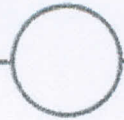


APA Group



Tindal MLV
Coating Assessment Report
Below Ground Station Piping Repair Project

APA Group



Tindal MLV Main Line Valve

Coating Assessment Report

Document No. BGS-RP-A-0005 Rev 0B				
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Report Approved by	STEPHEN DYKES <i>Stephen Dykes 22/4/13</i>			
Changes to be approved by				
Version control	Date	Version	Nature of Change	Approved by (Name)
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1 Introduction

Direct Current Voltage Gradient (DCVG) surveys have been conducted at each scraper station along the Amadeus Gas Pipeline (AGP) to give an indication of the condition of the coating at each site. However, the accuracy of these DCVG surveys at the scraper stations is uncertain due to the possibilities of Cathodic Protection (CP) shielding and interactions between different pipe sections.

To correlate the DCVG results to actual defects, 5 scraper stations, 4 Main Line Valves (MLVs) and 9 anchor blocks have been selected to be excavated and to undergo coating assessment. The results of these excavations and coating assessments will help determine the expected condition of the remaining stations and MLV's, and provide key information into the decision to excavate them or not.

Tindal is the first of the MLV sites to be excavated and assessed. This report compares the DCVG results for Tindal to the results of the coating assessment following excavation including Long Range Ultrasonic Testing (LRUT).

After coating assessments had been conducted, the station pipework was cleaned by abrasive blasting and recoated with Luxepoxy, a high build 2 part epoxy coating.

2 Method

In April 2012 a DCVG survey was conducted on the Tindal MLV. These results have been included in this report for comparison to determine if there is a correlation between the DCVG survey data and actual coating defects around the MLV.

The Tindal MLV has been excavated and assessed, see Appendix 1. For major defects a coating defect assessment has been conducted, completed coating defect assessment forms are in Appendix 2. Appendix 3 contains any referenced photos and the photo log.

The results of the DCVG survey and the coating defects assessments have been compared to determine if there is a correlation between the DCVG survey and actual coating defects in Section 4 Discussion.

3 Results

3.1 DCVG

There was one recorded DCVG result at Tindal MLV. The defect are summarised in Table 1 below. As there is only the single result a plan and elevation drawing is shown in Appendix 1.

Table 1: DCVG Detected Defects

DCVG Defect Number	Section	IR
1	Tindal MLV	10.0 %

Dig up of the Tindal MLV reported the following coating defects of Table 2.

Table 2: Coating Defects Within Vicinity of DCVG Detected Defects

DCVG Defect Number	Section	Photo Log / Notes
1	MLV	Appendix 3, Photo 0783, 0807, 0808 and 0818. Several coating defects on MLV. No corrosion evident.
-	North Canusa Sleeve	Appendix 3, Photo 0800, 0802, 0815 and 0867. No coating defect reported. Pitting corrosion underneath canusa sleeve.
-	South Canusa Sleeve	Appendix 3, Photo 0796, 0797, 0798, 0799, 0816, 0818, 0819. 1400mm crack downstream of south canusa sleeve. Pitting corrosion underneath canusa sleeve.

3.2 Coating Inspection

Several coating defects were found in the Coal Tar Epoxy (CTE) coating at Tindal MLV, which jeeped out under holiday testing; refer photo 0783. In spite of this the CTE coating at Tindal MLV did not suffer from blistering corrosion to the same extent as other sites. The canusa sleeves which join sections of yellow jacket did not appear damaged, though a 1400mm crack in the yellowjacket to the south canusa sleeve had developed partially into the sleeve.

3.3 Metal loss

Metal loss was reported underneath two areas of canusa sleeve to the north and south of the MLV. In both cases pitting corrosion was found, with a maximum penetration depth of 1.0mm into the pipe wall beneath the north canusa sleeve. The area of corrosion was limited to the pipe surface directly exposed to the canusa sleeves, this defect was not detected by DCVG survey which suggests that the corrosion is due to the shielding effect of the canusa sleeves. A Coating Damage Assessment report was used to document the metal losses, refer to Appendix 2.

3.4 Pigging Data

Pigging data is available for these line segments around the area of corrosion. Results of the magnetic field profile in the area around the south canusa sleeve weld are attached, refer to Appendix 4. Due to the small corrosion pit size the pig was unable to detect a significant disruption to the induced magnetic field strength in the area and metal loss does not appear apparent, note however that the pigging data is dated to 2003.

3.5 RSTRENG Analysis

RSTRENG analysis was completed over the more severe area of corrosion to the north anchor block. The pipe wall thickness in the area is 7.90mm (refer to Appendix 1) and the Coating Damage Assessment metal loss form issued from site (Appendix 2) indicates the maximum pit depth of 1.0mm. The results of the RSTRENG analysis indicate that the pipeline passes for the current Maximum Operating Pressure (MAOP) of 9,650kPag (refer to Appendix 5). The AGP design factor is 0.72 which translates to a required safety factor of 1.39 and the RSTRENG results satisfy this case.



3.6 LRUT

LRUT was conducted at Tindal MLV from September 17-18, 2012. Extracts from the LRUT report are presented in Appendix 6. The diagram in Appendix 6 shows the setup and location of the LRUT probe when undertaking the test. Two LRUT 'shots' were conducted from the north (Test Point 1, TP1) and south (Test Point 2, TP2) in order to examine the condition of the pipe wall underneath the support blocks.

Test Point 1

Test Point 1 is the forward LRUT shot at Tindal. The concrete support block begins 1.4m from the sensor head and as shown in the results of Appendix 6 there are no anomalies detected from this point onwards for this shot. The T-piece welds were detected at 2.2m and 2.7m, and the MLV was detected at a range of 3.53m.

Test Point 2

Test Point 2 is the backward shot at Tindal. The concrete support block begins 1.4m from the sensor head and as shown in the results of Appendix 6 there is a single anomaly detected at 1.76m in the horizontal plane of the pipe for this shot. There was no reported coating defect or corrosion evident during blasting and the LRUT report suspects that the anomaly is due to the clamp at that location. The T-piece welds were detected at 2.2m and 2.7m, and the MLV was detected at a range of 3.54m.

4 Discussion

Comparing the results of DCVG to the areas of excavation, it is possible to compare the results and correlate the DCVG data to areas of coating defects and corrosion. Due to the limited area of pipe which was dug up there are only few results to report.

DCVG and Coating Defects

There was one significant coating defect found at Tindal MLV, a 1400mm crack found in the yellowjacket which extended partially into the southern canusa sleeve. Traces of CP product build-up within the coating defect suggest that this is the likely cause of the DCVG reading. The pipe was recoated up to 5700mm from the MLV indicating that the yellowjacket defect was between 5700mm to 4300mm from the MLV, yet the 10.0% DCVG result was recorded at the MLV itself. Typically the DCVG is reported to be accurate to within 2 metres, therefore the DCVG result was either actually detecting the several coating defects on the MLV or the DCVG report generalised the 'MLV' result.

DCVG and Metal Loss Defects

Metal loss due to corrosion was detected in the areas identified by the DCVG survey underneath the canusa sleeves, however, the lack of coating damage and CP product in the area rules out the connection between the DCVG readings and corrosion.



Coating Condition

As can be seen in photo 0783 the pipe coating appeared to be in satisfactory condition with the exception of the yellowjacket crack in photo 0796. The areas of corrosion found were directly underneath the canusa sleeve to the point where the factory applied yellow jacket ended, therefore corrosion has resulted from the canusa sleeve being ineffective against water ingress, and simultaneously acting as the CP shield. Photo 0802 and 0803 clearly show the disbondment between the north canusa sleeve and the pipe, and subsequent corrosion resulting.

LRUT

One anomaly was reported in the area of the south concrete anchor block. The anomaly was detected in the horizontal flexural mode and was a grade 2 anomaly lying in the -32db to -26db range, and classified as a minor anomaly. The anomaly coincides with the point that the steel clamp is bolted over the pipe to secure the pipe to the concrete block, therefore given the location the coating has probably been locally affected and resulted in a localised change to the coating profile and detectable by LRUT.

5 Recommendation

LRUT reported that corrosion was not detected within the support blocks at Tindal MLV, however removal of the canusa sleeves uncovered areas of significant pitting corrosion both north and south of the MLV concrete support blocks. The condition of the yellowjacket coating to the south was poor due to a 1400mm long crack, and the canusa sleeves appeared satisfactory prior to removal, however incorrect application of the canusa sleeves at this site is the suspected cause of the corrosion as this is the second instance of this issue being recorded.

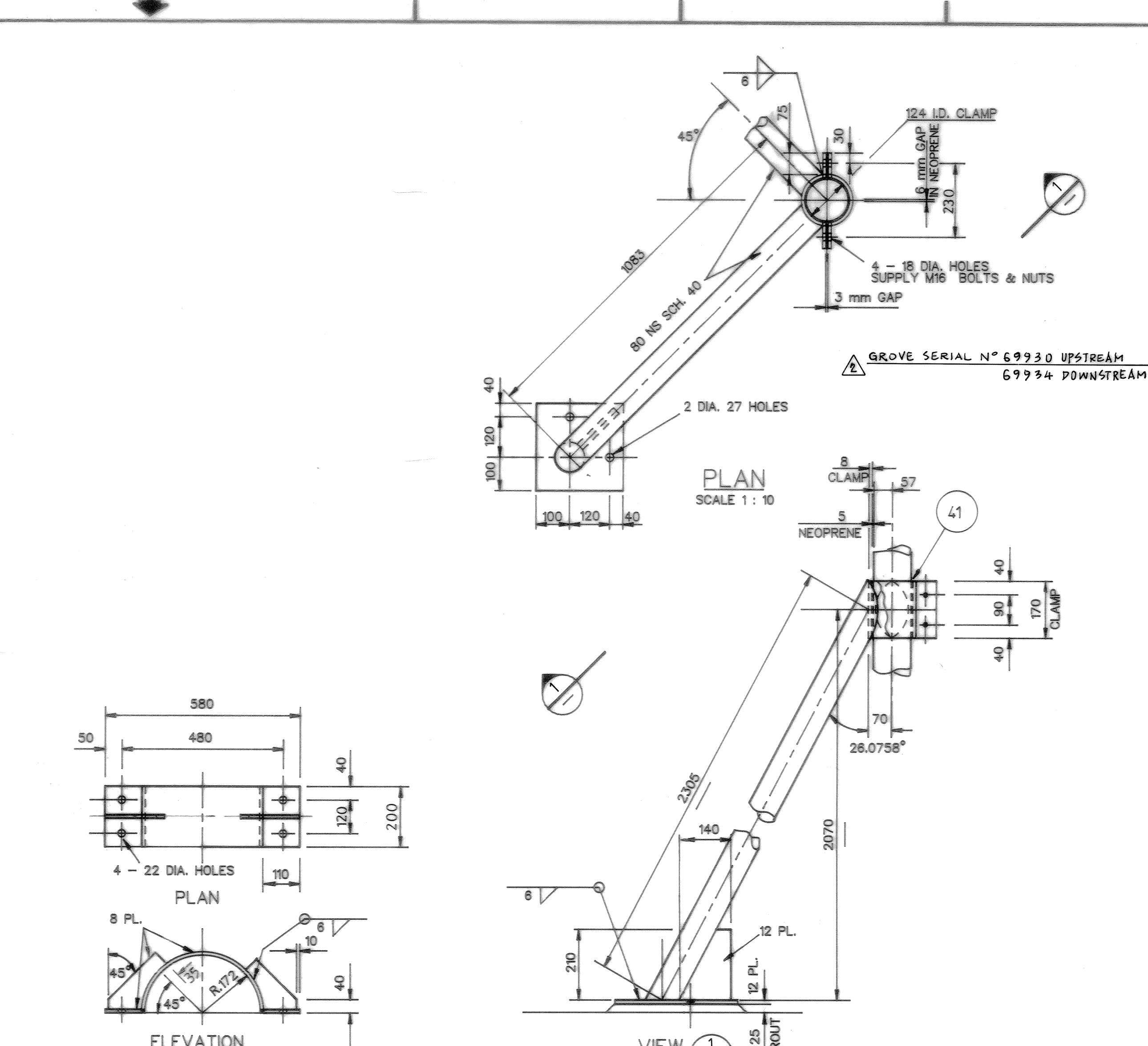
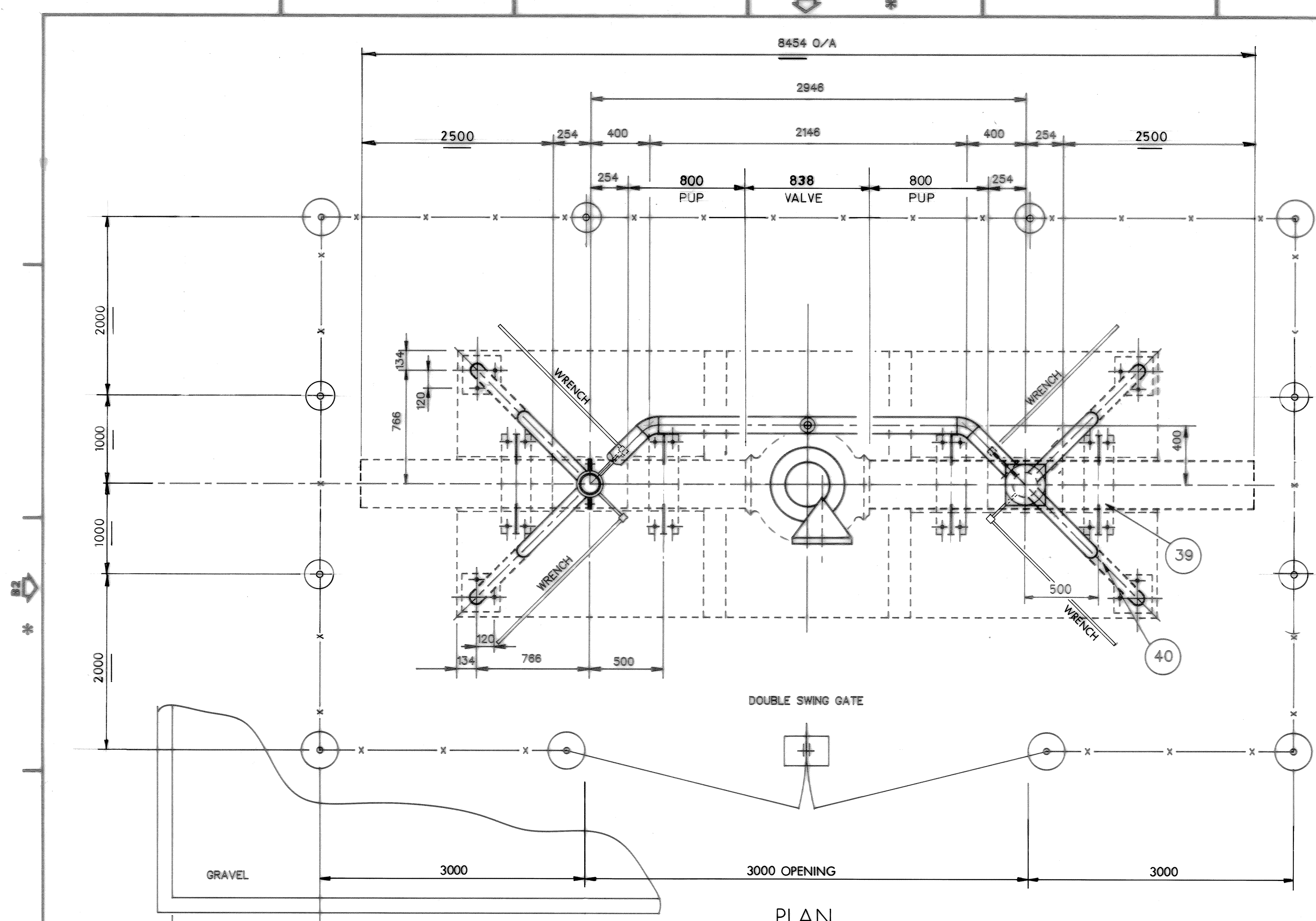
The canusa sleeve coating was removed, the exposed pipe area was sand blasted and recoated with a high build 2 part epoxy.

6 Conclusion

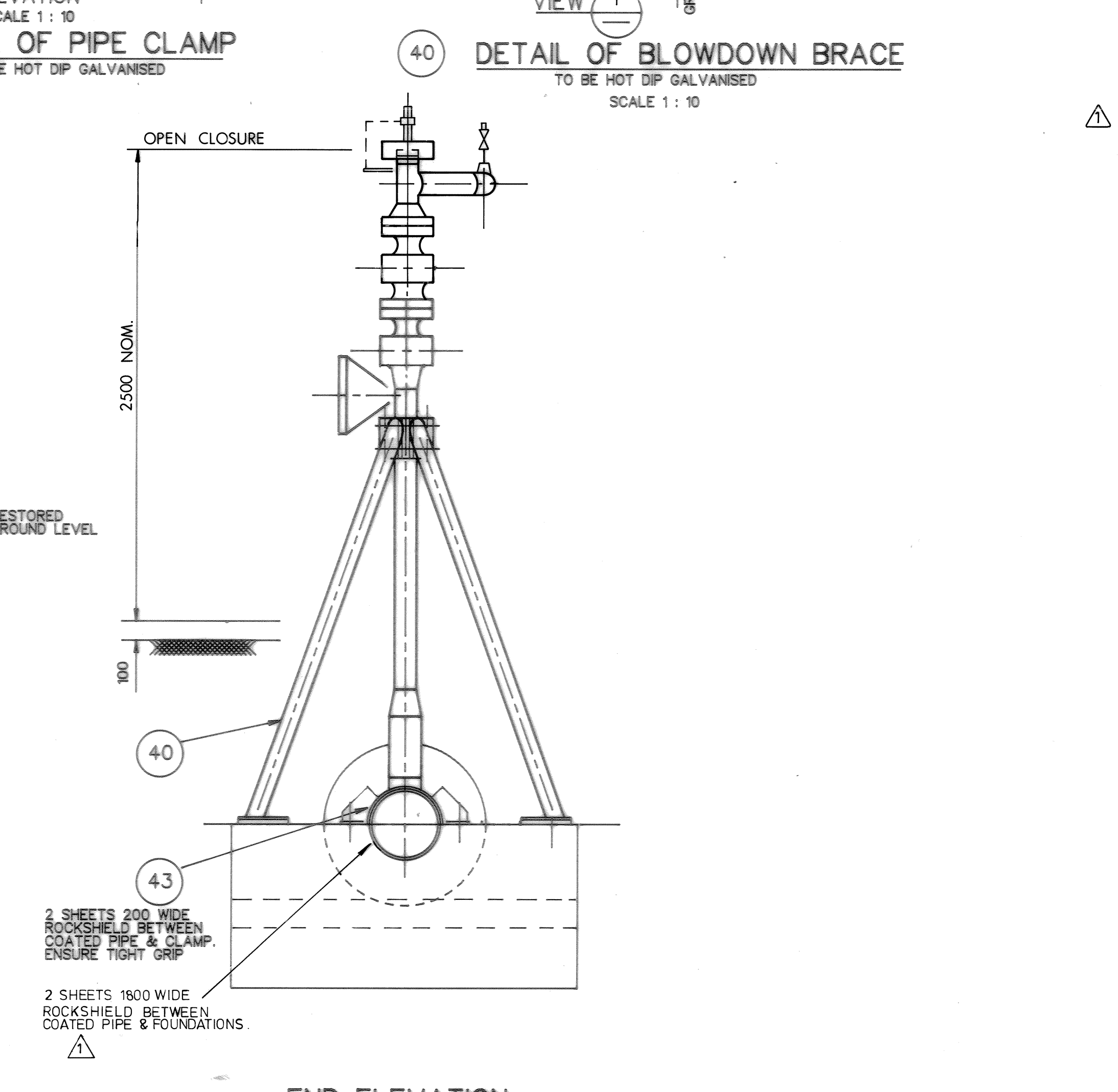
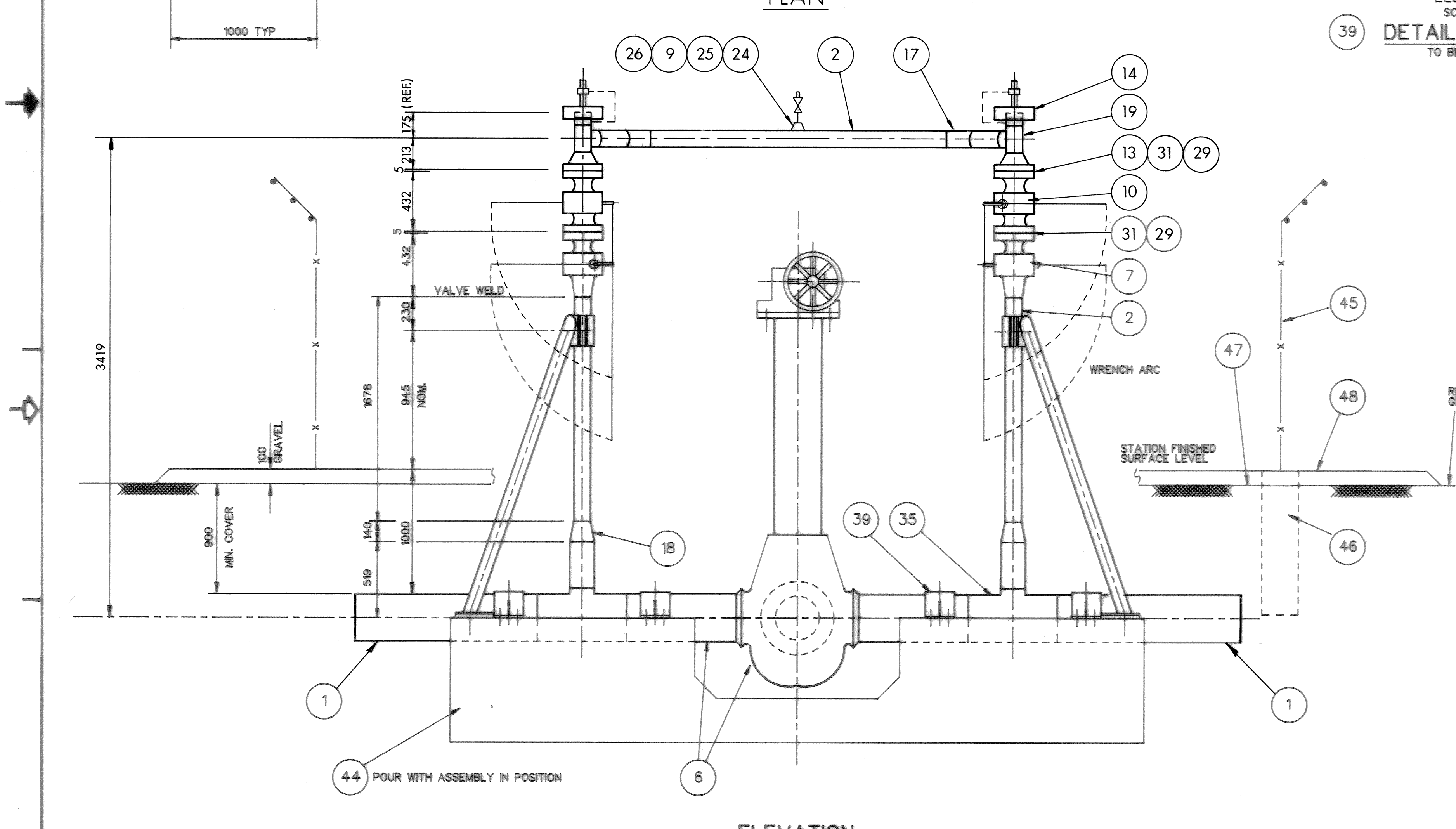
Due to the limited area of excavation at the site (MLV only), conclusions on the effectiveness of the DCVG survey completed at this site cannot be drawn on the basis of this survey alone. The DCVG did however successfully detect the appearance of a large crack defect in the yellowjacket coating directly to the south of the MLV. A minor anomaly detected using LRUT was determined to be coating related due to a pipe clamp over that point on the pipe, and not attributed to metal loss in the pipe. No metal loss was indicated by LRUT within the concrete anchor blocks.

The condition of the CTE coating inspected was satisfactory, however, the canusa sleeves to both north and south of the MLV have failed to protect the pipe from moisture ingress and led to shielding corrosion underneath. It is uncertain how widespread the problem with the canusa sleeves are along the AGP, however the issue is known to APA and a program of investigation and replacement is in progress.

Appendix 1 MLV Layout.



BILL OF MATERIAL						
ITEM	QTY.	DESCRIPTION				CODE NO
*INDICATES MATERIAL TO BE SUPPLIED BY PRINCIPAL						
1	5.0m	PIPE	300 NS	7.92 WT	API 5L X 60	C0010
2	8.2m	PIPE	100 NS	XS	ASTM A106 B	C0065
3						
4						
5						
6	1	VALVE BALL	300 NS	800# WE XS FULL BORE	C/W	C0161
PUPS 800 LONG AND GEAR						
OPERATOR MOUNTED ON EXTENSION 2100 ABOVE						
@ VALVE, GROVE SERIAL N° 70022						
7	2	VALVE BALL	100 NS	800# FE RF/WE XS FULL BORE		C0186
8						
9	1	VALVE BALL	25 NS	800# SW/NPT FULL BORE		C0240
10	2	ORBIT BALL VALVE	100NS	600# RF/RF XS INC. LEVER OPERATOR		
11						
12						
13	2	FLGE WN	100 NS	800# RF XS	ASTM A105	C0539
14	2	CLOSURE	100 NS	800# WE XS	ASTM A105	C0990
VERT C/W DAVIT						
15						
16						
17	2	ELBOW 45°	100 NS	XS	ASTM A234 WPB	C0739
18	2	REDUCER CON	150 x 100 NS	XS	ASTM A234 WPB	C0821
19	2	TEE EQUAL	100 NS	XS	ASTM A234 WPB	C0756
20						
21						
22						
23						
24	1	SOL 125-100 x 25 NS	3000#		ASTM A105	
25	1	NIPPLE	25 NS x 100	SCH 160 PBE	ASTM A106	
26	1	PLUG HEX HD	25 NS	SCR NPT	ASTM A105	
27						
28						
29	32	STUDBOLT	7/8" UNC x 140		ASTM A193 B7	
C/W 2 NUTS ASTM A194 2H						
30						
31	4	GASKET	100 NS	800# 4.4mm THK	METAFLEX SG	
32						
33						
34						
35	2	TEE RED BAR	300 x 150 NS		DRG No HB0000-6132	
36						
37						
38						
39	4	PIPE CLAMP (FABRICATE AS DETAILED)				
40	2	BLOWDOWN BRACE (FABRICATE AS DETAILED)				
41	2	NEOPRENE SHEET -- 60 DUROMETER	5 THK	170 x 368		
42						
43	AS REQD	ROCKSHIELD	5mm THK			
44	1	FOUNDATION		DRG No HB 1205-1005		
45	1 SET	FENCE 2 RAIL TYPE	2.29m HIGH INCL 45° OVERHANG			
30 m O/A LENGTH COMPRISING 4 CORNER, 2 GATE &						
6 INTERIM POSTS, DOUBLE GATE 3.0m OPENING WITH DROP						
BOLTS & LOCK, CHAINWIRE MESH, BARB WIRES -- GALVANISED						
CYCLONE OR EQUIV.						
46	1 SET	FENCE FOUNDATIONS	COMPRISING 6 / 250 DIA x 1010 DEEP			
CORNER/GATE POST FOOTINGS, 6 / 200 DIA x 710 DEEP						
INTERIM POST FOOTINGS ONE 300 x 200 x 200 DEEP GATE						
PAD WITH 2 HOLES FOR DROP BOLTS -- 20 MPa MASS CONCRETE						
47	90m ²	POLYTHENE SHEET	0.1 mm THK (COVER AREA GIVEN)			
48	9m ³	GRAVEL GRADED (COMPACTED VOLUME GIVEN)				



ASD9006103		DWG. No.		REFERENCE DRAWINGS		NOTES.	
INFORMATION CONFIDENTIAL: ALL PLANS, DRAWINGS, SPECIFICATIONS AND OR INFORMATION CONTAINED HEREIN OR FURNISHED HEREWITH ARE AND SHALL REMAIN THE PROPERTY OF WILLIAMS BROTHERS CMPS ENGINEERS AND SHALL BE HELD CONFIDENTIAL AND SHALL NOT BE USED FOR ANY PURPOSE OR PURPOSES OTHER THAN THOSE FOR WHICH THEY HAVE BEEN SUPPLIED OR PREPARED.		AD0000-7012		P & I DIAGRAM		1. ROCKSHIELD TO BE FIXED WITH PLASTIC TIES TO ENSURE TIGHT FIT WITH SURFACE COATING.	

Appendix 2 Coating Damage Assessment Forms

KP:

Work Order No:

Form created by Ben Parkin Apr 09
Approved by Henry Dupal**COATING DAMAGE ASSESSMENT**

Page 1

LocationPipeline: ABOPExcavation Date: 17/07/2012

Section: _____

Digup Reason: COATING INSPECTIONKilometre Point: TINDAL MLV

DCVG Measurement: _____

Zone: _____

Defect Length from survey (m): _____

Easting: _____

CMMS Work Order No: 131764

Northing: _____

Surrounding Description: _____

(Buildings, drains, etc)

Photos

- ☒ Has the camera date and time been set correctly?

Please remember to take both close up (no closer than 500mm) and wide photos.

Description	Time(s) photo taken or viewfinder number
Surrounding landscape	
Site facing increasing chainage	
Site facing decreasing chainage	
Pipe with coating	0794, 0795, 0796
Pipe with coating removed	0797, 0798
Pipe cleaned	0818
Pipe repaired	0819

Soil and CP

Soil Description (tick one or more from each column):

<input type="checkbox"/> Sand	<input type="checkbox"/> Fine	<input type="checkbox"/> Dusty
<input type="checkbox"/> Loam	<input type="checkbox"/> Coarse	<input type="checkbox"/> Dry
<input type="checkbox"/> Clay	<input type="checkbox"/> Gravel	<input checked="" type="checkbox"/> Damp
<input type="checkbox"/> Black	<input type="checkbox"/> Rocky	<input type="checkbox"/> Wet
<input checked="" type="checkbox"/> Red Dirt		

Pipeline Soil Cover Depth (m): 0.950Soil pH: 7.0Pipe To Soil Potential (V): -1.569

Soil Resistivity (Ohms): _____

Pin Spacing 1.5m

Coating

Coating Description:

- ☐ Yellow Jacket
☒ Sleeve
☐ Wrapping
☐ FBE
☐ Paint

Is there a coating defect (Y/N)? NAny white buildup from cathodic protection (Y/N)? NAny evidence of termite damage (Y/N)? NAny moisture inside the coating (Y/N)? YAny stress corrosion cracking (Y/N)? N/A
If yes, complete APA pipeline damage reportHas the coating lifted away from the pipe (Y/N)? NIf yes, how far around the pipe has it lifted (mm)? N/ASketch of coating / corrosion damage completed (Y/N)? YCoating Defect Length (mm): N/ACoating Defect Width (mm): N/A

Coating Defect Comments:

Metal Loss

Is there any deformation of the pipe
(dent, gouge or not round) (Y/N)? N

If Yes, Engineering must be contacted IMMEDIATELY.

Is there any metal loss (Y/N)? Y

If there is any metal loss, complete the remaining
section of this form and contact Engineering
IMMEDIATELY.

The following measurements should indicate whether defects INTERACT

Interaction Rules:

1. Consider each defect as a rectangular box.
2. Draw a larger box around each defect, extending length and width as per Figure 1.
3. IF BOTH larger boxes intersect with the original defect boxes, the defects interact.
4. The dimensions reported on this form are the dimensions of the defect after interaction - dimensions A and B as shown in Figure 1.

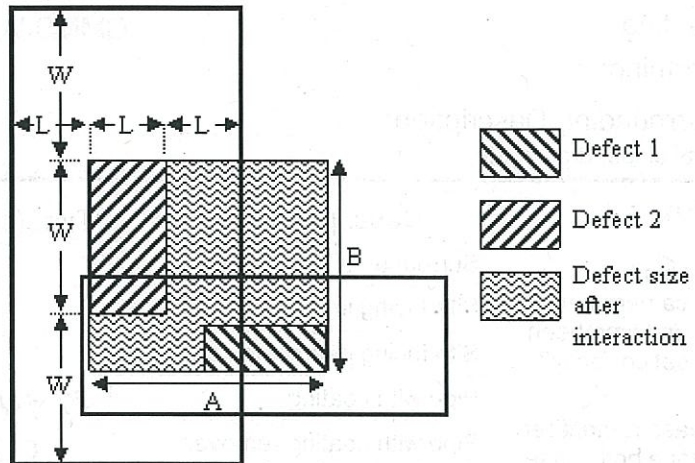


Figure 1

Maximum Depth (mm): 1.0

Wall thickness (mm): 7.9

Longitudinal dimension (A) (mm): 300

Circumferential dimension (B) (mm): 1025

Clock Position (looking in direction of flow): RIGHT AROUND PIPE

Distance from longitudinal weld (mm): 0

Distance from nearest girth weld (mm): 0
(if no girth weld has been found, do not excavate further)

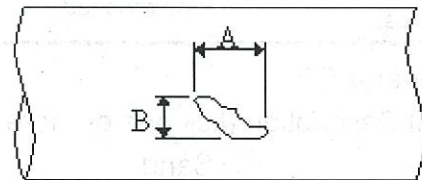


Figure 2

Repair

Length of Pipe PAINTED (mm): 5700

Other Repair Information:

LUXAPOXY UHB USED TO RE-COAT PIPE

Dig Up Comments:

PITTED CORROSION UNDER RAYCHEM SLIEVE ON SOUTH SIDE OF MLV
4030MM FROM VALVE. SLIEVE WAS OVER A BUTT WELD
RECOATED 5700MM OF PIPE FROM VALVE

Operator: W. DUFFY

Signature: [Signature]

Date: 17/09/2012

KP:

Form created by Ben Parkin Apr 09
Approved by Henry Dupal

Work Order No:

COATING DAMAGE ASSESSMENT

Page 1

LocationPipeline: ABOP

Section: _____

Kilometre Point: TINDAL MLV

Zone: _____

Easting: _____

Northing: _____

Surrounding Description: _____

(Buildings, drains, etc)

Excavation Date: 18/09/2012Digup Reason: COATING INSPECTION

DCVG Measurement: _____

Defect Length from survey (m): _____

CMMS Work Order No: 131764**Photos**

- ☒ Has the camera date and time been set correctly?

Please remember to take both close up (no closer than 500mm) and wide photos.

Description	Time(s) photo taken or viewfinder number
Surrounding landscape	
Site facing increasing chainage	
Site facing decreasing chainage	
Pipe with coating	0800
Pipe with coating removed	0815, 0802
Pipe cleaned	0818 0815
Pipe repaired	0867

Soil and CP

Soil Description (tick one or more from each column):

<input type="checkbox"/> Sand	<input type="checkbox"/> Fine	<input type="checkbox"/> Dusty
<input type="checkbox"/> Loam	<input type="checkbox"/> Coarse	<input type="checkbox"/> Dry
<input type="checkbox"/> Clay	<input type="checkbox"/> Gravel	<input checked="" type="checkbox"/> Damp
<input type="checkbox"/> Black	<input type="checkbox"/> Rocky	<input type="checkbox"/> Wet
<input checked="" type="checkbox"/> Red Dirt		

Pipeline Soil Cover Depth (m): 0.950Soil pH: 7.0Pipe To Soil Potential (V): -1.569Soil Resistivity (Ohms): 0.013

Pin Spacing 1.5m

Coating

Coating Description:

- ☐ Yellow Jacket
☒ Sleeve
☐ Wrapping
☐ FBE
☐ Paint

Is there a coating defect (Y/N)? NAny white buildup from cathodic protection (Y/N)? NAny evidence of termite damage (Y/N)? NAny moisture inside the coating (Y/N)? NAny stress corrosion cracking (Y/N)? N/A If yes, complete APA pipeline damage reportHas the coating lifted away from the pipe (Y/N)? NIf yes, how far around the pipe has it lifted (mm)? N/ASketch of coating / corrosion damage completed (Y/N)? YCoating Defect Length (mm): N/ACoating Defect Width (mm): N/A

Coating Defect Comments: _____

Metal Loss

Is there any deformation of the pipe
(dent, gouge or not round) (Y/N)?

N

If Yes, Engineering must be contacted IMMEDIATELY.

Is there any metal loss (Y/N)?

Y

If there is any metal loss, complete the remaining
section of this form and contact Engineering
IMMEDIATELY.

The following measurements should indicate whether defects INTERACT

Interaction Rules:

1. Consider each defect as a rectangular box.
2. Draw a larger box around each defect, extending length and width as per Figure 1.
3. IF BOTH larger boxes intersect with the original defect boxes, the defects interact.
4. The dimensions reported on this form are the dimensions of the defect after interaction - dimensions A and B as shown in Figure 1.

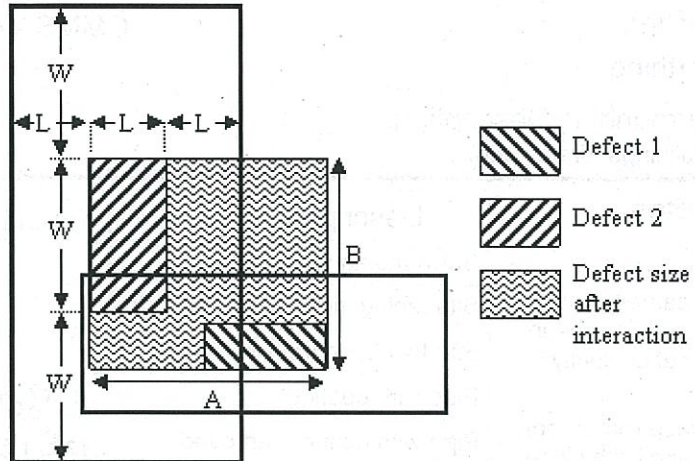


Figure 1

Maximum Depth (mm):

0.65

Wall thickness (mm):

7.9

Longitudinal dimension (A) (mm):

300 215

Circumferential dimension (B) (mm):

1025

Clock Position (looking in direction of flow):

RIGHT AROUND PIPE

Distance from longitudinal weld (mm):

0

Distance from nearest girth weld (mm):
(if no girth weld has been found, do not excavate further)

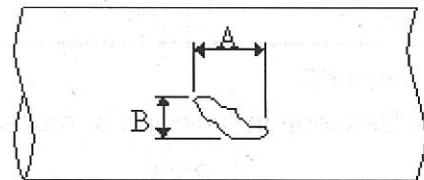
0

Figure 2

Repair

Length of Pipe PAINTED (mm): 4350

Other Repair Information:

LUXAPOXY UHB USED TO RE-COAT PIPE

Dig Up Comments:

PITTED CORROSION UNDER RAYCHEM SLEEVE ON NORTH SIDE OF MLV 4060mm
FROM VALVE. SLEEVE WAS OVER A BUTT WELD
RE-COATED 4350mm FROM MLV

Operator: W. DUFFY

Signature: [Signature]

Date: 12/09/2012

KP:

Work Order No:

Form created by Ben Parkin Apr 09
Approved by Henry Dupal**COATING DAMAGE ASSESSMENT**

Page 1

LocationPipeline: ABDPExcavation Date: 15/09/2012

Section: _____

Digup Reason: COATING INSPECTIONKilometre Point: TINDAL MLVDCVG Measurement: 10.0

Zone: _____

Defect Length from survey (m): _____

Easting: _____

CMMS Work Order No: 131764

Northing: _____

Surrounding Description: _____

(Buildings, drains, etc)

Photos

- ☒ Has the camera date and time been set correctly?

Please remember to take both close up (no closer than 500mm) and wide photos.

Description	Time(s) photo taken or viewfinder number
Surrounding landscape	
Site facing increasing chainage	<u>0782</u>
Site facing decreasing chainage	
Pipe with coating	<u>0782</u>
Pipe with coating removed	<u>0818, 0807, 0808</u>
Pipe cleaned	
Pipe repaired	<u>0819, 0828</u>

Soil and CP

Soil Description (tick one or more from each column):

<input type="checkbox"/> Sand	<input type="checkbox"/> Fine	<input type="checkbox"/> Dusty
<input type="checkbox"/> Loam	<input type="checkbox"/> Coarse	<input type="checkbox"/> Dry
<input type="checkbox"/> Clay	<input type="checkbox"/> Gravel	<input checked="" type="checkbox"/> Damp
<input type="checkbox"/> Black	<input type="checkbox"/> Rocky	<input type="checkbox"/> Wet
<input checked="" type="checkbox"/> Red Dirt		

Pipeline Soil Cover Depth (m): 0.950Soil pH: 7.0Pipe To Soil Potential (V): -1.569Soil Resistivity (Ohms): 0.013

Pin Spacing 1.5m

Coating

Coating Description:

- ☐ Yellow Jacket
☐ Sleeve
☒ Wrapping
☒ FBE
☐ Paint

Is there a coating defect (Y/N)? YAny white buildup from cathodic protection (Y/N)? NAny evidence of termite damage (Y/N)? NAny moisture inside the coating (Y/N)? NAny stress corrosion cracking (Y/N)? N/A If yes, complete APA pipeline damage reportHas the coating lifted away from the pipe (Y/N)? N

If yes, how far around the pipe has it lifted (mm)? _____

Sketch of coating / corrosion damage completed (Y/N)? N

Coating Defect Length (mm): _____

Coating Defect Width (mm): _____

Coating Defect Comments:

SEVERAL COATING DEFECTS ON MLVNO CORROSION EVIDENT

KP:

Work Order No:

Page 2

Metal Loss

Is there any deformation of the pipe (dent, gouge or not round) (Y/N)?

N

If Yes, Engineering must be contacted IMMEDIATELY.

Is there any metal loss (Y/N)?

N

If there is any metal loss, complete the remaining section of this form and contact Engineering IMMEDIATELY.

The following measurements should indicate whether defects INTERACT

Interaction Rules:

1. Consider each defect as a rectangular box.
2. Draw a larger box around each defect, extending length and width as per Figure 1.
3. IF BOTH larger boxes intersect with the original defect boxes, the defects interact.
4. The dimensions reported on this form are the dimensions of the defect after interaction - dimensions A and B as shown in Figure 1.

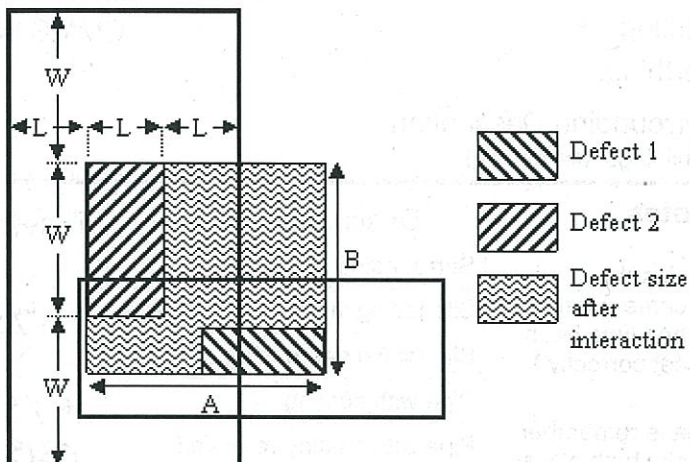


Figure 1

Maximum Depth (mm):

Wall thickness (mm):

Longitudinal dimension (A) (mm):

Circumferential dimension (B) (mm):

Clock Position (looking in direction of flow):

Distance from longitudinal weld (mm):

Distance from nearest girth weld (mm):
(if no girth weld has been found, do not excavate further)

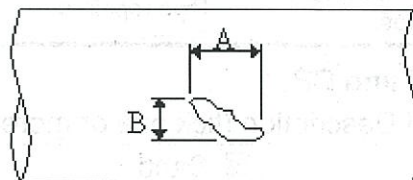


Figure 2

Repair

PAINTED

Length of Pipe Wrapped (mm): ALL BELOW GROUND SECTION OF VALVE.

Other Repair Information:

VALVE RE-COATED WITH LUXAPOXY UHB

Dig Up Comments:

Operator: IN. DUFFY

Signature:

[Signature]

Date: 15/09/2012



Appendix 3 Photo Log

Photos:

0783

0796

0797

0798

0799

0800

0802

0807

0808

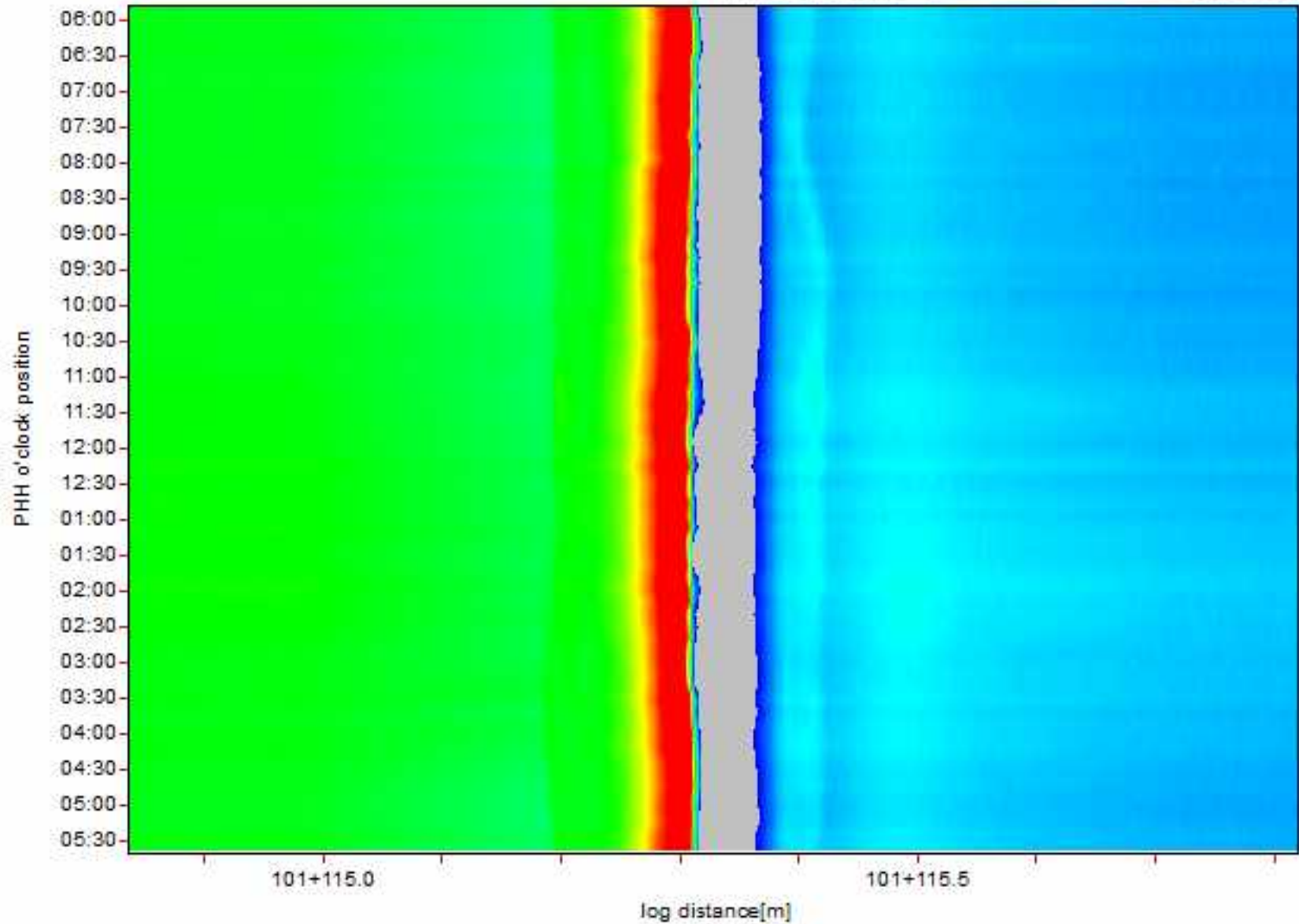
0815

0818

0867

Appendix 4 Pigging Data

PHH: 13.43 kA/m  34.97 kA/m



Appendix 5 RSTRENG Analysis

Site: Tindal MLV

Station: Tindal MLV

Date: 16/04/2013

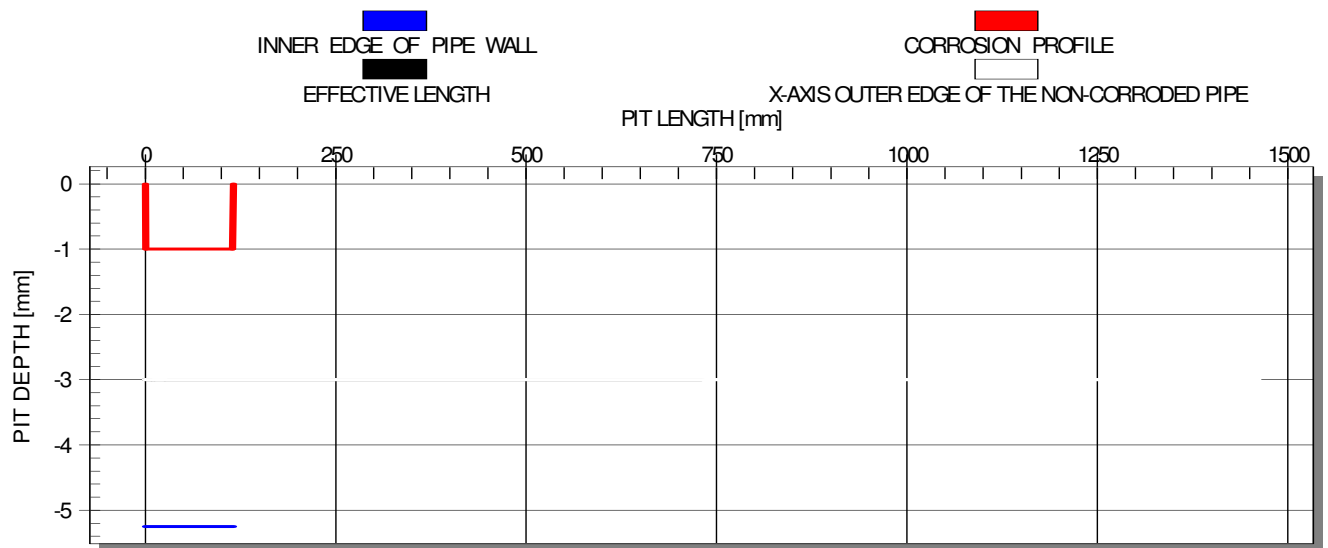
$P = 2StFT/D$ [kPa] - Calculated Pressure 9,639.644
Established MAOP [kPa] 9,650

Pipe Outside Diameter [mm]	323.90	Effective Length [mm]	114.00
Pipe Wall Thickness [mm]	5.250	Effective Area [mm] ²	114.01
SMYS [MPa]	413	Max. Pit Depth [mm]	1.000
Design Factor	0.72	Max.Depth/Wall Thickness	0.19
Total Length [mm]	116		
Effective Length: Start	1.00	End [mm]	115.00

RESULTS OF ANALYSIS:

METHOD	Max. Safe Pressure [kPa]	Burst Pressure [kPa]	Safety Factor
RSTRENG - Effective Area	9650	13755	1.43
RSTRENG - 0.85dL	9650	14042	1.46
ASME B31 G	9650	13490	1.4

CORROSION PROFILE:



Prepared By: Ben Parkin

Approved By:

Site: Tindal MLV

Station: Tindal MLV

Date: 16/04/2013

CORROSION MEASUREMENT:

Nr. Increment [mm] Pit Depth [mm]

1.	0	0
2.	1	1
3.	115	1
4.	116	0

Prepared By: Ben Parkin

Approved By:



Appendix 6 LRUT

GL Noble Denton



Client: APA Group (Australia) Pty Ltd

Job No.: A12A25-2/3

Date Completed : 18th September 2012

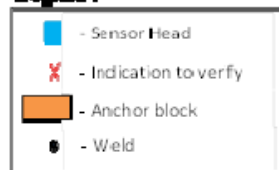
Location : Katherine, NT

Page : 8

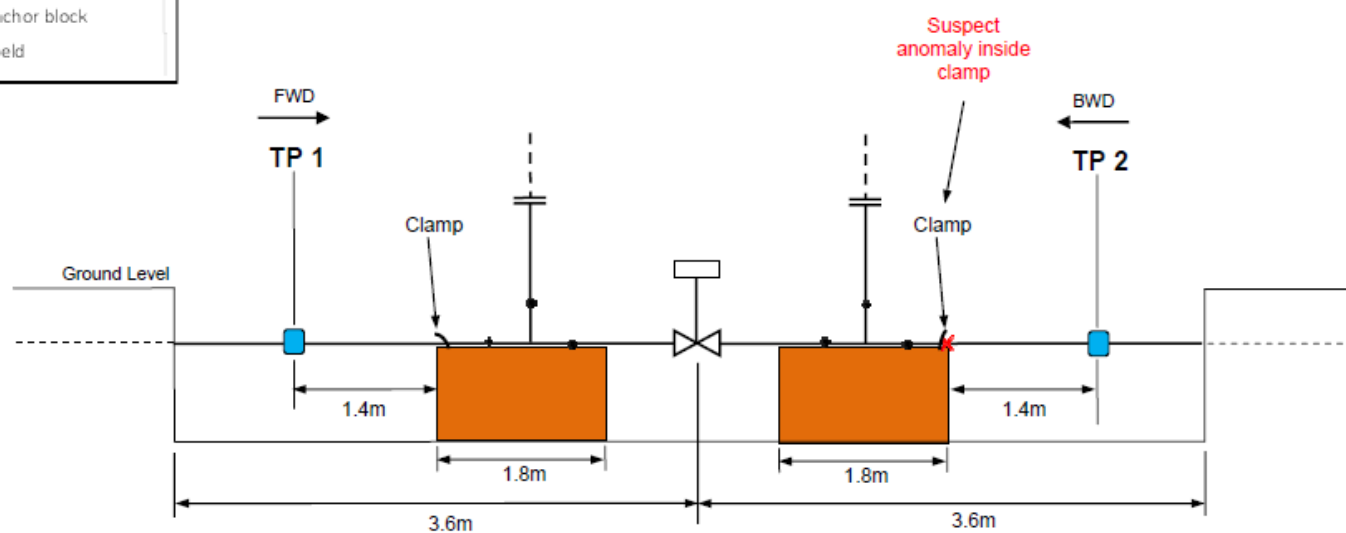
PIPELINE SCHEMATIC DRAWINGS

Line Identification: 12inch Tindal Heading North (Half concrete Block)

Legend :

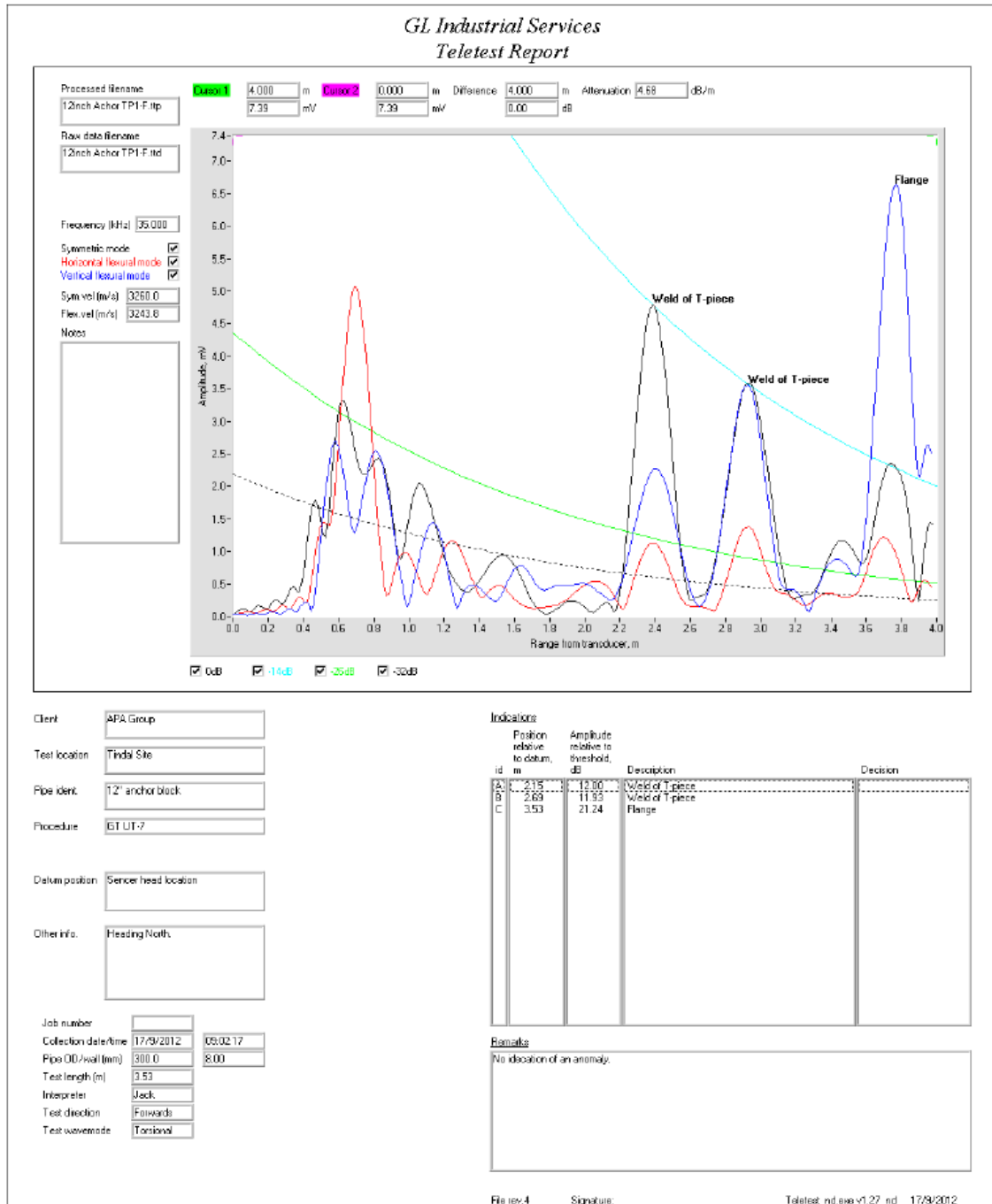


N ← → S



Test Point 1 Line ID: 12" Tindal Heading North

(Forward Shot only)



Test Point 2 Line ID: 12" Tindal Heading North

(Backward Shot only)

