

# Tindal MLV Main Line Valve

## Coating Assessment Report

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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.

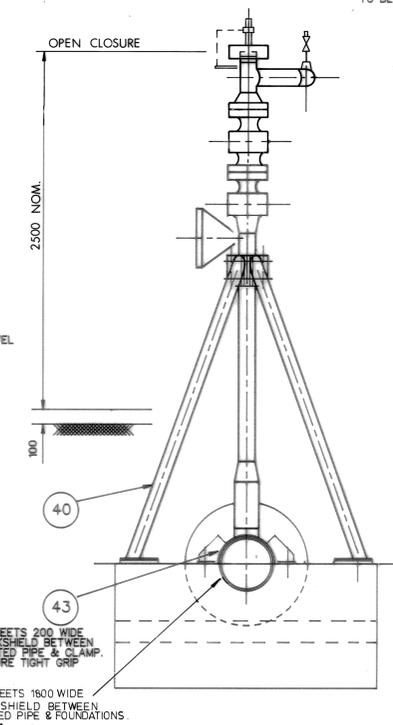
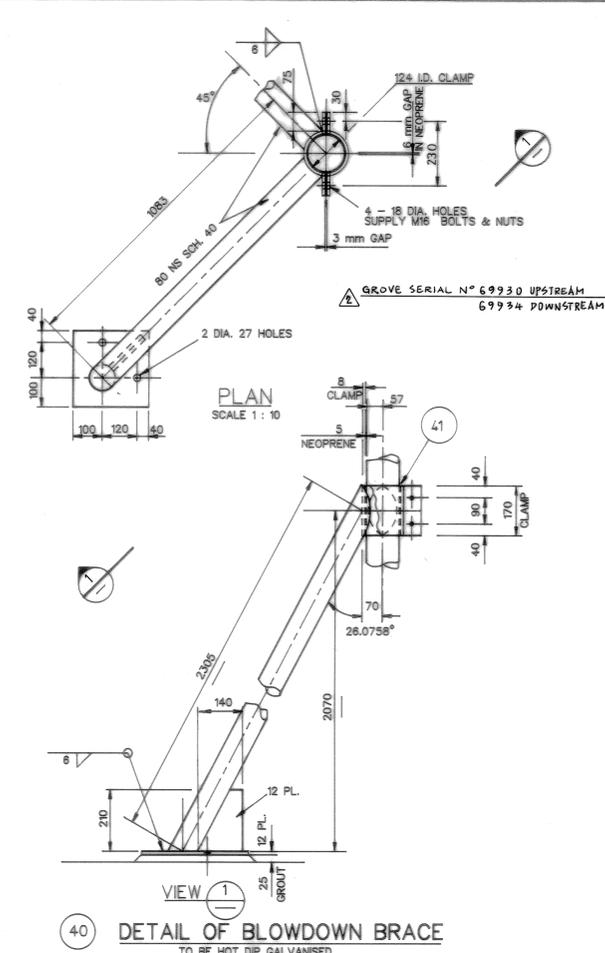
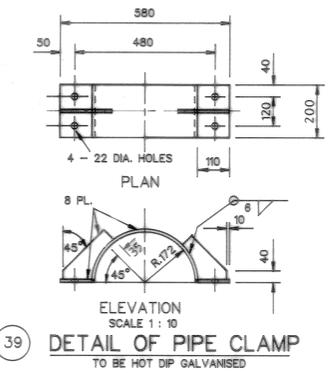
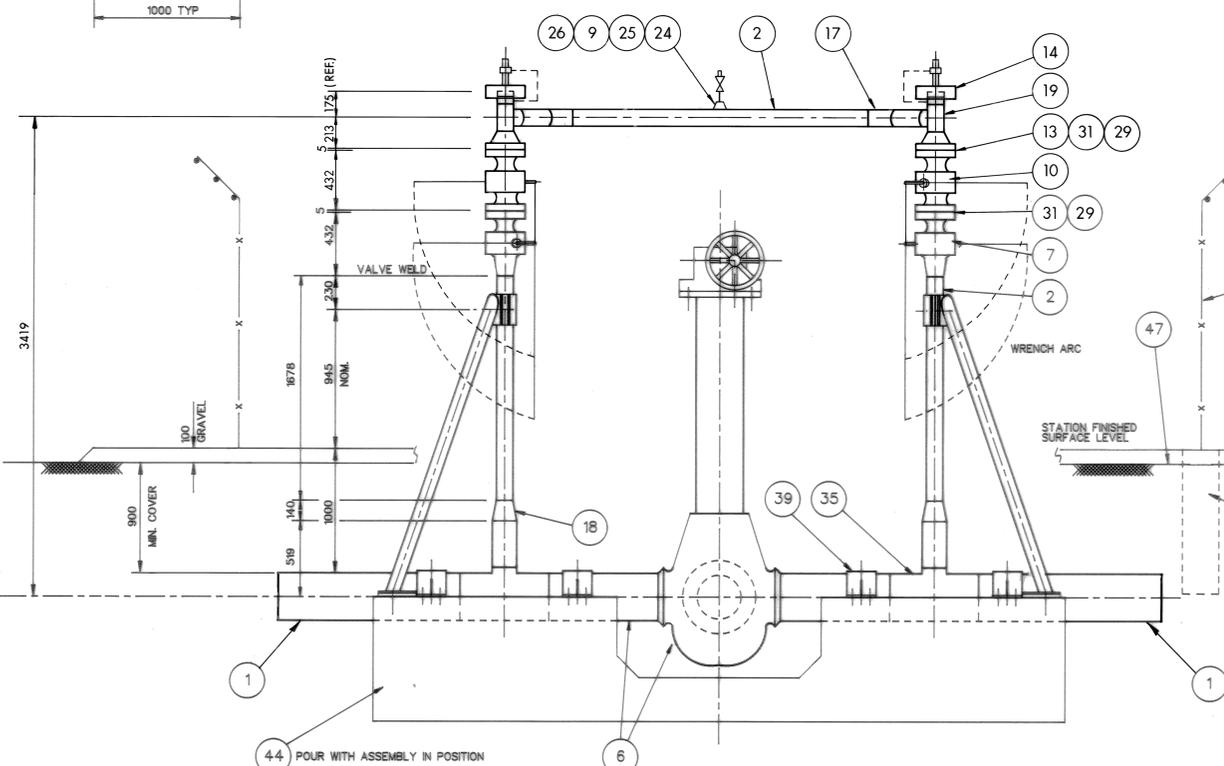
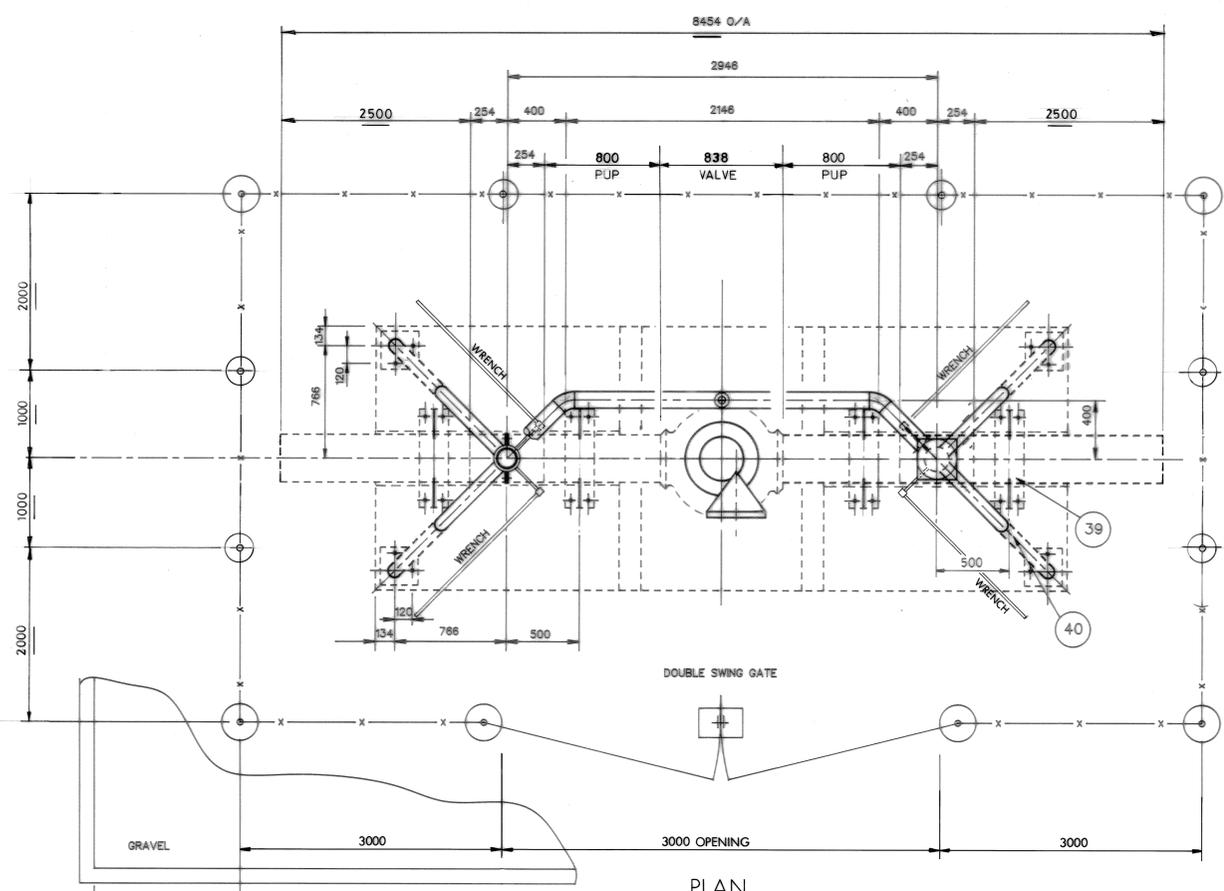
## **6 Conclusion**

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	6.2m	PIPE 100 NS XS ASTM A106 B	C0065	
3				
4				
5				
6	1	VALVE BALL 300 NS 800# WE XS FULL BORE C/W OPERATOR MOUNTED ON EXTENSION 2100 ABOVE @ VALVE, GROVE SERIAL N° 70022	C0161	
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 BALLVALVE 100NS 600# RF/RFX 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 VERT C/W DAVIT	C0990	
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 C/W 2 NUTS ASTM A193 B7 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 8 / 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 <sup>2</sup>	POLYTHENE SHEET 0.1 mm THK (COVER AREA GIVEN)		
48	9m <sup>3</sup>	GRAVEL GRADED (COMPACTED VOLUME GIVEN)		

ASD9006103

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DWG. No.	REFERENCE DRAWINGS
AD0000-7012	P & I DIAGRAM

NOTES.

1. ROCKSHIELD TO BE FIXED WITH PLASTIC TIES TO ENSURE TIGHT FIT WITH SURFACE COATING.

APPROVED FOR CONSTRUCTION

AS BUILT

No.	DATE	REVISION	By	CHKD.	ENG.	ENG. MGR.	PROJ. MGR.	APP'D.
3	3-10-89	2 - 100 NS VALVES (ITEM 10) ADDED; ITEM 29 QUANTITY WAS 1; ITEM 31 QUANTITY WAS 2	T.L.					
2	29.01.87	VALVE SERIAL NOS ADDED DWG N° WAS HB1205-6012	H					
1	27-5-86	BARRER TEE CODE N° & NOTE 2 DELETED.	GK.					
0	29.11.85	FOR CONSTRUCTION	B.K.					

SCALE: SCALE 1:20, 1:10

JOB No: 6850-000

NT GAS	
AMADEUS BASIN TO DARWIN PIPELINE MAINLINE VALVE ASSEMBLY km 1205 300 NS (900 COVER)	
WILLIAMS BROTHERS CMPS ENGINEERS SYDNEY N.S.W.	NUMBER AD1205-6012
	REV N 3



## **Appendix 2      Coating Damage Assessment Forms**

# COATING DAMAGE ASSESSMENT

## Location

Pipeline: ABOP Excavation Date: 17/07/2012  
 Section: \_\_\_\_\_ Digup Reason: COATING INSPECTION  
 Kilometre 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	<u>0794, 0795, 0796</u>
Pipe with coating removed	<u>0797, 0798</u>
Pipe cleaned	<u>0818</u>
Pipe repaired	<u>0819</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): 0.950 Soil pH: 7.0  
 Pipe 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)? N  
 Any white buildup from cathodic protection (Y/N)? N  
 Any evidence of termite damage (Y/N)? N  
 Any moisture inside the coating (Y/N)? Y  
 Any stress corrosion cracking (Y/N)? If yes, complete APA pipeline damage report N/A  
 Has the coating lifted away from the pipe (Y/N)? N  
 If yes, how far around the pipe has it lifted (mm)? N/A  
 Sketch of coating / corrosion damage completed (Y/N)? Y

Coating Defect Length (mm): N/A Coating 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.

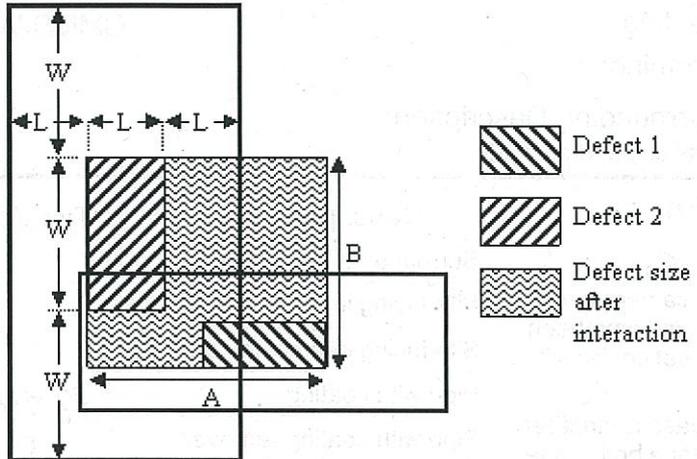


Figure 1

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):  
(if no girth weld has been found, do not excavate further)

0

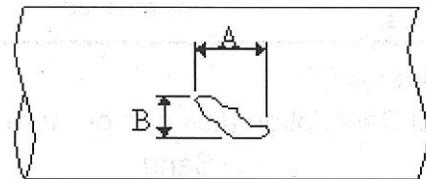


Figure 2

**Repair**

PAINTED

Length of Pipe ~~Wrapped~~ (mm):

5700

Other Repair Information:

LUXAPOXY UHB USED TO RE-COAT PIPE

Dig Up Comments:

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

Operator: W. DUFFY

Signature:

Date: 17/09/2012

KP:

Work Order No:

Form created by Ben Parkin Apr 09  
Approved by Henry Dupal

# COATING DAMAGE ASSESSMENT

Page 1

## Location

Pipeline: ABOP  
 Section: \_\_\_\_\_  
 Kilometre Point: TINDAL MLV  
 Zone: \_\_\_\_\_  
 Easting: \_\_\_\_\_  
 Northing: \_\_\_\_\_

Excavation Date: 18/09/2012  
 Digup Reason: COATING INSPECTION  
 DCVG Measurement: \_\_\_\_\_  
 Defect Length from survey (m): \_\_\_\_\_  
 CMMS Work Order No: 131764

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	<u>0800</u>
Pipe with coating removed	<u>0815, 0802</u>
Pipe cleaned	<del>0818</del> <u>0815</u>
Pipe repaired	<u>0867</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): 0.950 Soil pH: 7.0

Pipe To Soil Potential (V): -1.569 Soil Resistivity (Ohms): 0.013 Pin Spacing 1.5m

## Coating

Coating Description:

- Yellow Jacket
- Sleeve
- Wrapping
- FBE
- Paint

Is there a coating defect (Y/N)? N  
 Any white buildup from cathodic protection (Y/N)? N  
 Any evidence of termite damage (Y/N)? N  
 Any moisture inside the coating (Y/N)? N  
 Any stress corrosion cracking (Y/N)? N/A If yes, complete APA pipeline damage report  
 Has the coating lifted away from the pipe (Y/N)? N  
 If yes, how far around the pipe has it lifted (mm)? N/A  
 Sketch of coating / corrosion damage completed (Y/N)? Y

Coating Defect Length (mm): N/A Coating 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.

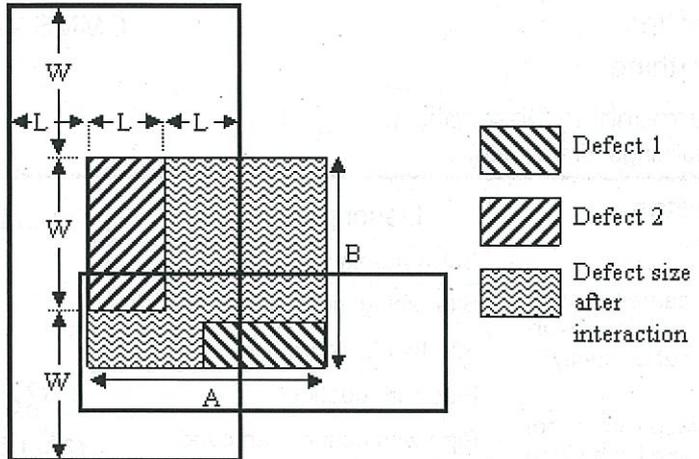


Figure 1

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

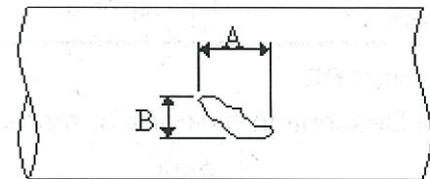


Figure 2

**Repair**

PAINTED

Length of Pipe ~~Wrapped~~ (mm): 4350

Other Repair Information:

LUXAPOXY UHB USED TO RE-COAT PIPE

**Dig Up Comments:**

PITTED CORROSION UNDER RAYCHEM SLAVES ON NORTH SIDE OF MLV 400mm FROM VALVE - SLAVES IN AS OVER A BUTT WELD  
RE-COATED 4350MM FROM MLV

Operator: W. DUFFY

Signature: [Signature]

Date: 18/09/2012

KP:

Work Order No:

Form created by Ben Parkin Apr 09  
Approved by Henry Dupal

# COATING DAMAGE ASSESSMENT

Page 1

## Location

Pipeline: ABDP  
 Section: \_\_\_\_\_  
 Kilometre Point: TINDAL MLV  
 Zone: \_\_\_\_\_  
 Easting: \_\_\_\_\_  
 Northing: \_\_\_\_\_

Excavation Date: 15/09/2012  
 Digup Reason: COATING INSPECTION  
 DCVG Measurement: 10.0  
 Defect Length from survey (m): \_\_\_\_\_  
 CMMS Work Order No: 131764

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): 0.950

Soil pH: 7.0

Pipe To Soil Potential (V): -1.569

Soil Resistivity (Ohms): 0.013

Pin Spacing 1.5m

## Coating

Coating Description:

- Yellow Jacket  
 Sleeve  
 Wrapping  
 FBE  
 Paint

Is there a coating defect (Y/N)? Y

Any white buildup from cathodic protection (Y/N)? N

Any evidence of termite damage (Y/N)? N

Any moisture inside the coating (Y/N)? N

Any stress corrosion cracking (Y/N)? N/A  
If yes, complete APA pipeline damage report

Has 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 MLV

NO CORROSION EVIDENT

**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.

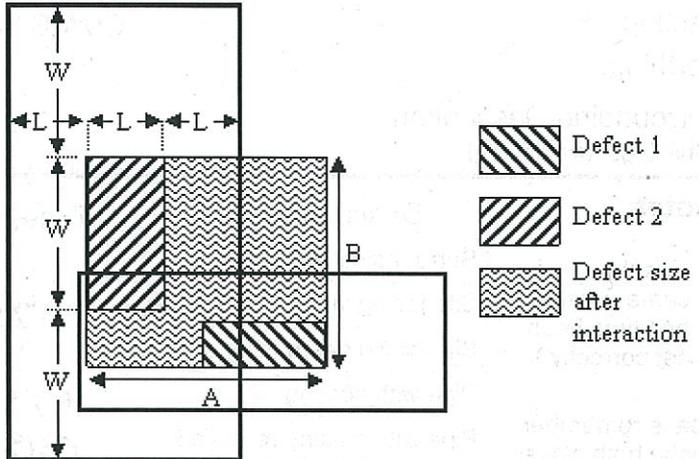


Figure 1

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)

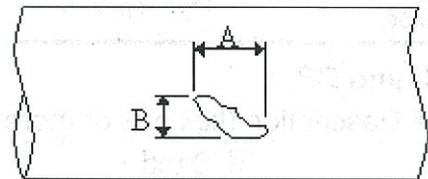


Figure 2

**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

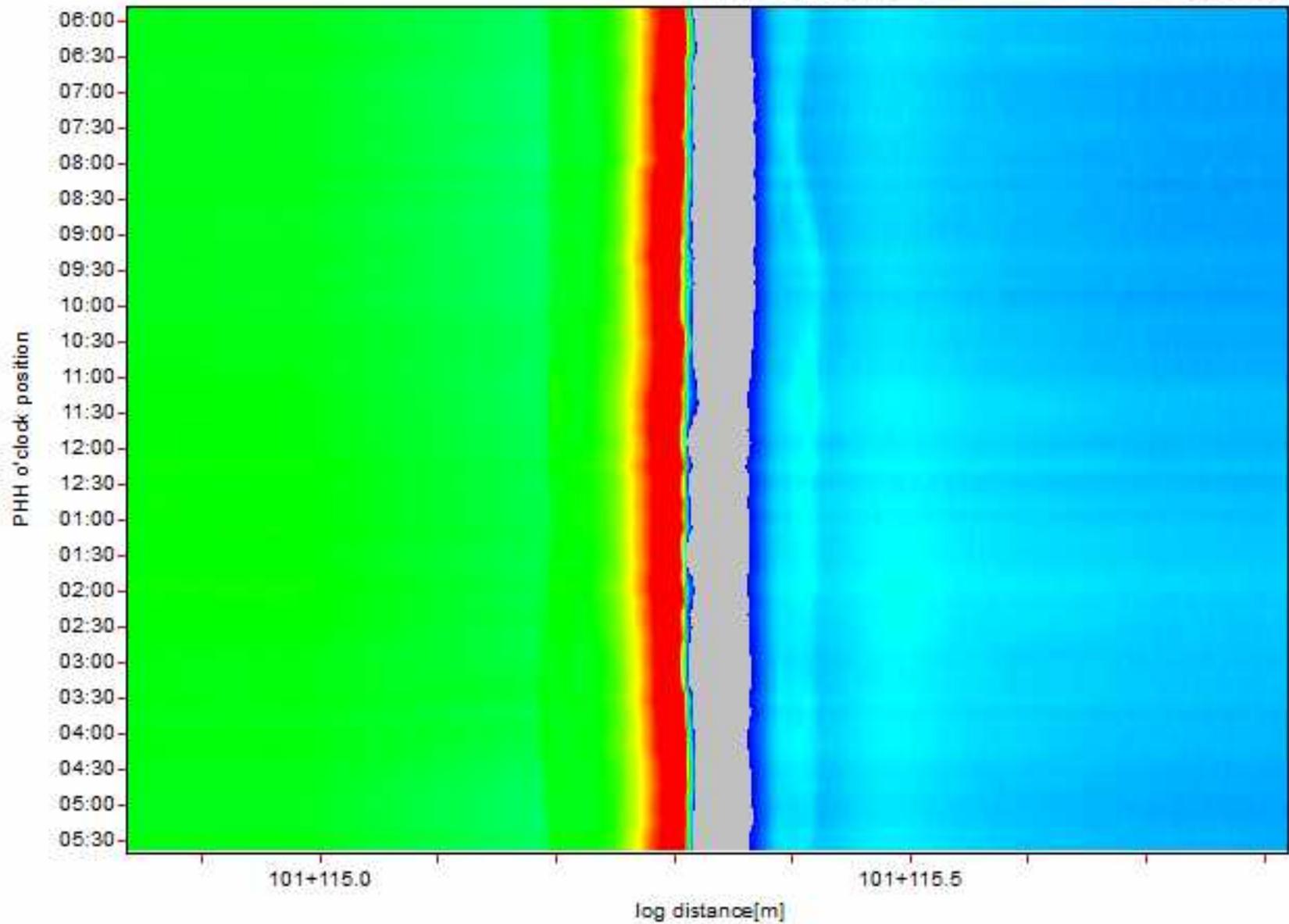
0818

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

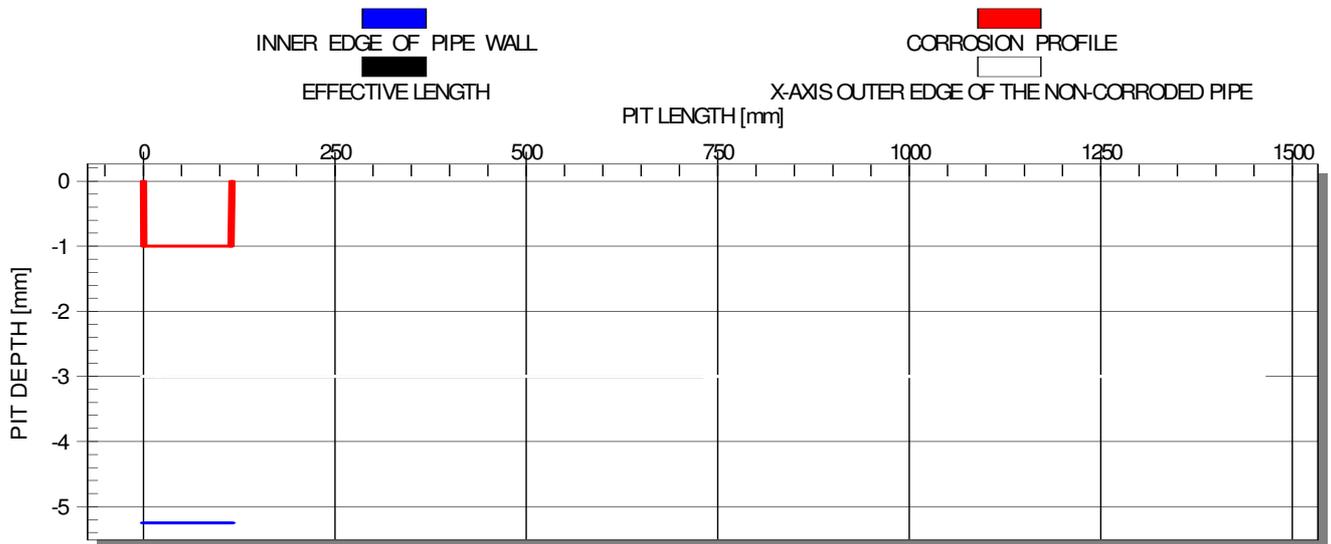
P = 2StFT/D [kPa] - Calculated Pressure 9,639.644  
Established MAOP [kPa] 9,650

Pipe Outside Diameter [mm] 323.90 Effective Length [mm] 114.00  
Pipe Wall Thickness [mm] 5.250 Effective Area [mm]<sup>2</sup> 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

**CORROSION MEASUREMENT:**

Nr.	Increment [mm]	Pit Depth [mm]
1.	0	0
2.	1	1
3.	115	1
4.	116	0

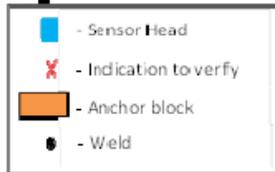


## Appendix 6 LRUT

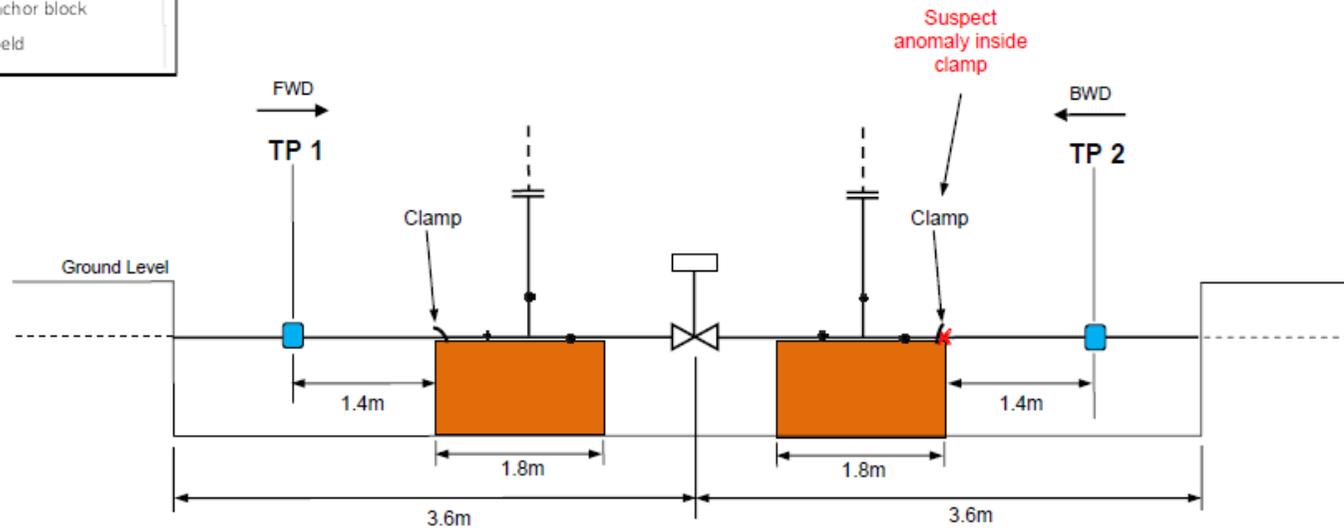
### PIPELINE SCHEMATIC DRAWINGS

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

**Legend :**



N ← → S



Test Point 1 Line ID: 12" Tindal Heading North

(Forward Shot only)

