.01	0.0005	99.930	0.122920	0.00	-0.35285	89	1	1.9E-13	7.9E-14	100
0.01	-0.0016	90	1	0.01	0.0004	99.936	0.123365	0.00	-0.35285	90	1	1.3E-13	5.6E-14	100
0.01	-0.0016	91	1	0.00	0.0004	99.941	0.123775	0.00	-0.35285	91	1	9.2E-14	3.9E-14	100
0.00	-0.0016	92	1	0.00	0.0004	99.945	0.124153	0.00	-0.35285	92	1	6.5E-14	2.7E-14	100
0.00	-0.0016	93	1	0.00	0.0003	99.950	0.124502	0.00	-0.35285	93	1	4.6E-14	1.9E-14	100
0.00	-0.0016	94	1	0.00	0.0003	99.954	0.124823	0.00	-0.35285	94	1	3.2E-14	1.4E-14	100
0.00	-0.0016	95	1	0.00	0.0003	99.957	0.125119	0.00	-0.35285	95	1	2.2E-14	9.5E-15	100
0.00	-0.0016	96	1	0.00	0.0003	99.961	0.125392	0.00	-0.35285	96	1	1.6E-14	6.7E-15	100
0.00	-0.0016	97	1	0.00	0.0003	99.964	0.125644	0.00	-0.35285	97	1	1.1E-14	4.7E-15	100
0.00	-0.0016	98	1	0.00	0.0002	99.966	0.125875	0.00	-0.35285	98	1	7.8E-15	3.3E-15	100
0.00	-0.0016	99	1	0.00	0.0002	99.969	0.126089	0.00	-0.35285	99	1	5.5E-15	2.3E-15	100
0.00	-0.0016	100	1	0.00	0.0002	99.972	0.126286	0.00	-0.35285	100	1	3.9E-15	1.6E-15	100
0.00	-0.0016	101	1	0.00	0.0002	99.974	0.126467	0.00	-0.35285	101	1	2.7E-15	1.1E-15	100

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THI' THIS SPREADSHEET PROVIDES COMPUTATION FOR THE FOLLOWING: REV.0 0/05JUNE88 FENAC ONLY

THI . THIS SPREADSHEET PROVIDES COMPUTATION FOR THE FOLLOWING: REV.0.0/05JUNE88 FENAC ONLY

1) 1) LOG Koc=mLOGX+b (ORICS) NOTE: Log Koc MUST BE MANUALLY TRANSFORMED TO Koc

2) 2)Kd=Koc * foc, (ORGANICS)

3) 3)LEACH FRACTION/YR.=CM/YR /POROSITY //CM(1+[GM/CC * Kd/POROSITY])

4) 4)MASS OF CHEMICAL IN THE SOILS=UG/KG * G/CC * .001KG/G * CC(VOL) * FRACTION OF SITE AFFECTED

5) 5)ANNUAL MASS TO GROUNDWATER=MASS IN SOIL(EQ. 4) * LEACH FRACTION(EQ. 3)

6) 6)ADJUSTED MASS TO GROUNDWATER

7) 7)EXPONENTIAL DECAY LEACHING

EQ 1	EQ.1	DESCRIPTION	SLOPE	X VAR.	CONST.	LOG Koc	Koc (DIMLESS)	COMMENT
A	A	FENAC	0.79	3467	-1.71	1.0865635	12.21	Kow=3467(FROM LEO'1., 1982)REG.EQ.(JOHNSON, etal., 1985)
B	B	FENAC	-0.55	200	3.64	2.3744335	236.83	S=200mg/l(VERSCHUEREN, 1983), REG.EQ.(KENAGA, 1980, EQ.4-5, LYMAN)
C	C	FENAC	-0.557	833	4.227	2.6002007	398.29	S=833uM/l(VERSCHUEREN, 1982),REG.EQ.(EQ. 4-7, LYMAN, 1981)
D	D	FENAC		0		ERR		

EQ 2	EQ.2	DESCRIPTION	Koc	foc	Kd	COMMENT
A	A	FENAC	12.21	0.01	0.122	
B	B	FENAC	236.83	0.01	2.368	
C	C	FENAC	398.29	0.01	3.983	
D	D	FENAC		0.01	0.000	

EQ 3	EQ 3	DESCRIPTION	INFIL. CM/YR.	POROSITY V/V	W.DEPTH CM	DENSITY G/CC	Kd ML/G	LCH.FRCT. /YR.	COMMENT
A	A	CASEA FENAC	40.64	0.4	381	1.7	0.122057	0.175583	Kd BASED ON Koc=12.21 (EQ.2-A)
B	B	CASEB FENAC	40.64	0.4	381	1.7	2.368282	0.024099	Kd BASED ON Koc=236.83145 (EQ.2-B)
C	C	CASEC FENAC	40.64	0.4	381	1.7	3.982911	0.014874	Kd BASED ON Koc=398.29 (EQ.2-C)
D	D	CASED FENAC	40.64	0.4	381	1.7	0		Kd BASED ON

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THIS THIS SPREADSHEET PROVIDES COMPUTATION FOR THE FOLLOWING: REV.0.0/05JUNE88 FENAC ONLY

TO.4	FO.4	DESCRIPTION *DISREGARD*	CONC. UG/KG	DENSITY G/CC	CONVERS. KG/G	VOLUME CC	FRACT. OBS/SAMP	MASS KG	COMMENT
A	A	FENAC	20	1.7	0.001	1.54E+11	0.82	5.984088	BASED ON MEDIAN CONC.OF 20UG/KG (Q1=11,Q3=74)
B	B	FENAC	71	1.7	0.001	1.54E+11	0.82	15.17393	BASED ON TRIMMED MEAN (.05) CONC. OF 74 UG/KG
C	C	FENAC	353	1.7	0.001	1.54E+11	0.82	75.44226	BASED ON MEAN CONC. OF 353 UG/KG (n=2021)
		REVISED DATA							
		BASED ON SECTOR MEANS							
D	D	FENAC SECTOR I	1588	1.7	0.001	6.35E+10	0.88	151.1747	
E	E	FENAC SECTOR II	1559	1.7	0.001	7.78E+10	0.56	115.9254	
F	F	FENAC SECTOR III	1031	1.7	0.001	5.14E+10	0.67	60.05426	
		TOTAL VOLUME & MASS 3 SECTORS				1.93E+11		327.1545	

FO.5	FO.5	DESCRIPTION *IGNORE*	MASS KG	LEACH FRACT/YR	ANN.LOAD KG/YR	ANN.LOAD KG/HR	DESCRIPTION
A	A	FENAC	5.984088	0.175583	1.050708	0.0001199	CASE A-1
B	B	FENAC	15.17393	0.175583	2.664297	0.0003041	CASE A-2
C	C	FENAC	75.44226	0.175583	13.24643	0.0015121	CASE A-3
D	D	FENAC	5.984088	0.024099	0.144214	0.0000164	CASE B-1
E	E	FENAC	15.17393	0.024099	0.365685	0.0000417	CASE B-2
F	F	FENAC	75.44226	0.024099	1.818126	0.0002075	CASE B-3
G	G	FENAC	5.984088	0.014874	0.089012	0.0000101	CASE C-1
H	H	FENAC	15.17393	0.014874	0.225709	0.0000257	CASE C-2
I	I	FENAC	75.44226	0.014874	1.122190	0.0001281	CASE C-3
J	J	FENAC	5.984088		0	0	CASE D-1
K	K	FENAC	15.17393		0	0	CASE D-2
L	L	FENAC	75.44226		0	0	CASE D-3

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THE THIS SPREADSHEET PROVIDES COMPUTATION FOR THE FOLLOWING: REV.0.0/05JUNE88 FENAC ONLY

ID ? ID ? FIRST ORDER DECAY ESTIMATE OF LEACHING

A A GENERAL: M=Mo exp(-k)(T)
EST k AS FOLLOWS:
ASSUME 1/ANNUAL LEACH RATE= 50% @ MASS LEACHED (J. HO)
THEN 1/0.014874/YR=67.231 YR (EQ. 3-C)
M/Mo=exp(k/YR)(67.231 YR)
.5=exp(-k/YR)(67.231 YR)
0.0103099/YR=k

CONSTANTS
Mo=327.15454 KG (EQ.4-D.E.F)
k=-0.0103099/YR (EQ.7-A)

B GENERAL: M=Mo exp(-k)(T)
EST k AS FOLLOWS:
ASSUME 1/ANNUAL LEACH RATE=95% @ MASS LEACHED
THEN 1/0.0445588/YR=67.231 YR
M/Mo=exp(-k/YR)(67.231 YR)
.05=exp(-k/YR)(67.231 YR)
0.0.445588=k

CONSTANTS: Mo=113.64 KG (EQ. 4-D,E,F)
k=-0.1029461/YR (EQ. 7-B)

DESCRIPTION	Mo(KG)	k(/YR)	STUDY YEAR	T(YRS)	RESIDUAL M(KG)	ANNUAL LOAD(KG)	% LEACHED	CUM.(KG) LEACHED
	327.1545	-0.0103	1	1	323.80	3.36	1.03	3.355602
	323.00	-0.0103	2	1	320.48	3.32	2.04	6.676786
	320.48	-0.0103	3	1	317.19	3.29	3.05	9.963905
	317.19	-0.0103	4	1	313.94	3.25	4.04	13.21730
	313.94	-0.0103	5	1	310.72	3.22	5.02	16.43734
	310.72	-0.0103	6	1	307.53	3.19	6.00	19.62434
	307.53	-0.0103	7	1	304.38	3.15	6.96	22.77866
	304.38	-0.0103	8	1	301.25	3.12	7.92	25.90062
	301.25	-0.0103	9	1	298.16	3.09	8.86	28.99056
	298.16	-0.0103	10	1	295.11	3.06	9.80	32.04881
	295.11	-0.0103	11	1	292.08	3.03	10.72	35.07569
	292.08	-0.0103	12	1	289.08	3.00	11.64	38.07153
	289.08	-0.0103	13	1	286.12	2.97	12.54	41.03663
	286.12	-0.0103	14	1	283.18	2.93	13.44	43.97132
	283.18	-0.0103	15	1	280.28	2.90	14.33	46.87592
	280.28	-0.0103	16	1	277.40	2.87	15.21	49.75071
	277.40	-0.0103	17	1	274.56	2.85	16.08	52.59603
	274.56	-0.0103	18	1	271.74	2.82	16.94	55.41216
	271.74	-0.0103	19	1	268.96	2.79	17.79	58.19940
	268.96	-0.0103	20	1	266.20	2.76	18.63	60.95805
	266.20	-0.0103	21	1	263.47	2.73	19.47	63.68841
	263.47	-0.0103	22	1	260.76	2.70	20.29	66.39077
	260.76	-0.0103	23	1	258.09	2.67	21.11	69.06540
	258.09	-0.0103	24	1	255.44	2.65	21.92	71.71261
	255.44	-0.0103	25	1	252.82	2.62	22.72	74.33266
	252.82	-0.0103	26	1	250.23	2.59	23.51	76.92584
	250.23	-0.0103	27	1	247.66	2.57	24.30	79.49241
	247.66	-0.0103	28	1	245.12	2.54	25.07	82.03267
	245.12	-0.0103	29	1	242.61	2.51	25.84	84.54687
	242.61	-0.0103	30	1	240.12	2.49	26.60	87.03528
	240.12	-0.0103	31	1	237.66	2.46	27.36	89.49817

CASE	Mo(KG)	k/YR	STUDY YEAR	T(YRS)	RESIDUAL M(KG)	ANNUAL LOAD(KG)	% LEACHED	CUM.(KG) LEACHED
B	327.1545	-0.04455	1	1	312.8968	14.25760	4.358063	11.11676
	312.8968	-0.04455	2	1	299.2606	13.63624	8.526200	24.75300
	299.2606	-0.04455	3	1	286.2186	13.04197	12.51268	37.79497
	286.2186	-0.04455	4	1	273.7450	12.47359	16.32544	50.26857
	273.7450	-0.04455	5	1	261.8151	11.92998	19.97203	62.19855
	261.8151	-0.04455	6	1	250.4050	11.41006	23.45970	73.60862
	250.4050	-0.04455	7	1	239.4922	10.91281	26.79537	84.52143
	239.4922	-0.04455	8	1	229.0549	10.43722	29.98568	94.95866
	229.0549	-0.04455	9	1	219.0726	9.982363	33.03694	104.9410
	219.0726	-0.04455	10	1	209.5253	9.547325	35.95524	114.4883
	209.5253	-0.04455	11	1	200.3940	9.131246	38.74635	123.6195
	200.3940	-0.04455	12	1	191.6607	8.733301	41.41582	132.3528
	191.6607	-0.04455	13	1	183.3080	8.352698	43.96896	140.7055
	183.3080	-0.04455	14	1	175.3193	7.988682	46.41083	148.6942
	175.3193	-0.04455	15	1	167.6788	7.640530	48.74628	156.3348
	167.6788	-0.04455	16	1	160.3712	7.307551	50.97995	163.6423
	160.3712	-0.04455	17	1	153.3822	6.989083	53.11627	170.6314
	153.3822	-0.04455	18	1	146.6977	6.684494	55.15949	177.3159
	146.6977	-0.04455	19	1	140.3045	6.393180	57.11367	183.7091
	140.3045	-0.04455	20	1	134.1899	6.114561	58.98268	189.8236
	134.1899	-0.04455	21	1	128.3418	5.848084	60.77025	195.6717
	128.3418	-0.04455	22	1	122.7486	5.593221	62.47990	201.2649
	122.7486	-0.04455	23	1	117.3992	5.349465	64.11505	206.6144
	117.3992	-0.04455	24	1	112.2828	5.116332	65.67894	211.7307
	112.2828	-0.04455	25	1	107.3895	4.893359	67.17467	216.6241
	107.3895	-0.04455	26	1	102.7094	4.680103	68.60527	221.3042
	102.7094	-0.04455	27	1	98.23326	4.476141	69.97343	225.7803
	98.23326	-0.04455	28	1	93.95219	4.281068	71.28200	230.0614
	93.95219	-0.04455	29	1	89.85770	4.094496	72.53355	234.1559
	89.85770	-0.04455	30	1	85.94164	3.916056	73.73056	238.0720
	85.94164	-0.04455	31	1	82.19625	3.745391	74.87540	241.8174

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237.66	-0.0103	32	1	235.22	2.44	28.10	91.93579	78.61408	-0.04455	33	1	75.18803	3.426052	77.01757	248.8256
235.22	-0.0103	33	1	232.81	2.41	28.84	94.34841	75.18803	-0.04455	34	1	71.91129	3.278742	78.01916	252.1023
232.81	-0.0103	34	1	230.42	2.39	29.57	96.73629	71.91129	-0.04455	35	1	68.77735	3.133940	78.97710	255.2363
230.42	-0.0103	35	1	228.05	2.36	30.29	99.09968	68.77735	-0.04455	36	1	65.77999	2.997361	79.89329	258.2336
228.05	-0.0103	36	1	225.72	2.34	31.01	101.4388	65.77999	-0.04455	37	1	62.91325	2.866734	80.76955	261.1003
225.72	-0.0103	37	1	223.40	2.32	31.71	103.7539	62.91325	-0.04455	38	1	60.17145	2.741800	81.60783	263.8421
223.40	-0.0103	38	1	221.11	2.29	32.41	106.0453	60.17145	-0.04455	39	1	57.54914	2.622310	82.40918	266.4645
221.11	-0.0103	39	1	218.84	2.27	33.11	108.3132	57.54914	-0.04455	40	1	55.04111	2.508028	83.17580	268.9725
218.84	-0.0103	40	1	216.60	2.24	33.79	110.5579	55.04111	-0.04455	41	1	52.64239	2.398727	83.90901	271.3712
216.60	-0.0103	41	1	214.37	2.22	34.47	112.7795	52.64239	-0.04455	42	1	50.34820	2.294169	84.61026	273.6654
214.37	-0.0103	42	1	212.18	2.20	35.14	114.9783	50.34820	-0.04455	43	1	48.15399	2.194206	85.28098	275.8598
212.18	-0.0103	43	1	210.00	2.18	35.81	117.1546	48.15399	-0.04455	44	1	46.05541	2.098581	85.92242	277.9582
210.00	-0.0103	44	1	207.85	2.15	36.47	119.3086	46.05541	-0.04455	45	1	44.04829	2.007124	86.53593	279.9653
207.85	-0.0103	45	1	205.71	2.13	37.12	121.4404	44.04829	-0.04455	46	1	42.12863	1.919652	87.12270	281.8850
205.71	-0.0103	46	1	203.60	2.11	37.77	123.5504	42.12863	-0.04455	47	1	40.29264	1.835992	87.68390	283.7210
203.60	-0.0103	47	1	201.52	2.09	38.40	125.6388	40.29264	-0.04455	48	1	38.53666	1.755979	88.22065	285.4769
201.52	-0.0103	48	1	199.45	2.07	39.04	127.7057	38.53666	-0.04455	49	1	36.85721	1.679452	88.73400	287.1564
199.45	-0.0103	49	1	197.40	2.05	39.66	129.7514	36.85721	-0.04455	50	1	35.25095	1.606260	89.22498	288.7627
197.40	-0.0103	50	1	195.38	2.02	40.28	131.7762	35.25095	-0.04455	51	1	33.71469	1.536259	89.69456	290.2989
195.38	-0.0103	51	1	193.37	2.00	40.89	133.7802	33.71469	-0.04455	52	1	32.24538	1.469307	90.14368	291.7682
193.37	-0.0103	52	1	191.39	1.98	41.50	135.7636	32.24538	-0.04455	53	1	30.84011	1.405274	90.57322	293.1735
191.39	-0.0103	53	1	189.43	1.96	42.10	137.7267	30.84011	-0.04455	54	1	29.49607	1.344031	90.98405	294.5175
189.43	-0.0103	54	1	187.48	1.94	42.69	139.6696	29.49607	-0.04455	55	1	28.21062	1.285457	91.37697	295.8030
187.48	-0.0103	55	1	185.56	1.92	43.28	141.5928	28.21062	-0.04455	56	1	26.98118	1.229436	91.75277	297.0324
185.56	-0.0103	56	1	183.66	1.90	43.86	143.4959	26.98118	0.04455	57	1	25.80532	1.175857	92.11218	298.2083
183.66	-0.0103	57	1	181.77	1.88	44.44	145.3797	25.80532	0.04455	58	1	24.68071	1.124612	92.45594	299.3329
181.77	-0.0103	58	1	179.91	1.86	45.01	147.2442	24.68071	-0.04455	59	1	23.60511	1.075601	92.78472	300.4085
179.91	-0.0103	59	1	178.06	1.85	45.57	149.0895	23.60511	-0.04455	60	1	22.57638	1.028725	93.09916	301.4372
178.06	-0.0103	60	1	176.24	1.83	46.13	150.9159	22.57638	0.04455	61	1	21.59249	0.983893	93.39990	302.4211
176.24	-0.0103	61	1	174.43	1.81	46.68	152.7236	21.59249	0.04455	62	1	20.65147	0.941014	93.68754	303.3621
174.43	-0.0103	62	1	172.64	1.79	47.23	154.5127	20.65147	-0.04455	63	1	19.75147	0.900004	93.96264	304.2621
172.64	-0.0103	63	1	170.87	1.77	47.77	156.2835	19.75147	-0.04455	64	1	18.89069	0.860781	94.22575	305.1229
170.87	-0.0103	64	1	169.12	1.75	48.31	158.0361	18.89069	-0.04455	65	1	18.06742	0.823268	94.47740	305.9462
169.12	-0.0103	65	1	167.38	1.73	48.84	159.7707	18.06742	-0.04455	66	1	17.28003	0.787399	94.71808	306.7336
167.38	0.0103	66	1	165.67	1.72	49.36	161.4876	17.28003	-0.04455	67	1	16.52695	0.753074	94.94827	307.4866
165.67	-0.0103	67	1	163.97	1.70	49.88	163.1868	16.52695	-0.04455	68	1	15.80670	0.720255	95.16842	308.2069
163.97	-0.0103	68	1	162.29	1.68	50.39	164.8686	15.80670	-0.04455	69	1	15.11783	0.688866	95.37899	308.8958
162.29	-0.0103	69	1	160.62	1.66	50.90	166.5331	15.11783	-0.04455	70	1	14.45899	0.658845	95.58037	309.5546
160.62	-0.0103	70	1	158.97	1.65	51.41	168.1806	14.45899	-0.04455	71	1	13.82886	0.630132	95.77298	310.1847
158.97	-0.0103	71	1	157.34	1.63	51.91	169.8112	13.82886	-0.04455	72	1	13.22618	0.602670	95.95720	310.7874
157.34	-0.0103	72	1	155.73	1.61	52.40	171.4251	13.22618	0.04455	73	1	12.64978	0.576405	96.13339	311.3638
155.73	-0.0103	73	1	154.13	1.60	52.89	173.0224	12.64978	-0.04455	74	1	12.09849	0.551285	96.30190	311.9151
154.13	-0.0103	74	1	152.55	1.58	53.37	174.6033	12.09849	-0.04455	75	1	11.57123	0.527260	96.46306	312.4424
152.55	-0.0103	75	1	150.99	1.56	53.85	176.1680	11.57123	-0.04455	76	1	11.06695	0.504281	96.61720	312.9467

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150.99	-0.0103	76	1	149.44	1.55	54.32	177.7167	10.58465	-0.04455	78	1	10.12336	0.461285	96.90563	313.8902
149.44	-0.0103	77	1	147.91	1.53	54.79	179.2494	10.12336	-0.04455	79	1	9.682182	0.441182	97.04048	314.3314
147.91	-0.0103	78	1	146.39	1.52	55.25	180.7665	9.682182	-0.04455	80	1	9.260226	0.421955	97.16946	314.7534
146.39	-0.0103	79	1	144.89	1.50	55.71	182.2680	9.260226	-0.04455	81	1	8.856660	0.403566	97.29282	315.1569
144.89	-0.0103	80	1	143.40	1.49	56.17	183.7541	8.856660	-0.04455	82	1	8.470681	0.385978	97.41080	315.5429
143.40	-0.0103	81	1	141.93	1.47	56.62	185.2249	8.470681	-0.04455	83	1	8.101523	0.369157	97.52363	315.9121
141.93	-0.0103	82	1	140.47	1.46	57.06	186.6807	8.101523	-0.04455	84	1	7.748453	0.353069	97.63156	316.2652
140.47	-0.0103	83	1	139.03	1.44	57.50	188.1215	7.748453	-0.04455	85	1	7.410771	0.337682	97.73477	316.6020
139.03	-0.0103	84	1	137.61	1.43	57.94	189.5476	7.410771	-0.04455	86	1	7.087805	0.322966	97.83349	316.9258
137.61	-0.0103	85	1	136.20	1.41	58.37	190.9590	7.087805	-0.04455	87	1	6.778914	0.308891	97.92791	317.2347
136.20	-0.0103	86	1	134.80	1.40	58.80	192.3559	6.778914	-0.04455	88	1	6.483484	0.295429	98.01821	317.5301
134.80	-0.0103	87	1	133.42	1.38	59.22	193.7386	6.483484	-0.04455	89	1	6.200930	0.282554	98.10458	317.8127
133.42	-0.0103	88	1	132.05	1.37	59.64	195.1070	6.200930	-0.04455	90	1	5.930689	0.270240	98.18718	318.0829
132.05	-0.0103	89	1	130.69	1.35	60.05	196.4614	5.930689	-0.04455	91	1	5.672226	0.258463	98.26619	318.3414
130.69	-0.0103	90	1	129.35	1.34	60.46	197.8019	5.672226	-0.04455	92	1	5.425027	0.247199	98.34175	318.5886
129.35	-0.0103	91	1	128.03	1.33	60.87	199.1287	5.425027	-0.04455	93	1	5.188601	0.236426	98.41402	318.8250
128.03	-0.0103	92	1	126.71	1.31	61.27	200.4418	5.188601	-0.04455	94	1	4.962478	0.226122	98.48313	319.0511
126.71	-0.0103	93	1	125.41	1.30	61.67	201.7415	4.962478	-0.04455	95	1	4.746210	0.216267	98.54924	319.2674
125.41	-0.0103	94	1	124.13	1.29	62.06	203.0279	4.746210	0.04455	96	1	4.539367	0.206842	98.61246	319.4742
124.13	-0.0103	95	1	122.85	1.27	62.45	204.3010	4.539367	-0.04455	97	1	4.341539	0.197828	98.67293	319.6721
122.85	-0.0103	96	1	121.59	1.26	62.83	205.5611	4.341539	-0.04455	98	1	4.152332	0.189207	98.73077	319.8613
121.59	-0.0103	97	1	120.35	1.25	63.21	206.8083	4.152332	-0.04455	99	1	3.971370	0.180961	98.78608	320.0422
120.35	-0.0103	98	1	119.11	1.23	63.59	208.0427	3.971370	-0.04455	100	1	3.798295	0.173074	98.83899	320.2153
119.11	-0.0103	99	1	117.89	1.22	63.97	209.2644	3.798295	-0.04455	101	1	3.632763	0.165532	98.88958	320.3808
117.89	-0.0103	100	1	116.68	1.21	64.33	210.4736	3.632763	-0.04455	102	1	3.474445	0.158318	98.93798	320.5392
116.68	-0.0103	101	1	115.48	1.20	64.70	211.6704	3.474445	-0.04455	103	1	3.323027	0.151418	98.98426	320.6906

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Line		J	F	M	A	M	J	Jy	A	S	O	N	D	Y
1	T °C	-3.2	-2.1	3.3	9.7	15.3	20.1	22.5	21.7	17.7	11.4	5.3	-0.9	10.1
2	I	0	0	0.53,	2.73,	5.44	8.22	9.75	9.23	6.78	3.48	1.09	0	47.25
3	Unadj. PE	0	0	0.4	1.3	2.3	3.2	3.7	3.5	2.8	1.6	0.6	0	
4	PE	0	0	12	43	86	121	141	125	87	46	15	0	
5	P	70.4	73.4	90.4	88.6	95.3	97.0	102.9	84.6	89.7	81.3	92.5	80.3	1046.4
6	P-PE	70.4	73.4	78.4	45.6	9.3	-24	-38.1	-40.4	2.7	35.3	77.5	80.3	370.4
7	Acc Pot WL	0	0	0	0	0	-24	-62.1	-102.5	0	0	0	0	
8	ST	275.7	349.7	125	125	125	102	75	54	56.7	92	125	205.3	
9	Δ ST	0	0	0	0	0	-23	-27	-21	+2.7	+35.3	+33	0	
10	AE*	0	0	12	43	86	120	129.9	105.6	87	46	15	0	644.5
11	D	0	0	0	0	0	1	11.1	19.4	0	0	0	0	31.5
12	S	0	0	78.4,	45.6	9.3	0	0	0	0	0	44.5	0	177.8
13	RO	7.8	5.5	39.2	42.4	21.5	12.9	6.5	3.2	2	1	22.5	13.3	177.8
14	SMRO	0	0	22.4	100	50	25	12	6	3	3	2.7	0	224.1
15	Tot RO	7.5	5.5	61.6	142.4	71.5	37.9	18.5	9.2	5	4	22.7	13.3	401.9
16	DT	131.7	128.9	368.7	210.3	186	126.5	87.8	62.8	62	97.7	180.2	122.7	

Note: PE, P in mm

- Use Shallow rooted silt loam: water holding capacity = 200mm/m

* Line 4 or Line 5 + |Line 9|

Retention Table 125mm, No. 27 Page 29

Computation Repeated For
- Fine Sand 2 of 4
- Clay Loam 3 of 4

(Silt Loam)

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Assume Grass-Rooted Crops (Ref pg 244, Table 10)

Soil Type	Water Holding Capacity (Table)	Actual Evapo Transp.	Run Off	Snow Melt Run Off	Total Precip
Fine Sand	5 cm	62.13 cm	19.61	22.91	104.65 cm
Clay Loam	10 cm	63.82 cm	18.38 cm	22.41 cm	104.61 cm
Silt Loam	12.5 cm	64.45 cm	17.78 cm	22.41 cm	104.64 cm.

Assume No Run-Off
- Railroad Berm Down Grade
- Leachate Lagoon Is Topographical Low & Receives Any Runoff

Then All Run Off Infiltrates - Ultimately

Leachate Estimates Are

- Fine Sand 19.61 cm + 22.91 cm = 42.52 cm; 16.7 inches
- Clay Loam 18.38 cm + 22.45 cm = 40.83 cm; 16.1 inches
- Silt Loam 17.78 cm + 22.41 cm = 40.19 cm; 15.8 inches

Mean = 16.2" σ, 0.458
Median = 16.2"

} 41.15 cm

16.2 inches Annually

AR302552

22-141 50 SHEETS
22-142 100 SHEETS
22-144 200 SHEETS
AMPAD

APPENDIX G

RISK ASSESSMENT

- TECHNICAL APPROACH
- COMPUTATIONS
- REFERENCE DOSE CALCULATION (FENAC)

TECHNICAL APPROACH

DRAKE CHEMICAL RI/FS NO ACTION AND REMEDIAL ALTERNATIVE TECHNOLOGY RISK ASSESSMENT

Introduction

This Technical Approach has been prepared to establish the framework for performing the public and environmental health effects assessment(s) at the Drake Chemical Site. This has been made necessary as a result of the recent decision to perform the RI/FS in an accelerated fashion. It has been prepared using existing knowledge from previous studies in conjunction with a partially completed database of information from the current Phase III Study.

The preliminary review of data collected in the Phase III Study supports previous conclusions. From a risk analysis perspective, these conclusions include; groundwater beneath the site is heavily contaminated with site related contaminants, nearby downgradient, offsite groundwater is also contaminated with site associated contaminants, though, it appears to be less severly impacted than the waters beneath the site. There is also indication that groundwaters distant from the site have also been impacted.

Included in this Technical Approach are a revised (from the WP) preliminary risk assessment (RPRA) based on a partial database (VOAs, 2-naphthylamine and fenac in groundwaters). The RPRA was conducted to get an initial analysis of the conditions so that the fast-track RI/FS could be focused to the most pressing issues. This is necessary because the FS is being conducted simultaneously and risk analysis information is required in the alternatives screening process. Also included in this Technical Approach are discussions of data and data qualifiers to be employed for the P&EHA (i.e., the risk assessment). Exposure scenarios, dose/risk models and parameters, a revised ARARs table are provided. The reader is cautioned that the data and assessment presented herein are preliminary and subject to change and the characterization of risks may change when a full databased is employed.

Revised Preliminary Risk Assessment

The purpose of this assessment is to provide an updated (from the WP) review of the current and potential future public health risks posed by the contaminated groundwater beneath the Drake Chemical Site and the surrounding property. The assessment will be based on a worst case scenario from ingestion of the contaminated groundwater using only analyses of VOAs, 2-naphthylamine and Fenac.

Based on previous sampling and analytical activities contaminant concentrations which exceed various ARARs (Applicable Relevant and Appropriate Requirements) have been detected in the groundwater at and around the Drake Chemical Site. These contaminants are also present in analytical results obtained from the most recent sampling efforts. Compounds including benzene, vinyl chloride, trichloroethene, 1,2-dichloroethane, chloroform and 1,1,2-trichloroethane are suspected carcinogens. Toluene, ethylbenzene, chlorobenzene, 1,2-dichlorobenzene, 1,3-dichlorobenzene and 1,4-dichlorobenzene are compounds known or suspected to cause adverse health effects. The compounds Fenac and 2-naphthylamine are also present in groundwater samples and are specific to known previous activities at the Drake Site.

The contamination is most extensive beneath the Site and just beyond the boundary. The plume of contamination is migrating to the southeast in the direction of the regional groundwater flow.

Groundwater Ingestion

The site and surrounding area has been divided into 3 zones of groundwater contamination. Zone 1 is defined as the area onsite and offsite bordered by the Penn Central RailRoad track bed. The data from samples taken from monitoring wells in this area will be used to attain a fenceline value of risk from site related contaminants. Zone 2 is defined as the area southeast of the site bordered by the Penn Central RailRoad track bed and Route 220 North. Zone 3 is the offsite area bordered by Route 220 North and Bald Eagle Creek.

Zone 1

Monitoring well samples from the area near the site fence line show the greatest extent of contamination. Maximum observed concentrations of the suspected human carcinogens 2-naphthylamine (3000 ug/l), chloroform (840 ug/l), benzene (110 ug/l), trichloroethene (500 ug/l) and 1,1,2-trichloroethane (12 ug/l) exceed Maximum Contaminant Levels (MCLs), Maximum Contaminant Level Goals (MCLGs), EPA Drinking Water Health Advisories and Ambient Water Quality Criteria (AWQC). Table 1 identifies the preliminary range of estimated health risks associated with potential ingestion to the Zone 1 maximum concentration of indicator compounds detected in groundwater.

The Hazard Index is less than one for individual indicator compounds, but exceeds unity additively. This result indicates that exposure to site contamination is likely to be associated with noncarcinogenic health effects. The carcinogenic risk estimates for ingestion suggest a significant potential carcinogenic risk to receptors. Carcinogenic risk represents the probability that a carcinogenic effect will occur.

Zone 2

Samples taken from the area just beyond the site fence line to the berm of Route 220 North indicate a general attenuating of contamination concentration. Suspected carcinogens including benzene (76 ug/l), trichloroethene (140 ug/l), 1,2-dichloroethane (680 ug/l), chloroform (32 ug/l) and 2-naphthylamine (13 ug/l) exceed MCLs, MCLGs, EPA Drinking Water Health Advisories and AWQC. The range of preliminary estimated health risks associated with potential ingestion of the maximum contamination concentration of indicator compounds detected in samples taken from zone 2 monitoring wells (Table 2).

The Hazard Index is less than one for those associated compounds both additively and individually. This result indicates that exposure to site contamination is unlikely to be associated with noncarinogenic health effects. The carcinogenic risk to potential groundwater consumption receptors, however, suggests a significant added carcinogenic risk.

Zone 3

Monitoring well samples from the area southeast of the site bordered by Route 220 North and Bald Eagle Creek indicate the occurance of low levels of site related contaminants. The compounds benzene (1.8 ug/l), vinyl chloride (1.6 ug/l), trichloroethene (28 ug/l), 1,2-dichloroethane (210 ug/l) and chloroform (45 ug/l) exceed MCLGs, PMCLGs and AWQC.

Both individual compound and total Hazard Index valves are less than one for Zone 3 groundwater ingestion. These results indicate that exposure to these contaminant concentrations is unlikely to cause adverse noncarcinogenic health effects (Table 3). The carcinogenic risk to receptors who may ingest groundwater suggest a carcinogenic risk less than in Zones 1 and 2.

Risk Assessment Approach

As indicated local groundwater is contaminated by Site associated contaminants. It is not however used as a potable water source (the community is serviced by a municipal water supply) and poses a low actual exposure risk. The site and surrounding area will be divided into three distinct "zones" and corresponding risks to human health will be calculated for the ingestion of the groundwater within these zones based on measured concentrations using methods considered normal and relevant on a nation-wide basis. These methodologies will be obtained from the most recent guidance documents including the Superfund Public Health Evaluation Manual and Superfund Exposure Assessment Manual. This assessment will provide EPA decision makers with a quantitative analysis of the risk posed by site conditions. The use of standard methodologies will provide a means for policy makers to compare the risks present at the Drake Chemical Site with other sites throughout the nation. This will enhance the Agency's risk management decision making process with respect to clean up costs, fund balancing and related policy matters.

Revised ARARs

Table 4 is an updated listing of the risk assessment related ARARs. This has been revised from the May 1987 Work Plan.

Data to be used in the Assessment

The analytical data generated by fixed base laboratory (CLP & REM III Team Labs) and field screening activities from samples taken from the Drake Chemical Site support the development of a public health evaluation. The public and environmental health assessment will be primarily based on Level IV and Level V data.

Volatile organic compounds are more mobile in environmental media than most base-neutral-acid extractables, pesticides or PCBs. The data generated by EPA methods 601/602 will, therefore, be used as a major analytical parameter in determining contaminant migration potential and calculating a public health risk. This data is characterized by rigorous QA/QC protocols outlined for Level V Data Quality Objectives (DQOs). Analyses for Fenac and 2-naphthylamine are also Level V quality. ertain BNA analyses are Level V while the majority are Level IV. All Pesticide/PCB and metals analyses are Level IV data.

Field screening data for volatile organic compounds and laboratory analyses for select phenolics (Level II) will also be used as a qualitative indicator of the extent of site related contamination in soils both on and offsite. The associated numerical values, however, will not be used directly in calculating risk since the QA/QC requirements associated with this data are deficient for this purpose. This Level II data will however be used for source characterization and therefore it may input into the groundwater contaminant transport model. As a consequence, when the modeling results are employed to evaluate the effectiveness of remedial alternatives, (by simulating source control) the Level II data will be indirectly used in the assessment of risks associated with site remediation.

Data Validation

A systematic data validation review was performed on the available VOA, fenac, and 2-naphthylamine data. Validation of the remainder of the analytical data is forthcoming. Validation provides the user with some assurance that the values are adequate for their intended use. The data has been qualified with letter designators to assist the user in the application of the data and the analytical certainity as specified by method precision and accuracy criteria. For assessment purposes the qualifiers B and R affect data usability and values with these qualifiers are not used in the assessment. All other qualified data is used "as is" unless some clear statistical estimation of bias can be determined. These qualifiers will not be applied to the numerical results in the preliminary risk assessment.

Exposure Scenarios to be considered

No human receptors of contaminated groundwater from the Site have been defined and none are expected in future development of the area. All risks associated with surfacial and shallow soil contamination (volatilization, wind erosion of particulates, dermal contact, accidental ingestion, etc.) have been characterized in previous studies and they will not be revisited in this analysis.

Consequently, the assessment will be focused exclusively on direct contact with groundwater through ingestion and direct contact with potentially affected surface waters. Contrasts of measured contaminant cncentrations with ARARs will be the primary means of determining remediation requirements.

Following are the exposure scenarios and dose models to be used for this assessment.

CASE A) Ingestion of groundwater: Adults

1) Lifetime Carcinogenic Effects Eq - 1

$$Risk_i = \frac{mg}{l} \; \frac{2l}{day} \; \frac{1}{70 \text{ kg man}} \quad q^*$$

$$Risk_{Total} = Risk_i \qquad \text{Eq - 2}$$

2) Chronic Non Carcinogenic Effects

$$HI_i = \frac{mg}{l} \quad \frac{2l}{day} \quad \frac{1}{70\ kg\ man} \quad \frac{1}{RfDose} \qquad \text{Eq - 3}$$

$$HI_{Total} = HI_i \qquad \text{Eq- 4}$$

CASE B) Ingestion of Fish, Adult

1) Lifetime Carcinogenic Effects Eq - 5

$$Risk_j = \frac{mg}{l} \quad \frac{BCF}{} \quad \frac{6.5\ gram}{day} \quad \frac{1l}{10^3 gram} \quad \frac{1}{70\ kg} \quad q^*$$

$$Risk_{Total} = Risk_j \qquad \text{Eq - 6}$$

2) Chronic Non Carcinogenic Effects Eq - 7

$$HI_j = \frac{mg}{l} \quad \frac{6.5\ gram}{day} \quad \frac{1l}{10^3 gram} \quad \frac{1}{70\ kg} \quad \frac{1}{RfDose}$$

$$HI_{Total} = HI_j \qquad \text{Eq - 8}$$

CASE C) Dermal Contact While Swimming; Child, 10yr period

1) Lifetime Carcinogenic Effects Eq - 9

$$Risk_k = \frac{mg}{l} \quad \frac{0.5mg}{cm^2\text{-}hr} \quad \frac{2hr}{day} \quad \frac{12day}{yr} \quad \frac{10yr}{1} \quad \frac{1}{70yr} \quad \frac{1yr}{365day} \quad \frac{1}{45kg} \quad \frac{1l}{10^3 mg} \quad \frac{12,000cm^2}{1} \quad q^*$$

$$Risk_{Total} = Risk_k \qquad \text{Eq - 10}$$

2) Chronic Non Carcinogenic Effects Eq - 11

$$HI_r = \frac{mg}{l} \quad \frac{0.5mg}{cm^2 hr} \quad \frac{2hr}{day} \quad \frac{12,000cm^2}{1} \quad \frac{1l}{10^3 mg} \quad \frac{1}{RfDose}$$

$$HI_{Total} = HI_k \qquad \text{Eq - 12}$$

CASE D) Accidental Ingestion During Swimming; Child, 10 yr. period

1) Lifetime Carcinogenic Effects Eq - 13

$$Risk_l = \frac{mg}{l} \quad \frac{0.24l}{day} \quad \frac{12day}{yr} \quad \frac{10yr}{1} \quad \frac{1}{45kg} \quad \frac{1yr}{365day} \quad \frac{1}{70yr} \quad \frac{1}{45kg} \quad q^*$$

$$Risk_{Total} = Risk_l$$

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2) Chronic Non Carcinogenic Effects Eq - 14

$$HI_1 = \frac{mg}{l} \quad \frac{0.24l}{day} \quad \frac{1}{45kg}$$

$$HI_{Total} = HI_1$$

CASE E) Summation of River Exposure Scenarios

1) Lifetime Carcinogenic Effects Eq - 15

$$Risk_{River} = Risk_{j,k,l}$$

2) Non Carcinogenic Effects Eq - 16

$$HI_{River} = HI_{j,k,l}$$

Dermal and absorption in the alimentary tract will be assumed to be 100% unless literature data indicate otherwise.

In general, HI's will be computed without differentiation as to the target organ or type effect associated with the specific chemical exposure. However, in cases where the HI approaches or exceeds unity, the HI will be apportioned according to the appropriate chemical specific toxicological response factors.

Due to time constraints, and not withstanding those presented in Table 4. NUS will not attempt to develop CPFs (Carcinogenicity Potency Factors), RfDs (Reference Doses) or ARARs for site contaminants other than 2-naphthylamine or fenac. At this point, it appears likely that a RfD for Fenac will have to be derived from non human, mammalian acute toxicity data using a safety factor approach. A CPF for 2-naphthylamine has been derived previously.

A no action Risk Assessment will be prepared reflective of "worst-case" conditions by using maximum observed concentrations. Additionally, a "best estimate" assessment reflective of the general conditions will also be provided. The "best estimate" will be based on measures of central tendancy such as the mean, median, 95% trimmed mean or geometric mean for the zones. A determination of the proper statistic to be employed will be based on a more detailed evaluation of the data and its distribution.

TABLE 1

PRELIMINARY RANGE OF THE ESTIMATED HEALTH IMPACTS
FROM THE INGESTION OF GROUNDWATER
DRAKE CHEMICAL SITE, LOCK HAVEN, PENNSYLVANIA
ZONE 1

Chemical	Maximum Concentration µg/l	Adult Daily Dosage mg/kg/day	Reference Dose (RfD)[1,2] mg/kg/day	Carcinogenicity Potency Factor[1,2]	Hazard Index	Estimated Lifetime Excess Cancer Risk
Bennene	110	3.14×10^{-3}	-	5.20×10^{-2}	-	1.63×10^{-4}
Vinyl Chloride	64	1.83×10^{-3}	-	2.30	-	4.21×10^{-3}
Trichloroethene	500	1.43×10^{-2}	-	1.10×10^{-2}	-	1.57×10^{-4}
Ethylbennene	1100	3.14×10^{-2}	9.70×10^{-1}	-	3.24×10^{-2}	-
Toluene	8100	2.31×10^{-1}	4.30×10^{-1}	-	5.37×10^{-1}	-
Chlorobennene	8800	2.51×10^{-1}	2.70×10^{-1}	-	9.27×10^{-1}	-
1,2-Dichloroethane	6500	1.86×10^{-1}	-	9.10×10^{-2}	-	1.69×10^{-2}
Chloroform	840	2.40×10^{-2}	-	8.10×10^{-2}	-	1.94×10^{-3}
B-naphthylamine	3000	8.57×10^{-2}	-	5.05	-	4.33×10^{-1}
Fenac	20,000	5.71×10^{-1}	-	-	-	-
1,1,2-trichloroethane	12	3.43×10^{-4}	-	5.73×10^{-2}		1.97×10^{-5}
				Total	1.50	4.56×10^{-1}

1. USEPA - 1986
2. USEPA - 1987 update

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TABLE 2

PRELIMINARY RANGE OF THE ESTIMATED HEALTH IMPACTS
FROM THE INGESTION OF GROUNDWATER
DRAKE CHEMICAL SITE, LOCK HAVEN, PENNSYLVANIA
ZONE 2

Chemical	Maximum Concentration µg/l	Adult Daily Dosage mg/kg/day	Reference Dose (RfD)[1,2] mg/kg/day	Carcinogenicity Potency Factor[1,2]	Hazard Index	Estimated Lifetime Excess Cancer Risk
Bennene	76	2.17×10^{-3}	-	5.20×10^{-2}	-	1.13×10^{-4}
Chlorobennene	7000	2.10×10^{-1}	2.70×10^{-1}	-	7.78×10^{-1}	-
Trichloroethene	140	4.00×10^{-3}	-	1.10×10^{-2}	-	4.40×10^{-5}
1,2-Dichloroethane	680	1.94×10^{-2}	-	9.10×10^{-2}	-	1.77×10^{-3}
Chloroform	32	9.14×10^{-4}	-	8.10×10^{-2}	-	7.40×10^{-6}
Toluene	32	9.14×10^{-4}	4.30×10^{-1}	-	2.13×10^{-3}	-
Fenac	7600	2.17×10^{-1}	-	-	-	-
B-naphthylamine	13	3.71×10^{-4}	-	5.05	-	1.87×10^{-3}
				Total	0.78	3.80×10^{-3}

1. USEPA - 1986
2. USEPA - 1987 update

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TABLE 3

PRELIMINARY RANGE OF THE ESTIMATED HEALTH IMPACTS
FROM THE INGESTION OF GROUNDWATER
DRAKE CHEMICAL SITE, LOCK HAVEN, PENNSYLVANIA
ZONE 3

Chemical	Maximum Concentration µg/l	Adult Daily Dosage mg/kg/day	Reference Dose (RfD)[1,2] mg/kg/day	Carcinogenicity Potency Factor[1,2]	Hazard Index	Estimated Lifetime Excess Cancer Risk
Bennene	1.8	5.14×10^{-5}	-	5.20×10^{-2}	-	2.67×10^{-6}
Vinyl Chloride	1.6	4.57×10^{-5}	-	2.30	-	1.05×10^{-4}
Trichloroethene	28	8.00×10^{-4}	-	1.10×10^{-2}	-	8.80×10^{-6}
Ethylbennene	-	-	9.70×10^{-1}	-	-	-
Toluene	1.0	2.86×10^{-5}	4.30×10^{-1}	-	6.65×10^{-5}	
Chlorobennene	26	7.43×10^{-4}	2.70×10^{-1}	-	2.75×10^{-3}	-
1,2-dichloroethane	210	6.00×10^{-3}	-	9.10×10^{-2}	-	5.46×10^{-4}
Chloroform	45	1.29×10^{-3}	-	8.10×10^{-2}	-	1.04×10^{-4}
Fenac	700	2.00×10^{-2}	-	-	-	-
				Total	2.82×10^{-3}	7.66×10^{-4}

1. USEPA - 1986
2. USEPA - 1987 update

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TABLE 4

COMPARISON OF EXISTING DATA AND HEALTH BASED ARARS

Constituent	NPDWR (µg/l)		Longer Term Health Advisories (µg/l)		AWQC			
					Aquatic Life (µg/l)		Human Health (µg/l)	
	MCLs/PMCLs	MCLGs/PMCLGS	Child	Adult	Acute	Chronic	Ingestion of Drinking Water and Aquatic Life	Ingestion of Drinking Water
Fenac	NKC/NKC	NKC/NKC	NKC	NKC	NKC	NKC	NKC	NKC
2,4-dimethylphenol	NKC/NKC	NKC/NKC	NKC	NKC	2,120	NKC	400	400
2,4-dichlorophenol	NKC/NKC	NKC/NKC	NKC	NKC	2,020	365	3,090	3,090
2,4-dinitrophenol	NKC/NKC	NKC/NKC	NKC	NKC	NKC	NKC	NKC	NKC
Phenol	NKC/NKC	NKC/NKC	NKC	NKC	10,200	2,560	3,500	3,500
Benzene	5.0/NKC	0.0/NKC	NKC	NKC	5,300	NKC	0(.66)*	0(.67)*
Chlorobenzene	NKC/NKC	NKC/60.0	9,000	30,000	250	NKC	NKC	NKC
Chloroform	100/NKC	NKC/NKC	NKC	NKC	28,900	1,240	0(.19)*	0(.19)*
1,2-dichloroethane	5/NKC	0.0/NKC	740	2,600	NKC	NKC	NKC	NKC
Ethylbenzene	NKC/NKC	NKC/680	NKC	NKC	32,000	NKC	NKC	NKC
Toluene	NKC/NKC	NKC/2000.0	NKC	NKC	17,500	NKC	14,300	15,000
Trichloroethene	5.0/NKC	0.0/0.0	NKC	NKC	NKC	NKC	NKC	NKC
1,2-dichlorobenzene	NKC/NKC	NKC/620.0	NKC	NKC	1,120	763	400	470
1,4-dichlorobenzene	75.0/NKC	75.0/NKC	NKC	NKC	1,120	763	400	470
Arsenic	50/NKC	NKC/50	50	50	440	NKC	0(.0022)*	0(.025)*
Beryllium	NKC/NKC	NKC/NKC	NKC	NKC	130	5.3	0(.0017)*	0(.0039)*

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TABLE 4
COMPARISON OF EXISTING DATA AND HEALTH BASED ARARS
PAGE TWO

Constituent	NPDWR (µg/l)		Longer Term Health Advisories (µg/l)		AWQC			
					Aquatic Life (µg/l)		Human Health (µg/l)	
	MCLs/PMCLs	MCLGs/PMCLGS	Child	Adult	Acute	Chronic	Ingestion of Drinking Water and Aquatic Life	Ingestion of Drinking Water
Total 1,2-dichloroethene	NKC/NKC	NKC/70	1000	3500	11,600	NKC	ID	ID
B-naphthylamine	NKC/NKC	NKC/NKC	NKC	NKC	NKC	NKC	NKC	NKC
Vinyl Chloride	2.0/1.0	0/NKC	13	46	NKC	NKC	0(2.0)*	0(2.0)*
1,1-dichloroethane	NKC/NKC	NKC/NKC	NKC	NKC	NKC	NKC	ID	ID
1,1,1-trichloroethane	200/NKC	200/NKC	35,000	125,00	18,000	8,400	18,400	19,000
1,3-dichlorobenzene	NKC/NKC	NKC/NKC	8,930	31,250	NKC	NKC	400	400
Lead	50.0/NKC	NKC/20.0	20 µg/day	20 µg/day	**	**	5200	5200
Mercury	2.0/NKC	NKC/3.0	NKC	NKC	0.0017	0.00057	50	50
Nickel	NKC/NKC	NKC/NKC	NKC	NKC	**	**	13.4	15.4
Thallum	NKC/NKC	NKC/NKC	NKC	NKC	1,400	40	13	17.8
Zinc	NKC/NKC	NKC/NKC	NKC	NKC	**	47	5,000	5,000

GW - Groundwater
SW - Surface Water
NPDWR - National Primary Drinking Water Regulations
MCLs - Maximum Contaminant Level (µg/l)

PMCL - Proposed MCL
MCLG - Maximum Contaminant Level Goal (µg/l)
PMCLG - Proposed MCLG
AWQC - Ambient Water Quality Criteria (µg/l)

ND - Not Detected
NA - Not Analyzed
NKC - No Known Criterion For This Category
* - AWQC is zero. The value in parentheses corresponds to a 1×10^{-6} lifetime cancer risk.
** - Criterion dependent on water hardness.
ID - Insufficient Data

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DRAKE CHEMICAL RI/FS
JOB 0620Y/552
DOSE & RISK COMPUTATIONS
PUBLIC & ENVIRONMENTAL HEALTH ASSESSMENT

SUBJECT: GW INGESTION, ZONE 1, WORST-CASE, MAXIMUM OBSERVATIONS.

DESCRIPTION	C UG/L	L/DAY	KG	MG/UG	DOSE MG/KG-DAY	CPF q*	REF. DOSE	CA RISK	% OF TOAL	NON CA RISK	% OF TOTAL	COMMENT
BENZENE	110	2	70	1000	0.003142	0.052		1.63E-04	0.000203	0	0	
TOLUENE	8100	2	70	1000	0.231428		0.3	0.00E+00	0	0.771428	0.011631	
ETHYLBENZENE	1600	2	70	1000	0.045714		0.1	0.00E+00	0	0.457142	0.006892	
CHLOROBENZENE	18000	2	70	1000	0.514285		0.027	0.00E+00	0	19.04761	0.287197	
1,1,2,2-DCA	0.09	2	70	1000	0.000002	0.2		5.14E-07	0.000000	0	0	
1,1,1-TCA	1	2	70	1000	0.000028		0.086	0.00E+00	0	0.000332	0.000005	
1,1,2-TCA	12	2	70	1000	0.000342	0.0573		1.96E-05	0.000024	0	0	
1,1-DCA	1.1	2	70	1000	0.000031	0.091	0.12	2.86E-06	0.000003	0.000261	0.000003	
1,2-DCA	5100	2	70	1000	0.145714	0.091		1.33E 02	0.016543	0	0	
TETRACHLOROETHENE	12	2	70	1000	0.000342	0.051	0.02	1.75E-05	0.000021	0.017142	0.000258	
TRICHLOROETHENE	500	2	70	1000	0.014285			0.00E+00	0	0	0	
TRANS-1,2-DCE	0.11	2	70	1000	0.000003			0.00E+00	0	0	0	
1,1-DCE	1.4	2	70	1000	0.00004	0.009	0.58	3.60E-07	0.000000	0.000068	0.000001	
V.C.	64	2	70	1000	0.001828	2.3		4.21E-03	0.005247	0	0	
CHLOROFORM	840	2	70	1000	0.024	0.081		1.94E-03	0.002425	0	0	
METHYLENE CHLORIDE	210	2	70	1000	0.006	0.0075	0.06	4.50E-05	0.000056	0.1	0.001507	
CIS-1,2-DCE	34	2	70	1000	0.000971			0.00E+00	0	0	0	
1,2-DCBZ	530	2	70	1000	0.015142			0.00E+00	0	0	0	
1,3-DCBZ	100	2	70	1000	0.002857			0.00E+00	0	0	0	
1,4-DCBZ	140	2	70	1000	0.004			0.00E+00	0	0	0	
1,2,4-TCBZ	130	2	70	1000	0.003714		0.02	0.00E+00	0	0.185714	0.002800	
BIS(2-ETHYLHEXYL)	2	2	70	1000	0.000057	0.000684		3.91E-08	0.000000	0	0	
NAPHTHALENE	29	2	70	1000	0.000828		0.41	0.00E+00	0	0.002020	0.000030	
NITROBENZENE	20	2	70	1000	0.000571			0.00E+00	0	0	0	
2,4-DMP	220	2	70	1000	0.006285			0.00E+00	0	0	0	
2-CHLOROPHENOL	47	2	70	1000	0.001342			0.00E+00	0	0	0	
2,4-DICHLOROPHENOL	210	2	70	1000	0.006		0.003	0.00E+00	0	2	0.030155	
FENAC	20000	2	70	1000	0.571428		0.07	0.00E+00	0	8.163265	0.123084	
B-NAPHTH	5300	2	70	1000	0.151428	5.05		7.65E-01	0.954084	0	0	
PHENOL	2500	2	70	1000	0.071428		0.04	0.00E+00	0	1.785714	0.026924	
ARSENIC	400	2	70	1000	0.011428	1.5		1.71E-02	0.021388	0	0	
CADMIUM	202	2	70	1000	0.005771		0.00029	0.00E+00	0	19.90147	0.300072	
CHROMIUM	440	2	70	1000	0.0126		0.005	0.00E+00	0	2.56	0.038599	
COPPER	299	2	70	1000	0.008542			0.00E+00	0	0	0	
LEAD	23.7	2	70	1000	0.000677		0.0014	0.00E+00	0	0	0	BACKGROUND
MANGANESE	129000	2	70	1000	3.685714		0.22	0.00E+00	0	0	0	BACKGROUND
MERCURY	1	2	70	1000	0.000028		0.0014	0.00E+00	0	0.020408	0.000307	
NICKEL	424	2	70	1000	0.012114		0.01	0.00E+00	0	1.211428	0.018265	
SILVER	19	2	70	1000	0.000542		0.003	0.00E+00	0	0.180952	0.002728	
THALLIUM	25	2	70	1000	0.000714		0.0004	0.00E+00	0	1.785714	0.026924	
VANADIUM	177	2	70	1000	0.005057		0.0057	0.00E+00	0	0.887218	0.013377	
ZINC	4150	2	70	1000	0.118571		0.21	0.00E+00	0	0.564625	0.008513	
CYANIDE	6780	2	70	1000	0.193714		0.029	0.00E+00	0	6.679802	0.100717	
TOTAL						TOTAL CA		8.02E-01		---------	1	
						TOTAL NONCA				66.32233		

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DRAKE CHEMICAL RI/FS
JOB #620Y/552
DOSE & RISK COMPUTATIONS
PUBLIC & ENVIRONMENTAL HEALTH ASSESSMENT

SUBJECT: GW INGESTION, ZONE 2, WORST-CASE, MAXIMUM OBSERVATIONS.

DESCRIPTION	C UG/L	L/DAY	KG	MG/UG	DOSE MG/KG-DAY	BACKGROUND SUBTRACTIONS CPF q*	REF. DOSE	CA RISK	% OF TOAL	NON CA RISK	% OF TOTAL	COMMENTS
BENZENE	76	2	70	1000	0.002171	0.052		1.13E-04	0.016634		0	
TOLUENE	32	2	70	1000	0.000914		0.3	0.00E+00	0	0.003047	0.000100	
CHLOROBENZENE	11000	2	70	1000	0.314285		0.027	0.00E+00	0	11.64021	0.384428	
1.1.2-TCA	6.3	2	70	1000	0.00018	0.0573		1.03E-05	0.001519		0	
1.1-DCA	0.88	2	70	1000	0.000025	0.091	0.12	2.29E-06	0.000337	0.000209	0.000006	
1.2-DCA	680	2	70	1000	0.019428	0.091		1.77E-03	0.260467		0	
TETRACHLOROETHENE	3.3	2	70	1000	0.000094	0.051	0.02	4.81E-06	0.000708	0.004714	0.000155	
TRICHLOROETHENE	130	2	70	1000	0.003714	0.011		4.09E-05	0.006019		0	
TRANS-1.2-DCE	1	2	70	1000	0.000028			0.00E+00	0		0	
1.1-DCE	0.97	2	70	1000	0.000027	0.009	0.58	2.49E-07	0.000036	0.000047	0.000001	
VINYL CHLORIDE	2.5	2	70	1000	0.000071	2.3		1.64E-04	0.024203		0	
CHLOROFORM	620	2	70	1000	0.017714	0.081		1.43E-03	0.211387		0	
METHYLENE CHLORIDE	2.7	2	70	1000	0.000077	0.0075	0.06	5.79E-07	0.000085	0.001285	0.000042	
CIS-1.2-DCE	2.2	2	70	1000	0.000062			0.00E+00	0		0	
1.2-DCBZ	56	2	70	1000	0.0016			0.00E+00	0		0	
1.4-DCBZ	27	2	70	1000	0.000771			0.00E+00	0		0	
1.2.4-TCBZ	120	2	70	1000	0.003428		0.02	0.00E+00	0	0.171428	0.005661	
PHENOL	360	2	70	1000	0.010285		0.04	0.00E+00	0		0	
2.4-DMP	41	2	70	1000	0.001171			0.00E+00	0		0	
2-CHLOROPHENOL	24	2	70	1000	0.000685			0.00E+00	0		0	
2.4-DICHLOROPHENOL	31	2	70	1000	0.000885		0.003	0.00E+00	0	0.295238	0.009750	
FENAC	9200	2	70	1000	0.262857		0.07	0.00E+00	0	3.755102	0.124015	
B-NAPHTH	12	2	70	1000	0.000342	5.05		1.73E-03	0.255079		0	
1.1.1-TCA	1.8	2	70	1000	0.000051		0.086	0.00E+00	0	0.000598	0.000019	
ARSENIC	35.4	2	70	1000	0.001011	1.5		1.52E-03	0.223510		0	
CADMIUM	100	2	70	1000	0.002857		0.00029	0.00E+00	0	9.852216	0.325378	
CHROMIUM	125	2	70	1000	0.003571		0.005	0.00E+00	0	0	0	BACKGROUND
COPPER	122	2	70	1000	0.003485			0.00E+00	0		0	
LEAD	139	2	70	1000	0.003971		0.0014	0.00E+00	0	2.836734	0.093685	
MANGANESE	176000	2	70	1000	5.028571		0.22	0.00E+00	0	0	0	BACKGROUND
MERCURY	0.82	2	70	1000	0.000023		0.0014	0.00E+00	0	0.016734	0.000552	
NICKEL	260	2	70	1000	0.007428		0.01	0.00E+00	0	0.742857	0.024533	
BERYLLIUM	5.4	2	70	1000	0.000154	0.0005	0.003	7.71E-08	0.000011	0	0	BACKGROUND
BARIUM	805	2	70	1000	0.023		0.051	0.00E+00	0	0	0	BACKGROUND
VANADIUM	137	2	70	1000	0.003914		0.0057	0.00E+00	0	0.686716	0.022679	
ZINC	2000	2	70	1000	0.057142		0.21	0.00E+00	0	0.272108	0.008986	
TOTAL CA								6.79E-03	1	---------	1	
TOTAL NONCA										30.27925		

AR302572

DRAKE CHEMICAL RI/FS
JOB #620Y/552
DOSE & RISK COMPUTATIONS
PUBLIC & ENVIRONMENTAL HEALTH ASSESSMENT

GW INGESTION.ZONE 3.WORST-CASE.MAXIMUM OBSERVATIONS. BACKGROUND CORRECTED

DESCRIPTION	C UG/L	L/DAY	KG	MG/UG	DOSE MG/KG-DAY	CPF q*	REF. DOSE	CA RISK	% OF TOTAL	NON CA RISK	% OF TOTAL	COMMENT
BENZENE	1.7	2	70	1000	0.000048	0.052		2.53E-06	0.000201		0	
CHLOROBENZENE	40	2	70	1000	0.001142		0.027	0.00E+00	0	0.042328	0.001216	
1.1.2-TCA	0.47	2	70	1000	0.000013	0.0573		7.69E-07	0.000061		0	
1.1-DCA	1.9	2	70	1000	0.000054	0.091	0.12	4.94E-06	0.000394	0.000452	0.000013	
1.2-DCA	210	2	70	1000	0.006	0.091		5.46E-04	0.043565		0	
TETRACHLOROETHENE	0.07	2	70	1000	0.000002	0.051	0.02	1.02E-07	0.000008	0.0001	0.000002	
TRICHLOROETHENE	40	2	70	1000	0.001142	0.011		1.26E-05	0.001003		0	
TRANS-1.2-DCE	0.11	2	70	1000	0.000003			0.00E+00	0		0	
1.1-DCE	0.18	2	70	1000	0.000005	0.009	0.58	4.63E-08	0.000003	0.000008	0.000000	
VINYL CHLORIDE	1.2	2	70	1000	0.000034	2.3		7.89E-05	0.006292		0	
CHLOROFORM	57	2	70	1000	0.001628	0.081		1.32E-04	0.010525		0	
METHYLENE CHLORIDE	6.8	2	70	1000	0.000194	0.0075	0.06	1.46E-06	0.000116	0.003238	0.000093	
CIS-1.2-DCE	1.2	2	70	1000	0.000034			0.00E+00	0		0	
CHLOROETHANE	0.66	2	70	1000	0.000018			0.00E+00	0		0	
BROMODICHLOROMETHANE	0.13	2	70	1000	0.000003	0.13		4.83E-07	0.000038		0	
BIS(2-ETHYLHEXYL)	27	2	70	1000	0.000771	0.000684		5.28E-07	0.000042		0	
FENAC	700	2	70	1000	0.02		0.07	0.00E+00	0	0.285714	0.008211	
ARSENIC	128	2	70	1000	0.003657	1.5		5.49E-03	0.437711		0	
CADMIUM	34	2	70	1000	0.000971		0.00029	0.00E+00	0	3.349753	0.096269	
CHROMIUM	468	2	70	1000	0.013371		0.005	0.00E+00	0	2.674285	0.076856	
COPPER	1320000	2	70	1000	37.71428			0.00E+00	0		0	
LEAD	372	2	70	1000	0.010628		0.0014	0.00E+00	0	7.591836	0.218183	
MANGANESE	76800	2	70	1000	2.194285		0.22	0.00E+00	0	0	0	BACKGROUND
MERCURY	0.2	2	70	1000	0.000005		0.0014	0.00E+00	0	0	0	BACKGROUND
NICKEL	1400	2	70	1000	0.04		0.01	0.00E+00	0	4	0.114956	
BERYLLIUM	31.8	2	70	1000	0.000908	0.0005	0.003	4.54E-07	0.000036	0.302857	0.008703	
ANTIMONY	188	2	70	1000	0.005371		0.0004	0.00E+00	0	13.42857	0.385925	
VANADIUM	552	2	70	1000	0.015771		0.0057	0.00E+00	0	2.766917	0.079518	
ZINC	2570	2	70	1000	0.073428		0.21	0.00E+00	0	0.349659	0.010048	
CYANIDE	16	2	70	1000	0.000457		0.029	6.27E-03	0.5		0	
TOTAL CA								0.012532	1	---------	1	
TOTAL NONCA										34.79572		

G-20

AR302573

BRAKE CHEMICAL RI/FS
JOB 8420Y/552
DOSE & RISK COMPUTATIONS
PUBLIC & ENVIRONMENTAL HEALTH ASSESSMENT

SUBJECT: PLAUSIBLE SCENARIO. DC-107-107 ZONE 1 BEDROCK WELL

DESCRIPTION	C UG/L	L/DAY	KG	MG/UG	DOSE MG/KG-DAY	CPF q*	REF. DOSE	CA RISK	% OF TOTAL	NON CA RISK	% OF TOTAL
1,2-DCA	0.08	2	70	1000	0.000002	0.091		2.08E-07	0.605959	0	0
CHLOROFORM	0.05	2	70	1000	0.000001	0.081		1.16E-07	0.337106	0	0
BIS(2-ETHYLHEXYL)	1	2	70	1000	0.000028	0.000684		1.95E-08	0.056933	0	0
ALUMINUM	36.4	2	70	1000	0.00104			0.00E+00	0	0	0
CALCIUM	102000	2	70	100	29.14285			0.00E+00	0	0	0
COPPER	11.1	2	70	1000	0.000317			0.00E+00	0	0	0
IRON	159	2	70	1000	0.004542			0.00E+00	0	0	0
LEAD	1.5	2	70	1000	0.000042		0.0014	0.00E+00	0	0.030612	0.646298
MAGNESIUM	9420	2	70	1000	0.269142			0.00E+00	0	0	0
MANGANESE	129	2	70	1000	0.003685		0.22	0.00E+00	0	0.016753	0.353701
POTASSIUM	936	2	70	1000	0.026742			0.00E+00	0	0	0
SODIUM	9170	2	70	1000	0.262			0.00E+00	0	0	0
TOTALCA								3.43E-07	1		
TOTAL NONCA										0.047365	1

G-21

BRAKE CHEMICAL RI/FS
JOB 8420Y/552
DOSE & RISK COMPUTATIONS
PUBLIC & ENVIRONMENTAL HEALTH ASSESSMENT — BACKGROUND CORRECTION

SUBJECT: PLAUSIBLE SCENARIO. DC-107-107 ZONE 1 BEDROCK WELL

DESCRIPTION	C UG/L	L/DAY	KG	MG/UG	DOSE MG/KG-DAY	CPF q*	REF. DOSE	CA RISK	% OF TOTAL	NON CA RISK	% OF TOTAL	COMMENT
1,2-DCA	0.08	2	70	1000	0.000002	0.091		2.08E-07	0.605959	0	0	
CHLOROFORM	0.05	2	70	1000	0.000001	0.081		1.16E-07	0.337106	0	0	
BIS(2-ETHYLHEXYL)	1	2	70	1000	0.000028	0.000684		1.95E-08	0.056933	0	0	
ALUMINUM	36.4	2	70	1000	0.00104			0.00E+00	0	0	0	
CALCIUM	102000	2	70	100	29.14285			0.00E+00	0	0	0	
COPPER	11.1	2	70	1000	0.000317			0.00E+00	0	0	0	
IRON	159	2	70	1000	0.004542			0.00E+00	0	0	0	
LEAD	1.5	2	70	1000	0.000042		0.0014	0.00E+00	0	0	0	BACKGROUND
MAGNESIUM	9420	2	70	1000	0.269142			0.00E+00	0	0	0	
MANGANESE	129	2	70	1000	0.003685		0.22	0.00E+00	0	0	0	BACKGROUND
POTASSIUM	936	2	70	1000	0.026742			0.00E+00	0	0	0	
SODIUM	9170	2	70	1000	0.262			0.00E+00	0	0	0	
TOTALCA								3.43E-07	1			
TOTAL NONCA										0	0	

AR302574

BRAKE CHEMICAL RI/FS
JOB 0620Y/552
DOSE & RISK COMPUTATIONS
PUBLIC & ENVIRONMENTAL HEALTH ASSESSMENT

SUBJECT: PLAUSIBLE SCENARIO BC-HIB-145 ZONE 1 DEEP OVERBURDEN WELL

DESCRIPTION	C UG/L	L/DAY	KG	MG/UG	DOSE MG/KG-DAY	CPF q*	REF. DOSE	CA RISK	% OF TOTAL	NON CA RISK	% OF TOTAL
BENZENE	30	2	70	1000	0.000857	0.052		4.46E-05	0.000057	0	0
TOLUENE	8100	2	70	1000	0.231428		0.3	0.00E+00	0	0.771428	0.019839
CHLOROBENZENE	2900	2	70	1000	0.082857		0.027	0.00E+00	0	3.068783	0.078923
1,1,2-TCA	12	2	70	1000	0.000342	0.0573		1.96E-05	0.000025	0	0
1,2-DCA	5100	2	70	1000	0.145714	0.091		1.33E-02	0.017022	0	0
TETRACHLOROETHENE	8.4	2	70	1000	0.00024	0.051	0.02	1.22E-05	0.000015	0.012	0.000308
TRICHLOROETHENE	42	2	70	1000	0.0012	0.011		1.32E-05	0.000016	0	0
CHLOROFORM	300	2	70	1000	0.010857	0.081		8.79E-04	0.001128	0	0
METHYLENE CHLORIDE	210	2	70	1000	0.006	0.0075	0.06	4.50E-05	0.000057	0.1	0.002571
NAPHTHALENE	29	2	70	1000	0.000828		0.41	0.00E+00	0	0.002020	0.000051
1,2-DICHLOROBENZENE	530	2	70	1000	0.015142			0.00E+00	0	0	0
1,4-DICHLOROBENZENE	140	2	70	1000	0.004			0.00E+00	0	0	0
1,2,4-TRICHLOROBENZE	130	2	70	1000	0.003714		0.02	0.00E+00	0	0.185714	0.004776
NITROBENZENE	20	2	70	1000	0.000571		0.0005	0.00E+00	0	1.142857	0.029392
4-CHLOROANILINE	620	2	70	1000	0.017714			0.00E+00	0	0	0
2,4-DNP	220	2	70	1000	0.006285			0.00E+00	0	0	0
2-CHLOROPHENOL	47	2	70	1000	0.001342			0.00E+00	0	0	0
2,4-DICHLOROPHENOL	210	2	70	1000	0.006		0.003	0.00E+00	0	2	0.051436
FENAC	21	2	70	1000	0.0006		0.07	0.00E+00	0	0.008571	0.000220
B-NAPHTH	5300	2	70	1000	0.151428	5.05		7.65E-01	0.981676	0	0
PHENOL	2500	2	70	1000	0.071428		0.04	0.00E+00	0	1.785714	0.045925
2-METHYLPHENOL	71	2	70	1000	0.002028			0.00E+00	0	0	0
4-METHYLPHENOL	200	2	70	1000	0.005714			0.00E+00	0	0	0
ALUMINUM	6760	2	70	1000	0.193142			0.00E+00	0	0	0
CADMIUM	46	2	70	1000	0.001314		0.00029	0.00E+00	0	4.532019	0.116554
CALCIUM	202000	2	70	1000	5.771428			0.00E+00	0	0	0
CHROMIUM	107	2	70	1000	0.003057		0.005	0.00E+00	0	0.611428	0.015724
COBALT	23	2	70	1000	0.000657			0.00E+00	0	0	0
COPPER	127	2	70	1000	0.003628			0.00E+00	0	0	0
IRON	319000	2	70	1000	9.114285			0.00E+00	0	0	0
LEAD	23.7	2	70	1000	0.000677		0.0014	0.00E+00	0	0.483673	0.012439
MAGNESIUM	358000	2	70	1000	10.22857			0.00E+00	0	0	0
MANGANESE	180000	2	70	1000	5.142857		0.22	0.00E+00	0	23.37662	0.601200
NICKEL	114	2	70	1000	0.003257		0.01	0.00E+00	0	0.325714	0.008376
POTASSIUM	208000	2	70	1000	5.942857			0.00E+00	0	0	0
SODIUM	892000	2	70	1000	25.48571			0.00E+00	0	0	0
VANADIUM	82	2	70	1000	0.002342		0.0057	0.00E+00	0	0.411027	0.010570
ZINC	410	2	70	1000	0.011714		0.21	0.00E+00	0	0.055782	0.001434
CYANIDE	10	2	70	1000	0.000285		0.029	0.00E+00	0	0.009852	0.000253
TOTAL CA								0.778908	1		
TOTAL NONCA										38.88321	1

G-22

AR302575

BRAKE CHEMICAL RI/FS
JOB 0620Y/552
DOSE & RISK COMPUTATIONS
PUBLIC & ENVIRONMENTAL HEALTH ASSESSMENT BACKGROUND CORRECTION

SUBJECT: PLAUSIBLE SCENARIO BC-MW-145 ZONE 1 DEEP OVERBURDEN WELL

DESCRIPTION	C UG/L	L/DAY	KG	MG/UG	DOSE MG/KG-DAY	CPF q*	REF. DOSE	CA RISK	% OF TOTAL	NON CA RISK	% OF TOTAL	COMMENT
BENZENE	30	2	70	1000	0.000857	0.052		4.46E-05	0.000057	0	0	
TOLUENE	8100	2	70	1000	0.231428		0.3	0.00E+00	0	0.771428	0.056643	
CHLOROBENZENE	2900	2	70	1000	0.082857		0.027	0.00E+00	0	3.068783	0.225331	
1,1,2-TCA	12	2	70	1000	0.000342	0.0573		1.96E-05	0.000025	0	0	
1,2-DCA	5100	2	70	1000	0.145714	0.091		1.33E-02	0.017022	0	0	
TETRACHLOROETHENE	8.4	2	70	1000	0.00024	0.051	0.02	1.22E-05	0.000015	0.012	0.000881	
TRICHLOROETHENE	42	2	70	1000	0.0012	0.011		1.32E-05	0.000016	0	0	
CHLOROFORM	300	2	70	1000	0.010857	0.081		8.79E-04	0.001128	0	0	
METHYLENE CHLORIDE	210	2	70	1000	0.006	0.0075	0.06	4.50E-05	0.000057	0.1	0.007342	
NAPHTHALENE	29	2	70	1000	0.000828		0.41	0.00E+00	0	0.002020	0.000148	
1,2-DICHLOROBENZENE	530	2	70	1000	0.015142			0.00E+00	0	0	0	
1,4-DICHLOROBENZENE	140	2	70	1000	0.004			0.00E+00	0	0	0	
1,2,4-TRICHLOROBENZE	130	2	70	1000	0.003714		0.02	0.00E+00	0	0.185714	0.013636	
NITROBENZENE	20	2	70	1000	0.000571		0.0005	0.00E+00	0	1.142857	0.083916	
4-CHLOROANILINE	620	2	70	1000	0.017714			0.00E+00	0	0	0	
2,4-DNP	220	2	70	1000	0.006285			0.00E+00	0	0	0	
2-CHLOROPHENOL	47	2	70	1000	0.001342			0.00E+00	0	0	0	
2,4-DICHLOROPHENOL	210	2	70	1000	0.006		0.003	0.00E+00	0	2	0.146854	
FENAC	21	2	70	1000	0.0006		0.07	0.00E+00	0	0.008571	0.000629	
B-NAPHTH	5300	2	70	1000	0.151428	5.05		7.65E-01	0.981676	0	0	
PHENOL	2500	2	70	1000	0.071428		0.04	0.00E+00	0	1.785714	0.131119	
2-METHYLPHENOL	71	2	70	1000	0.002028			0.00E+00	0	0	0	
4-METHYLPHENOL	200	2	70	1000	0.005714			0.00E+00	0	0	0	
ALUMINUM	6760	2	70	1000	0.193142			0.00E+00	0	0	0	
CADMIUM	46	2	70	1000	0.001314		0.00029	0.00E+00	0	4.532019	0.332772	
CALCIUM	202000	2	70	1000	5.771428			0.00E+00	0	0	0	
CHROMIUM	107	2	70	1000	0.003057		0.005	0.00E+00	0	0	0	BACKGROUND
COBALT	23	2	70	1000	0.000657			0.00E+00	0	0	0	
COPPER	127	2	70	1000	0.003628			0.00E+00	0	0	0	
IRON	319000	2	70	1000	9.114285			0.00E+00	0	0	0	
LEAD	23.7	2	70	1000	0.000677		0.0014	0.00E+00	0	0	0	BACKGROUND
MAGNESIUM	358000	2	70	1000	10.22857			0.00E+00	0	0	0	
MANGANESE	180000	2	70	1000	5.142857		0.22	0.00E+00	0	0	0	BACKGROUND
NICKEL	114	2	70	1000	0.003257		0.01	0.00E+00	0	0	0	BACKGROUND
POTASSIUM	200000	2	70	1000	5.942857			0.00E+00	0	0	0	
SODIUM	892000	2	70	1000	25.48571			0.00E+00	0	0	0	
VANADIUM	82	2	70	1000	0.002342		0.0057	0.00E+00	0	0	0	BACKGROUND
ZINC	410	2	70	1000	0.011714		0.21	0.00E+00	0	0	0	BACKGROUND
CYANIDE	10	2	70	1000	0.000285		0.029	0.00E+00	0	0.009852	0.000723	
TOTAL CA								0.778988	1			
TOTAL NONCA										13.61896	1	

PUBLIC & ENVIRONMENTAL HEALTH ASSESSMENT BACKGROUND CORRECTION

G-23

AR302576

BRAKE CHEMICAL RI/FS
JOB 04209/552
DOSE & RISK COMPUTATIONS
PUBLIC & ENVIRONMENTAL HEALTH ASSESSMENT

SUBJECT: GW INGESTION, PLAUSIBLE SCENARIO, BC-M15-142 ZONE 2 DEEP OVERBURDEN WELL

DESCRIPTION	C UG/L	L/DAY	KG	MG/UG	DOSE MG/KG-DAY	CPF q0	REF. DOSE	CA RISK	% OF TOTAL	NON CA RISK	% OF TOTAL
BENZENE	1.9	2	70	1000	0.000054	0.052		2.82E-06	0.000026	0	0
CHLOROBENZENE	120	2	70	1000	0.003428		0.027	0.00E+00	0	0.126984	0.008185
1,1,2-TCA	0.43	2	70	1000	0.000012	0.0573		7.04E-07	0.000006	0	0
1,1-DCA	0.48	2	70	1000	0.000013	0.091	0.12	1.25E-06	0.000011	0.000114	0.000007
1,2-DCA	130	2	70	1000	0.003714	0.091		3.38E-04	0.003113	0	0
TETRACHLOROETHENE	0.38	2	70	1000	0.000010	0.051	0.02	5.54E-07	0.000005	0.000542	0.000034
TRICHLOROETHENE	46	2	70	1000	0.001314			0.00E+00	0	0	0
CHLOROFORM	2.3	2	70	1000	0.000065	0.081		5.32E-06	0.000049	0	0
CIS-1,2-DCE	2.4	2	70	1000	0.000068			0.00E+00	0	0	0
1,4-DCBZ	5	2	70	1000	0.000142			0.00E+00	0	0	0
2,4-DNP	13	2	70	1000	0.000371			0.00E+00	0	0	0
B-NAPHTH	750	2	70	1000	0.021428	5.05		1.08E-01	0.996788	0	0
ALUMINUM	4690	2	70	1000	0.134					0	0
CADMIUM	22	2	70	1000	0.000628		0.00029	0.00E+00	0	2.167487	0.139718
CHROMIUM	44	2	70	1000	0.001257		0.005	0.00E+00	0	0.251428	0.016207
COPPER	38	2	70	1000	0.001085			0.00E+00	0	0	0
CALCIUM	177000	2	70	1000	5.057142					0	0
MANGANESE	91700	2	70	1000	2.62		0.22	0.00E+00	0	11.90909	0.767673
MAGNESIUM	102000	2	70	1000	2.914285					0	0
NICKEL	260	2	70	1000	0.007428		0.01	0.00E+00	0	0.742857	0.047885
POTASSIUM	28400	2	70	1000	0.811428					0	0
SODIUM	343000	2	70	1000	9.8					0	0
VANADIUM	56	2	70	1000	0.0016		0.0057	0.00E+00	0	0.280701	0.018094
ZINC	250	2	70	1000	0.007142		0.21	0.00E+00	0	0.034013	0.002192
TOTAL CA								1.09E-01			
TOTAL NONCA										15.51322	1

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AR302577

DRAKE CHEMICAL RI/FS
JOB 0420Y/552
DOSE & RISK COMPUTATIONS
PUBLIC & ENVIRONMENTAL HEALTH ASSESSMENT

SUBJECT: GW INGESTION. PLAUSIBLE SCENARIO, BC-N15-142 ZONE 2 DEEP OVERBURDEN WELL BACKGROUND CORRECTED

DESCRIPTION	C UG/L	L/DAY	KG	MG/UG	DOSE MG/KG-DAY	CPF q*	REF. DOSE	CA RISK	% OF TOTAL	NON CA RISK	% OF TOTAL	COMMENT
BENZENE	1.9	2	70	1000	0.000054	0.052		2.82E-06	0.000026	0	0	
CHLOROBENZENE	120	2	70	1000	0.003428		0.027	0.00E+00	0	0.126984	0.041798	
1,1,2-TCA	0.43	2	70	1000	0.000012	0.0573		7.04E-07	0.000006	0	0	
1,1-DCA	0.48	2	70	1000	0.000013	0.091	0.12	1.25E-06	0.000011	0.000114	0.000037	
1,2-DCA	130	2	70	1000	0.003714	0.091		3.38E-04	0.003113	0	0	
TETRACHLOROETHENE	0.38	2	70	1000	0.000010	0.051	0.02	5.54E-07	0.000005	0.000542	0.000178	
TRICHLOROETHENE	46	2	70	1000	0.001314			0.00E+00	0	0	0	
CHLOROFORM	2.3	2	70	1000	0.000065	0.081		5.32E-06	0.000049	0	0	
CIS-1,2-DCE	2.4	2	70	1000	0.000068			0.00E+00	0	0	0	
1,4-DCBZ	5	2	70	1000	0.000142			0.00E+00	0	0	0	
2,4-DNP	13	2	70	1000	0.000371			0.00E+00	0	0	0	
B-NAPHTH	750	2	70	1000	0.021428	5.05		1.08E-01	0.996788	0	0	
ALUMINUM	4690	2	70	1000	0.134					0	0	
CADMIUM	22	2	70	1000	0.000628		0.00029	0.00E+00	0	2.167487	0.713462	
CHROMIUM	44	2	70	1000	0.001257		0.005	0.00E+00	0	0	0	BACKGROUND
COPPER	38	2	70	1000	0.001085			0.00E+00	0	0	0	
CALCIUM	177000	2	70	1000	5.057142					0	0	
MANGANESE	91700	2	70	1000	2.62		0.22	0.00E+00	0	0	0	BACKGROUND
MAGNESIUM	102000	2	70	1000	2.914285					0	0	
NICKEL	260	2	70	1000	0.007428		0.01	0.00E+00	0	0.742857	0.244522	
POTASSIUM	28400	2	70	1000	0.811428					0	0	
SODIUM	343000	2	70	1000	9.8					0	0	
VANADIUM	56	2	70	1000	0.0016		0.0057	0.00E+00	0	0	0	BACKGROUND
ZINC	250	2	70	1000	0.007142		0.21	0.00E+00	0	0	0	BACKGROUND
TOTAL CA								1.09E-01				
TOTAL NONCA										3.037986	1	

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AR302578

BRAKE CHEMICAL RI/FS
JOB 8420Y/552
DOSE & RISK COMPUTATIONS
PUBLIC & ENVIRONMENTAL HEALTH ASSESSMENT

SUBJECT: GW INGESTION. PLAUSIBLE SCENARIO, BC-M109-109 ZONE 2 DEEP OVERBURDEN WELL

DESCRIPTION	C UG/L	L/DAY	KG	MG/UG	DOSE MG/KG-DAY	CPF q*	REF. DOSE	CA RISK	% OF TOAL	NON CA RISK	% OF TOTAL
CHLOROBENZENE	3.3	2	70	1000	0.000094		0.027	0.00E+00	0	0.003492	0.000705
1,1-DCA	0.22	2	70	1000	0.000006	0.091	0.12	5.72E-07	0.001514	0.000052	0.000010
1,2-DCA	6.1	2	70	1000	0.000174	0.091		1.59E-05	0.041980	0	0
CHLOROFORM	0.20	2	70	1000	0.000000	0.081		6.40E-07	0.001715	0	0
CIS-1,2-DCE	0.71	2	70	1000	0.000020			0.00E+00	0	0	0
B-NAPHTH	2.5	2	70	1000	0.000071	5.05		3.61E-04	0.954790	0	0
COPPER	33	2	70	1000	0.000942			0.00E+00	0	0	0
MANGANESE	2100	2	70	1000	0.062285		0.22	0.00E+00	0	0.283116	0.057221
NICKEL	61	2	70	1000	0.001742		0.01	0.00E+00	0	0.174285	0.035225
VANADIUM	15	2	70	1000	0.000428		0.0057	0.00E+00	0	0.075187	0.015196
ZINC	220	2	70	1000	0.006514		0.21	0.00E+00	0	0.031020	0.006269
ALUMINUM	184	2	70	1000	0.005257			0.00E+00	0	0	0
BARIUM	60	2	70	1000	0.001714		0.051	0.00E+00	0	0.033613	0.006793
CALCIUM	215000	2	70	1000	6.142857			0.00E+00	0	0	0
IRON	2040	2	70	1000	0.058857			0.00E+00	0	0	0
LEAD	213	2	70	1000	0.006085		0.0014	0.00E+00	0	4.346938	0.878576
MAGNESIUM	34900	2	70	1000	0.997142			0.00E+00	0	0	0
POTASSIUM	6020	2	70	1000	0.172			0.00E+00	0	0	0
SODIUM	143000	2	70	1000	4.085714			0.00E+00	0	0	0
TOTAL CA								0.000377	1		
TOTAL NONCA										4.947707	1

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AR302579

DRAKE CHEMICAL RI/FS
JOB 0620Y/552
DOSE & RISK COMPUTATIONS
PUBLIC & ENVIRONMENTAL HEALTH ASSESSMENT BACKGROUND CORRECTED

SUBJECT: GW INGESTION. PLAUSIBLE SCENARIO, DC-M109-109 ZONE 2 DEEP OVERBURDEN WELL

DESCRIPTION	C UG/L	L/DAY	KG	MG/MG	DOSE MG/KG-DAY	CPF q*	REF. DOSE	CA RISK	% OF TOAL	NON CA RISK	% OF TOTAL	COMMENT
CHLOROBENZENE	3.3	2	70	1000	0.000094		0.027	0.00E+00	0	0.003492	0.000802	
1,1-DCA	0.22	2	70	1000	0.000006	0.091	0.12	5.72E-07	0.001514	0.000052	0.000012	
1,2-DCA	6.1	2	70	1000	0.000174	0.091		1.59E-05	0.041990	0	0	
CHLOROFORM	0.28	2	70	1000	0.000008	0.081		6.48E-07	0.001715	0	0	
CIS-1,2-DCE	0.71	2	70	1000	0.000020			0.00E+00	0	0	0	
B-NAPHTH	2.5	2	70	1000	0.000071	5.05		3.61E-04	0.954790	0	0	
COPPER	33	2	70	1000	0.000942			0.00E+00	0	0	0	
MANGANESE	2180	2	70	1000	0.062285		0.22	0.00E+00	0	0	0	BACKGROUND
NICKEL	61	2	70	1000	0.001742		0.01	0.00E+00	0	0	0	BACKGROUND
VANADIUM	15	2	70	1000	0.000428		0.0057	0.00E+00	0	0	0	BACKGROUND
ZINC	220	2	70	1000	0.006514		0.21	0.00E+00	0	0	0	BACKGROUND
ALUMINUM	184	2	70	1000	0.005257			0.00E+00	0	0	0	
BARIUM	60	2	70	1000	0.001714		0.051	0.00E+00	0	0	0	BACKGROUND
CALCIUM	215000	2	70	1000	6.142857			0.00E+00	0	0	0	
IRON	2060	2	70	1000	0.058857			0.00E+00	0	0	0	
LEAD	213	2	70	1000	0.006085		0.0014	0.00E+00	0	4.346938	0.999185	
MAGNESIUM	34900	2	70	1000	0.997142			0.00E+00	0	0	0	
POTASSIUM	6020	2	70	1000	0.172			0.00E+00	0	0	0	
SODIUM	143000	2	70	1000	4.085714			0.00E+00	0	0	0	
TOTAL CA								0.000377	1			
TOTAL NONCA										4.350483	1	

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AR302580

BRAKE CHEMICAL RI/FS
JOB 6620Y/552
DOSE & RISK COMPUTATIONS
PUBLIC & ENVIRONMENTAL HEALTH ASSESSMENT

SUBJECT: PLAUSIBLE SCENARIO, DC-114-114 ZONE 3 BEDROCK WELL

DESCRIPTION	C UG/L	L/DAY	KG	MG/UG	DOSE MG/KG-DAY	CPF q*	REF. DOSE	CA RISK	% OF TOAL	NON CA RISK	% OF TOTAL
CHLOROFORM	0.17	2	70	1000	0.000004	0.081		3.93E-07	0.952677	0	0
DIS(2-ETHYLHEXYL)	1	2	70	1000	0.000028	0.000684		1.95E-08	0.047322	0	0
ALUMINUM	103	2	70	1000	0.002942			0.00E+00	0	0	0
BARIUM	35	2	70	1000	0.001		0.051	0.00E+00	0	0.019607	0.362664
CALCIUM	92600	2	70	1000	2.645714			0.00E+00	0	0	0
IRON	188	2	70	1000	0.005371			0.00E+00	0	0	0
LEAD	1.6	2	70	1000	0.000045		0.0014	0.00E+00	0	0.032653	0.603947
MAGNESIUM	32600	2	70	1000	0.931428			0.00E+00	0	0	0
MANGANESE	13.9	2	70	1000	0.000397		0.22	0.00E+00	0	0.001805	0.033388
POTASSIUM	1890	2	70	1000	0.054			0.00E+00	0	0	0
SODIUM	5000	2	70	1000	0.142857			0.00E+00	0	0	0
TOTALCA								4.13E-07	1		
TOTAL NONCA										0.054066	1

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BRAKE CHEMICAL RI/FS
JOB 6620Y/552
DOSE & RISK COMPUTATIONS
PUBLIC & ENVIRONMENTAL HEALTH ASSESSMENT BACKGROUND CORRECTION

SUBJECT: PLAUSIBLE SCENARIO, DC-114-114 ZONE 3 BEDROCK WELL

DESCRIPTION	C UG/L	L/DAY	KG	MG/UG	DOSE MG/KG-DAY	CPF q*	REF. DOSE	CA RISK	% OF TOAL	NON CA RISK	% OF TOTAL	COMMENT
CHLOROFORM	0.17	2	70	1000	0.000004	0.081		3.93E-07	0.952677	0	0	
DIS(2-ETHYLHEXYL)	1	2	70	1000	0.000028	0.000684		1.95E-08	0.047322	0	0	
ALUMINUM	103	2	70	1000	0.002942			0.00E+00	0	0	0	
BARIUM	35	2	70	1000	0.001		0.051	0.00E+00	0	0	0	BACKGROUND
CALCIUM	92600	2	70	1000	2.645714			0.00E+00	0	0	0	
IRON	188	2	70	1000	0.005371			0.00E+00	0	0	0	
LEAD	1.6	2	70	1000	0.000045		0.0014	0.00E+00	0	0	0	BACKGROUND
MAGNESIUM	32600	2	70	1000	0.931428			0.00E+00	0	0	0	
MANGANESE	13.9	2	70	1000	0.000397		0.22	0.00E+00	0	0	0	BACKGROUND
POTASSIUM	1890	2	70	1000	0.054			0.00E+00	0	0	0	
SODIUM	5000	2	70	1000	0.142857			0.00E+00	0	0	0	
TOTALCA								4.13E-07	1			
TOTAL NONCA										0	0	

AR302581

BRAKE CHEMICAL RI/FS
JOB 6620Y/552
DOSE & RISK COMPUTATIONS
PUBLIC & ENVIRONMENTAL HEALTH ASSESSMENT

SUBJECT: PLAUSIBLE SCENARIO, BC-12A-13B ZONE 3 OVERBURDEN WELL

DESCRIPTION	C UG/L	L/DAY	KG	MG/UG	DOSE MG/KG-DAY	CPF q*	REF. DOSE	CA RISK	% OF TOTAL	NON CA RISK	% OF TOTAL
TOLUENE	1.5	2	70	1000	0.000042		0.3	0.00E+00	0	0.000142	0.001497
1,2-DCA	0.08	2	70	1000	0.000002	0.091		2.08E-07	0.573318	0	0
CHLOROFORM	0.05	2	70	1000	0.000001	0.081		1.16E-07	0.318947	0	0
DIS(2-ETHYLHEXYL)	2	2	70	1000	0.000057	0.000484		3.91E-08	0.107733	0	0
DI-N-BUTYL PHTHALATE	2	2	70	1000	0.000057			0.00E+00	0	0	0
ALUMINUM	205	2	70	1000	0.008142			0.00E+00	0	0	0
BARIUM	35.8	2	70	1000	0.001022		0.051	0.00E+00	0	0.020056	0.210216
CALCIUM	42700	2	70	1000	1.22			0.00E+00	0	0	0
IRON	477	2	70	1000	0.013628			0.00E+00	0	0	0
MAGNESIUM	10200	2	70	1000	0.291428			0.00E+00	0	0	0
MANGANESE	193	2	70	1000	0.005514		0.22	0.00E+00	0	0.025064	0.262716
NICKEL	17.6	2	70	1000	0.000502		0.01	0.00E+00	0	0.050285	0.527067
POTASSIUM	890	2	70	1000	0.025428			0.00E+00	0	0	0
SODIUM	29900	2	70	1000	0.854285			0.00E+00	0	0	0
TOTALCA								3.63E-07	1		
TOTAL NONCA										0.095404	1

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BRAKE CHEMICAL RI/FS
JOB 6620Y/552
DOSE & RISK COMPUTATIONS
PUBLIC & ENVIRONMENTAL HEALTH ASSESSMENT BACKGROUND CORRECTION

SUBJECT: PLAUSIBLE SCENARIO, BC-12A-13B ZONE 3 OVERBURDEN WELL

DESCRIPTION	C UG/L	L/DAY	KG	MG/UG	DOSE MG/KG-DAY	CPF q*	REF. DOSE	CA RISK	% OF TOTAL	NON CA RISK	% OF TOTAL	COMMENT
TOLUENE	1.5	2	70	1000	0.000042		0.3	0.00E+00	0	0.000142	0	
1,2-DCA	0.08	2	70	1000	0.000002	0.091		2.08E-07	0.573318	0	0	
CHLOROFORM	0.05	2	70	1000	0.000001	0.081		1.16E-07	0.318947	0	0	
DIS(2-ETHYLHEXYL)	2	2	70	1000	0.000057	0.000484		3.91E-08	0.107733	0	0	
DI-N-BUTYL PHTHALATE	2	2	70	1000	0.000057			0.00E+00	0	0	0	
ALUMINUM	205	2	70	1000	0.008142			0.00E+00	0	0	0	
BARIUM	35.8	2	70	1000	0.001022		0.051	0.00E+00	0	0	0	BACKGROUND
CALCIUM	42700	2	70	1000	1.22			0.00E+00	0	0	0	
IRON	477	2	70	1000	0.013628			0.00E+00	0	0	0	
MAGNESIUM	10200	2	70	1000	0.291428			0.00E+00	0	0	0	
MANGANESE	193	2	70	1000	0.005514		0.22	0.00E+00	0	0	0	BACKGROUND
NICKEL	17.6	2	70	1000	0.000502		0.01	0.00E+00	0	0	0	BACKGROUND
POTASSIUM	890	2	70	1000	0.025428			0.00E+00	0	0	0	
SODIUM	29900	2	70	1000	0.854285			0.00E+00	0	0	0	
TOTALCA								3.63E-07	1			

AR302582

DESCRIPTION	UG/L	HOURS DAY	% CONTACT	KG	FLUX INTO SKIN	CA. DOSE	DOSE MG/KG/DAY	q	REF DOSE	CA. RISK	% OF TOT CA	NON CA RISK	% OF NON CA RISK	COMMENT
aluminum	609	2	100	45	0.5	497.9184	7.31E-03			0.00E+00	0	0	0	BACKGROUND
barium	73	2	100	45	0.5	59.6848	8.76E-04		0.051	0.00E+00	0	0	0	BACKGROUND
calcium	41600	2	100	45	0.5	34012.16	4.99E-01			0.00E+00	0	0	0	BACKGROUND
cobalt	25	2	100	45	0.5	20.44	3.00E-04			0.00E+00	0	0	0	BACKGROUND
iron	175	2	100	45	0.5	143.08	2.10E-03			0.00E+00	0	0	0	BACKGROUND
magnesium	14900	2	100	45	0.5	12182.24	1.79E-01			0.00E+00	0	0	0	BACKGROUND
manganese	1510	2	100	45	0.5	1234.576	1.81E-02		0.22	0.00E+00	0	0	0	BACKGROUND
nickel	31	2	100	45	0.5	25.3456	3.72E-04		0.01	0.00E+00	0	0	0	BACKGROUND
potassium	1470	2	100	45	0.5	1201.872	1.76E-02			0.00E+00	0	0	0	BACKGROUND
sodium	14000	2	100	45	0.5	11446.4	1.68E-01			0.00E+00	0	0	0	BACKGROUND
zinc	62	2	100	45	0.5	50.6912	7.44E-04		0.21	0.00E+00	0	0	0	BACKGROUND
fecac	0.88	2	100	45	0.5	0.719488	1.06E-05		0.07	0.00E+00	0	0.000150857	0.002213	
silver	17	2	100	45	0.5	13.8992	2.04E-04		0.003	0.00E+00	0	0.068	0.997786	
TOTAL CA RISK										0.00E+00			1	
TOTAL NON CA RISK												0.068150857		

SUMMARY TABLE	CA RISK	NONCA RISK	% OF TOTAL CA	% OF TOT NONCA
FISH INGESTION	0.00	1.621004	0.00	0.521396
SWIMMING INGESTION	0.00	1.419809	0.00	0.456682
DERMAL CONTACT	0.00	0.068150	0.00	0.021920
TOTAL CA. RISK	0.00			
TOTAL NONCA. RISK		3.108964		

AR302583

DRAKE CHEMICAL RI/FS
JOB #620Y/552
DOSE & RISK COMPUTATIONS
PUBLIC & ENVIRONMENTAL HEALTH ASSESSMENT

Worst-case Scenario

SUBJECT: INGESTION OF FISH

DESCRIPTION	UG/L	BCF	G/DAY	MG/UG	KG	L/G	DOSE MG/KG-DAY	q*	REF. DOSE	CA. RISK	% OF TOTAL CA	NONCA. RISK	%OF NONCA	COMMENT
aluminum	609	1	6.5	1000	70	1000	0.000056			0.00E+00	0	0	0	BACKGROUND
barium	73	1	6.5	1000	70	1000	0.000006		0.051	0.00E+00	0	0	0	BACKGROUND
calcium	41600	1	6.5	1000	70	1000	0.003862			0.00E+00	0	0	0	BACKGROUND
cobalt	25	1	6.5	1000	70	1000	0.000002			0.00E+00	0	0	0	BACKGROUND
iron	175	1	6.5	1000	70	1000	0.000016			0.00E+00	0	0	0	BACKGROUND
magnesium	14900	1	6.5	1000	70	1000	0.001383			0.00E+00	0	0	0	BACKGROUND
manganese	1510	1	6.5	1000	70	1000	0.000140		0.22	0.00E+00	0	0	0	BACKGROUND
nickel	31	47	6.5	1000	70	1000	0.000135		0.01	0.00E+00	0	0	0	BACKGROUND
potassium	1470	1	6.5	1000	70	1000	0.000136			0.00E+00	0	0	0	BACKGROUND
sodium	14000	1	6.5	1000	70	1000	0.0013			0.00E+00	0	0	0	BACKGROUND
zinc	62	47	6.5	1000	70	1000	0.000270		0.21	0.00E+00	0	0	0	BACKGROUND
fenac	0.88	289	6.5	1000	70	1000	0.000023		0.07	0.00E+00	0	0.000337	0.0002081	
silver	17	3080	6.5	1000	70	1000	0.004882		0.003	0.00E+00	0	1.620666	0.9997918	
TOTAL CA. RISK										0.00E+00			1	
TOTAL NONCA. RISK												1.621004		

SUBJECT: ACCIDENTAL INGESTION DURING SWIMMING

DESCRIPTION	UG/L	L/DAY	KG	UG/MG	FRACT. SORBED.	DOSE MG/KG-DAY	q*	REF. DOSE	CA. RISK	% OF TOTAL CA	NONCA RISK	% OF TOT NONCA	COMMENT
aluminum	609	0.25	45	1000	1	0.003383			0.00E+00	0	0	0	BACKGROUND
barium	73	0.25	45	1000	1	0.000405		0.051	0.00E+00	0	0	0	BACKGROUND
calcium	41600	0.25	45	1000	1	0.231111			0.00E+00	0	0	0	BACKGROUND
cobalt	25	0.25	45	1000	1	0.000138			0.00E+00	0	0	0	BACKGROUND
iron	175	0.25	45	1000	1	0.000972			0.00E+00	0	0	0	BACKGROUND
magnesium	14900	0.25	45	1000	1	0.082777			0.00E+00	0	0	0	BACKGROUND
manganese	1510	0.25	45	1000	1	0.008388		0.22	0.00E+00	0	0	0	BACKGROUND
nickel	31	0.25	45	1000	1	0.000172		0.01	0.00E+00	0	0	0	BACKGROUND
potassium	1470	0.25	45	1000	1	0.008166			0.00E+00	0	0	0	BACKGROUND
sodium	14000	0.25	45	1000	1	0.077777			0.00E+00	0	0	0	BACKGROUND
zinc	62	0.25	45	1000	1	0.000344		0.21	0.00E+00	0	0	0	BACKGROUND
fenac	0.88	0.25	45	1000	1	0.000004		0.07	0.00E+00	0	0.000069	0.002213	
silver	17	0.25	45	1000	1	0.000094		0.003	0.00E+00	0	0.031481	0.997786	
TOTAL CA. RISK									0.00E+00			1	
TOTAL NONCA. RISK											0.031551		

AR302584

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DRAKE CHEMICAL RI/FS
JOB #620Y/552
DOSE & RISK COMPUTATIONS
PUBLIC & ENVIRONMENTAL HEALTH ASSESSMENT

Average Case

SUBJECT: INGESTION OF FISH

DESCRIPTION	UG/L	BCF	G/DAY	MG/UG	KG	L/G	DOSE MG/KG-DAY	q*	REF. DOSE	CA. RISK	% OF TOTAL CA	NONCA. RISK	%OF NONCA	COMMENT
aluminum	350.57	1	6.5	1000	70	1000	0.000032			0.00E+00	0	0	0	BACKGROUND
barium	53.86	1	6.5	1000	70	1000	0.000005		0.051	0.00E+00	0	0	0	BACKGROUND
calcium	35357.14	1	6.5	1000	70	1000	0.003283			0.00E+00	0	0	0	BACKGROUND
cobalt	17.86	1	6.5	1000	70	1000	0.000001			0.00E+00	0	0	0	BACKGROUND
iron	151.71	1	6.5	1000	70	1000	0.000014			0.00E+00	0	0	0	BACKGROUND
magnesium	14014.29	1	6.5	1000	70	1000	0.001301			0.00E+00	0	0	0	BACKGROUND
manganese	1055.57	1	6.5	1000	70	1000	0.000098		0.22	0.00E+00	0	0	0	BACKGROUND
nickel	22.29	47	6.5	1000	70	1000	0.000097		0.01	0.00E+00	0	0	0	BACKGROUND
potassium	1071	1	6.5	1000	70	1000	0.000099			0.00E+00	0	0	0	BACKGROUND
sodium	10974.29	1	6.5	1000	70	1000	0.001019			0.00E+00	0	0	0	BACKGROUND
zinc	45.57	47	6.5	1000	70	1000	0.000198		0.21	0.00E+00	0	0	0	BACKGROUND
fenac	0.38	289	6.5	1000	70	1000	0.000010		0.07	0.00E+00	0	0.000145	0.0001131	
silver	13.5	3080	6.5	1000	70	1000	0.003861		0.003	0.00E+00	0	1.287	0.9998868	
TOTAL CA. RISK										0.00E+00			1	
TOTAL NONCA. RISK												1.287145		

SUBJECT: ACCIDENTAL INGESTION DURING SWIMMING

DESCRIPTION	UG/L	L/DAY	KG	UG/MG	FRACT. SORBED.	DOSE MG/KG-DAY	q*	REF. DOSE	CA. RISK	% OF TOTAL CA	NONCA RISK	% OF TOT NONCA	COMMENT
aluminum	350.57	0.25	45	1000	1	0.001947			0.00E+00	0	0	0	BACKGROUND
barium	53.86	0.25	45	1000	1	0.000299		0.051	0.00E+00	0	0	0	BACKGROUND
calcium	35357.14	0.25	45	1000	1	0.196428			0.00E+00	0	0	0	BACKGROUND
cobalt	17.86	0.25	45	1000	1	0.000099			0.00E+00	0	0	0	BACKGROUND
iron	151.71	0.25	45	1000	1	0.000842			0.00E+00	0	0	0	BACKGROUND
magnesium	14014.29	0.25	45	1000	1	0.077857			0.00E+00	0	0	0	BACKGROUND
manganese	1055.57	0.25	45	1000	1	0.005864		0.22	0.00E+00	0	0	0	BACKGROUND
nickel	22.29	0.25	45	1000	1	0.000123		0.01	0.00E+00	0	0	0	BACKGROUND
potassium	1071	0.25	45	1000	1	0.00595			0.00E+00	0	0	0	BACKGROUND
sodium	10974.29	0.25	45	1000	1	0.060968			0.00E+00	0	0	0	BACKGROUND
zinc	45.57	0.25	45	1000	1	0.000253		0.21	0.00E+00	0	0	0	BACKGROUND
fenac	0.38	0.25	45	1000	1	0.000002		0.07	0.00E+00	0	0.000030	0.001204	
silver	13.5	0.25	45	1000	1	0.000075		0.003	0.00E+00	0	0.025	0.998795	
TOTAL CA. RISK									0.00E+00			1	
TOTAL NONCA. RISK											0.025030		

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SUBJECT : DERMAL CONTACT WHILE SWIMMING

DESCRIPTION	UG/L	HOURS DAY	% CONTACT	KG	FLUX INTO SKIN	CA. DOSE	NON CA DOSE MG/KG/DAY	q	REF DOSE	CA. RISK	% OF TOT CA	NON CA RISK	% OF NON CA RISK	COMMENT
aluminum	350.57	2	100	45	0.5	286.6260	4.21E-03			0.00E+00	0	0	0	BACKGROUND
barium	53.86	2	100	45	0.5	44.03593	6.46E-04		0.051	0.00E+00	0	0	0	BACKGROUND
calcium	35357.14	2	100	45	0.5	28907.99	4.24E-01			0.00E+00	0	0	0	BACKGROUND
cobalt	17.86	2	100	45	0.5	14.60233	2.14E-04			0.00E+00	0	0	0	BACKGROUND
iron	151.71	2	100	45	0.5	124.0380	1.82E-03			0.00E+00	0	0	0	BACKGROUND
magnesium	14014.29	2	100	45	0.5	11458.06	1.68E-01			0.00E+00	0	0	0	BACKGROUND
manganese	1055.57	2	100	45	0.5	863.0340	1.27E-02		0.22	0.00E+00	0	0	0	BACKGROUND
nickel	22.29	2	100	45	0.5	18.22430	2.67E-04		0.01	0.00E+00	0	0	0	BACKGROUND
potassium	1071	2	100	45	0.5	875.6496	1.28E-02			0.00E+00	0	0	0	BACKGROUND
sodium	10974.29	2	100	45	0.5	8972.579	1.32E-01			0.00E+00	0	0	0	BACKGROUND
zinc	45.57	2	100	45	0.5	37.25803	5.47E-04		0.21	0.00E+00	0	0	0	BACKGROUND
fenac	0.38	2	100	45	0.5	0.310688	4.56E-06		0.07	0.00E+00	0	0.000065142	0.001204	
silver	13.5	2	100	45	0.5	11.0376	1.62E-04		0.003	0.00E+00	0	0.054	0.998795	
TOTAL CA RISK										0.00E+00			1	
TOTAL NON CA RISK												0.054065142		

SUMMARY TABLE	CA RISK	NONCA RISK	% OF TOTAL CA	% OF TOT NONCA
FISH INGESTION	0.00	1.287145	0.00	0.942107
SWIMMING INGESTION	0.00	0.025030	0.00	0.018320
DERMAL CONTACT	0.00	0.054065	0.00	0.039572
TOTAL CA. RISK	0.00			
TOTAL NONCA. RISK		1.366240		

AR302586

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NUS CORPORATION AND SUBSIDIARIES			STANDARD CALCULATION SHEET
CLIENT: Ebasco/Region III	FILE NO.: 620Y	BY: R. Hoff/D. Smith	PAGE 1 OF 2
SUBJECT: FENAC		CHECKED BY:	DATE: 03 June 88

① Safety Factor method.

$$RfD_A = (LOAEL, NOEL, NOAEL) \Big/ \prod_{i=1}^{n} F_i$$

$F_1 = 1$ (not applicable)
$F_2 = 10$ (assume synergism)
$F_3 = 1$ (appropriate route)
$F_4 = 1$ (assume ingestion only)
$F_5 = 10$ (LOAEL = LD_{50} Oral Rat)
$F_6 = 10$ (using animal Data)
$F_7 = 10$ (Uncertanity using LD_{50} For Chronic Exposure)

LD_{50} FENAC Oral Rat = 700 mg/kg

est RfD = $\frac{700 \text{ mg/kg}}{10{,}000}$ 0.07 mg/kg

② Comparison With Other Herbicides & Structurally Similiars

	Compound	LD_{50} Oral Rat *	RfD
A)	2,3,5,6-DCPA	3000	0.05
B)	2,4-Dichlorophenoxy acetic acid	375	0.01
C)	2,4,5-Trichlorophenol	300	0.03
D)	2,4-Dichloro butyric phenoxy acid	700	0.008
E)	2,Methyl,4,Chlorophenoxy Acetic Acid	700	0.001
F)	2,4,5 Trichlorophenol	820	0.01
G)	1,2,4 Trichlorobenzene	—	0.02

G-34.

* LD_{50} From

AR302587

NUS 156A REVISED 0286

NUS CORPORATION AND SUBSIDIARIES			STANDARD CALCULATION SHEET
CLIENT: Ebasco/Reg III	FILE NO.: 620Y	BY:	PAGE 2 OF 2
SUBJECT: Fenac		CHECKED BY:	DATE:

(3) Regression Analysis of LD_{50} on RfD yields:

$$y = (-0.0001473)(x) + (0.16)$$

$$r = 0.757$$

Using LD_{50} Fenac = 700 mg/kg

$$RfD = (-0.0001473)(700\ mg/kg) + 0.16$$

$$RfD = 0.05689$$

~ 0.06 vs. 0.07 via Safety Factors

- Use 0.07 mg/kg as chronic toxicity Rf

NUS 156A REVISED 0285

AR302588