2

LETTER REPORT

RISER CONFIGURATION TANK 241-A-105 LIGHT-DUTY UTILITY ARM

WORK ORDER ER5505

Prepared for

Westinghouse Hanford Company

August 1994

For the U.S. Department of Energy
Contract DE-AC06-93RL12359

Prepared by

ICF Kaiser Hanford Company
Richland, Washington

ER5505LR

ICF Kaiser Hanford Company

DISCLAIMER

DISTRIBUTION SHEET

To	From	Page 1 of 1
Distribution	C. H. Brevick G7-56	Date August 16, 1994
Project Title/Work Order Riser Configuration, Tank 241-A-105, Light Duty Utility Arm/ER5505		EDT No. ECN No.

Name	MSIN	Text With All Attach.	Text Only	Attach./ Appendix Only	EDT/ECN Only
<u>Westinghouse Hanford Company</u>					
D. D. Bachand	R1-51	X			
D. H. Brown	N1-21	X (5)			
B. A. Carteret	N1-21	X			
J. G. Chandler	S5-10	X			
D. A. Clark	N1-42	X			
J. W. Engstrom	N1-21	X			
R. C. Eschenbaum	N1-21	X			
G. R. Kiebel	N1-42	X			
J. D. Potter	H5-70	X			
J. G. Propson	S4-58	X			
R. E. Raymond	R2-54	X			
T. J. Samuel	N1-21	X			
G. H. Smith	N1-21	X			
LDUA File No. 5.2.5	N1-21	X			
TFIC (Tank Farm Information Center)	R1-20	X			
Central Files	L8-04	X (2)			
OSTI	L8-07	X (2)			
<u>ICF Kaiser Hanford Company</u>					
T. D. Boucher	G7-57	X			
C. H. Brevick	G7-56	X (5)			
L. A. Gaddis	G7-57	X			
R. B. Johnson	G7-56	X			
D. A. Ochu	G7-57	X			
ICF-KH Publications	E6-63	0			X
ICF-KH Doc Control	G3-11	X			
<u>Pacific Northwest Laboratory</u>					
D. W. Bennett	K5-22	X			
C. M. Smith	K5-22	X			
L. A. Strope	K5-22	X			

13 STA 4
SEP 08 1994

ENGINEERING DATA TRANSMITTAL

1. EDT 136994

2. To: (Receiving Organization) TWRS	3. From: (Originating Organization) ICF KH
5. Proj./Prog./Dept./Div.: ER5505	6. Cog. Engr.: L.A. Gaddis/T.D.Boucher

4. Related EDT No.:

7. Purchase Order No.:

8. Originator Remarks:

For original release.

9. Equip./Component No.: N/A

10. System/Bldg./Facility: Tank Farms

11. Receiver Remarks:

12. Major Assm. Dwg. No.: N/A

13. Permit/Permit Application No.: N/A

14. Required Response Date: N/A

15. DATA TRANSMITTED

(A) Item No.	(B) Document/Drawing No.	(C) Sheet No.	(D) Rev. No.	(E) Title or Description of Data Transmitted	(F) Impact Level	(G) Reason for Transmittal	(H) Originator Disposition	(I) Receiver Disposition
1	WHC-SD-WM-ER-377		0	Riser Configuration, Tank 241-A-105, Light Duty Utility Arm	N/A	1	1	1

16. KEY

Impact Level (F)	Reason for Transmittal (G)	Disposition (H) & (I)
1, 2, 3, or 4 (see MRP 5.43)	1. Approval 2. Release 3. Information 4. Review 5. Post-Review 6. Dist. (Receipt Acknow. Required)	1. Approved 2. Approved w/comment 3. Disapproved w/comment 4. Reviewed no/comment 5. Reviewed w/comment 6. Receipt acknowledged

17. SIGNATURE/DISTRIBUTION (See Impact Level for required signatures)

(G) Reason	(H) Disp.	(J) Name	(K) Signature	(L) Date	(M) MSIN	(J) Name	(K) Signature	(L) Date	(M) MSIN	(G) Reason	(H) Disp.
1	1	Cog. Eng. L.A. Gaddis	LA Gaddis	8/31/94	67-57	T.D. Boucher	Todd D. Boucher	8/26/94	67-57	1	1
1	1	Cog. Mgr. C.H. Brevick	CH Brevick	8/26/94	67-56						
		QA									
		Safety									
		Env.									

18.	19.	20.	21. DOE APPROVAL (if required)
T.D. Boucher T.D. Boucher 8-26-94 Signature of EDT Originator Date	D.H. Brown WHB 8/31/94 D H Brown 8/26/94 Authorized Representative for Receiving Organization Date	C.H. Brevick (CHB 8/31/94) Chris H Brevick 8/26/94 Cognizant Manager Date	Ltr No. ☐ Approved ☐ Approved w/comments ☐ Disapproved w/comments

RELEASE AUTHORIZATION

Document Number:	WHC-SD-WM-ER-377, REV 0
Document Title:	RISER CONFIGURATION, TANK 241-A-105, LIGHT DUTY UTILITY ARM
Release Date:	9/8/94

* * * * * * * * * * * * *

This document was reviewed following the procedures described in WHC-CM-3-4 and is:

APPROVED FOR PUBLIC RELEASE

* * * * * * * * * * * * *

WHC Information Release Administration Specialist:

Kara Broz
Kara Broz
(Signature)

9/8/94
(Date)

A-6001-400 (07/94) WEF256

SUPPORTING DOCUMENT	1. Total Pages 36

2. Title	3. Number	4. Rev No.
Riser Configuration, Tank 241-A-105, Light Duty Utility Arm	WHC-SD-WM-ER-377	0

5. Key Words	6. Author
Riser Configuration, Tank Farm Access, Deployment, Robotics, Light Duty Utility Arm, Hot Test	Name: T.D. Boucher
APPROVED FOR PUBLIC RELEASE KMB 9/8/94	T.D. Boucher Signature
	Organization/Charge Code 58250 /ER5505 Tank Farms Technical Support

7. Abstract

This letter report provides information on access to Tank 241-A-105 for the deployment of the Light Duty Utility Arm. It includes riser sizes and measurements to surrounding equipment and obstacles. Land surveys, radiation surveys and equipment siting studies have been conducted to assist in locating the Light Duty Utility Arm system to an available riser for deployment and hot test certification.

9. Impact Level N/A

10. RELEASE STAMP

OFFICIAL RELEASE 13
BY WHC
DATE SEP 08 1994
Sta 4

ER5505LR

LETTER REPORT

RISER CONFIGURATION TANK 241-A-105 LIGHT-DUTY UTILITY ARM

WORK ORDER ER5505

Gina M Bayless — 8-26-94
Technical Documents — **Date**

Todd D. Boucher TDB 8-31-94 — 8-26-94
Technical Author — **Date**

Lawrence A Gedlis LAG 8-31-94 — 8-26-94
Principal Lead Engineer — **Date**

Chris H Brevick CHB 8-31-94 — 8/26/94
Project Manager — **Date**

Westinghouse Hanford Company

WH Brown WHB 8/31/94 — 8/26/94
Senior Project Engineer — **Date**

LETTER REPORT

RISER CONFIGURATION TANK 241-A-105 LIGHT-DUTY UTILITY ARM

WORK ORDER ER5505

INTRODUCTION

The light-duty utility arm (LDUA) is a seven-joint stainless steel robotic arm with a payload capacity of 34 kg (75 lb). The robotic arm is deployed vertically with a maximum vertical reach of 19,202 mm (63 ft) and a maximum horizontal reach of 4,115 mm (13.5 ft). The functional requirements of the LDUA system are mapping and characterization of waste in Hanford single-shell tanks (SST) before and during waste retrieval (ref 1).

The LDUA system consists of a mobile deployment system (MDS), a vertical positioning mast (VPM), a tank riser interface confinement (TRIC), the LDUA, and a controller subsystem or support trailer (ref 2). Currently, the system is in design and is subject to change; however, the LDUA or robotic arm will be deployed through a 300-mm (12-in.) riser above the tank dome.

Field trips were performed to gather specifics for future deployment of the LDUA in Tank 241-A-105. The purpose of this report is to support two previous reports (WHC-SD-WM-ER-204 and WHC-SD-WM-ER-222) for the investigation of SSTs for deployment of the LDUA system (ref 3 and 4). The first report (ref 3) identified the availability of 300- to 1,050-mm (12- to 42-in.) risers while the second report (ref 4) identified the availability of Tanks 241-A-105, 241-A-S-109, 241-A-T-101, and 241-A-T-109 for deployment of the LDUA system. The second report (ref 4) also identified those 100- and 300-mm (4- and 12-in.) risers that could be used for deployment of the LDUA and camera system. This report addresses accessibility to the 241-A Tank Farm and the usability of the Tank 241-A-105 risers.

The following information for assisting in the design and deployment of the LDUA will be discussed in this report:

- Radiation survey
- Flange identification
- High resolution video
- Computer simulated model
- Field survey

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

RADIATION SURVEY

A radiation survey was performed to determine the radiation/contamination areas and the general dose rates around the work zone during deployment of the LDUA system. The radiation plot for Tank 241-A-105 is in Appendix A. The health physics technician (HPT) noted that the survey results were a general indication and new readings should be taken again when the project is initiated. The HPT also noted that when a blind flange is removed from a riser, radiation levels could change. The following radiation and contaminated areas may be of concern and are listed with their location in relation to the R-4 observation port:

- The soil under the breather filter and the flexible hose between the filter and the 100-mm (4-in.) R-21 riser (due west).

- The soil between the central pump pit and the instrument house (southeast).

- The 300-mm (12-in.) riser/observation port R-4 itself.

- The central pump pit (due east).

- The thermocouple tree in the 200-mm (8-in.) R-9 riser (due south).

- The flexible trunk between the 200-mm (8-in.) R-2 riser and the portable exhauster (due east).

The HPT surveyed the area where support trailers will be parked and found no contamination greater than background or detectable. The contamination that was found under the breather filter and between the pump pit and the instrument house is fairly immobile because of the hardening solution that was added to the tank farm soil to limit contamination spreading.

FLANGE IDENTIFICATION

The 300-mm (12-in.) R-4 observation port and the 100-mm (4-in.) R-8 pressure gauge risers were Standard Class 150 slip-on flanges; however, the 100-mm (4-in.) R-14, R-18, and R-20 flanges are nonstandard flanges (see Appendix C). The nonstandard flanges are 25.4-mm (1-in.) thick steel plates that are welded to the riser and have a blind flange bolted on top. The 100-mm (4-in.) risers R-14 and R-18 are suitable for installation of a camera or lighting system in support of the LDUA system because of their location.

HIGH RESOLUTION VIDEO

For safety reasons and best management practices, the preferred and easiest access route to Tank 241-A-105 is through the Buffalo Avenue gate. Although the old entry gate does not have a personnel change trailer or decontamination zone for surveying out equipment, the 241-AY change trailer could be used for daily entry/exit and a temporary decontamination zone could be set up next to the gate prior to equipment evacuation (ref 5). The access route between the Buffalo Avenue gate and Tank 241-A-105 will be the shortest route and will be obstructed by the least amount of equipment.

Several obstacles exist in the vicinity of Tank 241-A-105. A piping berm will be encountered between Tanks 241-A-104 and 241-A-105. This berm that runs north to south is a concern because of the clearance between the truck and the breather filter. The berm is approximately 457 mm (18 in.) high and will cause the truck to tilt towards the breather filter which is attached to the R-21 100-mm (4-in.) riser. Depending on the TRIC orientation, the 100-mm (4-in.) riser R-20 could in the way of the MDS tires. The 100-mm (4-in.) R-8 riser has a pressure gauge that rises approximately 406 mm (16 in.) above grade. Finally, the center of the R-4 observation port is located 673 mm (26.5 in.) from the edge of the central pump pit and may be directly in the way of the TRIC support structures. The support structure may have to be modified to limit loading of the central pump pit by the LDUA system (see Appendix D).

COMPUTER SIMULATED MODEL

Measurement activities were conducted during the video portion and the preliminary walk through. The various obstacles were noted during the video. The video portion, walk through, and field survey were used to create a three-dimensional computer simulation model of the LDUA system and general area around Tank 241-A-105. The three-dimensional computer simulation model was used to demonstrate the recommended route for mobilization of the MDS and TRIC. The model provided a view of possible interference points between the leveling pads of the TRIC and the central pump pit and other risers.

FIELD SURVEY

The field survey shows the contours of berms and locations of obstructions along the path of the MDS (see Appendix E). A route from the Buffalo Avenue gate along the berm located between Tanks 241-A-104 and 241-A-105 has been surveyed. The locations of pump pits and risers were also noted. The LDUA should be able to negotiate the turns and obstacles of Tank 241-A-105. The field survey and measurements were used to determine the access route for the MDS.

APPROACH/EVALUATION

RADIATION SURVEY

Areas where workers would be setting down equipment and lower dose rate areas were identified to aid in project set up (see Appendix A). Furthermore, radiation and contamination areas were designated as hazardous areas and they should be avoided. Less than background levels or less than 0.5 mrem/hr are indicated around the general working area of the LDUA, TRIC, and MDS to show where the radiation monitoring equipment did not detect radioactivity or contamination. Soil samples could not be taken to determine soil contamination because a solution was spread on the tank farm to eliminate dust and wind blown contamination. The solution hardens the soil and makes sampling difficult. It was noted that in past experiences, the soil becomes more contaminated with depth above Tank 241-A-105. The increased contamination is due to a violent reaction that occurred in January 1965, which caused the steel liner to bulge and crack. When the liner bulged, the tank was pressurized resulting in tank contents being pushed out of the tank risers and onto the ground around the tank. Soil sampling or clearing for TRIC pad leveling could lead to exposure of buried contamination.

Monitoring will be required when the flanges are removed and then a better understanding of dose rate can be established. The HPT indicated that radiation on the farm is a very dynamic system and dose rates may vary widely depending on factors such as wind, exhausters, breather filter operations, and other tank farm work.

Currently, Level B dress, consisting of one pair of white coveralls, gloves, and shoe covers but no mask, is required in the 241-A Tank Farm; however, requirements may change when the riser flanges are removed. Health physics personnel stated that various glove bags designed specifically for risers could be used when the TRIC is attached. The glove bags will eliminate airborne contamination from flange removal. Normally, masks will be used during these type of operations and self-contained breathing apparatus will be used in extreme situations. The contamination below the filter housing and between the pump pit and instrument house should be avoided to prevent spreading.

FLANGE IDENTIFICATION

Detailed information about the five available risers is shown on Table 1 in Appendix C. The table contains general information and physical dimensions/descriptions of the five available risers. The table also includes the current and suggested uses of the particular riser to support the LDUA project. Asbestos gaskets were found on all five of the available risers (ref 6).

Photographs of the R-4 observation port/riser and the R-8 pressure gauge/riser are in Appendix D, pages D-2 and D-3. Riser R-4 has lead shielding wrapped around the riser and lead plates on top of the riser. A pressure gauge is attached to riser R-8 which measures internal pressure in Tank 241-A-105. The pressure gauge may be an obstacle for the TRIC.

A cross-section that shows risers R-4 and R-8 and the central pump pit is shown on page D-8. The flanges are standard Class 150 slip-on flanges, the dimensions were obtained from a Taylor Forged Table (ref 7).

An unidentified port where some electrical equipment was disconnected is shown on page D-4. The port is located next to riser R-8 and was not identified on any previous drawings (see page D-5). Piping Waste Isolation 241-A-105 (reference Drawing H-2-73387) shows some abandoned equipment in the approximate location of this port but places it in the northwest quadrant of the tank instead of the southwest quadrant where the unknown port is. After a radiation survey of the port, the port was opened in an attempt to determine its uses. The port does not penetrate the tank dome. The port contained a coaxial wire that was grounded to a bar which, in turn, was grounded to the riser. A piece of duct tape with the words "from 102 to 105" was attached to the wire.

Risers R-14, R-18, and R-20 are similar in design and could be used for a camera or lighting system. A still photograph of riser R-18 is shown on page D-6. The R-14 spare/riser and R-20 spare/riser are not shown, but have dimensions that are similar to those of the R-18 riser because they are all nonstandard flanges. A typical cross-section through risers R-14, R-18, and R-20 is shown on page D-8. The dimensions are approximate because the flanges are nonstandard and, therefore, have odd sizes.

Two photographs of the LDUA show two potential final positions of the very rear end of the truck. The photographs show an elevation view of risers R-4 and R-8, the unknown port, and the central pump pit and riser R-18. Riser R-18 is of particular interest because of its location with respect to the MDS tires. A closer profile photograph of the R-4 and R-8 risers, the unknown port, and central pump pit looking east; shows the location of the risers of interest. A close up profile photograph of the R-18 riser shows the nonstandard flange design (see page D-7).

HIGH RESOLUTION VIDEO

The video was used to show the conditions of the entry routes, heights of obstructions, and available space. The video was shot along the access route and the general areas where the MDS and TRIC would be in final position. The video portion of the project shows the two routes that are thought to be the best access routes to Tank 241-A-105. The video portion from the second letter report WHC-SD-WM-ER-222, Rev. 0 (ref 4) was incorporated into the video taken during this project. The video from the previous report was taken entirely outside the tank farm; therefore, the external video and internal video from this project compliment each other.

For the video, a 2,591-mm (8.5-ft) survey stick with 152-mm (6-in.) black and white sections was used to represent the overall width of the MDS and for other general measuring activities. The survey stick was used to measure the clearances of the truck as it negotiates obstacles in the 241-A Tank Farm. A steel tape measure was used to establish the dimensions of the obstructions that are closest to the five main usable risers. The measurements can be seen on the video portion of the reports. A detailed engineering sketch showing dimensions is in Appendix B, page B-1.

COMPUTER SIMULATED MODEL

A three-dimensional computer model simulation of the TRIC and MDS can be seen on the end section of the video portion (see Appendix D, page D-1). Views of the three-dimensional computer simulation model are shown on pages D-9 through D-13. The aerial view shows the various positions of the MDS while it is maneuvered into position next to the stationary TRIC. The five maneuvering positions where the MDS will be positioned in the three-dimensional computer model are noted on the view (see page D-9). The next view shows the various camera positions in relation to the stationary TRIC and MDS in the final deployment position (see page D-10). The third view on page D-11 shows the MDS and TRIC in position with the robotic arm fully deployed as seen by camera 2 in position 5. The fourth view shows the three-dimensional computer model simulation superimposed onto a photograph taken above Tank 241-A-105 (see page D-12). The last view shows a suggested method to provide adjustability for the TRIC leveling pads that avoids interference between the TRIC and the tank components and equipment (see page D-13).

FIELD SURVEY

The field survey was used to determine if any obstacles would directly affect the route of the LDUA MDS. The approximate route of the MDS, excluding the maneuvering of the MDS around the available riser, is depicted on the engineering sketch on page E-1. The sketch shows a potential final position of the LDUA system and the location of the support trailer is shown inside the 241-A Tank Farm. An enlarged view of the MDS, TRIC, and area above Tank 241-A-105 is shown on page E-2.

UNCERTAINTIES AND RECOMMENDATIONS FOR FURTHER STUDY

Two uncertainties about the LDUA system exist: the ability of the TRIC to rest and apply additional load to the central pump pit, and the possibility that the dimensions of the LDUA system may change which would affect this report.

The following recommendations have been made:

- Field work should be scheduled at least 6 weeks in advance which would be more efficient for Westinghouse Operations because of prior commitments scheduled for Fiscal Year 1995.

- Heath Physics personnel recommended removing asbestos gaskets before actual use of the risers for deployment of the LDUA system. Asbestos gaskets may be removed while a plug gauge is used to check risers for acceptance of the LDUA system. The asbestos gaskets could be replaced with neoprene gaskets.

- All electrical equipment will require grounding according to the National Electrical Code (NEC).

- An additional simulated model view of the TRIC suggests more adjustability for the level pads of the TRIC. The field trip and video show a limited space to place the TRIC. The photograph demonstrates more adjustability because of the tight areas where the TRIC may be placed (see Appendix D, page D-13). This view demonstrates more adjustability for location of leveling pads and will offer more versatility for use of the LDUA on other tanks.

REFERENCES

1. Report, "Functions and Requirements for the Integrated Light Duty Utility Arm System," prepared by Pacific Northwest Laboratories, July 1993.

2. Report, "Light Duty Utility Arm LDUA and Deployment System Concept Design Report," prepared by Spar Aerospace Limited, SPAR-LDUA-R.003, October 1993.

3. Report, "Single-Shell Riser Configuration," prepared by Kaiser Engineers Hanford Company, Document No. WHC-SD-WM-ER-204, Rev. 0, September 1993.

4. Report, "Single-Shell Tank and Riser Access Study," prepared by ICF Kaiser Engineers Hanford, Document No. WHC-SD-WM-ER-222, Rev. 0, March 1994.

5. Telephone Conference Memorandum with Doug Hastings of Westinghouse 200-East Tank Farms Scheduling, April 14, 1994.

6. Telephone Conference Memorandum with Bryce Reynolds of 200-East and -West Tank Farm Operations, April 7, 1994.

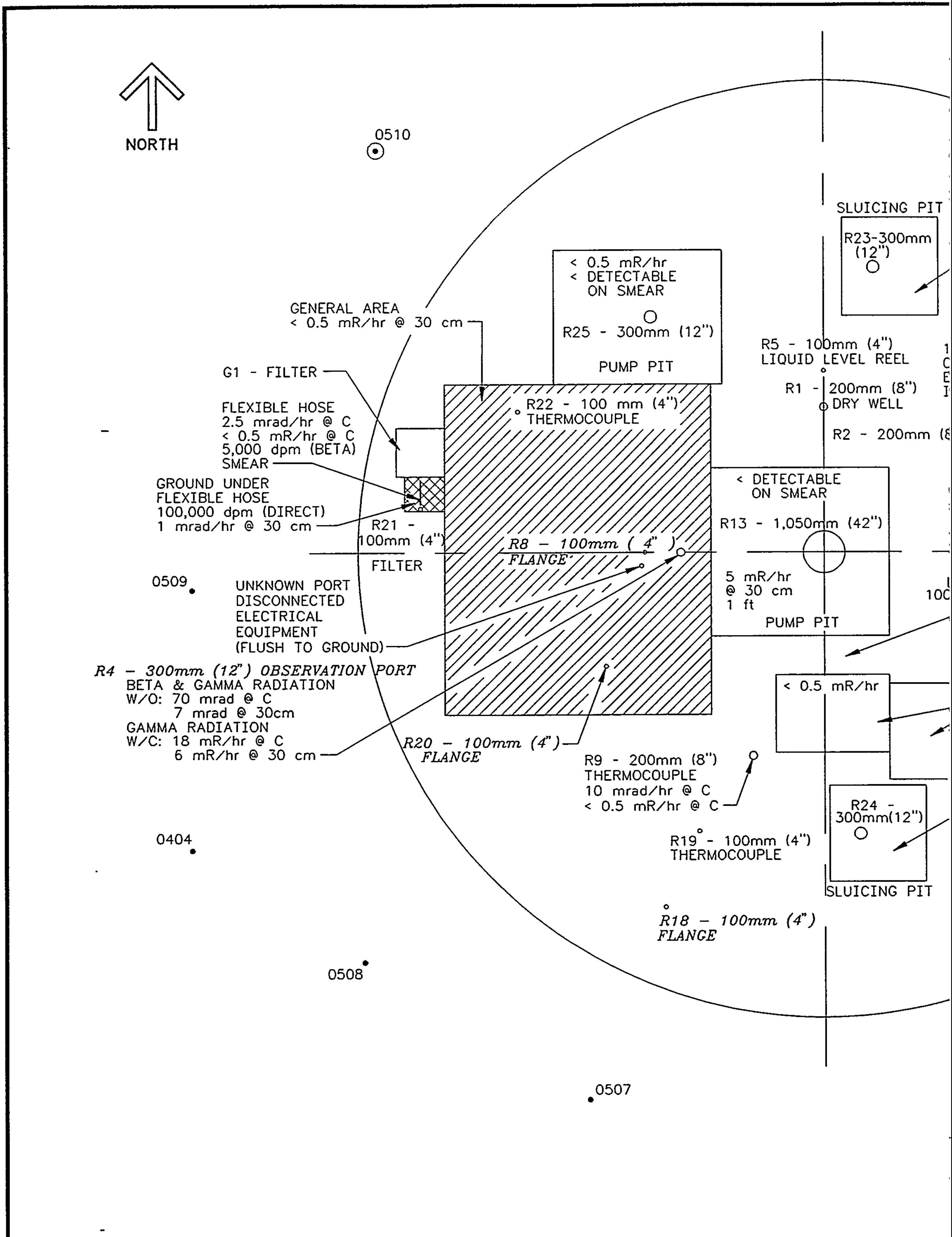
7. Reference, "Paramount Supply Company," page 98, Taylor Forged Steel Flanges Table, 1979.

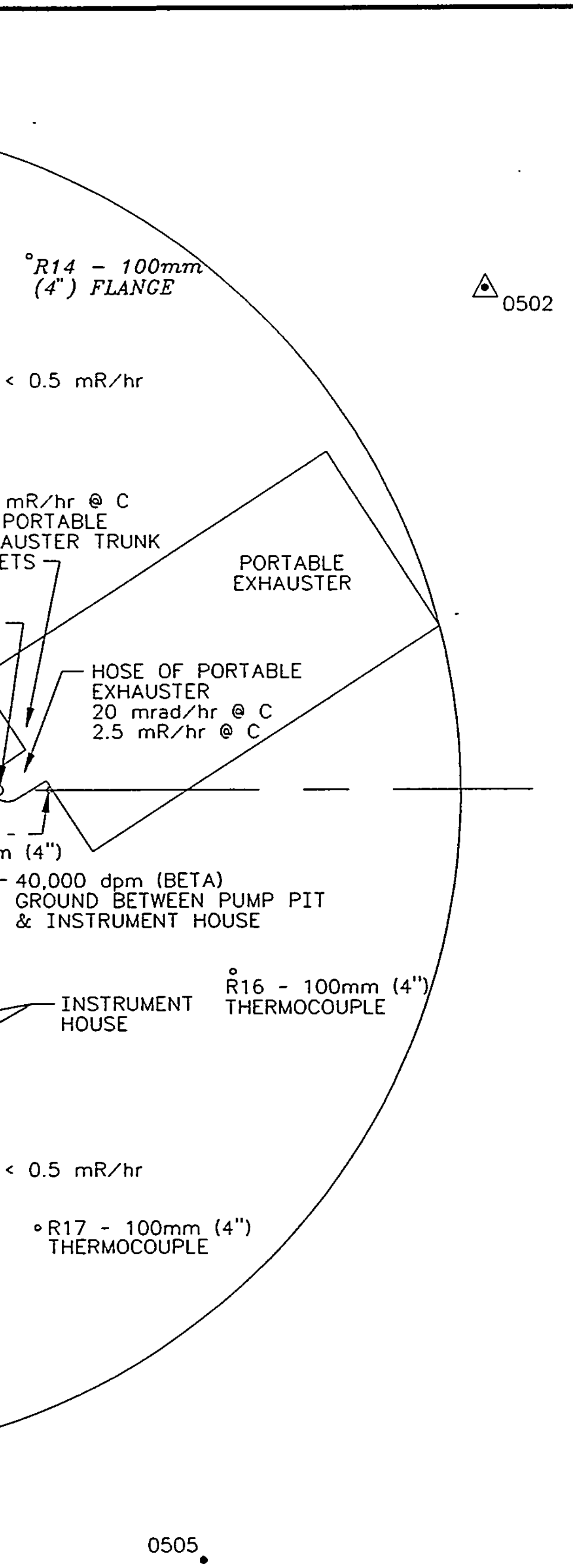
APPENDICES

Appendix A.	Tank 241-A-105 Radiation Plot
Appendix B.	Tank 241-A-105 Surface Plot
Appendix C.	Available Riser Table
Appendix D.	High Resolution Video and Three-Dimensional Compûter Simulated Model
Appendix E.	Field Survey Plot of Access Route

APPENDIX A

Tank 241-A-105 Radiation Plot


NORTH
0510
SLUICING PIT
R23-300mm (12")
< 0.5 mR/hr
< DETECTABLE ON SMEAR
R25 - 300mm (12")
PUMP PIT
GENERAL AREA
< 0.5 mR/hr @ 30 cm
R5 - 100mm (4")
LIQUID LEVEL REEL
G1 - FILTER
R1 - 200mm (8")
DRY WELL
R22 - 100 mm (4")
THERMOCOUPLE
FLEXIBLE HOSE
2.5 mrad/hr @ C
< 0.5 mR/hr @ C
5,000 dpm (BETA)
SMEAR
R2 - 200mm
GROUND UNDER
FLEXIBLE HOSE
100,000 dpm (DIRECT)
1 mrad/hr @ 30 cm
< DETECTABLE ON SMEAR
R13 - 1,050mm (42")
R21 - 100mm (4")
FILTER
R8 - 100mm (4")
FLANGE
0509
UNKNOWN PORT
DISCONNECTED
ELECTRICAL
EQUIPMENT
(FLUSH TO GROUND)
5 mR/hr
@ 30 cm
1 ft
PUMP PIT
R4 - 300mm (12") OBSERVATION PORT
BETA & GAMMA RADIATION
W/O: 70 mrad @ C
7 mrad @ 30cm
GAMMA RADIATION
W/C: 18 mR/hr @ C
6 mR/hr @ 30 cm
< 0.5 mR/hr
R20 - 100mm (4")
FLANGE
R9 - 200mm (8")
THERMOCOUPLE
10 mrad/hr @ C
< 0.5 mR/hr @ C
R24 - 300mm(12")
0404
R19 - 100mm (4")
THERMOCOUPLE
SLUICING PIT
R18 - 100mm (4")
FLANGE
0508
0507



LEGEND

DOSE RATES:
- @ C = CONTACT
- @ 30 cm = at 30 cm (1 foot) from object
- mR/hr = milirem/hour (GAMMA: PENETRATING)
- mrad/hr = milirad/hour (BETA: NON-PENETRATING)
- < DET OR < 0.5 mR/hr = LESS THEN DETECTABLE OR BACKROUND
- W/O = WITHOUT COVER FOR DETECTING GAMMA AND BETA RADIATION
- W/C = WITH COVER FOR DETECTING GAMMA RADIATION

CONTAMINATION:
- dpm = DISINTEGRATIONS PER MINUTE
- DIRECT = DIRECT MEASUREMENT WITH INSTRUMENT
- SMEAR = SWIPE WITH CLOTH AND THEN A MEASUREMENT FROM CLOTH WITH INSTRUMENT

1" = 3,048mm

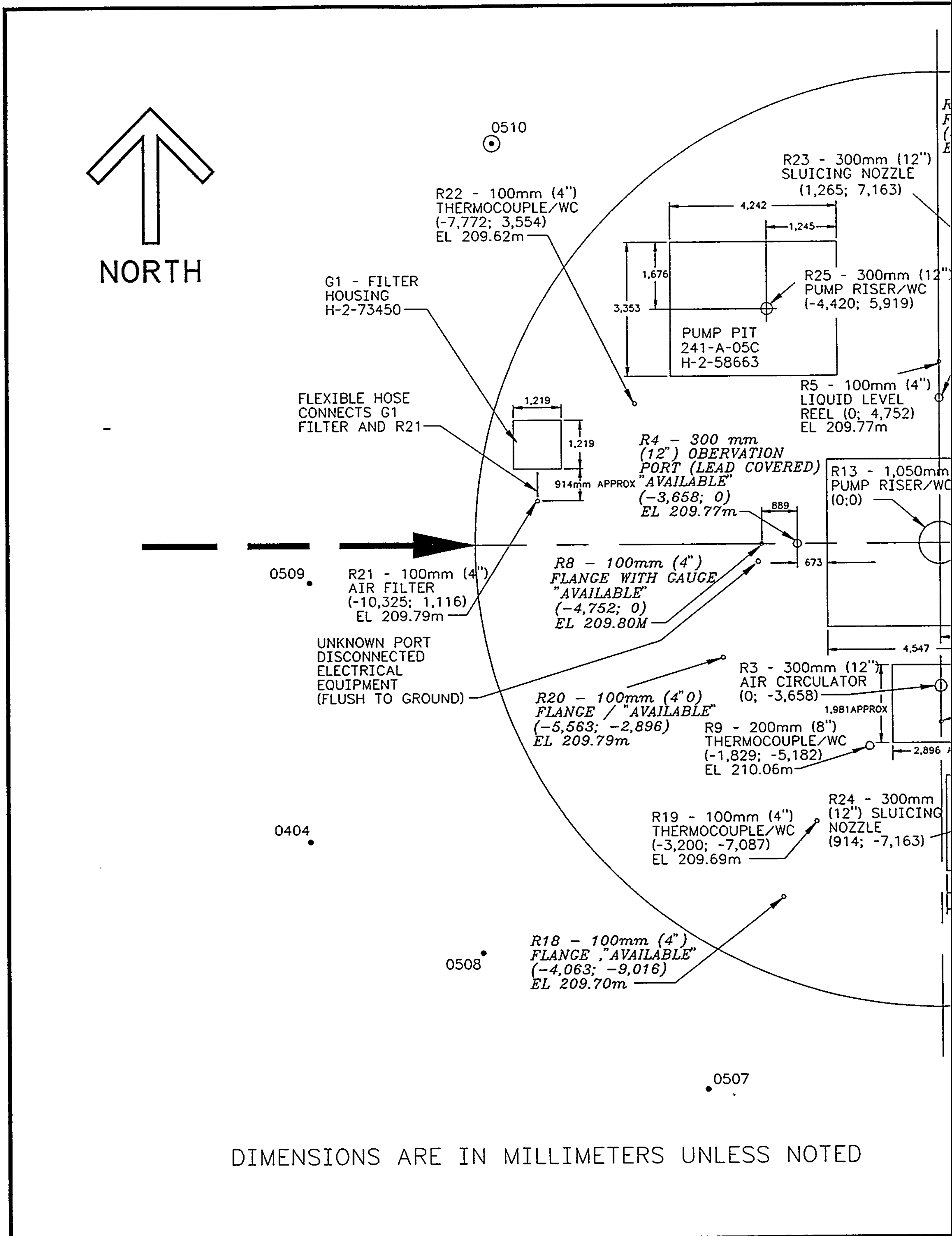
0 1,524 3,048 6,096

SCALE

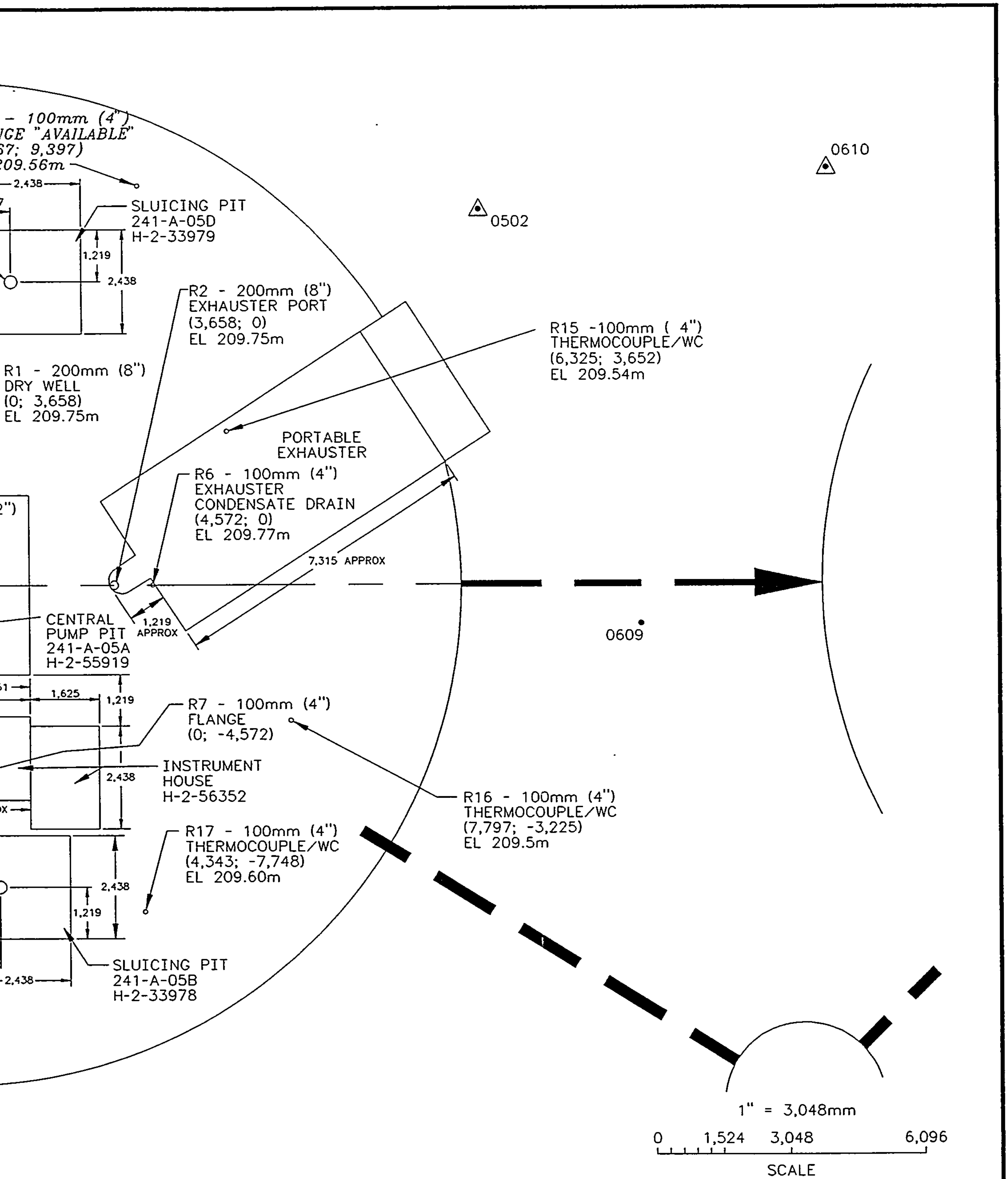
	ENGINEERING SKETCH			
Title: SINGLE-SHELL TANK 241-A-105 RADIATION PLOT	Prepared by: BA LORENZO	Sh 1 of 1	Sketch no. ES-5505-E1	Rev 2
	Checked by: TD BOUCHER	Cadfile ES5505E1		

APPENDIX B

Tank 241-A-105 Surface Plot



NORTH
0510
0509
0404
0508
0507
R22 - 100mm (4") THERMOCOUPLE/WC (-7,772; 3,554) EL 209.62m
G1 - FILTER HOUSING H-2-73450
FLEXIBLE HOSE CONNECTS G1 FILTER AND R21
R23 - 300mm (12") SLUICING NOZZLE (1,265; 7,163)
4,242
1,245
1,676
3,353
R25 - 300mm (12") PUMP RISER/WC (-4,420; 5,919)
PUMP PIT 241-A-05C H-2-58663
R5 - 100mm (4") LIQUID LEVEL REEL (0; 4,752) EL 209.77m
1,219
1,219
914mm APPROX
R4 - 300 mm (12") OBERVATION PORT (LEAD COVERED) "AVAILABLE" (-3,658; 0) EL 209.77m
889
R13 - 1,050mm PUMP RISER/WC (0;0)
673
R21 - 100mm (4") AIR FILTER (-10,325; 1,116) EL 209.79m
R8 - 100mm (4") FLANGE WITH GAUGE "AVAILABLE" (-4,752; 0) EL 209.80M
UNKNOWN PORT DISCONNECTED ELECTRICAL EQUIPMENT (FLUSH TO GROUND)
4,547
R3 - 300mm (12") AIR CIRCULATOR (0; -3,658)
1,981APPROX
R20 - 100mm (4"0) FLANGE / "AVAILABLE" (-5,563; -2,896) EL 209.79m
R9 - 200mm (8") THERMOCOUPLE/WC (-1,829; -5,182) EL 210.06m
2,896
R24 - 300mm (12") SLUICING NOZZLE (914; -7,163)
R19 - 100mm (4") THERMOCOUPLE/WC (-3,200; -7,087) EL 209.69m
R18 - 100mm (4") FLANGE ,"AVAILABLE" (-4,063; -9,016) EL 209.70m
DIMENSIONS ARE IN MILLIMETERS UNLESS NOTED



KAISER ENGINEERS HANFORD	ENGINEERING SKETCH			
Title: SINGLE-SHELL TANK 241-A-105 SURFACE PLOT	Prepared by: BA LORENZO Checked by: TD BOUCHER	Sh 1 of 1 Cadfile ES5505E2	Sketch no. ES-5505-E2	Rev 2

APPENDIX C

Available Riser Table

Table 1. FIVE AVAILABLE RISERS ON TANK 241-A-105

RISER	R-4	R-8	R-14	R-18	R-20
STYLE	*Forged	*Forged	**Fabricated	**Fabricated	**Fabricated
SIZE(nominal)	300mm (12in)	100mm (4in)	100mm (4in)	100mm (4in)	100mm (4in)
SPECIFICATION	Class 150 Slip-On Flange	Class 150 Slip-On Flange	NA	NA	NA
CURRENT USE	Observation Port	Pressure Gauge	Spare	Spare	Spare
RECOMMENDATIONS	Robotic Arm	Currently has a pressure gauge on riser.	Lighting or Camera	Too close to R-8 Observation Port to be useful	Lighting or Camera
*A forged flange is a manufactured flange with standard dimensions. **A fabricated flange is a hand made flange with non standard dimensions.					
PHYSICAL DIMENSIONS / DESCRIPTIONS					
Flange Style	Raised Face	Raised Face	Flat-Faced	Flat-Faced	Flat-Faced
Outside Diameter of Flange	483mm (19in)	229mm (9in)	203 mm (8in)	203 mm (8in)	203 mm (8in)
Outside Diameter of Blind Flange	483mm (19in)	229mm (9in)	203 cm (8in)	195mm (7.69in)	191mm (7.5in)
Bolt Circle	432mm (17in)	191mm (7.5in)	~159mm (6.25in)	~159mm (6.25in)	~159mm (6.25in)
Number of Bolt Holes / Number of Bolts Used	12/4	8/4	4/4	4/4	4/4
Thickness of Flange	31.8mm (1.25in)	23.9mm (0.94in)	25.4mm (1in)	25.4mm (1in)	25.4mm (1in)
Hole Size	25.4mm (1in)	19.1mm (0.75in)	16mm (0.63 in)	16mm (0.63 in)	16mm (0.63 in)
Bolt Head Size	28.7mm (1.13in)	25.4mm (1in)	19.1mm (0.75in)	19.1mm (0.75in)	19.1mm (0.75in)
Gasket	Asbestos / Raised Faced	Asbestos / Raised Faced	Asbestos / Flat-Faced	Asbestos / Flat-Faced	Asbestos / Flat-Faced
Distance to Nearest Obstacle from Riser Center	673mm (26.5in) Center Pump Pit	559mm (22in) Riser R-8 Observation Port	1,448mm (57in) North Sluicing Pit	2,743 mm (108in) Center Pump Pit	2,108mm (83in) Riser R-19 Thermocouple Tree
Riser Height Above Grade (top of blind flange)	152 mm (6in)	203 mm (8in)	127 mm (5in)	South side close to grade and north at 64mm (2.5in)	127 mm (5in)

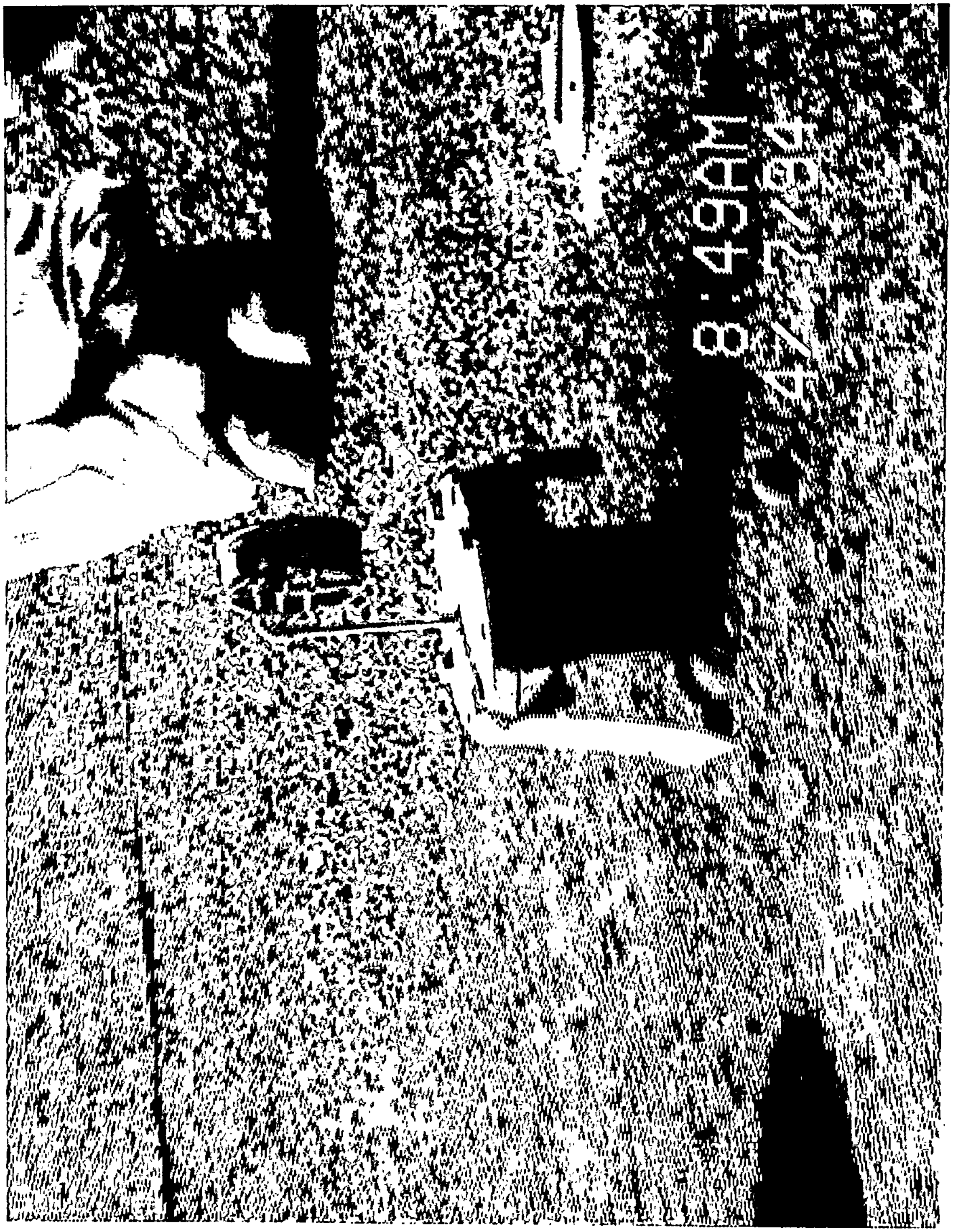
APPENDIX D

High Resolution Video and Three-Dimensional Computer Simulated Model

ST.......
Super VHS
3M
Master Broadcast
Videocassette
Riser configuration
Tank 241-A-105
Light duty utility arm
ER5505 High resolution video
and three-dimensional
computer model
S VHS

ST.......
Master Broadcast
Videocassette
S VHS
Super VHS
Riser configuration Tank 241-A-105
Light duty utility arm
ER5505 High resolution video and
Three-dimensional computer model
3M

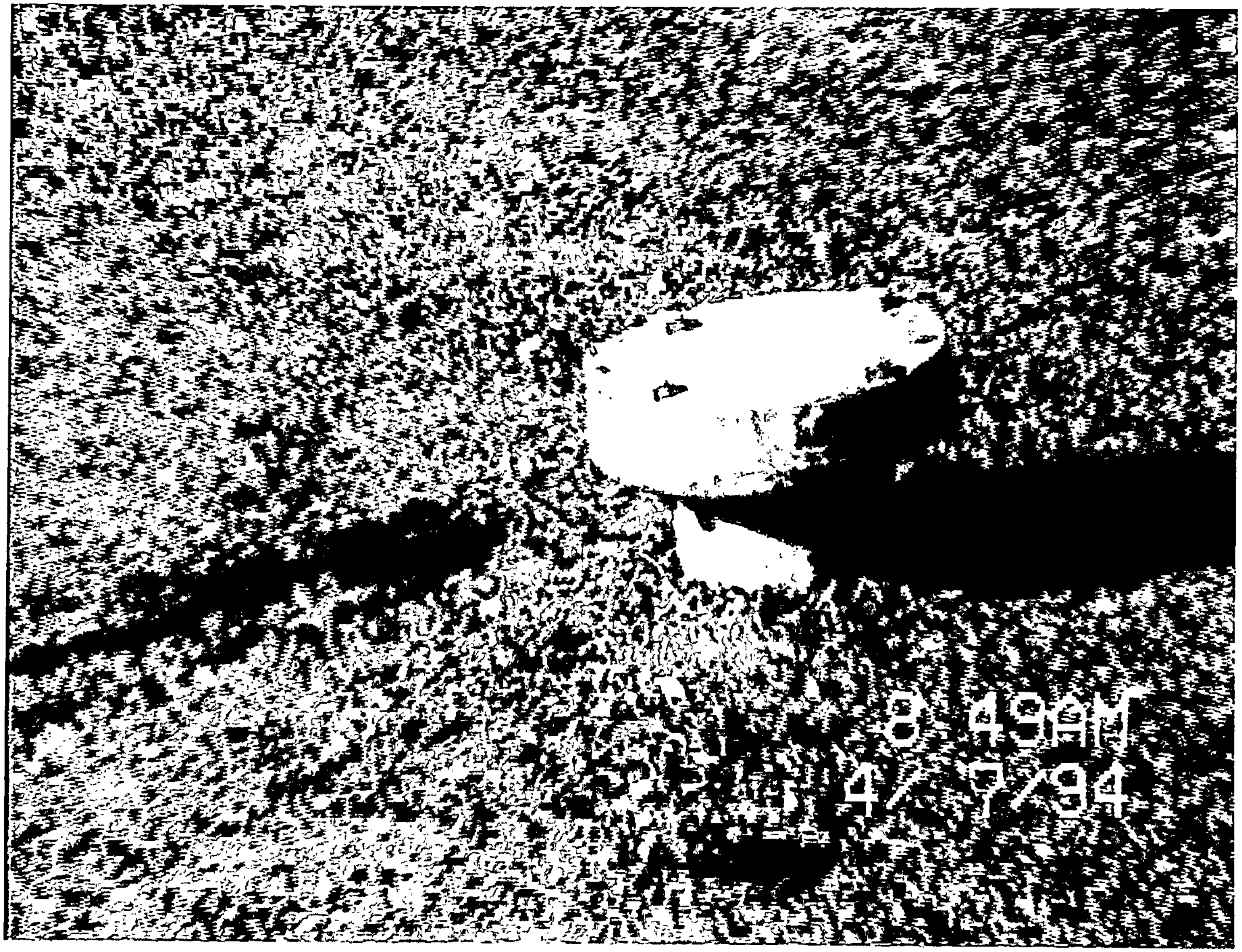
Riser R-4 Observation Port--main 30.5 cm (12 in.) riser for LDUA system.



Riser R-8 Pressure Gauge--may be a obstacle to TRIC or MDS. (Unknown port with disconnected electrical equipment to the right)

Unknown Port--disconnected electrical equipment found under lid.

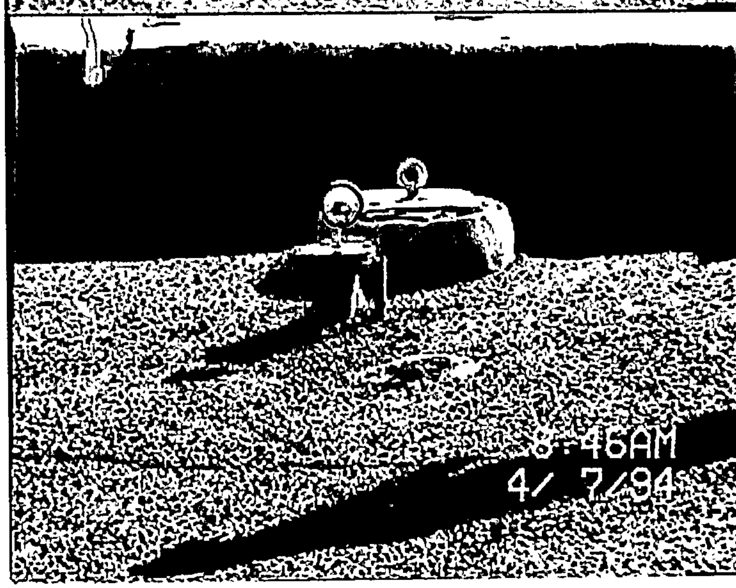
View from central pump pit (in foreground) looking west at risers R-4 observation port, R-8 pressure gauge, and unknown port.



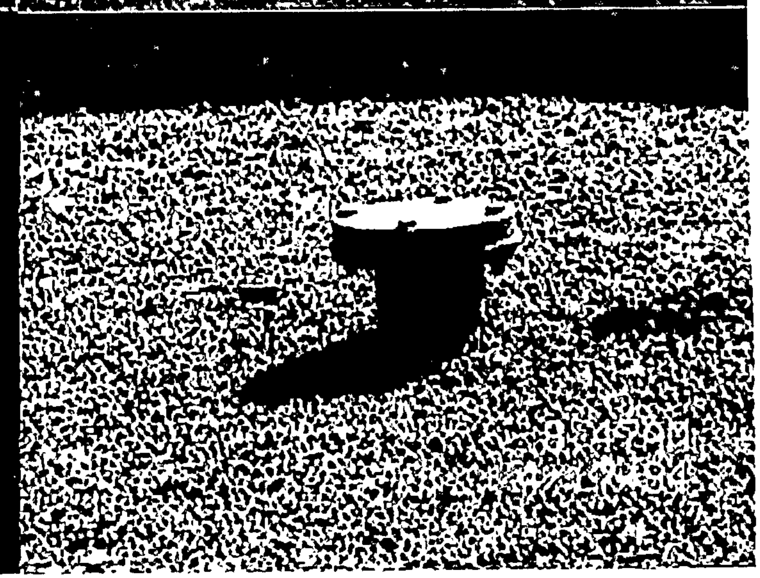
Spare/Riser R-18 that may be used for camera equipment or for lighting. (Similar construction to risers R-14 and R-20)

1. First potential resting spot for MDS rear end. (looking east)

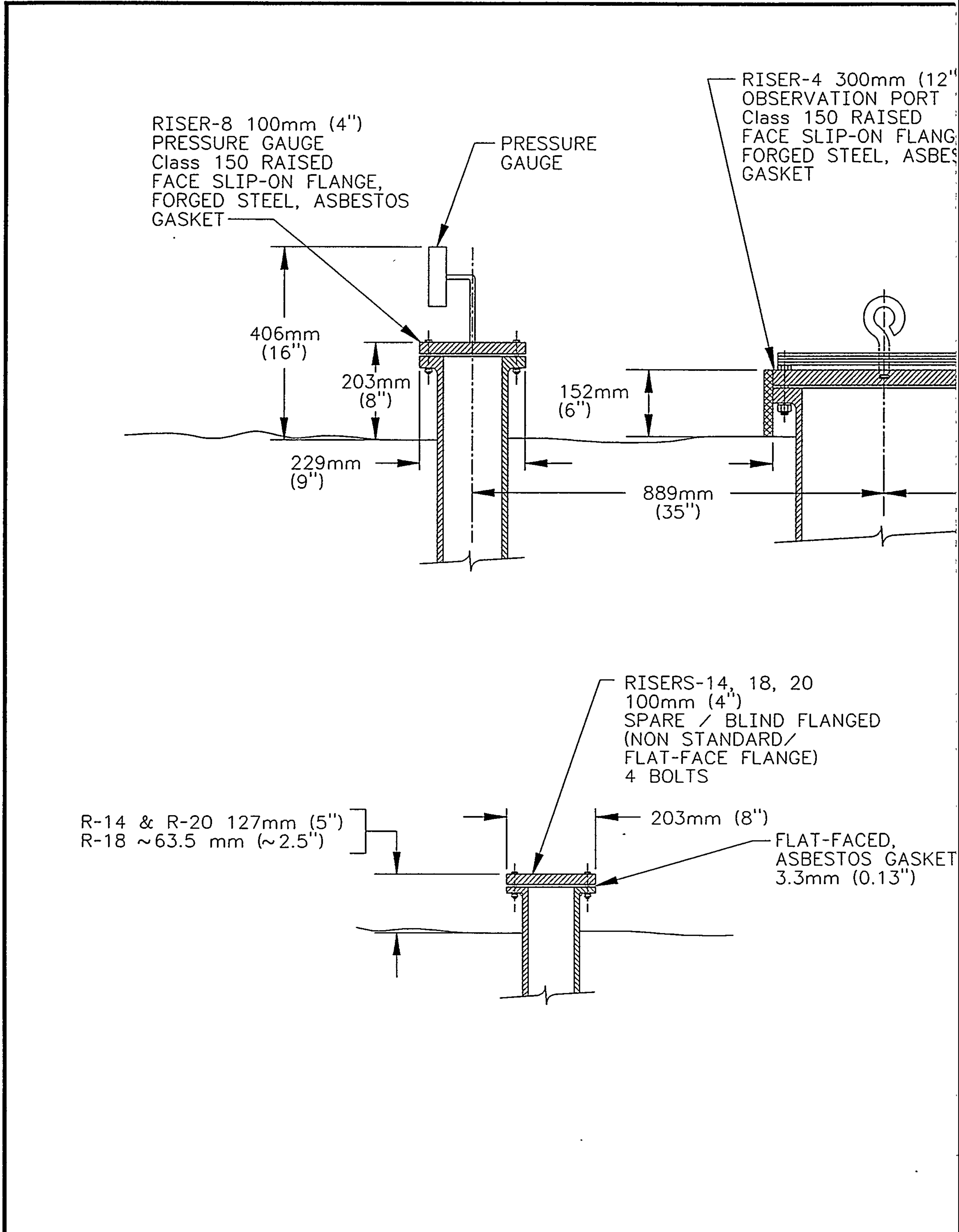
2. Second potential resting spot for MDS rear end. (looking northeast)

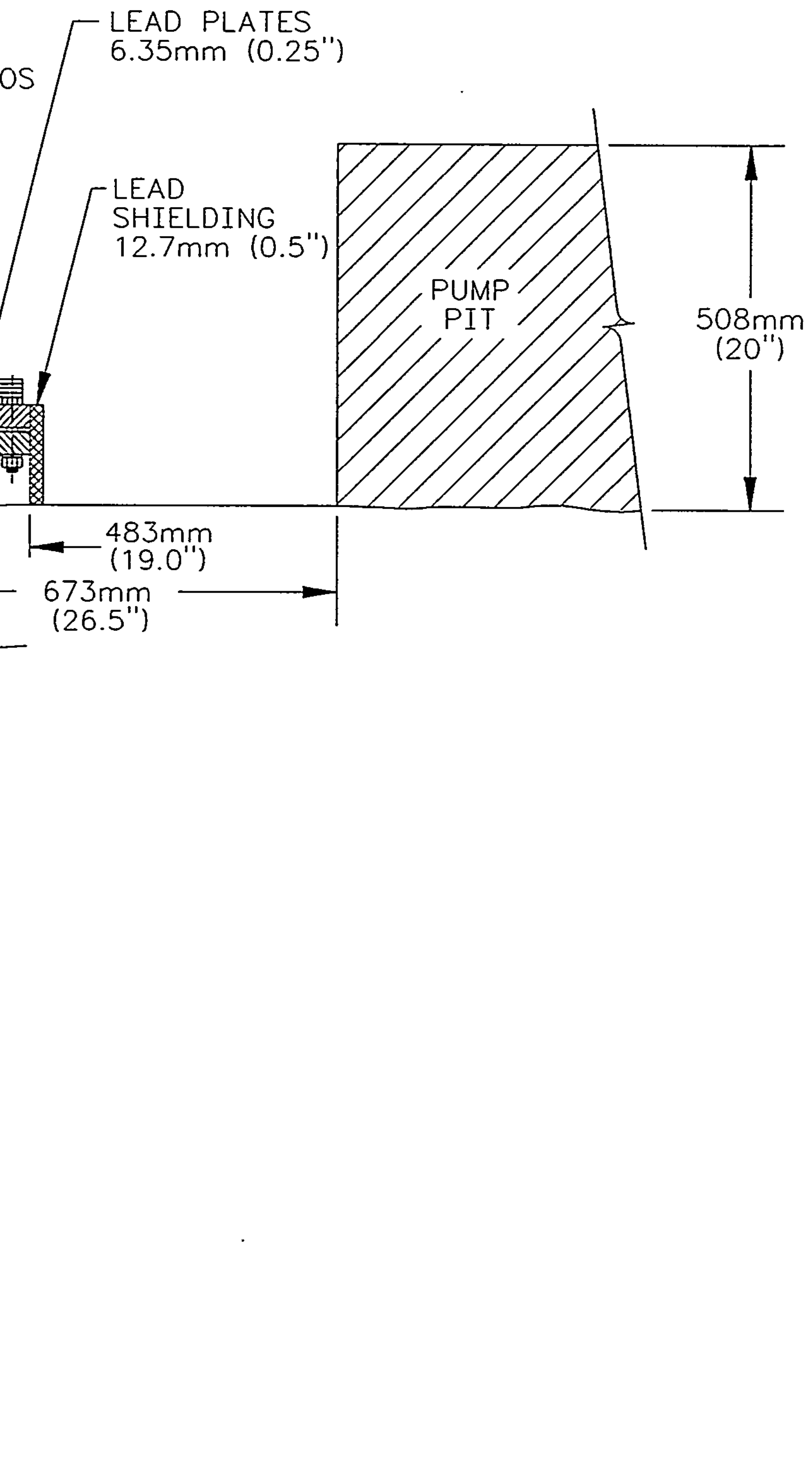


3. R-4 and R-8 Risers with central pump pit in background. (looking east)

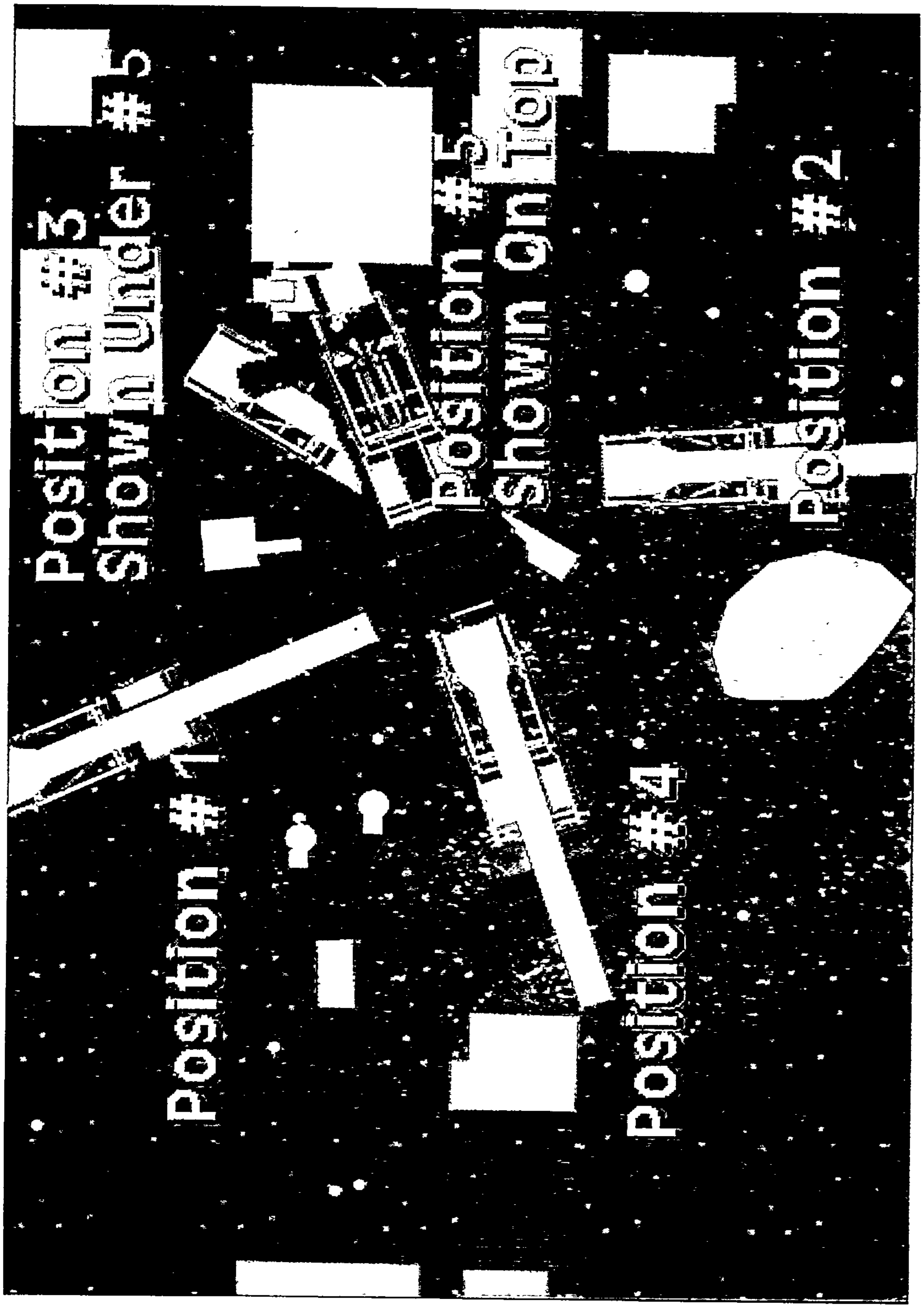


4. R-18 Spare/Riser of similar construction to R-14 and R-20 risers.

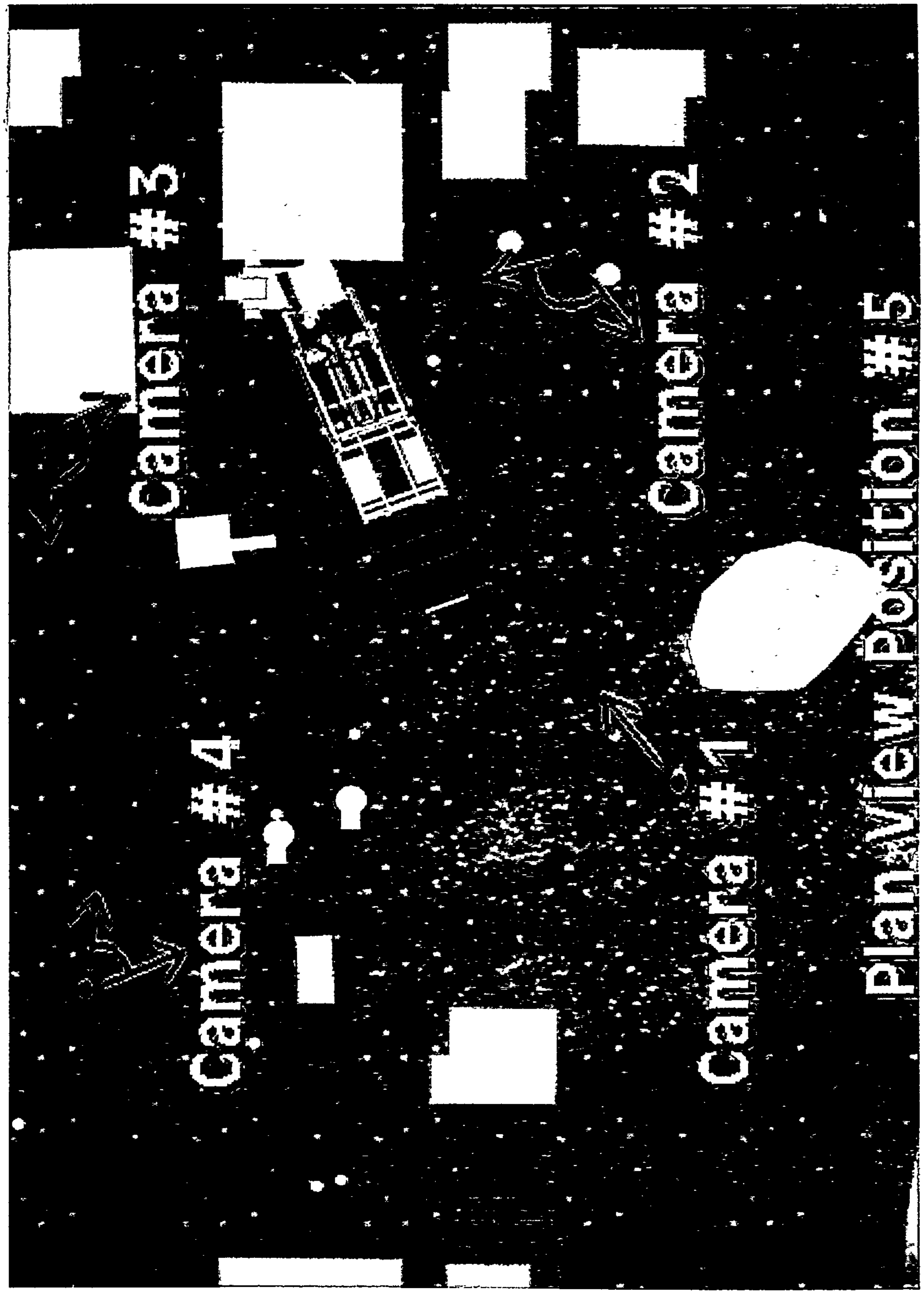

RISER-8 100mm (4")
PRESSURE GAUGE
Class 150 RAISED
FACE SLIP-ON FLANGE,
FORGED STEEL, ASBESTOS
GASKET
PRESSURE
GAUGE
RISER-4 300mm (12"
OBSERVATION PORT
Class 150 RAISED
FACE SLIP-ON FLANG
FORGED STEEL, ASBES
GASKET
406mm
(16")
203mm
(8")
152mm
(6")
229mm
(9")
889mm
(35")
RISERS-14, 18, 20
100mm (4")
SPARE / BLIND FLANGED
(NON STANDARD/
FLAT-FACE FLANGE)
4 BOLTS
R-14 & R-20 127mm (5")
R-18 ~63.5 mm (~2.5")
203mm (8")
FLAT-FACED,
ASBESTOS GASKET
3.3mm (0.13")



KAISER ENGINEERS HANFORD	ENGINEERING SKETCH			
Title: SINGLE-SHELL TANK 241-A-105 LDUA TRUCK AND TRIC BOX	Prepared by: BA LORENZO	Sh 1 of 1	Sketch no. ES-5505-E3	Rev 2
	Checked by: TD BOUCHER	Cadfile ES5505E3		



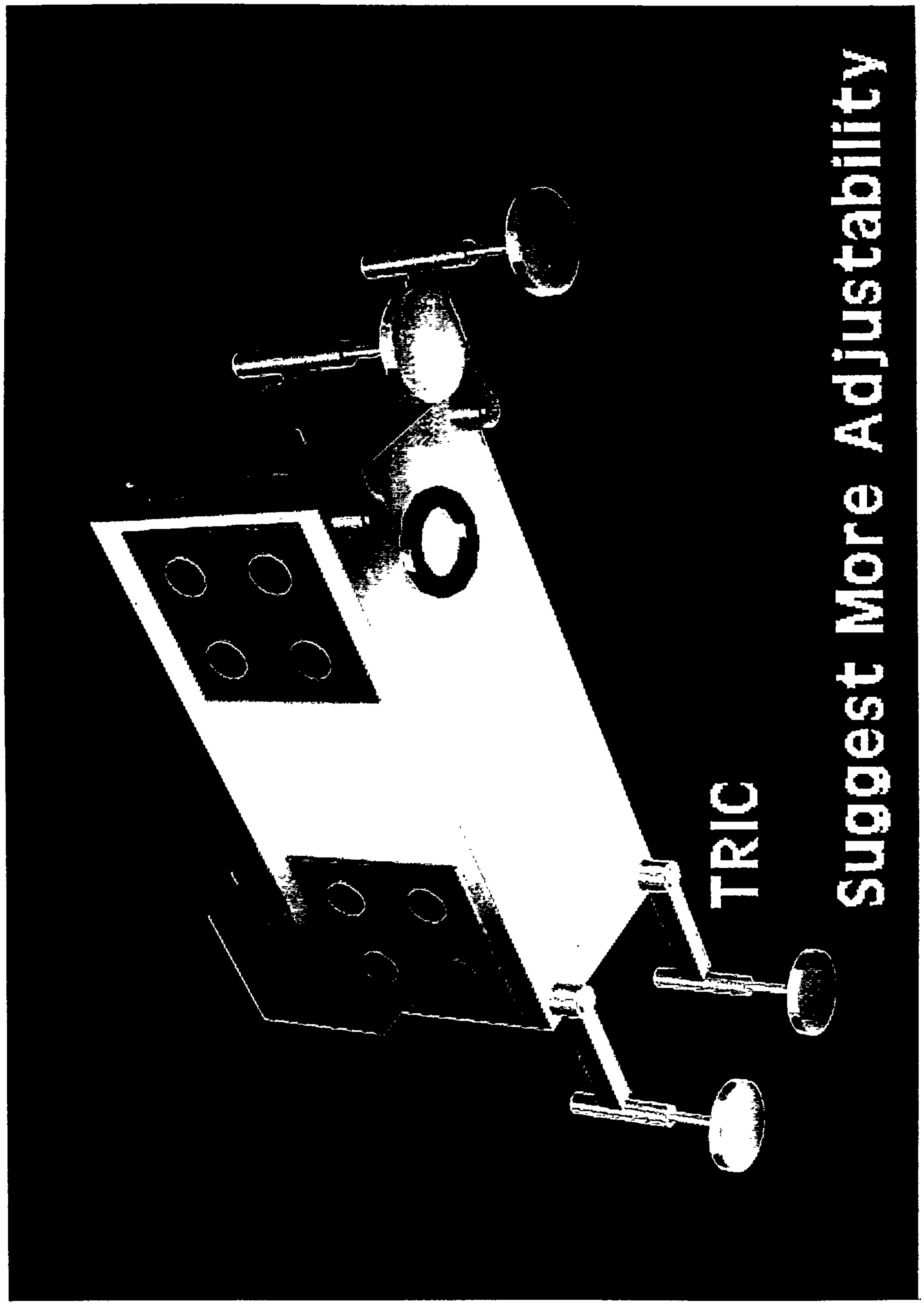
Various positions of MDS while being maneuvered into position above 241-A-105.



Various camera positions showing positions of the MDS and TRIC in relation to equipment.

View from Camera no. 2 Position no. 5 showing the TRIC, MDS, and the LDUA deployed.

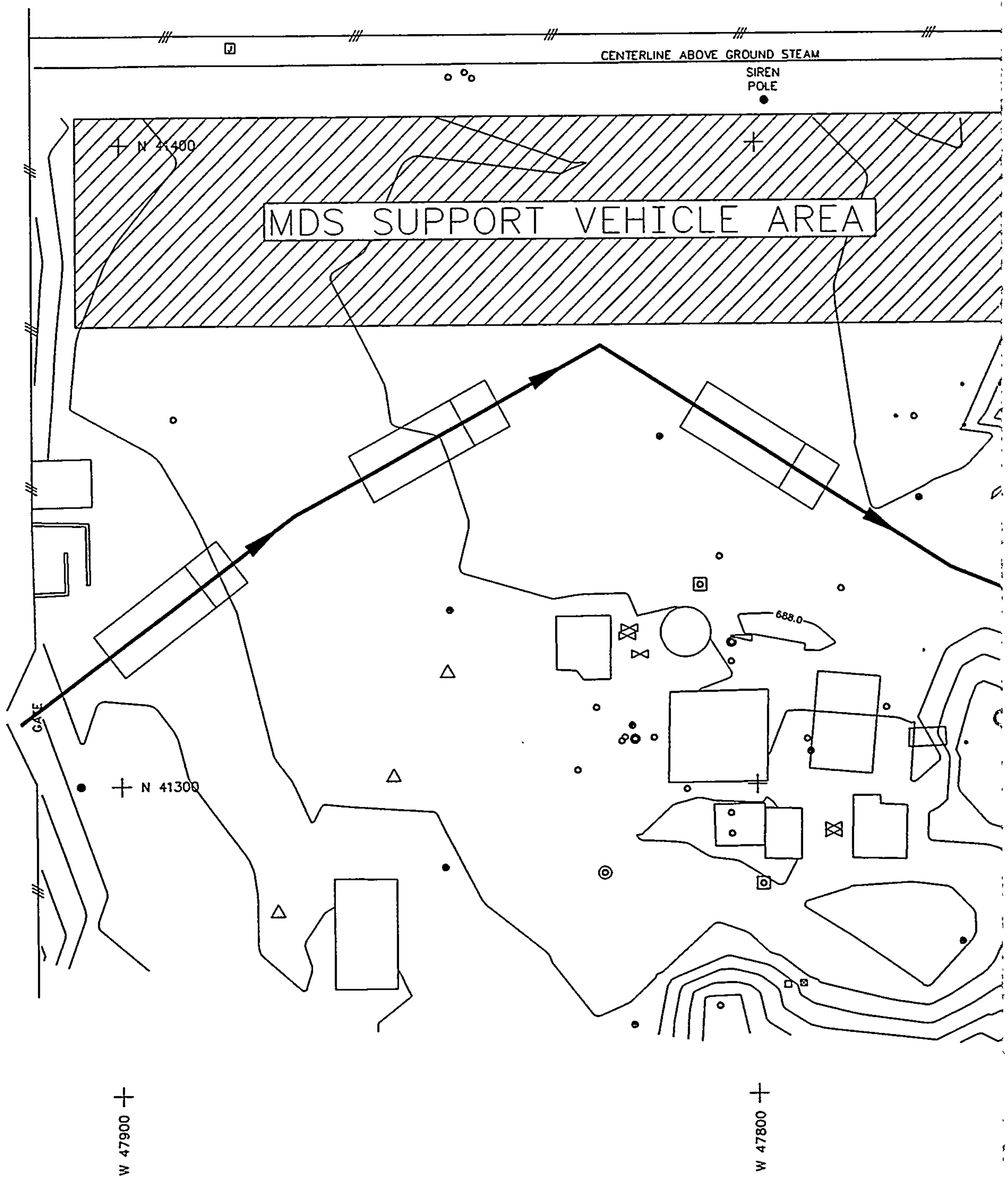
Still picture of three-dimensional computer model placed on a photograph of Tank 241-A-105.

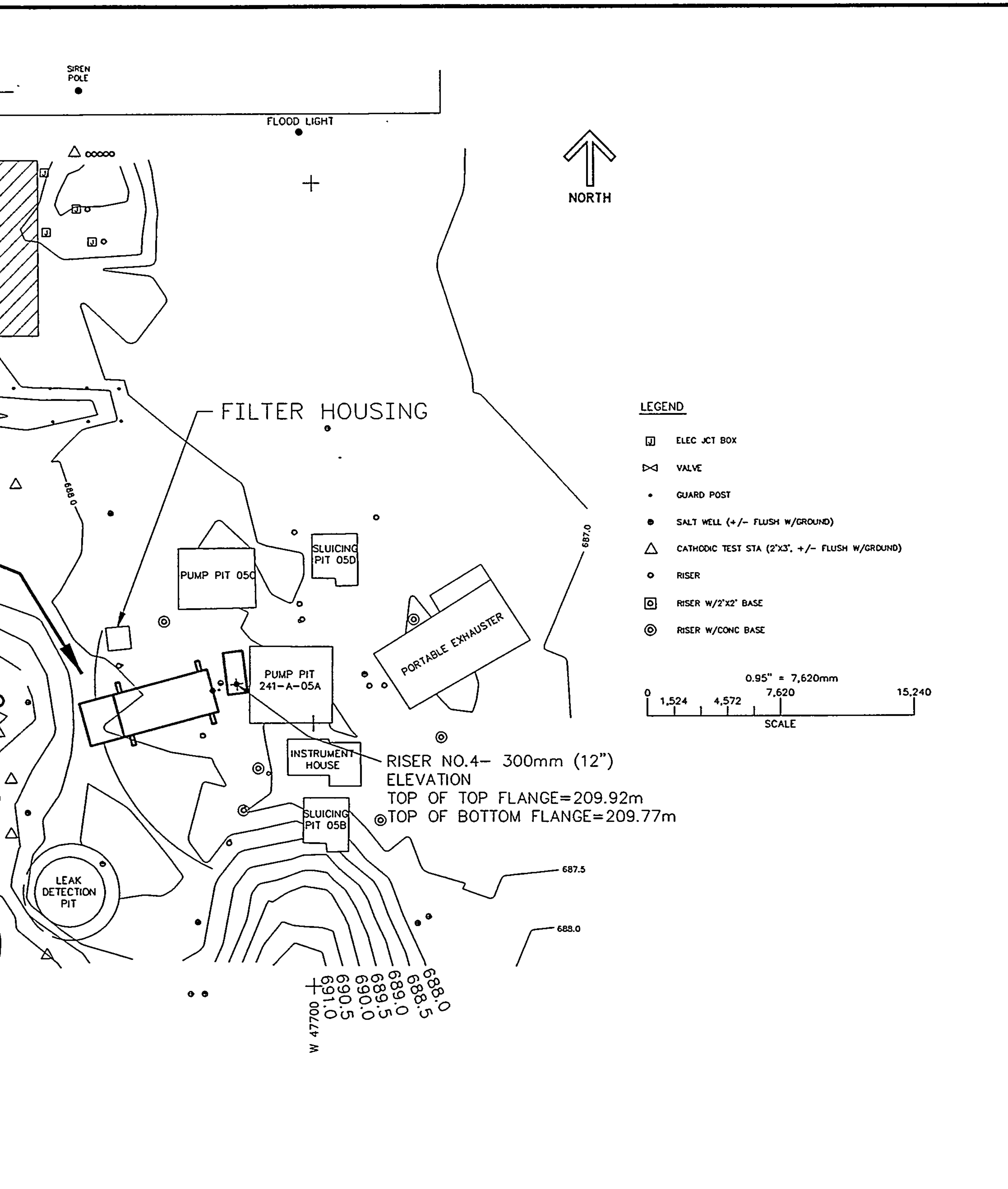


Suggested adjustability for TRIC leveling pads.

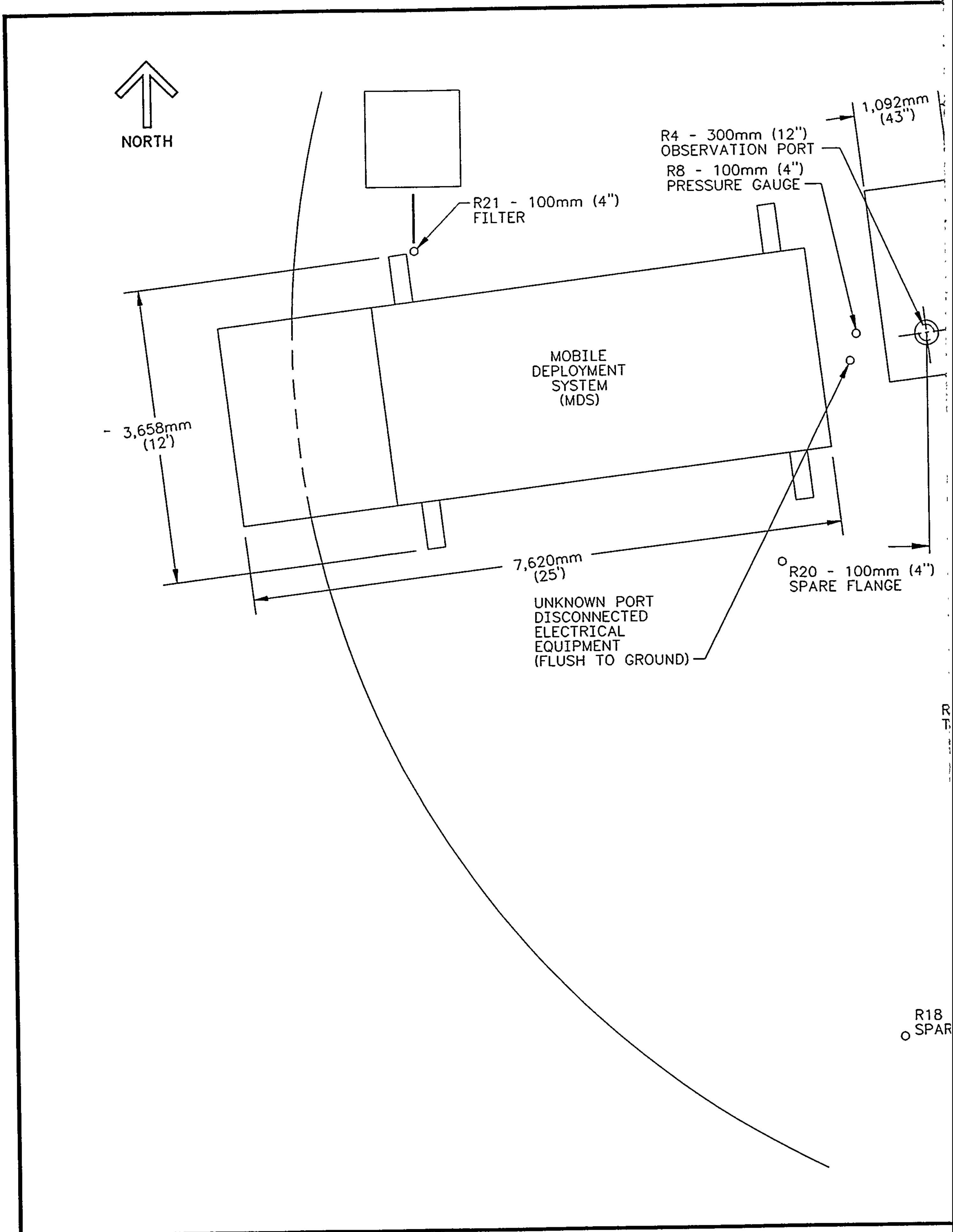
APPENDIX E

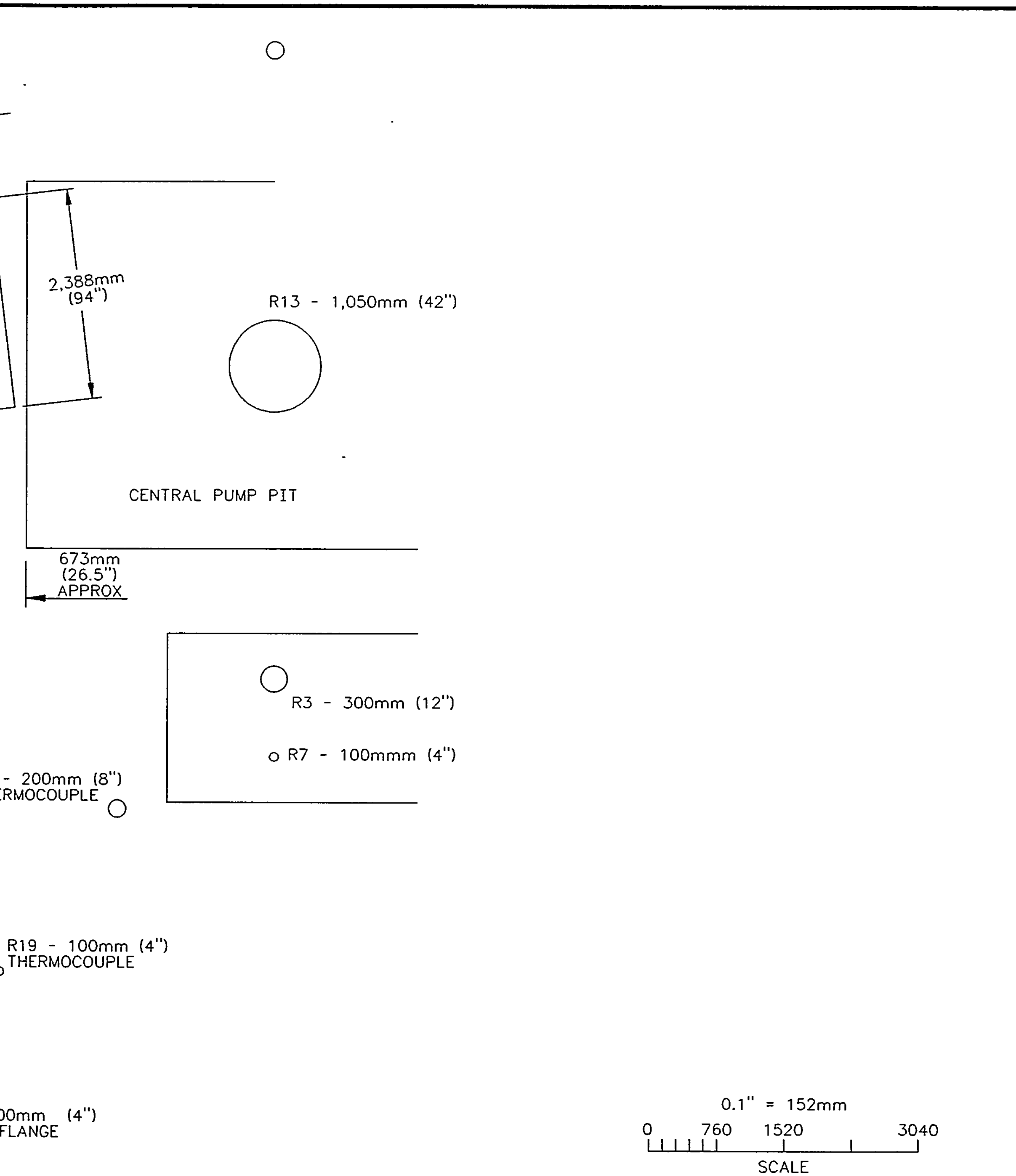
Field Survey Plot of Access Route


CENTERLINE ABOVE GROUND STEAM
SIREN
POLE
N 41400
MDS SUPPORT VEHICLE AREA
688.0
GATE
N 41300
W 47900
W 47800



KAISER ENGINEERS HANFORD	ENGINEERING SKETCH			
Title: SINGLE-SHELL TANK 241-A-105 ACCESS ROUTE FOR LDUA MDS TRUCK	Prepared by: DK GOODENOUGH	Sh 1 of 1	Sketch no. ES-5505-E5	Rev 2
	Checked by: TD BOUCHER	Cadfile ES5505E5		


NORTH
R21 - 100mm (4")
FILTER
R4 - 300mm (12")
OBSERVATION PORT
R8 - 100mm (4")
PRESSURE GAUGE
1,092mm
(43")
MOBILE
DEPLOYMENT
SYSTEM
(MDS)
3,658mm
(12')
7,620mm
(25')
R20 - 100mm (4")
SPARE FLANGE
UNKNOWN PORT
DISCONNECTED
ELECTRICAL
EQUIPMENT
(FLUSH TO GROUND)
R18
SPAR



KAISER ENGINEERS *HANFORD*	ENGINEERING SKETCH			
Title: SINGLE-SHELL TANK 241-A-105 LDUA MDS TRUCK AND TRIC	Prepared by: BA LORENZO	Sh 1 of 1	Sketch no. ES-5505-E4	Rev 2
	Checked by: TD BOUCHER	Cadfile ES5505E4		