

APA Group

Warrego Scraper Station  
Coating Assessment Report  
Below Ground Station Piping Repair Project

APA Group

# Warrego Scraper Station

## Coating Assessment Report

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## Contents

1	Introduction .....	1
2	Method .....	1
3	Results.....	2
3.1	DCVG .....	2
3.2	Coating Inspection .....	3
3.3	Metal loss .....	3
3.4	RSTRENG Analysis .....	4
3.5	LRUT .....	4
4	Discussion.....	8
5	Recommendation.....	9
6	Conclusion.....	10
Appendix 1	Station Layout, DCVG Survey, Coating Defects and Metal Loss Results .....	11
Appendix 2	Coating Damage Assessment Forms.....	12
Appendix 3	Photo Log .....	13
Appendix 4	RSTRENG ANALYSIS .....	16
Appendix 5	LRUT .....	17



## 1 Introduction

Direct Current Voltage Gradient (DCVG) surveys have been conducted at each scraper station along the Amadeus Gas Pipeline 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 CP shielding and interactions between different pipe sections.

To correlate the DCVG results to actual defects, 5 scraper stations and 4 MLV's and 9 anchor blocks have been selected to be excavated and to undergo coating assessment. The results of these 10 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.

Warrego is the third scraper station to be excavated and assessed. This report compares the DCVG results for Warrego to the results of the coating assessment following excavation.

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 Warrego scraper station. 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.

The Warrego site 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. Failure of a holiday detector test results in a white painted ring around that area. All sections of pipe with coating defects have been photographed, see Appendix 3 for referenced photos and the photo log. To quantify the defects and identify trends in defect activity the results are presented on a mark-up of the facility layout drawing, refer to Appendix 1.

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 were 12 areas highlighted as having coating defects by the DCVG survey. These defects are summarised in Table 1 below. Locations of each defect are shown on the drawing in Appendix 1.

**Table 1: DCVG Detected Defects**


DCVG Defect Number	Section	IR
1	South compressor line	5.7 %
2	South pig trap drain line	1.8 %
3	NRV	14.9 %
4	V11 – MLV bypass valve south	9.8 %
5	MLV	16.4 %
6	V12 – MLV bypass valve north	3.0 %
7	Station blowdown line	17.9 %
8	Station blowdown line	14.9 %
9	Support block D/S of V14	7.8 %
10	North pig trap line	16.4 %
11	Station blowdown line 90° concrete support block	3.9 %
12	Station blowdown stack	3.6 %

The Warrego DCVG Survey drawing has been included in Appendix 1. Dig up of the areas indicated in the DCVG survey revealed the coating defects described in the following Table 2.

**Table 2: Coating Damage Assessments**

Defect ID#	Section	Photo Log / Notes
1	Section F – Downstream of MLV, upstream of V14. Canusa sleeve.	Appendix 4, Photos 1653, 1654, 1655, 1656, 1658, 1659, 1844, 1960.
2	Blowdown line upstream of 90° elbow support block.	Appendix 4, Photos 1634, 1635, 1830, 1831, 1832, 1948, 1952, 1969.
3	Blowdown line white ant damage.	Appendix 4, Photos 1634, 1828, 1829, 1953, 1954, 1955.
4	Pig Reciever line – Yellow jacket split.	Appendix 4, Photos 1784, 1669, 1840, 1841, 1842, 1939, 1940, 1941, 1942, 1972.
5	North anchor block (northern side).	Appendix 4, Photos 1780, 1783, 1812, 1813, 1814, 1820, 1970.
6	Southern anchorblock tee.	Appendix 4, Photos 1587, 1588, 1652, 1987,
7	Pig Reciever line – Coating split between canusa sleeves	Appendix 4, Photos 1668, 1669, 1784, 1931, 1943, 1972.
8	North of station MLV –	Appendix 4, Photo 1653, 1654, 1655, 1660, 1962,



	Warrego Scraper Station Coating Assessment Report Below Ground Station Piping Repair Project
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	Yellowjacket split	1963, 2168.
9	Blowdown line 90° bend support block	Appendix 4, Photo 1772, 1773, 2143
10	V07 support block	Appendix 4, Photo 1589, 1590, 1591, 1785, 2183
11	Pig Launcher	Appendix 4, Photo 1580, 1979, 2176

### 3.2 Coating Inspection

A significant amount of the coating found at Warrego was in poor condition. Many areas of coating were found to be blistering and the coating in places was cracked and pulling away from the pipework. Recorded coating defects have been illustrated on the Warrego Coating Defect layout drawing in Appendix 2. Areas of coating found to fail a holiday test were circled with white paint (refer photos). Some specific examples include:

- Blistering on the southern tee (photo 1588).
- White ant damage to the south tee, MIJ (Monolithic Insulating Joint) and blowdown line (photos 1580, 1798, 1828 and 1832).
- North pig receiver yellowjacket split (photo 1669).
- North side of north anchor block yellowjacket split (photo 1804).
- North side of MLV yellowjacket split (photo 1654).
- Blowdown line 90° elbow concrete support block blistering (photo 1773).

The following table lists coating defects that were attributed to significant metal loss on the pipe documented on-site with a Coating Damage Assessment form (see Appendix 2).

**Table 3: Coating Defects Near Areas of Identified Metal Loss**

ID	Section	Defect Description	Correlation to DCVG	DCVG Survey IR
1	Canusa Sleeve North of MIJ	Yellowjacket split into the canusa sleeve.	Close To 7	17.9%
2	Blowdown Line	Coating was tape wrapped with termite damage.	8	14.9%
3	Blowdown Line	Coating was tape wrapped with termite damage.	7	17.9%
5	North Anchor Block	Canusa sleeves; failed holiday detection and had moisture underneath.	N/A	N/A

### 3.3 Metal loss

There were 4 areas of metal loss found on the pipework at Warrego. Of these 4 areas containing metal loss, all 4 areas had visible coating defects. The metal loss section of the coating damage assessment form was filled out for each defect – refer to 0.

**Table 4: Metal Loss Reports**

ID	Section	Coating Defect (Y/N)	Maximum Depth (mm)	Correlation to DCVG	DCVG Survey IR
1	Canusa Sleeve North of MIJ	Y	0.55	Close To 7	17.9%
2	Blowdown Line	Y	0.80	8	14.9%
3	Blowdown Line	Y	0.61	7	17.9%
5	North Anchor Block	Y	2.28	N/A	N/A

The metal loss noted has been analysed in Table 5 below for its possible cause. Account has been taken for the most likely cause of the metal loss considering whether there is a coating defect possibly associated (refer photos and coating damage assessment reports of Appendix 2), evidence of rust product (photos) and physical appearance of the defect (photos).

**Table 5: Metal Loss Defect Analysis**

ID	Section	Coating Defect (Y/N)	Cause	Notes
1	Canusa Sleeve North of MIJ	Y	Corrosion	Refer to photo 1653, 1655, 1656 and 1961. Visual examination of coating condition showed signs of shielding. Pit appearance seems consistent with pit corrosion due to shielding.
2	Blowdown Line	Y	Corrosion	Refer to photos 1634, 1831, 1948. Evidence of pitting and pattern of defects consistent with typical corrosion.
3	Blowdown Line	Y	Corrosion	Refer to photos 1634, 1829, 1953. Evidence of pitting and pattern of defects consistent with typical corrosion.
5	North Anchor Block	Y	Corrosion	Refer to photos 1783, 1813, 1814. Evidence of pitting consistent with typical corrosion.

The location and details of metal loss has been included on the Warrego Metal Loss Results drawing in Appendix 2.

### **3.4 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 8.74mm (refer to Appendix 1) and the Coating Damage Assessment metal loss form issued from site (Appendix 2) indicates the maximum pit depth of 2.28mm, 8mm axial length and 5mm circumferential length. The results of the RSTRENG analysis indicate that the pipeline passes for the current Maximum Allowable Operating Pressure (MAOP) of 9,650kPag (refer to Appendix 4). The AGP design factor is 0.72 which translates to a required safety factor of 1.39 and the RSTRENG results satisfy this case.

### **3.5 LRUT**

LRUT was conducted at Warrego scraper station from January 22-24, 2013. Extracts from the LRUT report are presented in Appendix 5. The diagrams in Appendix 5 shows the setup and location of the LRUT probe when undertaking the test. 12 LRUT 'shots' were conducted upon the 14inch pipe (Test Point 1 to 12; TP1, ... TP12) and 5 shots to the 10inch blowdown line pipe (Test Point 1 to 5; TP1, ... TP5) in order to examine the condition of the pipe wall within the concrete support blocks and anchor blocks.

**14" Test Point 1**

Test Point 1 is the forward LRUT shot at Warrego's south concrete anchor block, looking north. The concrete anchor block begins 1.4m from the sensor head as shown in the results of Appendix 5. There are no anomalies detected from this point onwards for this shot. The flange within the block was detected at a distance of 1.71m, 310mm into the block. Corrosion was not identified within the concrete block.

**14" Test Point 2**

Test Point 2 is a backward LRUT shot at Warrego's south concrete anchor block, looking south. The concrete anchor block begins 1.8m from the sensor head as shown in the results of Appendix 5. The flange was detected at -2.11m which is 310mm inside of the block. Corrosion was not identified within the concrete block.

**14" Test Point 3**

Test Point 3 is the forward LRUT shot at Warrego's V07 concrete support block, looking east. The body of V07 is 1.7m from the LRUT device with the concrete support block in-between. As shown in Appendix 5 there are no anomalies detected within the concrete support block. The valve body was identified at a distance of 1.68m. Corrosion was not identified within the concrete block.

**14" Test Point 4**

Test Point 4 is the forward LRUT shot at Warrego's V07 concrete support blocks, looking west. The LRUT has detected 4 significant anomalies identified as 3 welds and the valve body at 3.42m. The bill of materials on Appendix 1 drawing AD0610-6004 Rev. 0 identifies the tee as DN350 schedule 80 which has 560mm weld-to-weld length according to pipe charts. The T-piece welds are identified as the first two welds which were detected at 1.53m and 2.06m respectively. The 530mm is within the measurement margin for error for LRUT. The third weld detected at 2.52m is the valve girth weld correctly identified, refer to photo 1789. Corrosion was not identified within the concrete block.

**14" Test Point 5**

Test Point 5 is the backward LRUT shot at Warrego's NRV concrete support blocks, looking south. The LRUT has detected 4 significant anomalies identified as a weld at 0.6m, a vertical branched tee at 1.10m, a weld at 1.55m and the horizontal kicker line tee at 2.14m. Photo 1765 of Appendix 3 confirms the position and identification of these fittings and welds. Corrosion was not identified within the concrete block.

**14" Test Point 6**

Test Point 6 is the forward LRUT shot at Warrego's MLV south concrete support block, looking north. The LRUT has detected 7 significant anomalies identified as a weld at 0.55m (0.05m from edge concrete block to schematic, refer Appendix 5), a coating anomaly at 0.83m, a pipe clamp at 0.99m, a weld at 1.37m and 1.95m, the other edge of the concrete block at 2.45m and the valve body at 2.82m. Photo 1990 of Appendix 3 confirms the position and identification of these clamp fittings and



welds. The coating anomaly identified at 0.83m is 200-300mm inside of the concrete support block and presents a vertical flexural reading indicating reflections at the top or bottom of the pipe which the LRUT technician has identified as coating related. Corrosion was not identified within the concrete block.

#### **14" Test Point 7**

Test Point 7 is the forward LRUT shot at Warrego's MLV north concrete support block, looking south. The LRUT has detected 7 significant anomalies identified as a weld at 0.54m and 1.07m, two vertical branched tees at 1.35m and 2.03m, a horizontal tee at 2.53m, a coating anomaly at 3.11m and the valve body at 3.65m. Photo 1991 of Appendix 3 confirms the position and identification of these fittings and welds, and the coating anomaly is identified as the interface between the rock guard and the CTE coating – no corrosion was identified. Corrosion was not identified within the concrete block.

#### **14" Test Point 8**

Test Point 8 is the forward LRUT shot at Warrego's MIJ north concrete support block, looking south. The LRUT has detected no significant anomalies between the concrete support block 1.3m from the LRUT device and the MIJ which was detected at 2.73m. Photo 1639 of Appendix 3 and drawing AD0610-6004 Rev. 0 confirms the detected distance between the concrete block and the MIJ. Corrosion was not identified within the concrete block.

#### **14" Test Point 9**

Test Point 9 is the forward LRUT shot at Warrego's V14 concrete support blocks, looking west. The LRUT has detected 6 significant anomalies identified as 3 welds and the valve body at 4.07m. The first two anomalies are identified as coating anomalies due to identified bubbles outside of the concrete support block at 0.47m and 0.67m. The concrete block begins at 1.1m to the TP9 schematic drawing in Appendix 5. The bill of materials on Appendix 1 drawing AD0610-6004 Rev. 0 identifies the tee as DN350 schedule 80 which has 560mm weld-to-weld length according to pipe charts. The T-piece welds are identified as the first two welds which were detected at 2.15m and 2.78m respectively. The 530mm is within the measurement margin for error for LRUT. The third weld detected at 3.14m is the valve girth weld correctly identified, refer to photo 1676. Corrosion was not identified within the concrete block.

#### **14" Test Point 10**

Test Point 10 is the forward LRUT shot at Warrego's V14 concrete support block, looking east. The concrete block begins 0.8m from the LRUT device according to TP10 schematic drawing in Appendix 5. As shown in Appendix 5 there are no anomalies detected within the concrete support block between the start of the concrete block at 0.8m and the valve body identified at a distance of 1.64m. Corrosion was not identified within the concrete block.

**14" Test Point 11**

Test Point 11 is the forward LRUT shot at Warrego's north concrete anchor block, looking north. The concrete anchor block begins 1.3m from the sensor head as shown in the results of Appendix 5, and the pig-sig tee is 0.6m from the sensor head. The pig-sig tee is identified by LRUT at a distance of 0.73m, a coating transition (CTE to tape wrap) is identified at 1.07m, the concrete block interface is detected at 1.38m and the flange within the block was detected at a distance of 1.63m, 250mm into the block. Corrosion was not identified within the concrete block.

**14" Test Point 12**

Test Point 12 is the forward LRUT shot at Warrego's north concrete anchor block, looking south. The concrete anchor block begins 1.3m from the sensor head as shown in the results of Appendix 5. Two coating anomalies were identified at 0.50m and 0.67m, the concrete block interface is detected at 1.16m and the flange within the block was detected at a distance of 1.60m, 440mm into the block. Corrosion was not identified within the concrete block.

**10" Test Point 1**

Test Point 1 is the forward LRUT shot at Warrego's blowdown stack concrete support block, looking west. The concrete interface is 1.3m in front of the sensor head as shown in the results of Appendix 5. 3 coating anomalies were detected at 0.50m, 0.73m and 1.15m from the device, outside of the concrete block. The tee piece was identified within the concrete block at a distance of 1.58m, 280mm inside of the block. The other end of the concrete block was identified by LRUT at a distance of 2.01m. Corrosion was not identified within the concrete block.

**10" Test Point 2**

Test Point 2 is the forward LRUT shot at Warrego's blowdown stack concrete support block, looking vertically down. The concrete interface is 1.4m in front of the sensor head as shown in the results of Appendix 5. No anomalies were detected, only the girth weld into the equal tee at 1.66m; 260mm inside of the concrete block. Corrosion was not identified within the concrete block.

**10" Test Point 3**

Test Point 3 is the forward LRUT shot at Warrego's blowdown line 90° elbow concrete support block, looking west. The concrete interface is 1.3m in front of the sensor head as shown in the results of Appendix 5. 3 coating anomalies were detected at 0.34m, 0.65m and 0.88m from the device, outside of the concrete block. The elbow piece girth weld was identified within the concrete block at a distance of 1.41m, 110mm inside of the block. Corrosion was not identified within the concrete block.

**10" Test Point 4**

Test Point 4 is the forward LRUT shot at Warrego's blowdown line 90° elbow concrete support block, looking north. The concrete interface is 1.2m in front of the sensor head as shown in the results of Appendix 5. 3 coating anomalies were detected at 0.31m, 0.64m and 1.05m from the device, outside

of the concrete block. The elbow piece girth weld was identified within the concrete block at a distance of 1.31m, 110mm inside of the block. Corrosion was not identified within the concrete block.

#### **10" Test Point 5**

Test Point 4 is the forward LRUT shot at Warrego's blowdown line concrete support block between V11 and V12, looking south. The concrete interface is 0.75m in front of the sensor head as shown in the results of Appendix 5. No defects or anomalies were detected within the concrete support block. The elbow piece girth weld was identified within the concrete block at a distance of 2.31m on the other side of the block. Corrosion was not identified within the concrete block.

## **4 Discussion**

Compiling the results of DCVG, coating defects noted and corrosion found at Warrego it should be possible to determine links between the three sets of results. A complete set of results for the DCVG, Coating Defects and Metal loss is included in the Warrego DCVG, Coating Defects and Metal Loss layout drawing of Appendix 1.

#### DCVG and Coating Defects

The DCVG survey discovered CP leaks which have been referenced back to coating defects found during the dig-up as described in Table 2 and referenced photos of Appendix 1. However, DCVG failed to find blistering on the TEE downstream of V07, blistering around the concrete support downstream of V07, blistering on the south and north trap kicker line, white ant coating damage to the MIJ, the yellowjacket split north of the MIJ, V14 blistering, blistering around the north anchor block and a yellowjacket split north of the northern anchor block.

DCVG Defect #7, 9 and 12 were not related back to specific defects found in the coating during dig-up, and yet were relatively high %IR readings. DCVG Defect #9 and 12 detections were around concrete support blocks however, therefore there could be a detected defect within the support block. The risk of severe corrosion within these concrete blocks is low, despite making for ideal CP (Cathodic Protection) shielding structures, as the block is securely sealed where the pipe enters and exits the concrete blocks.

#### DCVG and Metal Loss Defects

The DCVG survey identified 2 out of 4 metal loss defects found at Warrego. Metal loss defects ID# 1, 2, 3 and 5 were identified as resulting from pit corrosion due to shielding. The fact that defects #1 and were not found by DCVG, and defects #2 and 3 were near the DCVG Defect #8 is consistent with the shielding premise.

#### Coating Condition

As can be seen by the photos the pipe coating is failing in many locations leading to many detected holidays. Although corrosion has not been found to be widespread at the stage dig-up occurred, the

degrading condition of the coating does indicate it is nearing the end of its effective life, and corrosion rates will accelerate as a result.

### Corrosion

The corrosion that has occurred at metal loss ID #2 and #3 was in an area where the coating type was tape wrap. Coating defects caused by termite damage were also located nearby which allows for electrolyte migration underneath the coating along the pipe metal surface. The pipe was wrapped circumferentially, and corrosion occurred axially to the pipe for ID #3 and circumferentially for ID #2. This indicates moisture ingress through the tape wrap defect has collected some distance away from where the corrosion subsequently occurred, shielded by the tape wrap from CP.

Metal loss ID #1 occurred underneath a canusa sleeve over a girth weld. The corrosion seen is typical of that seen underneath canusa sleeves; pitting corrosion spanning the circumference of the pipe for the length of the canusa sleeve. The corrosion mechanism is shielding type, with the canusa sleeve acting as the CP shield.

Metal loss ID #5 is most likely to be due to very localised pit corrosion resulting from shielding underneath the canusa sleeve. The coating damage assessment form for ID #5 identifies moisture underneath all of the canusa sleeves in the area including the one with corrosion underneath it. The dis-bondment of the canusa sleeve at the pit site is considered to have resulted in the localised shielding and pit corrosion which has occurred. The appearance of the pit corrosion here is not consistent with pit corrosion evident beneath yellowjacket or tape coating systems generally found elsewhere, it is similar to the pit corrosion found at V14 at Newcastle Waters. Shielding normally results in a very uniform corrosion rate during periods when the local environment is corrosive and cathodic protection currents cannot reach the site to prevent the corrosion.

## **5 Recommendation**

Corrosion has been largely mitigated at the site by the pipe coating and CP, and as a result corrosion has been fairly minor. Corrosion rates will probably accelerate with time given the degrading condition of the coating. There is reasonable evidence of shielding both in the yellow-jacket and tape systems. Shielding can lead to very rapid rates of pit corrosion which can ultimately result in a leak.

In the absence of shielding, the amount of general corrosion is reasonably low and the cathodic protection system is providing the secondary level of steel protection as per the design.

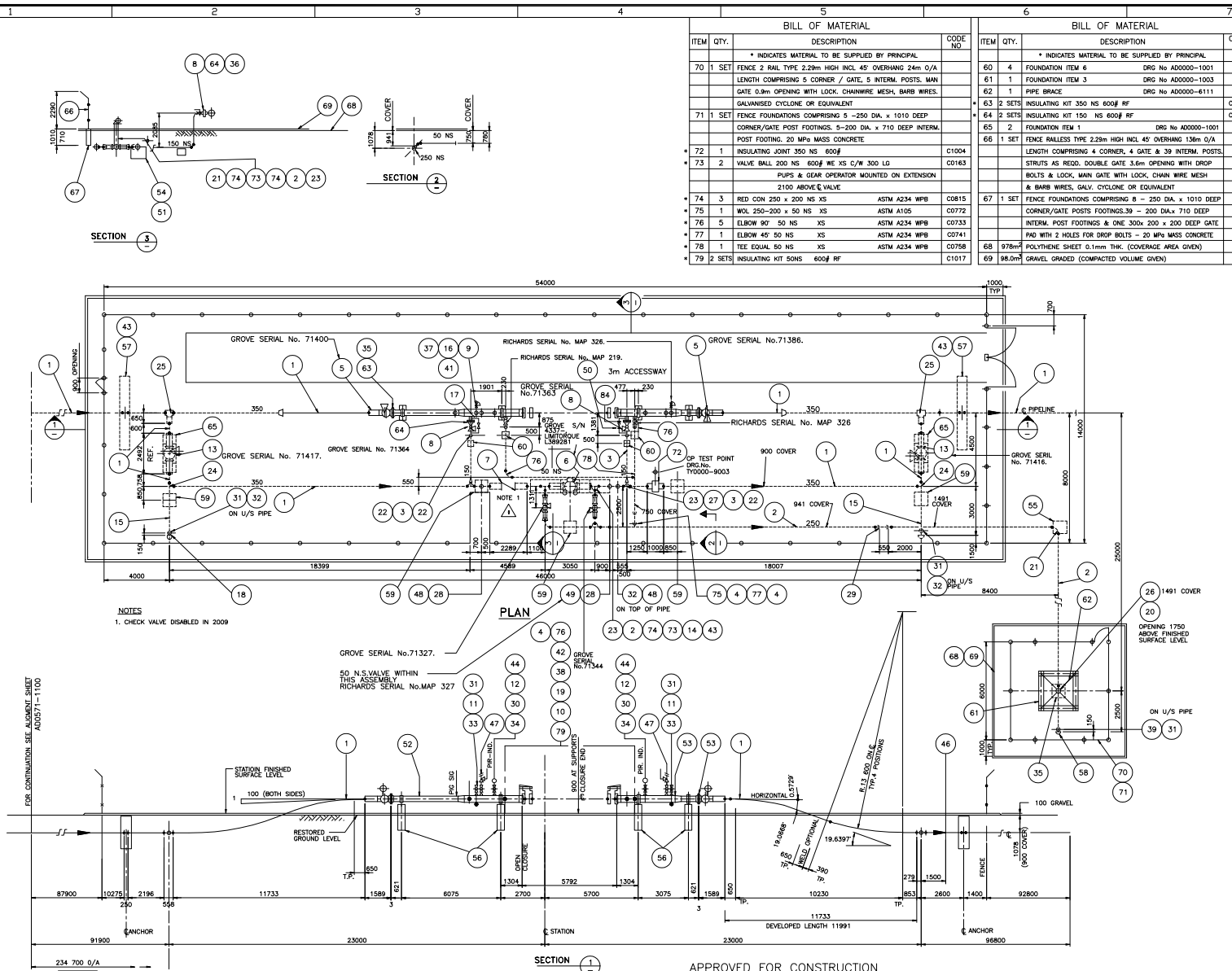


## 6 Conclusion

The DCVG survey has not been able to accurately detect all of the coating damage or metal loss at the Warrego scraper station. The condition of the coating was generally poor and the DCVG survey indicated many CP leaks. The resolution and accuracy of the DCVG survey was shown to be a short-coming, as not all of the defects were spotted – this is probably due to the high number of defects in a relatively small area at the scraper station, therefore the gradient changes which would be an expected result of a coating defect are difficult to measure and locate given the high number.

There were several areas of metal loss on the station pipework where there had been coating degradation. The amount of general corrosion is low and the station cathodic protection system appears to be working as it should. However, there is evidence of shielding issues at this station.

## **Appendix 1      Station Layout, DCVG Survey, Coating Defects and Metal Loss Results.**



APPROVED FOR CONSTRUCTION

INITIALS SIGNATURE DATE

DRAWN  
DESIGN CHECKED  
DRAWING CHECKED  
APPROVED



**N.T. GAS**  
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TITLE AMADEUS BASIN TO DARWIN PIPELINE  
SCRAPER STATION 350 NS  
ARRANGEMENT - WARREGO

DRG. SIZE  
A1

SCALE  
1:100

DRAWING NUMBER  
AD0610-6004

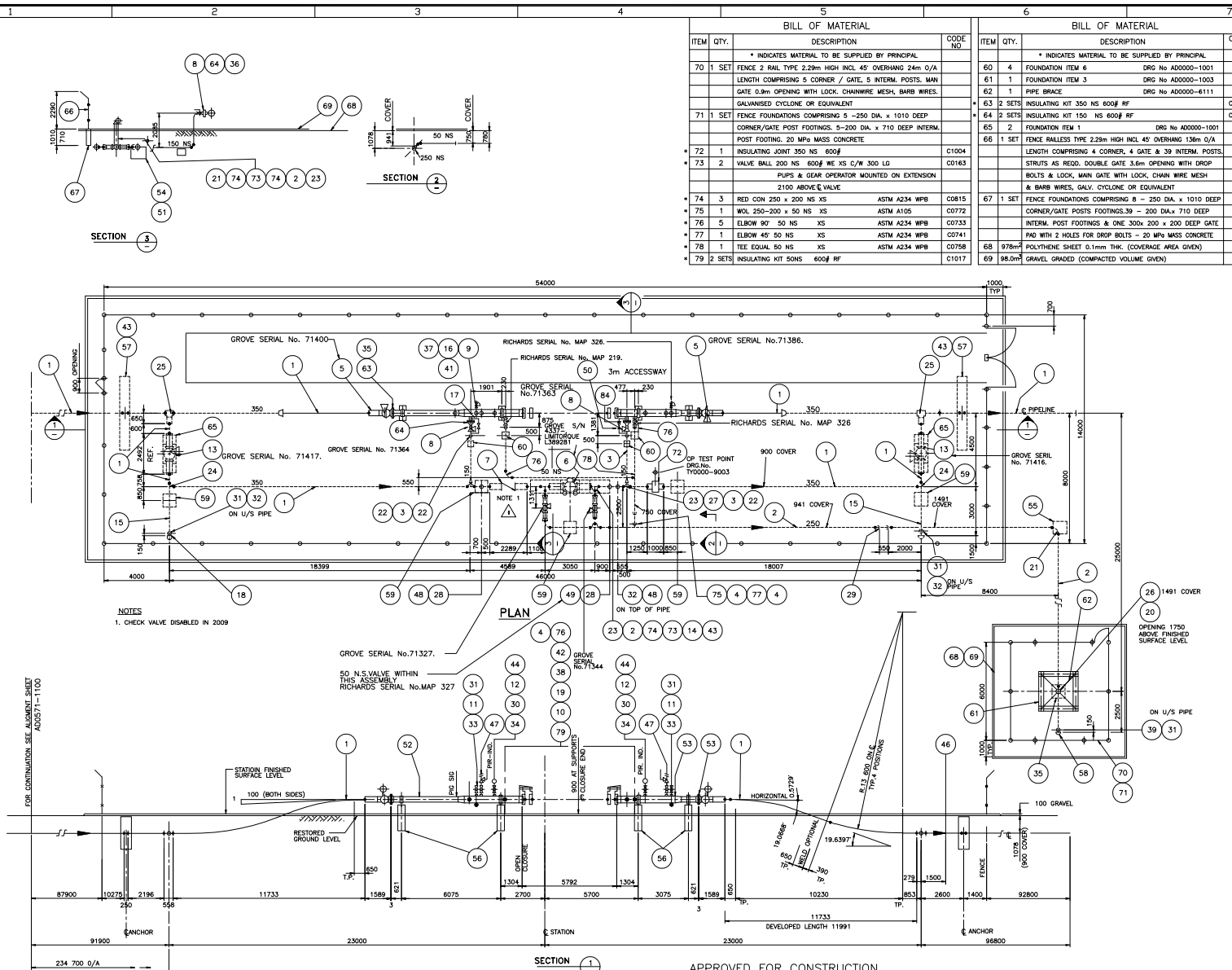
REV.  
0

REV.	REVISION DESCRIPTION	DRAWN	CHECK'D	APP'D	DATE	REFERENCE DRAWINGS
0	NEW DWG NO. REF AD0607-6004 REV 3. CHECK VALVE DISABLED	BP	ML	HD	15/2/10	AD0610-7001 P & I DIAGRAM

BILL OF MATERIAL			
ITEM	QTY.	DESCRIPTION	CODE NO.
* INDICATES MATERIAL TO BE SUPPLIED BY PRINCIPAL			
70	1 SET	FENCE 2 RAIL TYPE 2.29m HIGH INCL 45° OVERHANG 24m O/A	
		LENGTH COMPRISING 5 CORNER / GATE, 5 INTERM. POSTS, MAIN	
		GATE 0.9m OPENING WITH LOCK, CHAINWIRE MESH, BARB WIRES.	
		GALVANISED CYCLONE OR EQUIVALENT	
71	1 SET	FENCE FOUNDATIONS COMPRISING 5 - 250 DIA. x 1010 DEEP	
		CORNER/GATE POST FOOTINGS. 5-200 DIA. x 710 DEEP INTERM.	
		POST FOOTING. 20 MPa MASS CONCRETE	
72	1	INSULATING JOINT 350 NS 600# RF	C1004
73	2	VALVE BALL 200 NS 600# WE XS C/W 300 LG	C0163
		PIPS & GEAR OPERATOR MOUNTED ON EXTENSION	
		2100 ABOVE E/V	
74	3	RED CON 250 x 200 NS XS	ASTM A234 WPB C0815
75	1	WOL 250-200 x 50 NS XS	ASTM A105 C0772
76	5	ELBOW 90° 50 NS XS	ASTM A234 WPB C0733
77	1	ELBOW 45° 50 NS XS	ASTM A234 WPB C0741
78	1	TEE EQUAL 50 NS XS	ASTM A234 WPB C0758
79	2 SETS	INSULATING KIT 50NS 600# RF	C1017

BILL OF MATERIAL			
ITEM	QTY.	DESCRIPTION	CODE NO.
* INDICATES MATERIAL TO BE SUPPLIED BY PRINCIPAL			
60	4	FOUNDATION ITEM 6	DRG No AD00000-1001
61	1	FOUNDATION ITEM 3	DRG No AD00000-1003
62	1	PIPE BRACE	DRG No AD00000-6111
63	2 SETS	INSULATING KIT 350 NS 600# RF	C1010
64	2 SETS	INSULATING KIT 150 NS 600# RF	C1014
65	2	FOUNDATION ITEM 1	DRG No AD00000-1001
66	1 SET	FENCE RAILLESS TYPE 2.29m HIGH INCL 45° OVERHANG 136m O/A	
		LENGTH COMPRISING 4 CORNER, 4 GATE & 39 INTERM. POSTS.	
		STRUTS AS REQD. DOUBLE GATE 3.6m OPENING WITH DROP	
		BOLTS & LOCK. MAIN GATE WITH LOCK, CHAIN WIRE MESH	
		& BARB WIRES. GATE. CYCLONE OR EQUIVALENT	
67	1 SET	FENCE FOUNDATIONS COMPRISING 8 - 250 DIA. x 1010 DEEP	
		CORNER/GATE POSTS FOOTINGS. 39 - 200 DIA. x 710 DEEP	
		INTERM. POST FOOTINGS & ONE 300x 200 x 200 DEEP GATE	
		PAO WITH 2 HOLES FOR DROP BOLTS - 20 MPa MASS CONCRETE	
68	978m	POLYETHYLENE SHEET 0.1mm THK. (COVERAGE AREA GIVEN)	
69	98.0m	GRAVEL GRADED (COMPACTED VOLUME GIVEN)	

BILL OF MATERIAL			
ITEM	QTY.	DESCRIPTION	CODE NO.
* INDICATES MATERIAL TO BE SUPPLIED BY PRINCIPAL			
1	252m	PIPE 350 NS 8.74 WT API 5L X-60	C0008
2	56m	PIPE 250 NS XS ASTM A106 B	C0062
3	8.3m	PIPE 150 NS XS ASTM A106 B	C0064
4	21m	PIPE 50 NS XS ASTM A106 B	C0067
5	2	VALVE BALL 350 NS 600# FE RF/WE FULL BORE C/W	C0166
		PUP 700 LG & WITH GEAR OPERATOR	
6	1	VALVE BALL 350 NS 600# WE FULL BORE 2482 O/A	C0154
		LGTH. C/W PUPS & WITH GAS HYDRAULIC OPERATOR	
		MOUNTED ON EXTENSION 2100 ABOVE E/V	
7	1	VALVE CHECK 350 NS 600# WE 8.74 WT BRNG C/W	C0401
		PUPS 700 LG. - DISABLED IN 2009	
8	2	VALVE BALL 150 NS 600# WE XS/FE RF	C0180
		WITH GEAR OPERATOR	
9	2	VALVE BALL 80 NS 600# FE RF	C0212
10	2	VALVE BALL 50 NS 600# FE RF	C0213
11	2	VALVE BALL 25 NS 600# SW/NPT	C0240
12	2	VALVE GAUGE 15 NS 600# SCR NPT C/W BLEED. W/F	C0247
13	2	VALVE BALL 350 NS 600# WE FULL BORE 2482 O/A LGTH.	C0160
		C/W PUPS & WITH GEAR OPERATOR	
		MOUNTED ON EXTENSION 2100 ABOVE E/V	
14	0.4m	PIPE 200 NS XS ASTM A106 B	C0363
15	5.5m	PIPE 350 NS 12.7 WT API 5L X-52	C0335
16	2	FLG BLIND 80 NS 600# RF	ASTM A105 C0564
17	1	PIPE ASSY	DRG No AD00000-6156
18	2	CAP 350 NS XS	MSS SP 75 WPHY-52 C0657
19	2	FLG WN 50 NS 600# RF XS	ASTM A105 C0541
20	1	CLOSURE 250 NS 600# WE XS	ASTM A105 C0985
		VERT C/W DAWT	
21	2	ELBOW 90° LR 250 NS XS	ASTM A234 WPB C0728
22	4	ELBOW 90° LR 150 NS XS	ASTM A234 WPB C0730
23	4	TEE RED 350x250NS XS	MSS SP 75 WPHY-52 C0662
24	2	TEE EQUAL 350 NS XS	MSS SP 75 WPHY-52 C0662
25	2	TEE BARRED 350 NS	DRG No AD00000-6102
26	1	TEE EQUAL 250 NS XS	ASTM A234 WPB C0763
27	2	RED CON 250 x 150 NS XS	ASTM A234 WPB C0816
28	2	WOL 450-300x50 NS XS	ASTM A105 C0771
29	2	ELBOW 45° 250 NS XS	ASTM A234 WPB C0736
30	2	COUPLING 15 NS 3000# NPT	ASTM A105
31	5	PLUG HEX 25 NS SCR NPT	ASTM A105
32	3	TOL 800-300 x 25 NS 3000# NPT	ASTM A105
33	2	NIPPLE 25 NS x 100 SCH 160 PBE	ASTM A106 B
34	2	NIPPLE 15 NS x 75 SCH 160 PBE/TOE	ASTM A106 B
35	40	STUDBOLT 1 3/8" UNF x 235	ASTM A193 B7
		C/W 2 NUTS	ASTM A194 2H
36	24	STUDBOLT 1" UNF x 170	ASTM A193 B7
		C/W 2 NUTS	ASTM A194 2H
37	32	STUDBOLT 3/4" UNF x 125	ASTM A193 B7
		C/W 2 NUTS	ASTM A194 2H
38	32	STUDBOLT 5/8" UNF x 110	ASTM A193 B7
		C/W 2 NUTS	ASTM A194 2H
39	1	TOL 250-150 x 25 NS 3000# NPT	ASTM A105
40	1	THERMOWELL 25 NS WITH PLUG	PART OF C3078
41	4	GASKET 80 NS 600# 4.4 THK	METAFLEX SG
42	2	GASKET 50 NS 600# 4.4 THK	METAFLEX SG
43	2	FLG ANCHOR 350 NS	DRG No AD00000-6101 C0994
44	2	PLUG HEX 15 NS SCR NPT	ASTM A105
45	1	TEE RED 250 x 200 NS XS	ASTM A234 WPB C0766
46	1	PIG SIG	EXTENDED 1.8m (350 NS) C1020
47	2	PIPE ASSY	DRG No AD00000-6112
48	1	PIPE ASSY	DRG No AD00000-6104
49	1	PIPE ASSY	DRG No AD00000-6109
50	1	PIPE ASSY	DRG No AD00000-6157
51	4	PIPE CLAMP	DRG No AD00000-6110
52	1	TRAP RECEV. 350 NS	DRG No AD00000-6122
53	1	TRAP LAUN 350 NS	DRG No AD00000-6121
54	1	FOUNDATION ITEM 1	DRG No AD00000-1003
55	2	FOUNDATION ITEM 2	DRG No AD00000-1003
56	4	FOUNDATION ITEM 3	DRG No AD00000-1001
57	2	ANCH BLOCK ITEM 3	DRG No AD00000-1001
58	1	CAP 250 NS XS	ASTM A234 WPB C0744
59	5	FOUNDATION ITEM 5	DRG No AD00000-1001



APPROVED FOR CONSTRUCTION

INITIALS SIGNATURE DATE

DRAWN

DESIGN CHECKED

DRAWING CHECKED

APPROVED



**N.T. GAS**  
Pty. Limited  
ACN 050 221 415

16 Georgina Crescent PALMERSTON NT  
PO Box 7 PALMERSTON NT 0831  
Telephone: (08) 8935 1611  
Facsimile: (08) 8932 1663

TITLE AMADEUS BASIN TO DARWIN PIPELINE  
SCRAPER STATION 350 NS  
ARRANGEMENT-WARREGO

DRG. SIZE

SCALE

DRAWING NUMBER

REV.

A1

1:100

AD0610-6004

0

REV.	REVISION DESCRIPTION	DRAWN	CHECK'D	APP'D	DATE	REFERENCE DRAWINGS
0	NEW DWG NO. REF AD0607-6004 REV 3. CHECK VALVE DISABLED	BP	ML	HD	15/2/10	AD0610-7001 P & I DIAGRAM

DCVG      IR (%)

DEFECT 1:    5.7

DEFECT 2:    1.8

DEFECT 3:    14.9

DEFECT 4:    9.8

DEFECT 5:    16.4

DEFECT 6:    3.0

DEFECT 7:    17.9

DEFECT 8:    14.9

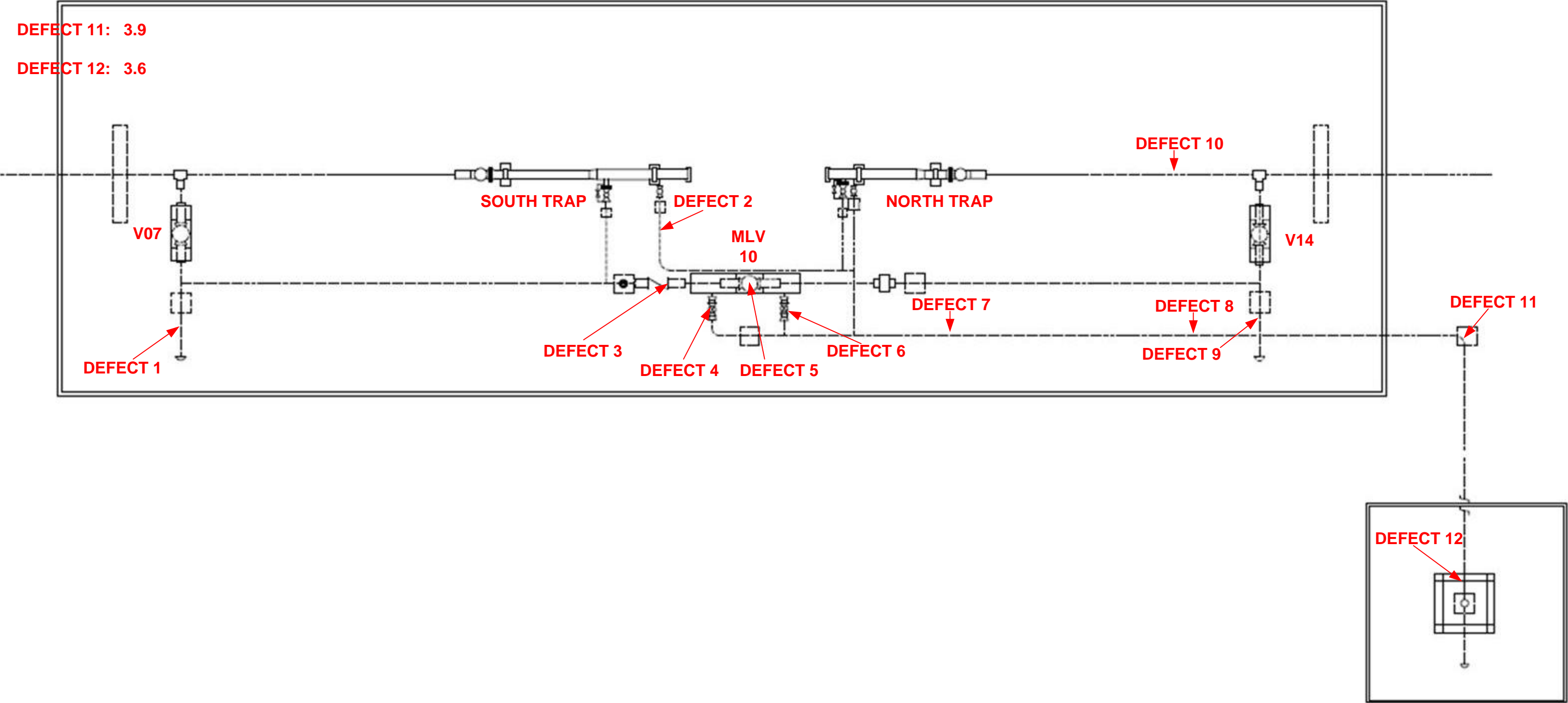
DEFECT 9:    7.8

DEFECT 10:  16.4

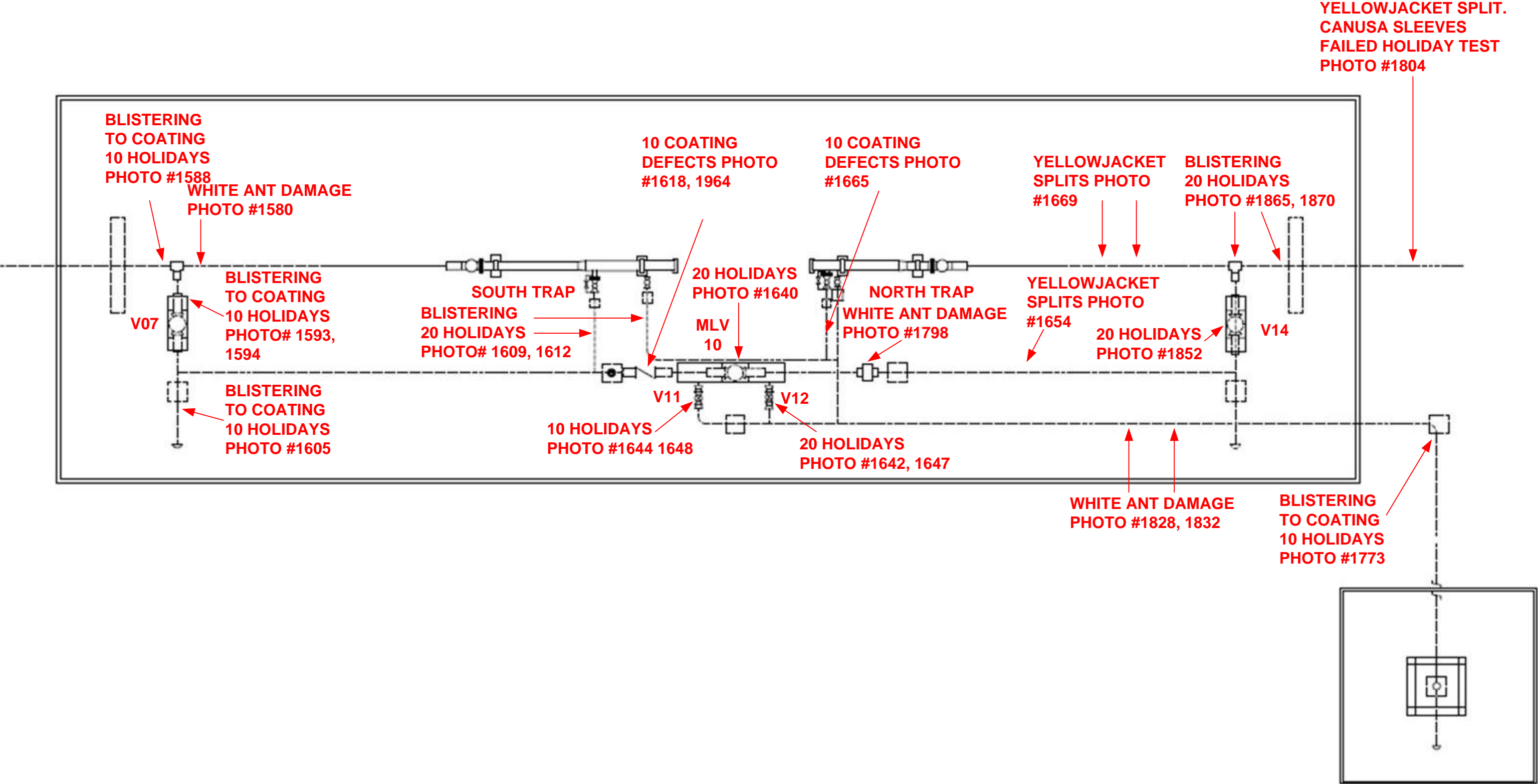
DEFECT 11:  3.9

DEFECT 12:  3.6

WARREGO DCVG SURVEY

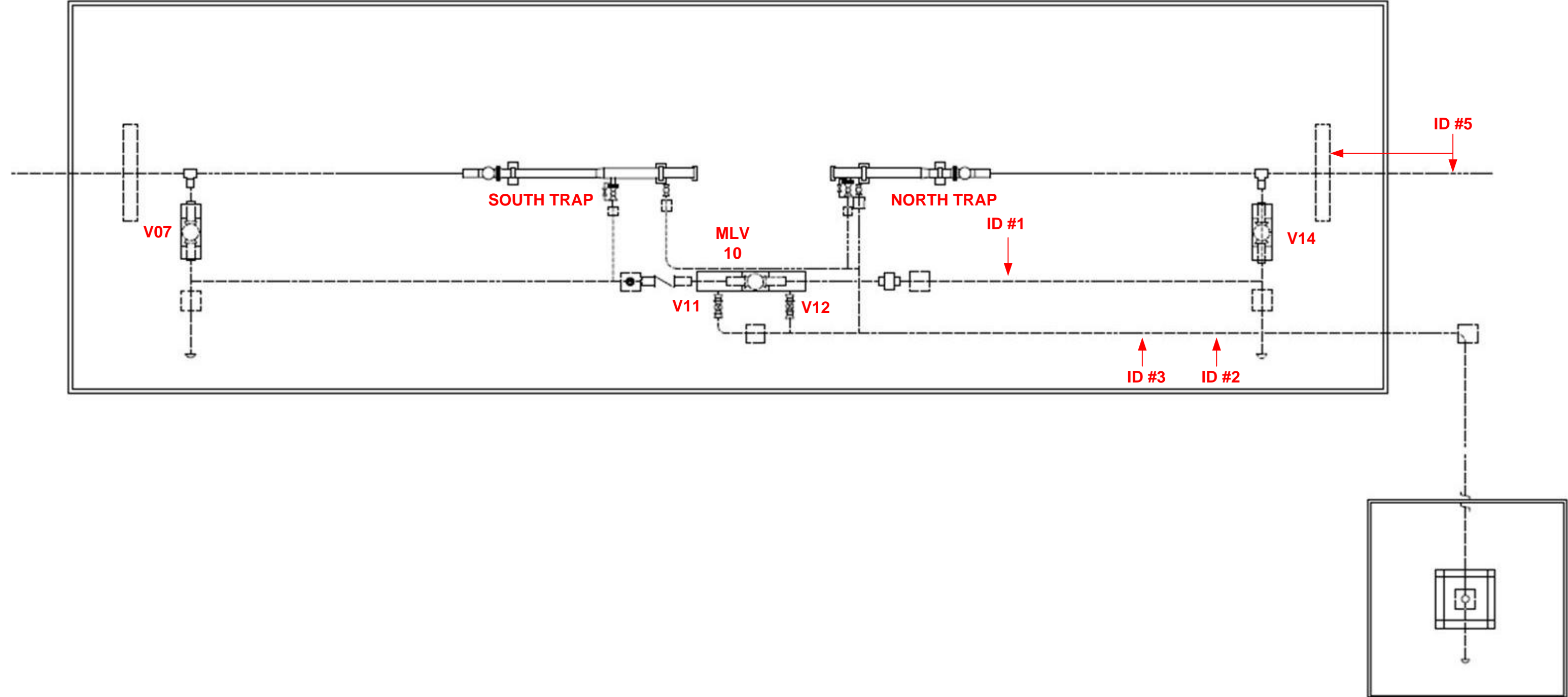


**WARREGO COATING DEFECT – VISUAL  
INSPECTION & HOLIDAY DETECTOR RESULTS**



WARREGO METAL LOSS RESULTS

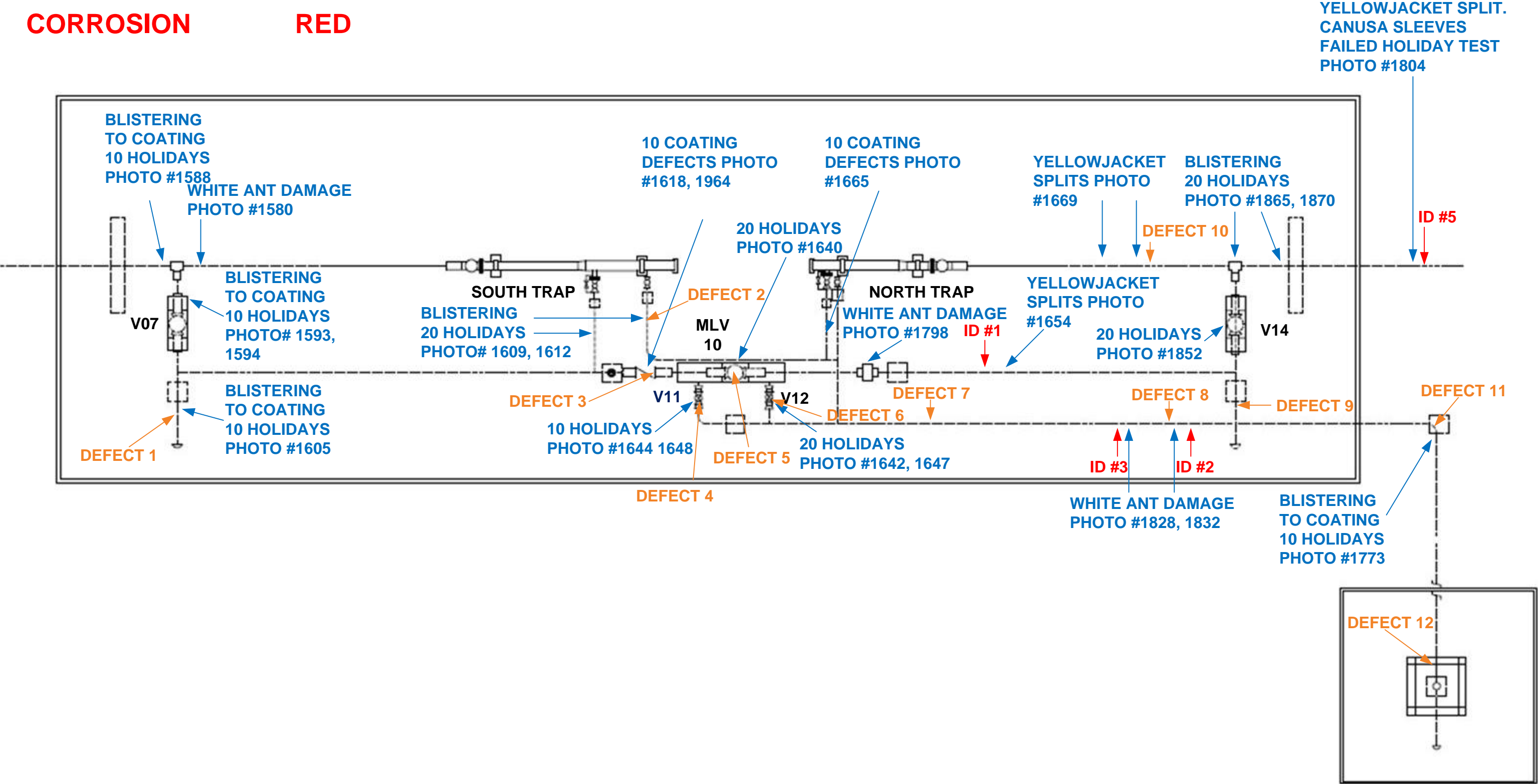
COATING DAMAGE ASSESSMENT REPORT ID#	DEFECT DIMENSION (mm) LxWxDPTH O'CLOCK POSITION ON PIPE	CAUSE OF METAL LOSS
1	220 x AROUND PIPE x 0.55	CORROSION
2	8x12x0.80 3 O'CLOCK	CORROSION
3	30x5x0.61 2:30 O'CLOCK	CORROSION
5	8x5x2.28 6 O'CLOCK	CORROSION





WARREGO DCVG, COATING DEFECTS & METAL LOSS

LEGEND	COLOUR
DCVG	ORANGE
COATING DEFECT	BLUE
CORROSION	RED



**Appendix 2      Coating Damage Assessment Forms**

~~#2~~ ~~Defect~~ ID #1

KP:

Work Order No:

Form created by Ben Parkin Apr 09  
Approved by Henry Dupal

## COATING DAMAGE ASSESSMENT

Page 1

### Location

Pipeline: DEFECT 1 Excavation Date: 20/1/2013  
Section: SECTION 1F Digup Reason: COATING REPAIR  
Kilometre Point: 144430 DCVG Measurement: N/A  
Zone: \_\_\_\_\_ Defect Length from survey (m): N/A  
Easting: \_\_\_\_\_ CMMS Work Order No: 144304  
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>1654, 1653</u>
Pipe with coating removed	<u>1844, 1655, 1658, 1659, 1660, 1661, 1662</u>
Pipe cleaned	<u>1960, 1961, 1962</u>
Pipe repaired	

### 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): 1-3 Soil pH: 5-6  
Pipe To Soil Potential (V): -1.523 Soil Resistivity (Ohms): PHOTO 1570 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)?

Y

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)?

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

Coating Defect Length (mm): RIGHT AROUND PIPE Coating Defect Width (mm): 220

Coating Defect Comments:

CANUSIA SLEEVE. WHITE ANTS HAD EATEN THROUGH THE BODIES OF THE SLEEVE. YELLOW JACKET HAD SPLIT AWAY FROM SLEEVE.

ID #1

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)?

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.

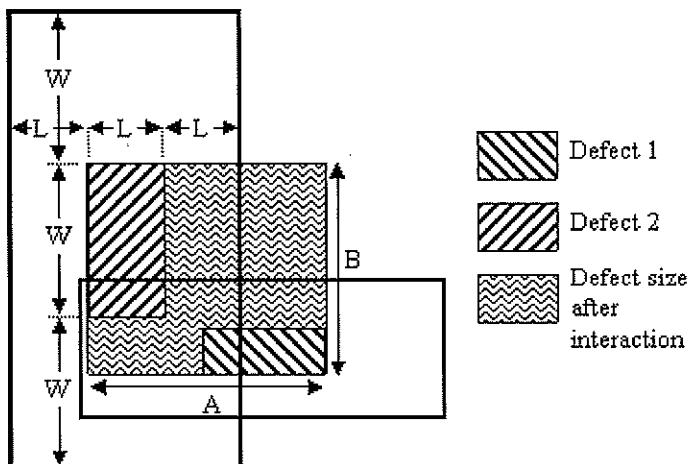


Figure 1

Maximum Depth (mm):

0.55

Wall thickness (mm):

8.74

Longitudinal dimension (A) (mm):

220

Circumferential dimension (B) (mm):

RIGHT AROUND PIPE

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)

ON WELD

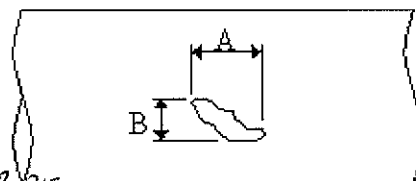


Figure 2

**Repair**

Length of Pipe Wrapped (mm):

Other Repair Information:

CORROSION WAS UNDER A CANUSA SLEEVE. THE PIPE INCLUDING  
THIS AREA WAS ABRASIVE BLASTED AND PAINTED WITH LUXAPOXY UMB  
TO A THICKNESS OF 3MM

Dig Up Comments:

SOFT RED SOIL

Operator: Wayne Dylly

Signature:

Date: 3/1/2013

ID #2

KP:

Form created by Ben Parkin Apr 09  
Approved by Henry Dupal

Work Order No:

## COATING DAMAGE ASSESSMENT

Page 1

## Location

Pipeline: DEFECT #2  
 Section: BLOW DOWN LINE.  
 Kilometre Point: WARRECO  
 Zone: \_\_\_\_\_  
 Easting: \_\_\_\_\_  
 Northing: \_\_\_\_\_

Excavation Date: 20/1/2013  
 Digup Reason: COATING INSPECTION  
 DCVG Measurement: # 8 14.9  
 Defect Length from survey (m): \_\_\_\_\_  
 CMMS Work Order No: 144 304

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>1634, 1635</u>
Pipe with coating removed	<u>1830, 1831, 1832</u>
Pipe cleaned	<u>1952, 1948, 1949, 1950, 1951</u>
Pipe repaired	<u>1969</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): 1-3

Soil pH: 5-6

Pipe To Soil Potential (V): -1.523

Soil Resistivity (Ohms): \_\_\_\_\_

Pin Spacing 1.5m

PHOTOS  
1967  
1970

## 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)? Y

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

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

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)? \_\_\_\_\_

Coating Defect Length (mm): UP TO 400

Coating Defect Width (mm): 250

Coating Defect Comments:

TERMITES DAMAGE IN WRAP

1D#2

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)?

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.

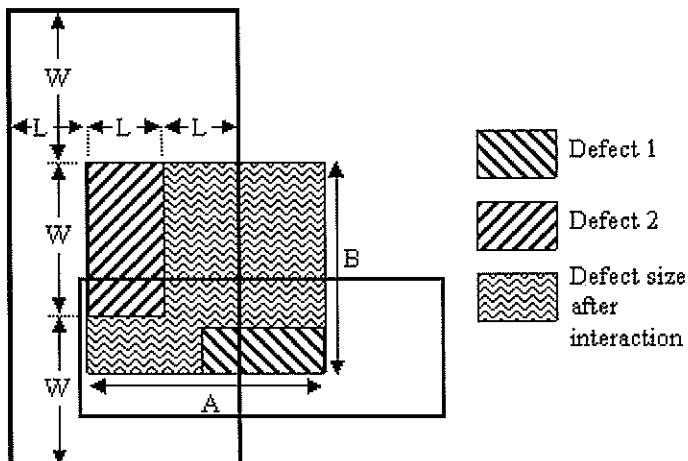


Figure 1

Maximum Depth (mm):

0.80

Wall thickness (mm):

Longitudinal dimension (A) (mm):

8mm

Circumferential dimension (B) (mm):

12mm

Clock Position (looking in direction of flow):

3 O'CLOCK

Distance from longitudinal weld (mm):

70

Distance from nearest girth weld (mm):

2180

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

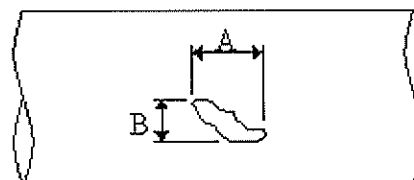


Figure 2

**Repair**

Length of Pipe Wrapped (mm):

Other Repair Information:

ENTIRE BLOW DOWN LINE PAINTED WITH DULUX UHB

Dig Up Comments:

SOIL WAS DAMP AND FRIE OF ROCK &amp; STONE

Operator:

Wayne Duffly

Signature:

[Signature]

Date: 3/1/2013



1D#3

KP:

Work Order No:

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

Page 1

**Location**Pipeline: DEFECT 123Excavation Date: 20/1/2013Section: BLOW DOWN LINEDigup Reason: COATING INSPECTIONKilometre Point: WARRIEGODCVG Measurement: #7 17.9

Zone: \_\_\_\_\_

Defect Length from survey (m): \_\_\_\_\_

Easting: \_\_\_\_\_

CMMS Work Order No: 144304

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>1634, 1635, 1628, 1629,</u>
Pipe with coating removed	<u>1829, 1828</u>
Pipe cleaned	<u>1954, 1955, 1953, 1958</u>
Pipe repaired	

**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): 1.03Soil pH: 5-6Pipe To Soil Potential (V): -1.523

Soil Resistivity (Ohms): \_\_\_\_\_ Pin Spacing 1.5m

PHOTOS  
1567  
1570**Coating**

Coating Description:

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

Is there a coating defect (Y/N)? YAny white buildup from cathodic protection (Y/N)? YAny evidence of termite damage (Y/N)? YAny 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)? N

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

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

Coating Defect Length (mm): UP TO 300Coating Defect Width (mm): UP TO 200

Coating Defect Comments:

TERMITE DAMAGE IN WRAP



ID #3

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)?

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.

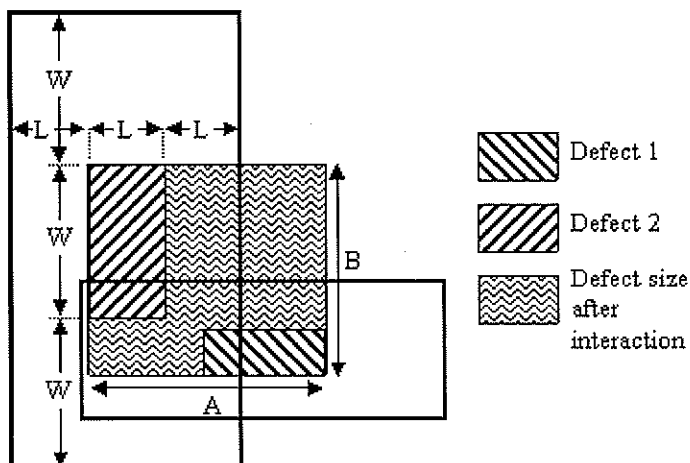


Figure 1

Maximum Depth (mm):

0.61

Wall thickness (mm):

12.7

Longitudinal dimension (A) (mm):

30

Circumferential dimension (B) (mm):

5

Clock Position (looking in direction of flow):

2.30

Distance from longitudinal weld (mm):

62

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

5730

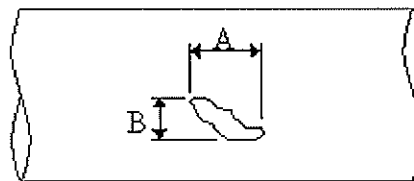


Figure 2

**Repair**~~Length of Pipe Wrapped (mm):~~ \_\_\_\_\_

Other Repair Information:

ENTIRE BLOW DOWN LINE PAINTED WITH DULUX UHB

Dig Up Comments:

SOIL WAS DAMP &amp; FREE OF ROCK &amp; STONES.

Operator:

*[Signature]*

Signature:

*[Signature]*

Date:

31/1/2013

ID #4

KP:

Work Order No:

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

Page 1

**Location**

Pipeline:

Section:

Kilometre Point:

Zone:

Easting:

Northing:

Surrounding Description:

(Buildings, drains, etc)

Excavation Date:

Digup Reason:

DCVG Measurement: #10

Defect Length from survey (m):

CMMS Work Order No:

19/1/2013

COATING REPAIR

16.4

144 304

**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	1784, 1669
Pipe with coating removed	1841, 1840, 1842
Pipe cleaned	1939, 1940, 1931, 1941, 1942
Pipe repaired	1972.

**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): 1.3

Soil pH:

5-6

Pipe To Soil Potential (V): -1.523

Soil Resistivity (Ohms): Approx 1570

Pin Spacing 1.5m

**Coating**

Coating Description:

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

Is there a coating defect (Y/N)?

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

Any evidence of termite damage (Y/N)?

Any moisture inside the coating (Y/N)?

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

Has the coating lifted away from the pipe (Y/N)?

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

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

Coating Defect Length (mm): 1.5

Coating Defect Width (mm): 450

Coating Defect Comments:

TERMITES DAMAGE WHEN WRAP CAME ONTO YELLOW JACKET.

1D#4

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.

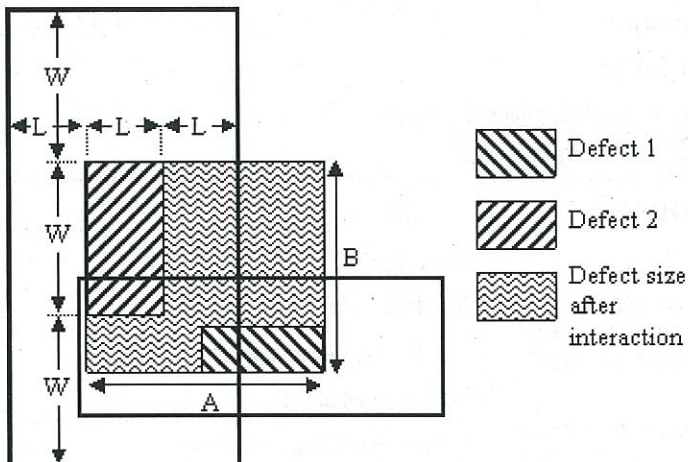


Figure 1

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)

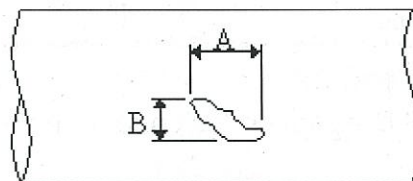


Figure 2

## Repair

Length of Pipe Wrapped (mm):

Other Repair Information:

ALL BELOW GROUND PIPE PAINTED WITH LUXAPOXY

Dig Up Comments:

SOIL RIED & DAMP, NO STONE

Operator: Wayne Duff

Signature:

[Signature]

Date: 29/1/2013

ID #5

KP:

Work Order No:

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

Page 1

**Location**

Pipeline: \_\_\_\_\_ Excavation Date: 19/1/2013  
 Section: NORTH ANCHOR BLOCK Digup Reason: LRUT  
 Kilometre Point: WARRIEGO DCVG Measurement: NIL  
 Zone: \_\_\_\_\_ Defect Length from survey (m): 144 304  
 Easting: \_\_\_\_\_ CMMS Work Order No: 144 304  
 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>1783, 1780, 1804</u>
Pipe with coating removed	
Pipe cleaned	<u>1812, 1813, 1814, 1821, 1820</u>
Pipe repaired	<u>1970</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): 1.3 Soil pH: 5.6  
 Pipe To Soil Potential (V): -1.523 Soil Resistivity (Ohms): Photo 1570 Pin Spacing 1.5m

**Coating**

Coating Description:

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

Is there a coating defect (Y/N)?

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

Any evidence of termite damage (Y/N)?

Any moisture inside the coating (Y/N)?

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

Has the coating lifted away from the pipe (Y/N)?

If yes, how far around the pipe has it lifted (mm)? 300 ON BOTTOM

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

Coating Defect Length (mm): RIGHT AROUND PIPE Coating Defect Width (mm): 400 WIDTH OF SLEEVE

Coating Defect Comments:

SEVERAL SANUSIA SLEEVES FITTED TO PIPE OUTSIDE NORTH ANCHOR BLOCK. ALL SLEEVES FAILED HOLIDAY DETECTION & HAD MOISTURE UNDER THEM. ONLY ONE SLEEVE HAD CORROSION UNDER IT.

1D#5

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)?

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.

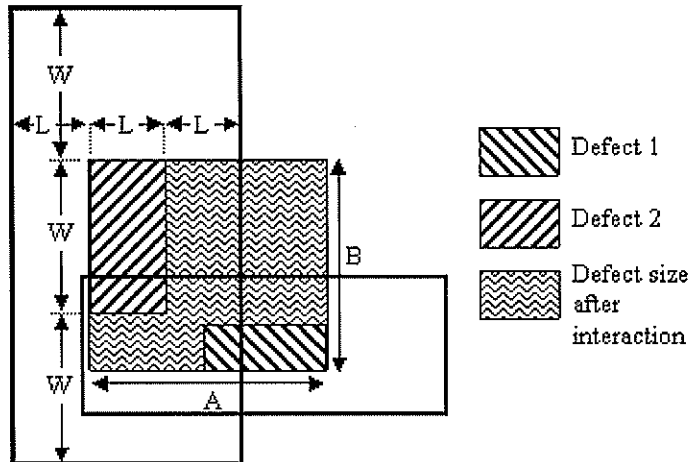


Figure 1

Maximum Depth (mm):

2-28

Wall thickness (mm):

8.74

Longitudinal dimension (A) (mm):

8 mm

Circumferential dimension (B) (mm):

5 mm

Clock Position (looking in direction of flow):

6:05

Distance from longitudinal weld (mm):

367

SEAM WELD AT 10:00 O'CLOCK

Distance from nearest girth weld (mm):

485

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

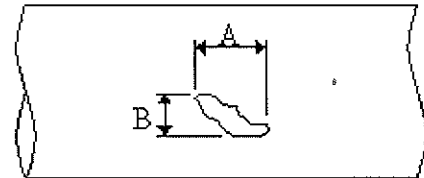


Figure 2

**Repair**

Length of Pipe Wrapped (mm):

Other Repair Information:

5.3 M COATED WITH DOLUX UHB

Dig Up Comments:

SOIL WAS DAMP &amp; FREE OF ROCK.

Operator:

Wayne Duff

Signature:

Duff

Date:

28/1/2013



10#6

KP:

Work Order No:

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

Page 1

**Location**

Pipeline: \_\_\_\_\_

Excavation Date: \_\_\_\_\_

Section: \_\_\_\_\_

Digup Reason: \_\_\_\_\_

Kilometre Point: WARRIERO

DCVG Measurement: \_\_\_\_\_

Zone: \_\_\_\_\_

Defect Length from survey (m): \_\_\_\_\_

Easting: \_\_\_\_\_

CMMS Work Order No: \_\_\_\_\_

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>1588, 1587, 1652</u>
Pipe with coating removed	<u>1978, 1987</u>
Pipe cleaned	<u>1978, 1987</u>
Pipe repaired	

**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): 1.1

Soil pH: \_\_\_\_\_

Pipe To Soil Potential (V): -1.523Soil Resistivity (Ohms): PHOTO 1570

Pin Spacing 1.5m

**Coating**

Coating Description:

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

Is there a coating defect (Y/N)?

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

Any evidence of termite damage (Y/N)?

Any moisture inside the coating (Y/N)?

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

Has the coating lifted away from the pipe (Y/N)?

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

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

Coating Defect Length (mm): 300 450Coating Defect Width (mm): 300

Coating Defect Comments:

CP CABLES WERE TAPE WRAPPED. COATING DEFECT WAS ON  
THE OUTER EDGES OF WRAP.  
WHEN ABRASIVE BLASTED, NO CORROSION WAS EVIDENT.

ID #6

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.

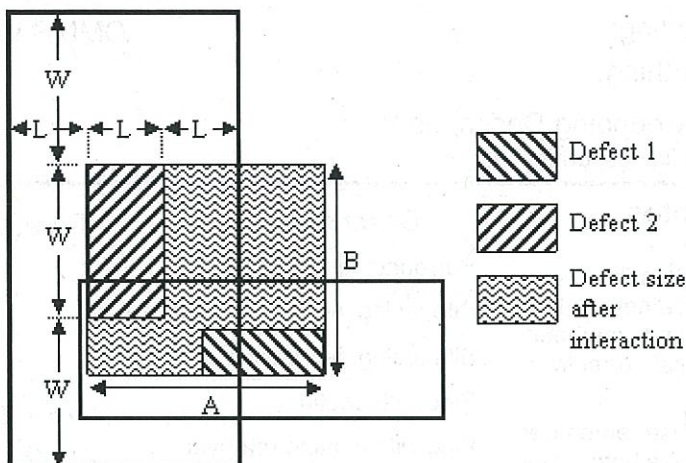


Figure 1

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):

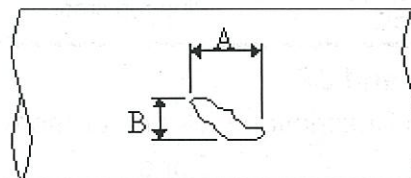
Distance from nearest girth weld (mm):  
(if no girth weld has been found, do not excavate further)

Figure 2

**Repair**Length of Pipe Wrapped (mm): 2700

Other Repair Information:

2.7 m OF PIPE ACROSS THIS AREA WAS PAINTED WITH  
DOLUX LUXAPOXY UHB.

Dig Up Comments:

SOFT RED SOIL, AND DAMP.Operator: Wayne DuffSignature: [Signature]Date: 30/1/2013



ID# 7

KP:

Work Order No:

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

Page 1

**Location**

Pipeline: \_\_\_\_\_ Excavation Date: 19/1/2013  
 Section: Pipe Receiver (North) Digup Reason: Coating Repair  
 Kilometre Point: Warrie GO DCVG Measurement: # 10 16.4%  
 Zone: \_\_\_\_\_ Defect Length from survey (m): \_\_\_\_\_  
 Easting: \_\_\_\_\_ CMMS Work Order No: 144304  
 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>1668, 1669, 1784</u>
Pipe with coating removed	
Pipe cleaned	<u>1943, 1931</u>
Pipe repaired	<u>1972</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): 1.0 Soil pH: 5-6  
 Pipe To Soil Potential (V): 1.523 Soil Resistivity (Ohms): Photo 1570 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)? Y  
 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)? Y  
 If yes, how far around the pipe has it lifted (mm)? 150  
 Sketch of coating / corrosion damage completed (Y/N)? \_\_\_\_\_

Coating Defect Length (mm): 2000 Coating Defect Width (mm): 150

Coating Defect Comments:

YELLOW JACKET HAD SPLIT BETWEEN CANUSA SLEEVELESS AND OUT FROM THE OTHER SIDE OF ONE.  
WHEN PIPE WAS ABRASIVE BLASTED THERE WASN'T ANY CORROSION EVIDENT.

ID#7

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.

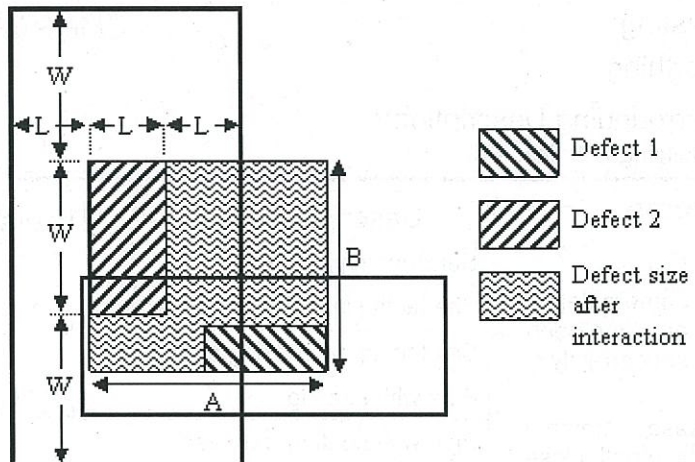


Figure 1

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)

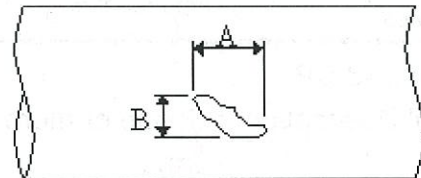


Figure 2

**Repair**

Length of Pipe Wrapped (mm):

Other Repair Information:

ENTIRE BELOW GROUND PIPE PAINTED WITH DULUX LUXAPOXY UHB.

Dig Up Comments:

RED SOFT SOIL, DAMP.

Operator: Wayne Duffly

Signature:

Date: 30/1/2013



ID#8

KP:

Work Order No:

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

Page 1

**Location**

Pipeline: \_\_\_\_\_ Excavation Date: 19/1/2013  
 Section: F Digup Reason: COATING REPAIR  
 Kilometre Point: WARRERO DCVG Measurement: NIL  
 Zone: \_\_\_\_\_ Defect Length from survey (m): \_\_\_\_\_  
 Easting: \_\_\_\_\_ CMMS Work Order No: 144304  
 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>1653, 1654</u>
Pipe with coating removed	<u>1655</u>
Pipe cleaned	<u>1963</u>
Pipe repaired	<u>2168, 2169</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): 1.3 Soil pH: 5-6  
 Pipe To Soil Potential (V): -1.523 Soil Resistivity (Ohms): Photo 1570 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)? Y

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

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

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)? Y

If yes, how far around the pipe has it lifted (mm)? 80

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

Coating Defect Length (mm): 950 Coating Defect Width (mm): 80

Coating Defect Comments:

TERMITE DAMAGE ON THE EDGE OF A CANUSA SLEEVE  
WHERE YELLOW JACKET HAD SPLIT.

1D#8

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.

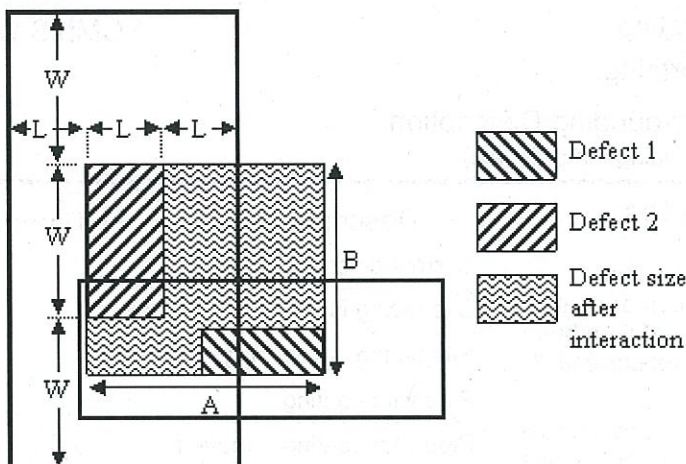


Figure 1

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)

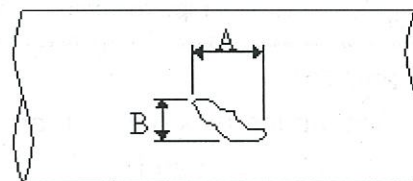


Figure 2

**Repair**

Length of Pipe Wrapped (mm):

Other Repair Information:

APPROXIMATELY 8m OF PIPE FROM THIS AREA TO MLV  
WAS PAINTED WITH DULUX LUXAPOXY UHB.

Dig Up Comments:

SOIL WAS DAMP & FREE OF STONES.

Operator:

Wayne Duff

Signature:

[Signature]

Date:

30/1/2013



1D#9

KP:

Form created by Ben Parkin Apr 09  
Approved by Henry Dupal

Work Order No:

**COATING DAMAGE ASSESSMENT**

Page 1

**Location**

Pipeline: \_\_\_\_\_ Excavation Date: 20/1/2013  
 Section: BLOW DOWN LINE Digup Reason: COATING REPAIR  
 Kilometre Point: 144260 DCVG Measurement: # 11 3.9  
 Zone: \_\_\_\_\_ Defect Length from survey (m): \_\_\_\_\_  
 Easting: \_\_\_\_\_ CMMS Work Order No: 144304  
 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>1773, 1772.</u>
Pipe with coating removed	
Pipe cleaned	<u>CAMERA UNAVAILABLE TO TAKE PHOTOS.</u>
Pipe repaired	<u>2143.</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): 1-8 Soil pH: 5-6  
 Pipe To Soil Potential (V): 1.523 Soil Resistivity (Ohms): PHOTO 1570 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)? Y  
 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)? \_\_\_\_\_

Coating Defect Length (mm): AROUND PIPE Coating Defect Width (mm): 200

Coating Defect Comments:

PAINT BLISTERING JUST OUTSIDE SUPPORT BLOCK.

NO CORROSION EVIDENT WHEN AREA WAS ABRASIVE BLASTED.

1D#9

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.

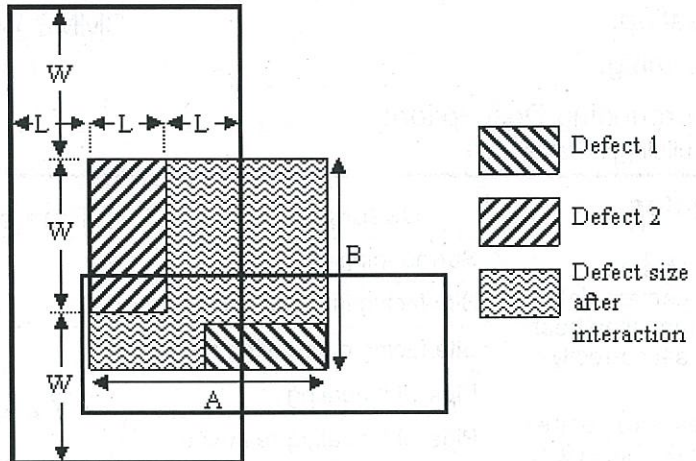


Figure 1

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)

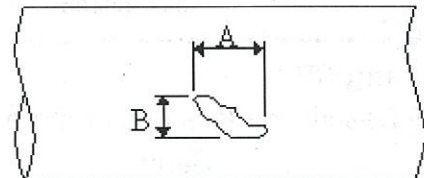


Figure 2

## Repair

Length of Pipe Wrapped (mm):

Other Repair Information:

ENTIRE BLOW DOWN LINE PAINTED WITH DULUX LUXAPOXY UMB

Dig Up Comments:

SOIL WAS DAMP & FULL OF STONES.

Operator:

Wayne Dyff

Signature:

[Signature]

Date:

30/1/2019.



ID #10

KP:

Work Order No:

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

Page 1

**Location**

Pipeline: \_\_\_\_\_ Excavation Date: 16/1/2013.  
 Section: V07 SUPPORT BLOCK. Digup Reason: COATING REPAIR.  
 Kilometre Point: WARRERO DCVG Measurement: NIL  
 Zone: \_\_\_\_\_ Defect Length from survey (m): \_\_\_\_\_  
 Easting: \_\_\_\_\_ CMMS Work Order No: 144 304  
 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>1589, 1590, 1591</u>
Pipe with coating removed	
Pipe cleaned	<u>1785</u>
Pipe repaired	<u>2183</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): 1.0 Soil pH: 5-6  
 Pipe To Soil Potential (V): -1.523 Soil Resistivity (Ohms): PHOTO 1570 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)? Y  
 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)? \_\_\_\_\_

Coating Defect Length (mm): 280 Coating Defect Width (mm): 200

Coating Defect Comments:

PAINT BLISTERS NEAR EDGE OF V07 SUPPORT BLOCK.  
NO CORROSION EVIDENT.



10#10

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.

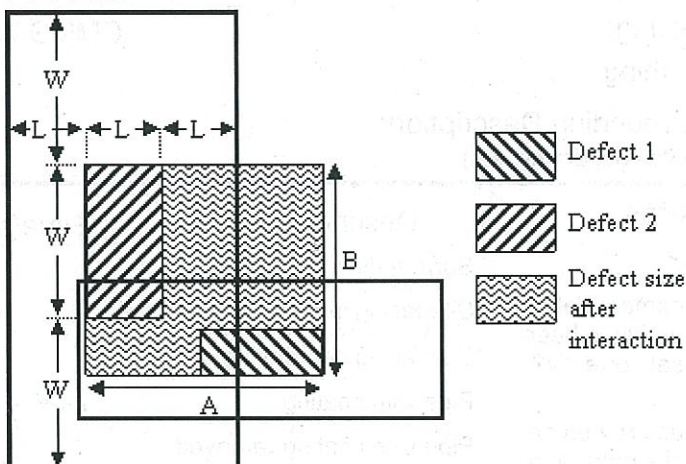


Figure 1

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)

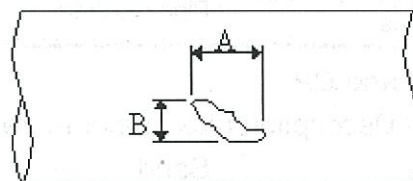


Figure 2

**Repair**

Length of Pipe Wrapped (mm): \_\_\_\_\_

Other Repair Information:

ENTIRE SECTION PAINTED WITH DULUX LUXAPOXY UHB

Dig Up Comments:

SOFT DIGGING. SOIL DAMP & FREE OF STONES.

Operator: Wayne Duffy

Signature: [Signature]

Date: 20/1/2013

~~11~~ ID# 11

KP:

Work Order No:

Form created by Ben Parkin Apr 09  
Approved by Henry Dupal

# COATING DAMAGE ASSESSMENT

Page 1

## Location

Pipeline: \_\_\_\_\_ Excavation Date: 19/1/2013  
 Section: PIE LAUNCHER. Digup Reason: COATING REPAIR.  
 Kilometre Point: WARRIEGO DCVG Measurement: NIL  
 Zone: \_\_\_\_\_ Defect Length from survey (m): \_\_\_\_\_  
 Easting: \_\_\_\_\_ CMMS Work Order No: 144304  
 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>1580</u>
Pipe with coating removed	
Pipe cleaned	<u>1979</u>
Pipe repaired	<u>2176</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): 1.3 Soil pH: 5-6  
 Pipe To Soil Potential (V): -1.523 Soil Resistivity (Ohms): Approx 1570 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)? Y  
 Any evidence of termite damage (Y/N)? Y  
 Any moisture inside the coating (Y/N)? Y  
 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)? \_\_\_\_\_

Coating Defect Length (mm): 110 Coating Defect Width (mm): 150

Coating Defect Comments:

DUNNAGE WAS LEFT STACKED UNDER THE PIPE. TERMITES ATE THE DUNNAGE AND PART OF THE YELLOW JACKET COATING.



~~11~~ ID# 11

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.

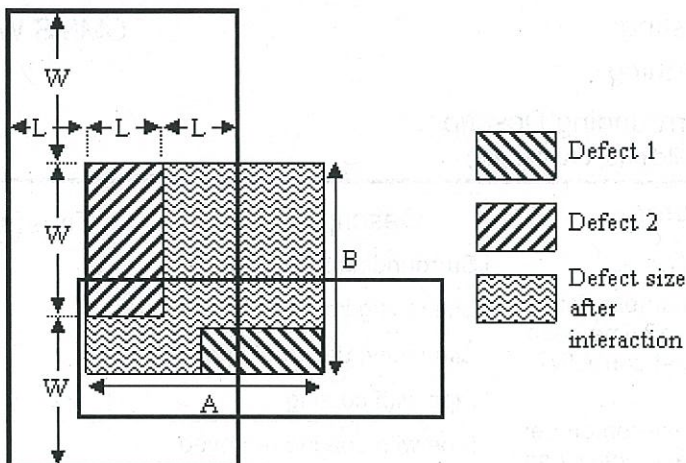


Figure 1

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)

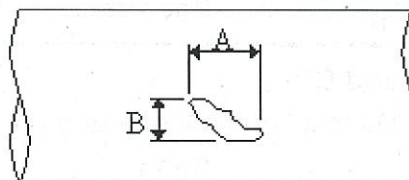


Figure 2

## Repair

Length of Pipe <sup>PAINTED</sup> Wrapped (mm): 1700

Other Repair Information:

PIPE WAS ABRASIVE BLASTED AND PAINTED WITH LUXAPOXY UHB

Dig Up Comments:

SOIL WAS DAMP & FAIRLY OK STONIE

Operator: Wayne Duff

Signature: [Signature]

Date: 29/1/2013



## Appendix 3 Photo Log

Photos:

1580

1587

1588

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2183

**Appendix 4 RSTRENG ANALYSIS**



Site: Warrego - anchor block nth

Station: Warrego - anchor block nth

Date: 29/01/2013

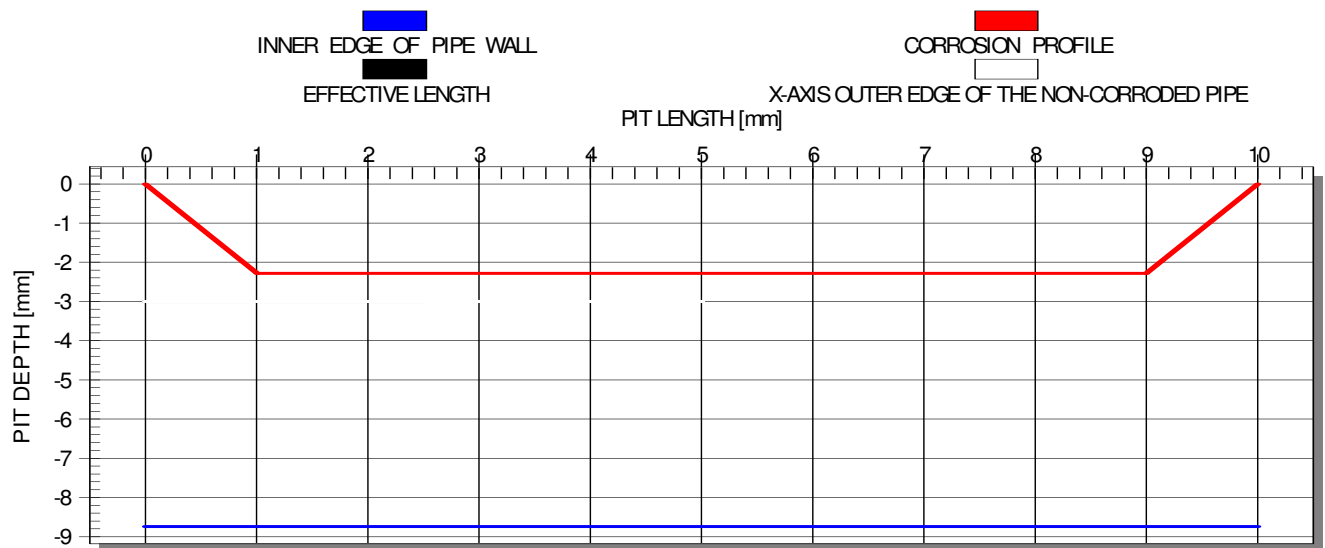
$P = 2StFT/D$  [kPa] - Calculated Pressure 14,617.138  
Established MAOP [kPa] 9,650

Pipe Outside Diameter [mm]	355.60	Effective Length [mm]	10.00
Pipe Wall Thickness [mm]	8.740	Effective Area [mm] <sup>2</sup>	20.52
SMYS [MPa]	413	Max. Pit Depth [mm]	2.3
Design Factor	0.72	Max.Depth/Wall Thickness	0.26
Total Length [mm]	10.00		
Effective Length: Start [mm]	0.00	End [mm]	10.00

### RESULTS OF ANALYSIS:

METHOD	Max.Safe Pressure [kPa]	Burst Pressure [kPa]	Safety Factor
RSTRENG - Effective Area	14617	23619	2.45
RSTRENG - 0.85dL	14617	23624	2.45
ASME B31 G	14617	22273	2.31

### CORROSION PROFILE:



Prepared By: Ben Parkin

Approved By:

Site: Warrego - anchor block nth

Station: Warrego - anchor block nth

Date: 29/01/2013

**CORROSION MEASUREMENT:**

Nr.      Increment [mm]    Pit Depth [mm]

1.	0	0
2.	1	2.28
3.	9	2.28
4.	10	0

Prepared By: Ben Parkin

Approved By:

## Appendix 5 LRUT

GL Noble Denton



Client: APA Group (Australia) Pty Ltd

Location: Northern Territory, Australia

Job No.: ABA25-1

Date Completed: 24<sup>th</sup> January 2013

Page: 6

### INSPECTION REPORTS

A comprehensive *LRUT* Inspection on the 10 and 14inch to concrete anchor block gas line at Kelly well MLV and Warrego scraper station in Northern Territory Australia, has been conducted and the following is the summary of findings:

	Date of Insp.	Thickness measured at Head Location (mm)		LRUT Coverage Distance (m)			Anomaly categories			Inspection Findings / Comments / Remarks
		Min	Max	AG	UG	R/C	1	2	3	
Line ID: 14" Kelly well MLV (Forward only)										
TP 1	23.1.2013	8.8	8.9	-	3.48	-				No significant findings noted along test length during testing.
Line ID: 14" Kelly well MLV (Forward only)										
TP 2	23.1.2013	8.8	9.0	-	3.5	-				No significant findings noted along test length during testing.
Line ID: 14" Warrego Scrapper Station (Forward only)										
TP 1	23.1.2013	8.8	9.0	-	1.71	-				No significant findings noted along test length during testing.
Line ID: 14" Warrego Scrapper Station (Backward only)										
TP2	23.1.2013	8.8	8.9	-	2.11	-				No significant findings noted along test length during testing.
Line ID: 14" Warrego Scrapper Station (Forward only)										
TP3	23.1.2013	8.7	9.2	-	1.68	-				No significant findings noted along test length during testing.
Line ID: 14" Warrego Scrapper Station (Forward only)										
TP 4	23.1.2013	8.8	8.9	-	3.42	-				No significant findings noted along test length during testing.

Legend: Underground (UG), Aboveground (AG), Road Crossing (RC), NRWT – Net Remaining Wall Thickness

**INSPECTION REPORTS – Cont'd**

	Date of Insp.	Thickness measured at Head Location (mm)		LRUT Coverage Distance (m)			Anomaly categories			Inspection Findings / Comments / Remarks
		Min	Max	AG	UG	R/C	1	2	3	
Line ID: 14" Warrego Scrapper Station (Backward only)										
TP 5	23.1.2013	8.8	9.0	-	2.5	-				No significant findings noted along test length during testing.
Line ID: 14" Warrego Scrapper Station (Forward only)										
TP 6	23.1.2013	8.7	9.0	-	2.82	-				No significant findings noted along test length during testing.
Line ID: 14" Warrego Scrapper Station (Forward only)										
TP 7	23.1.2013	8.8	9.0	-	3.65	-				No significant findings noted along test length during testing.
Line ID: 14" Warrego Scrapper Station (Forward only)										
TP 8	23.1.2013	8.8	8.9	-	2.73	-				No significant findings noted along test length during testing.
Line ID: 14" Warrego Scrapper Station (Forward only)										
TP 9	23.1.2013	9.0	9.1	-	4.07	-				No significant findings noted along test length during testing.
Line ID: 14" Warrego Scrapper Station (Forward only)										
TP 10	23.1.2013	8.8	9.0	-	1.64	-				No significant findings noted along test length during testing.
Line ID: 14" Warrego Scrapper Station (Forward only)										
TP 11	23.1.2013	8.7	9.0	-	1.63	-				No significant findings noted along test length during testing.

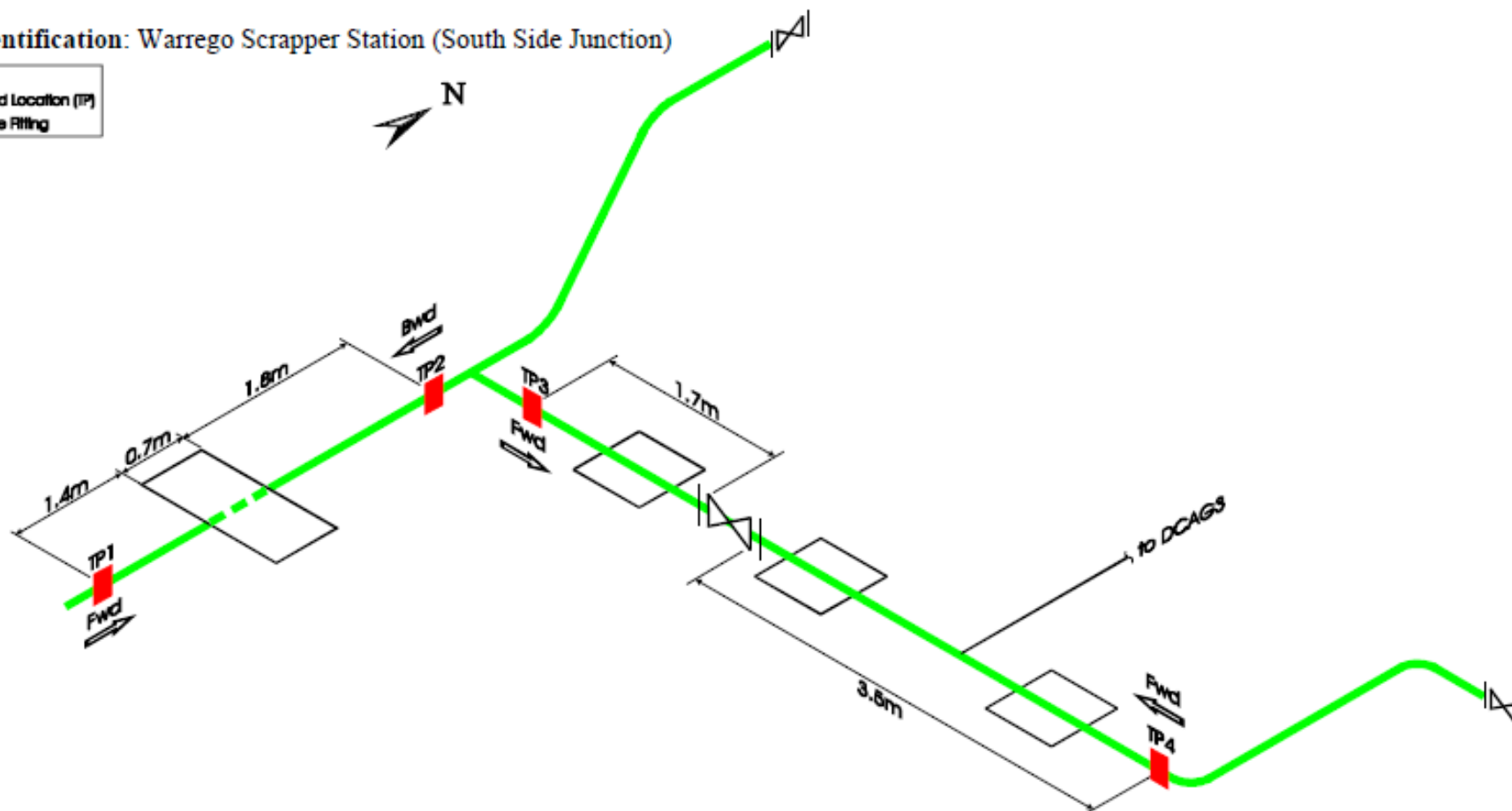
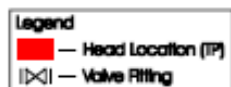
Legend: Underground (UG), Aboveground (AG), Road Crossing (RC), NRWT – Net Remaining Wall Thickness

**INSPECTION REPORTS – Cont'd**

	Date of Insp.	Thickness measured at Head Location (mm)		LRUT Coverage Distance (m)			Anomaly categories			Inspection Findings / Comments / Remarks
		Mm	Max	AG	UG	R/C	1	2	3	
Line ID: 14" Warrego Scrapper Station (Forward only)										
TP 12	23.1.2013	8.8	9.0	-	1.60	-				No significant findings noted along test length during testing.
Line ID: 10" Warrego Scrapper Station Blow down line (Forward only)										
TP 1	23.1.2013	7.7	8.0	-	2.70	-				No significant findings noted along test length during testing.
Line ID: 10" Warrego Scrapper Station Blow down line (Forward only)										
TP 2	23.1.2013	7.8	8.0	-	1.66	-				No significant findings noted along test length during testing.
Line ID: 10" Warrego Scrapper Station Blow down line (Forward only)										
TP 3	23.1.2013	7.7	8.0	-	1.41	-				No significant findings noted along test length during testing.
Line ID: 10" Warrego Scrapper Station Blow down line (Forward only)										
TP 4	23.1.2013	7.7	8.0	-	1.31	-				No significant findings noted along test length during testing.
Line ID: 10" Warrego Scrapper Station Blow down line (Forward only)										
TP 5	23.1.2013	7.8	8.0	-	2.31	-				No significant findings noted along test length during testing.

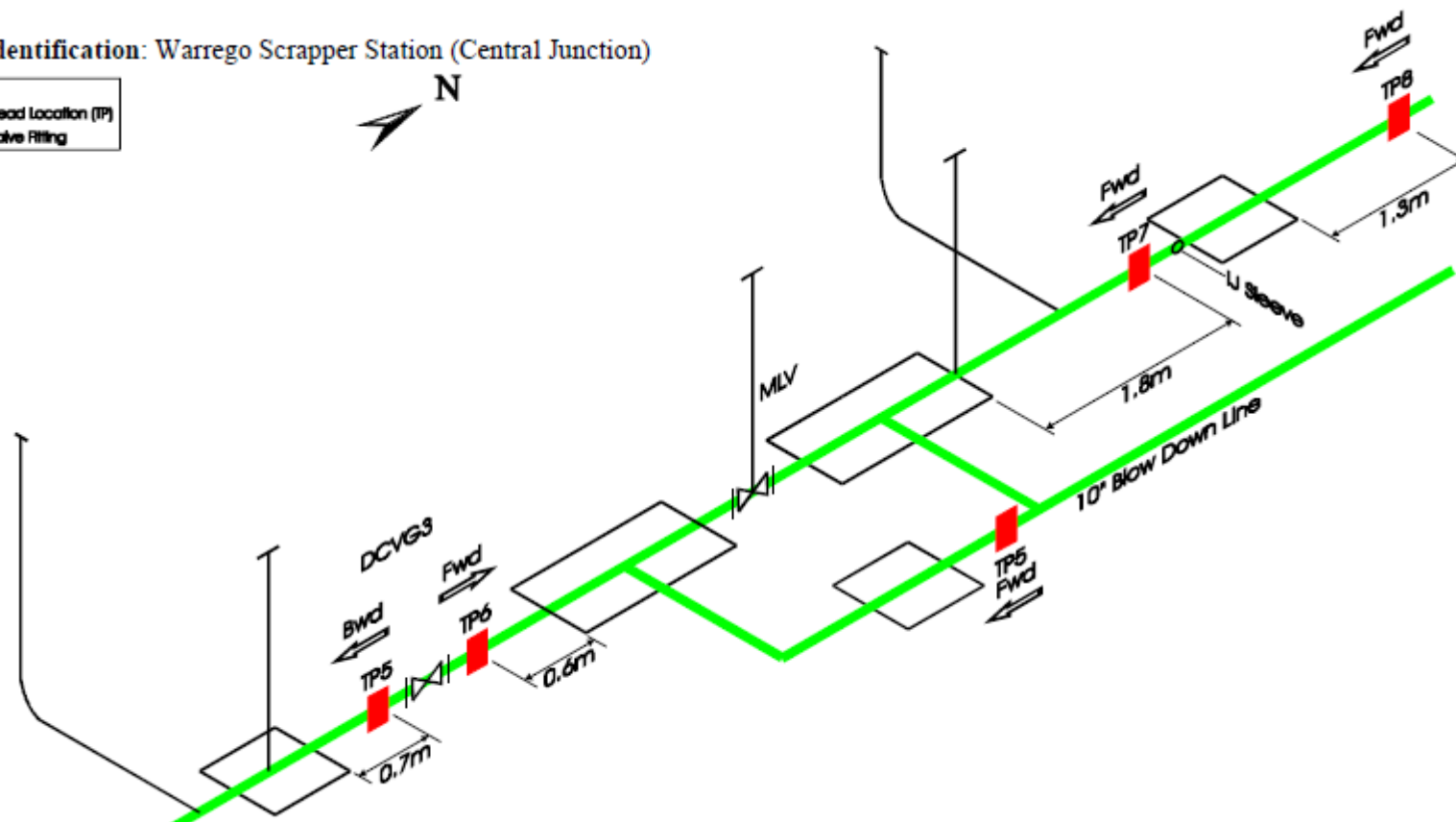
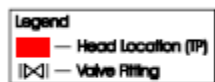
Legend: Underground (UG), Aboveground (AG), Road Crossing (RC), NRWT – Net Remaining Wall Thickness

**Line Identification: Warrego Scraper Station (South Side Junction)**

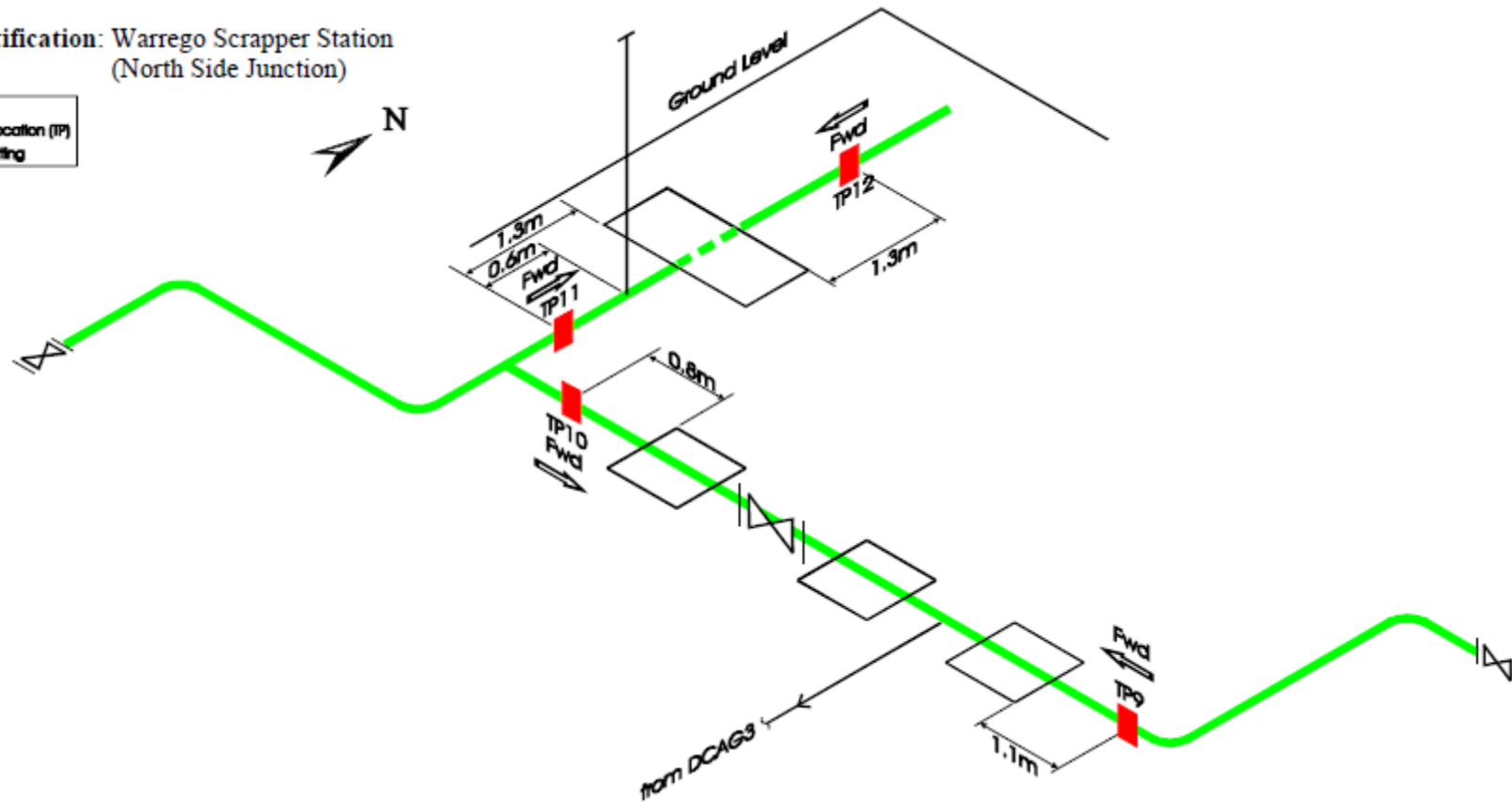
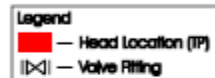




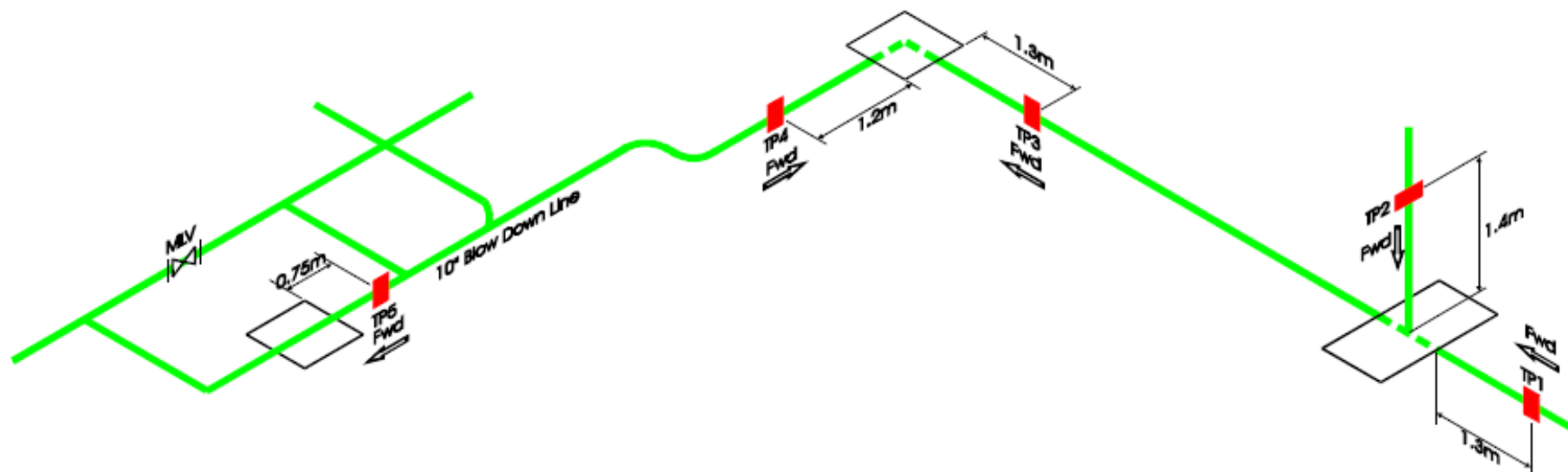
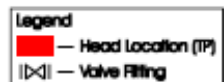
Line Identification: Warrego Scraper Station (Central Junction)



**Line Identification:** Warrego Scrapper Station  
(North Side Junction)

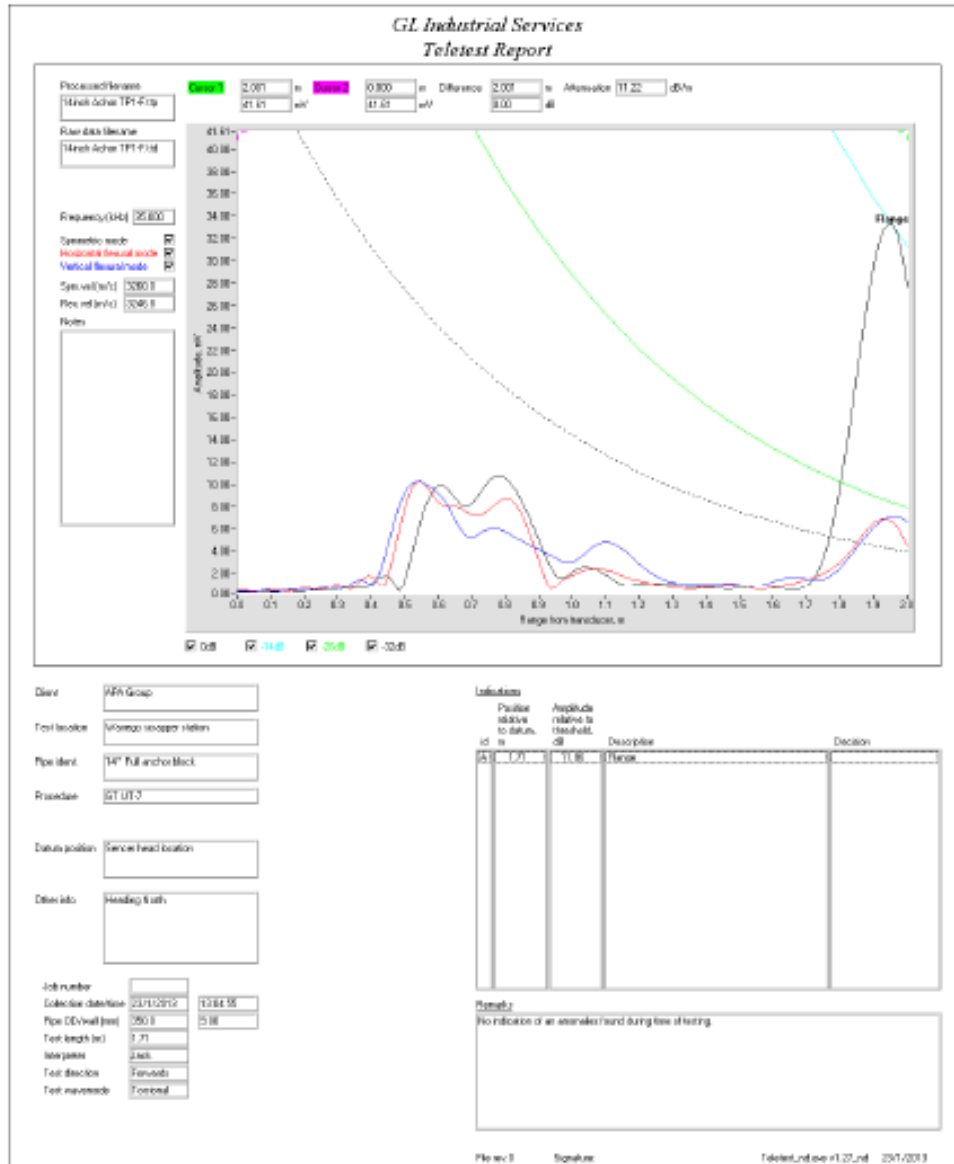


Line Identification: 10" Blow Down Line



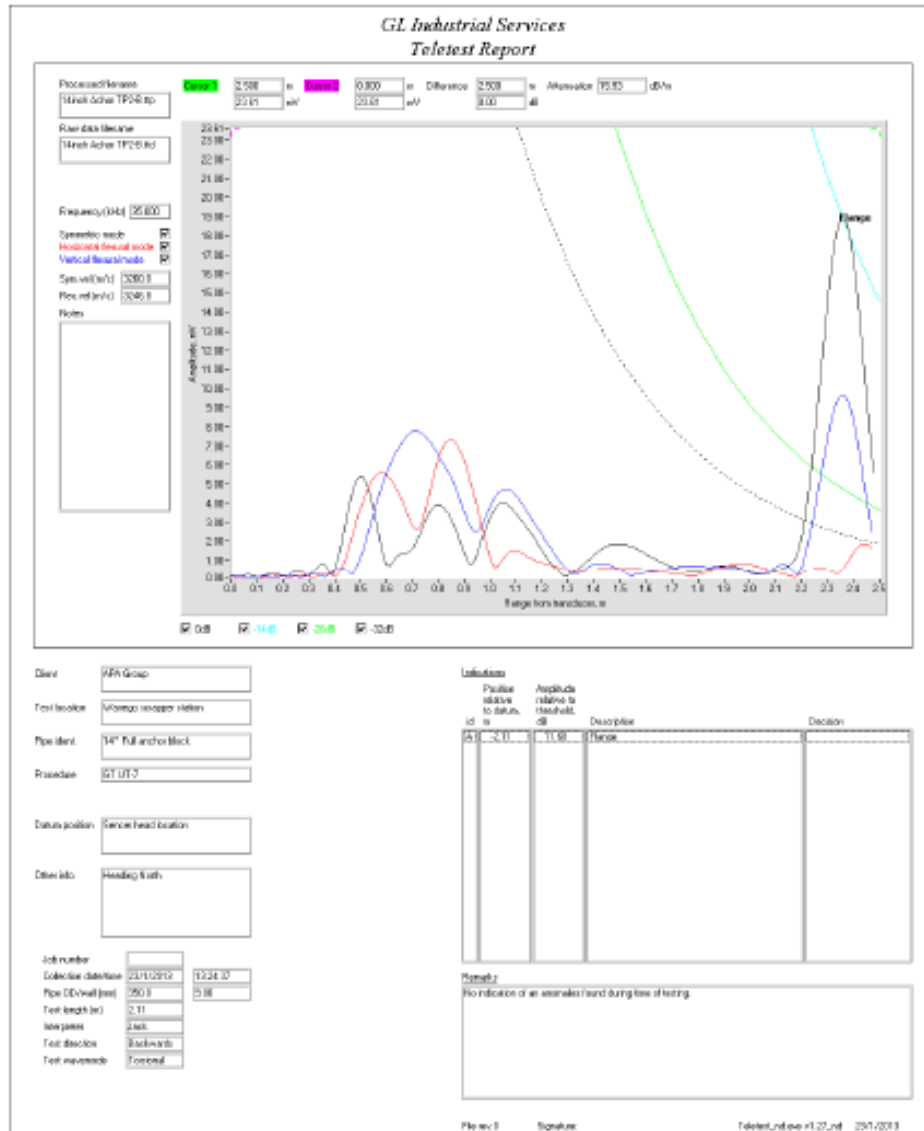
Test Point 1 Line ID: 14" Warrego scapper station

(Forward Shot only)



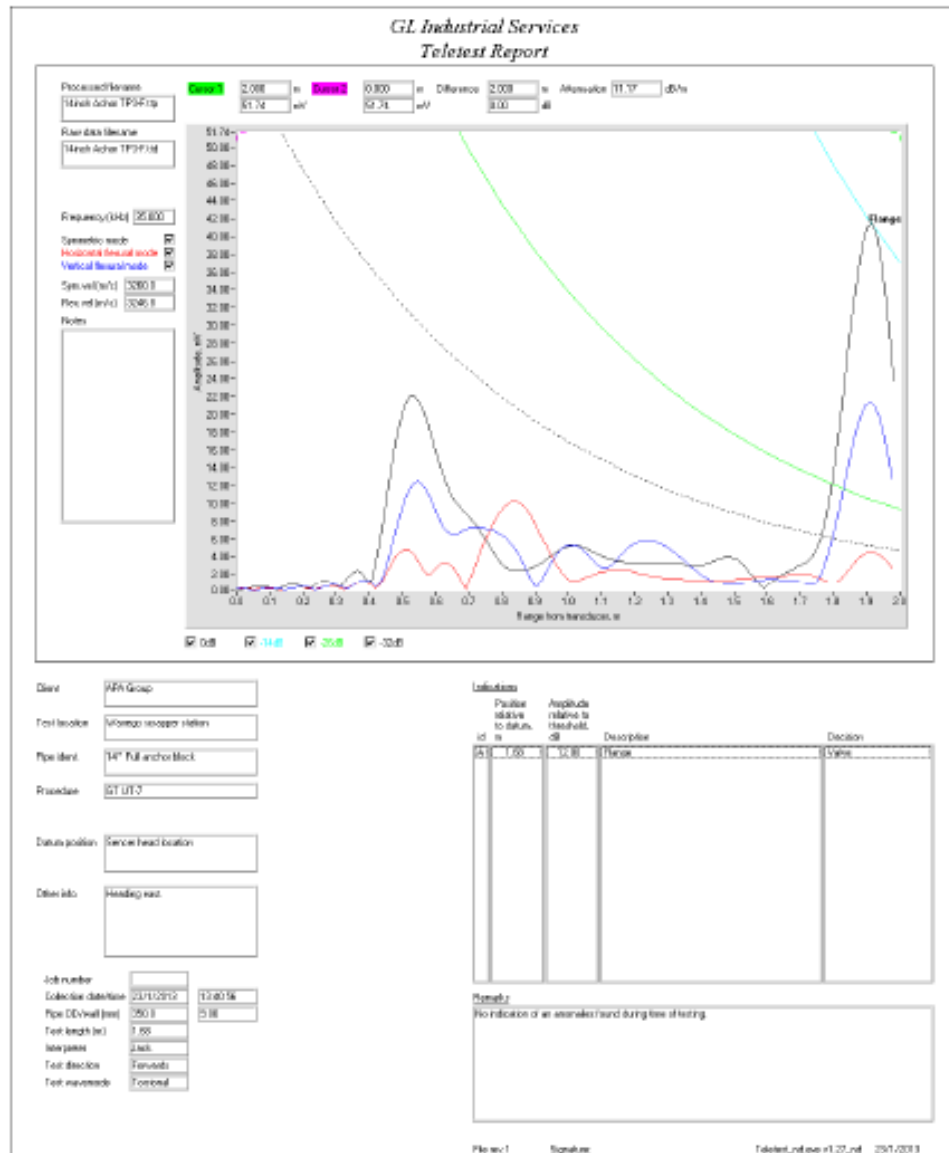
Test Point 2 Line ID: 14" Warrego scrapper station

(Backward Shot only)



Test Point 3 Line ID: 14" Warrego scraper station

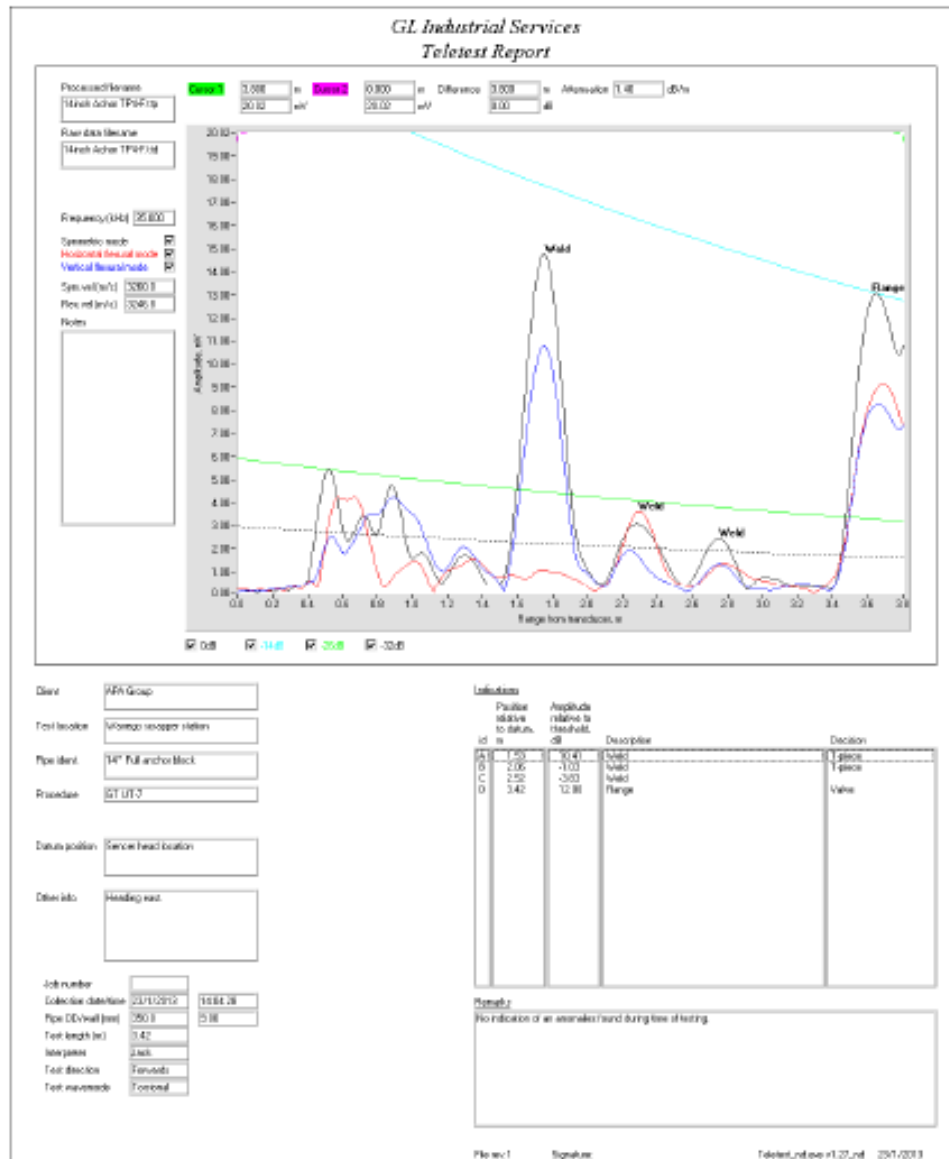
(Forward Shot only)





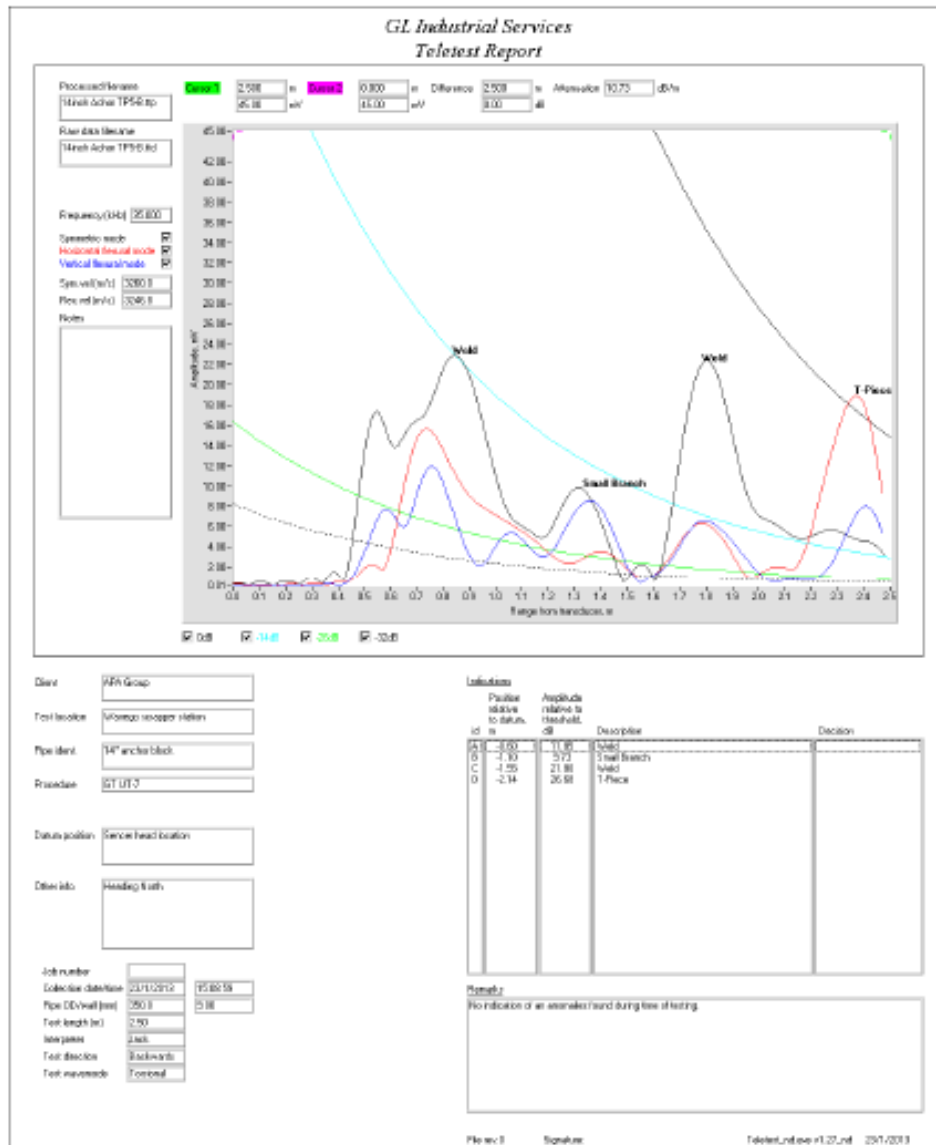
Test Point 4 Line ID: 14" Warrego scrapper station

(Forward Shot only)



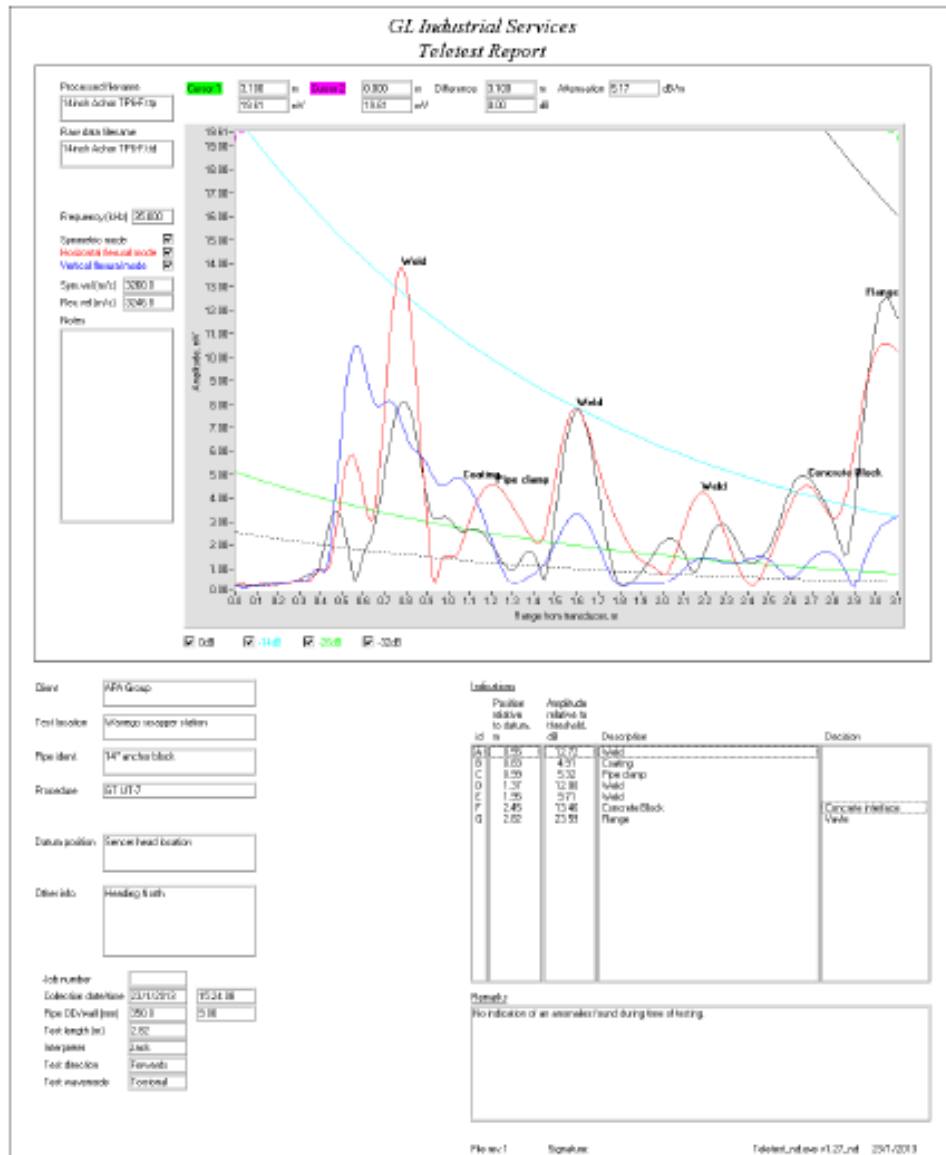
Test Point 5 Line ID: 14" Warrego scrapper station.

(Backward Shot only)



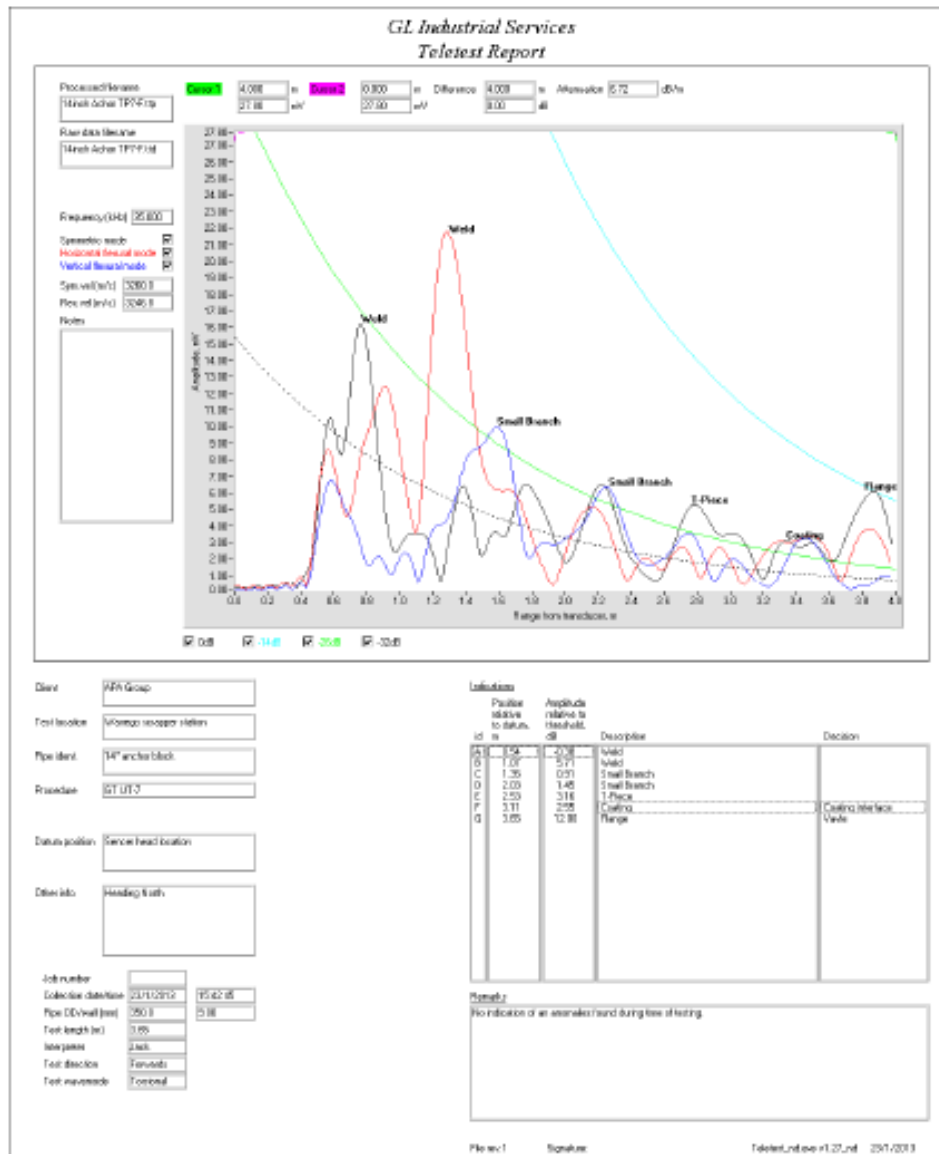
Test Point 6 Line ID: 14" Warrego scraper station

(Forward Shot only)



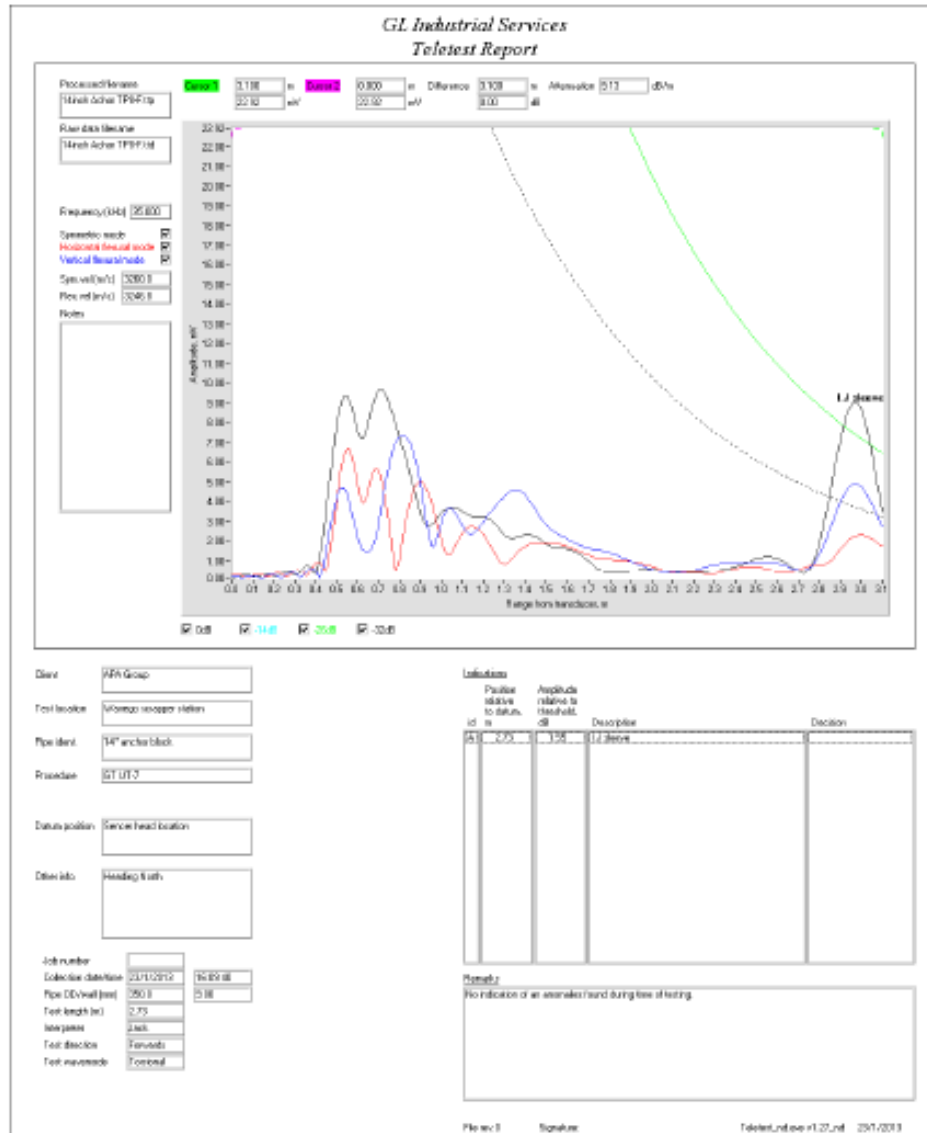
Test Point 7 Line ID: 14" Warrego scrapper station

(Forward Shot only)



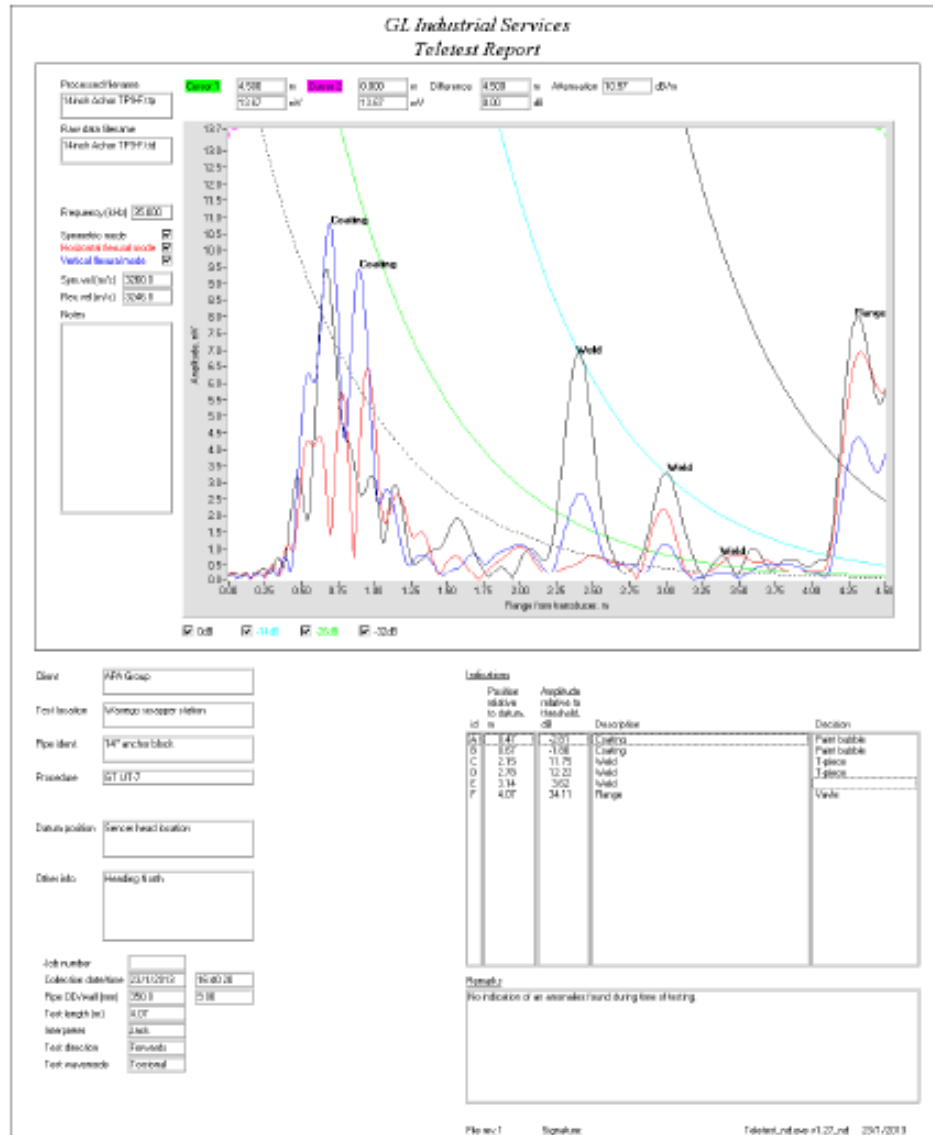
Test Point 8 Line ID: 14" Warrego scrapper station

(Forward Shot only)



Test Point 9 Line ID: 14" Warrego scrapper station

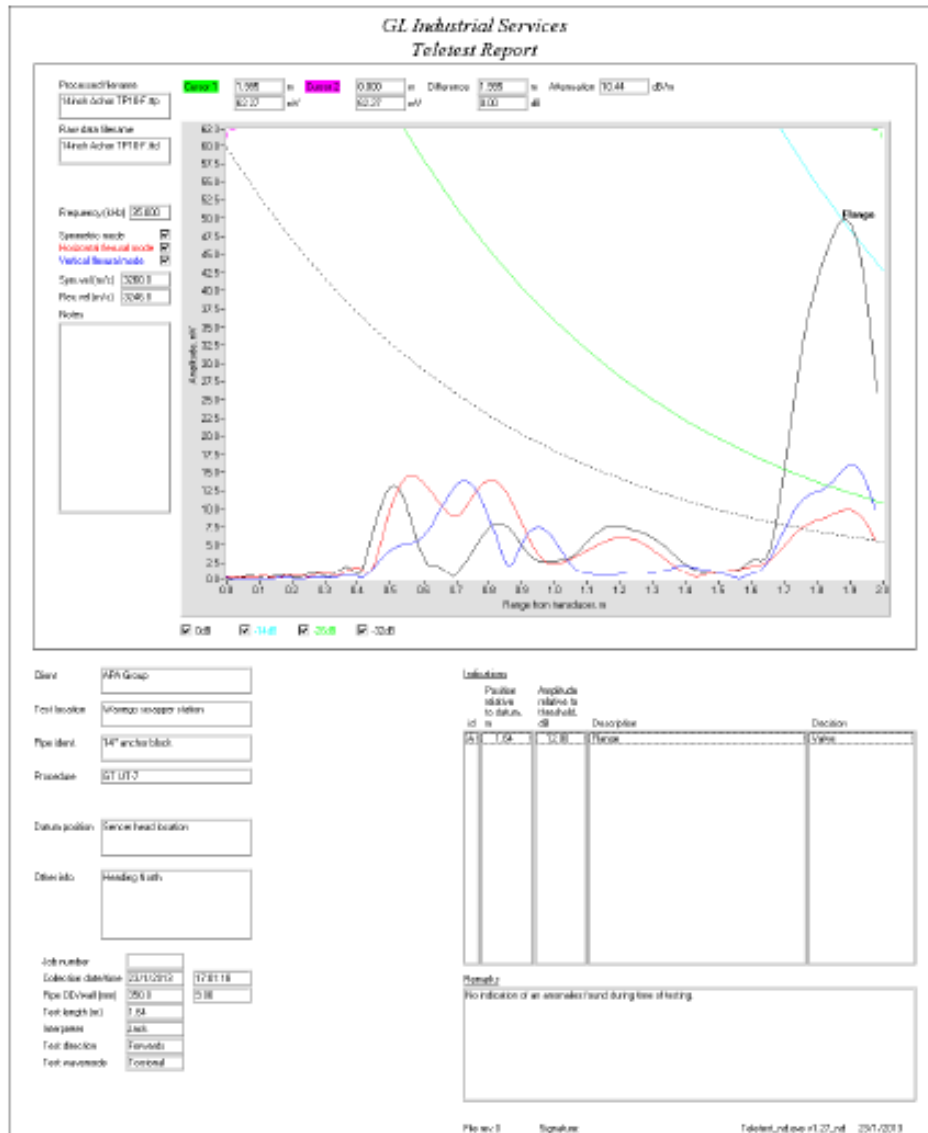
(Forward Shot only)





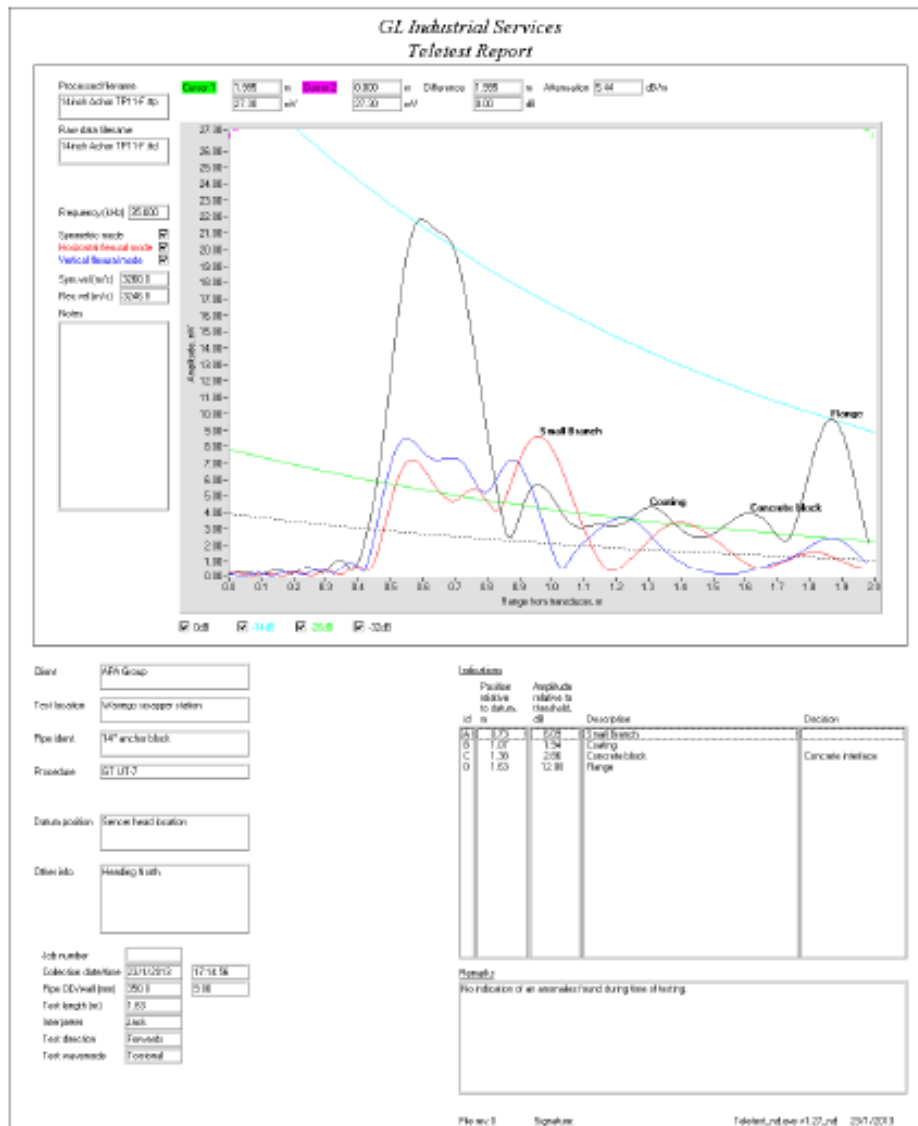
Test Point10 Line ID: 14" Warrego scraper station

(Forward Shot only)



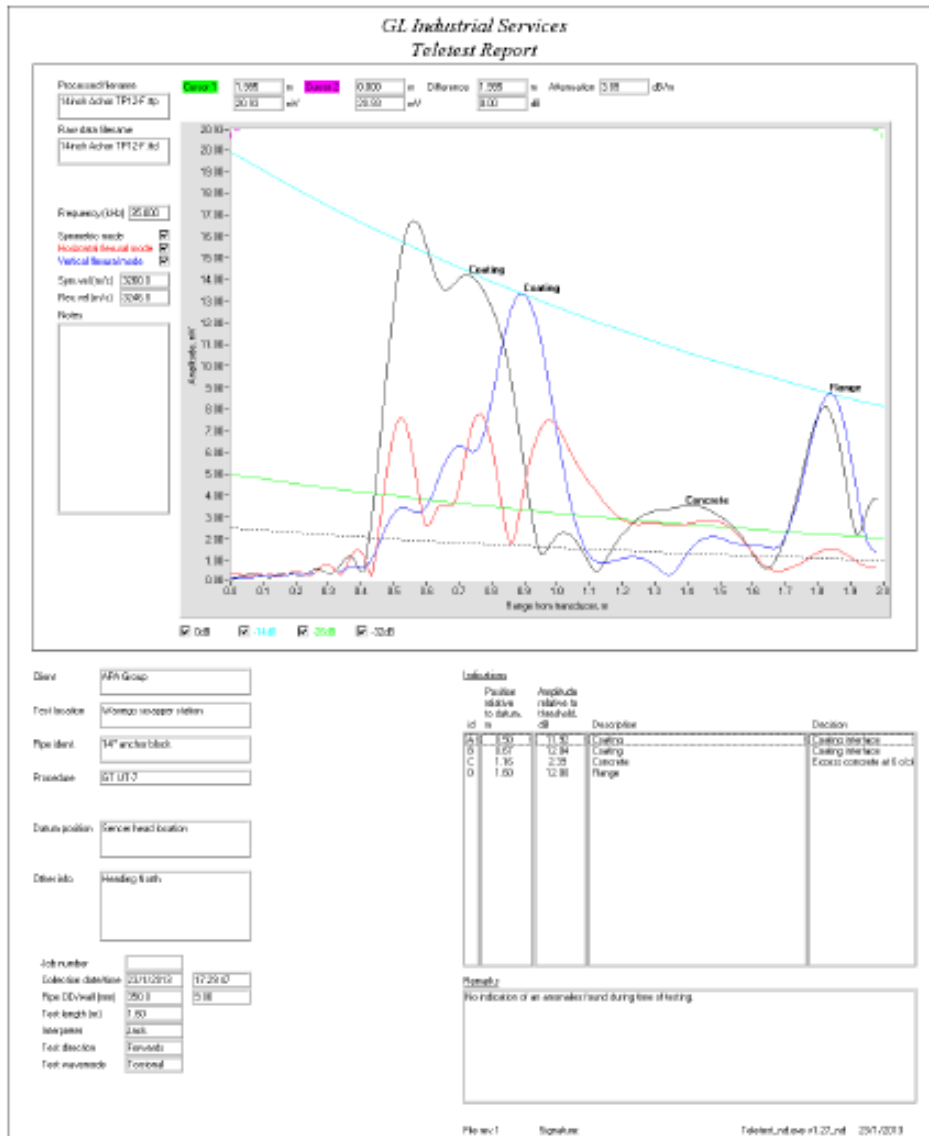
Test Point11 Line ID: 14" Warrego scraper station

(Forward Shot only)

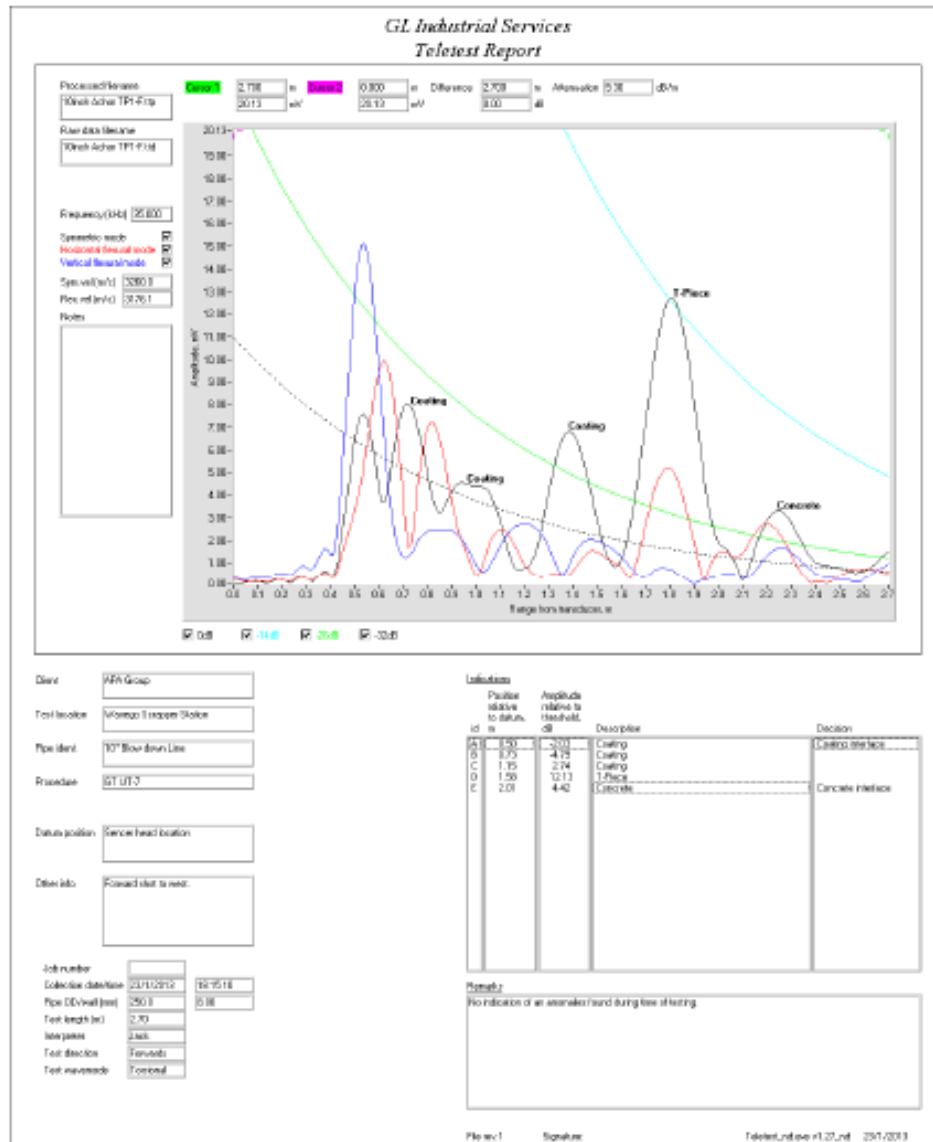


Test Point12 Line ID: 14" Warrego scraper station

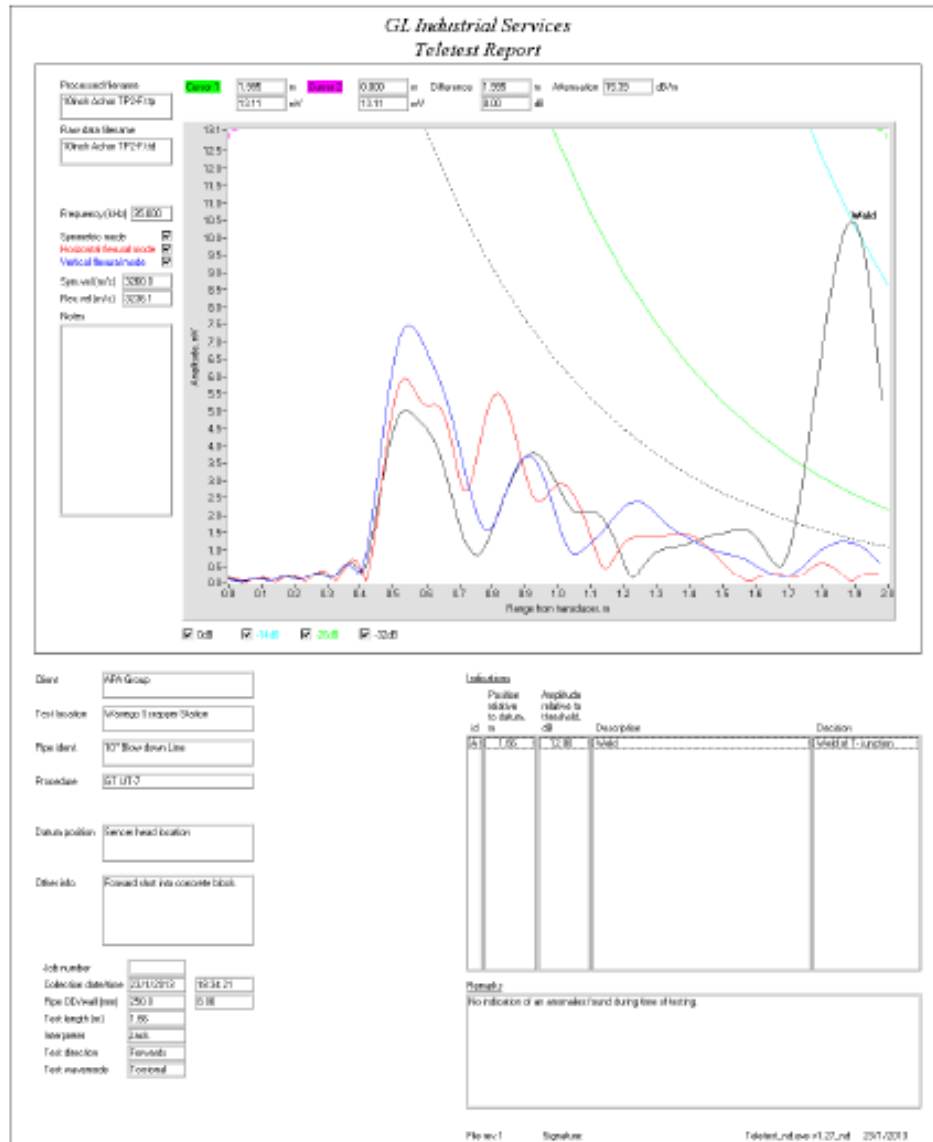
(Forward Shot only)



**Test Point 1 Line ID: 10" Warrego Scraper station Blow Down line (Forward Shot only)**

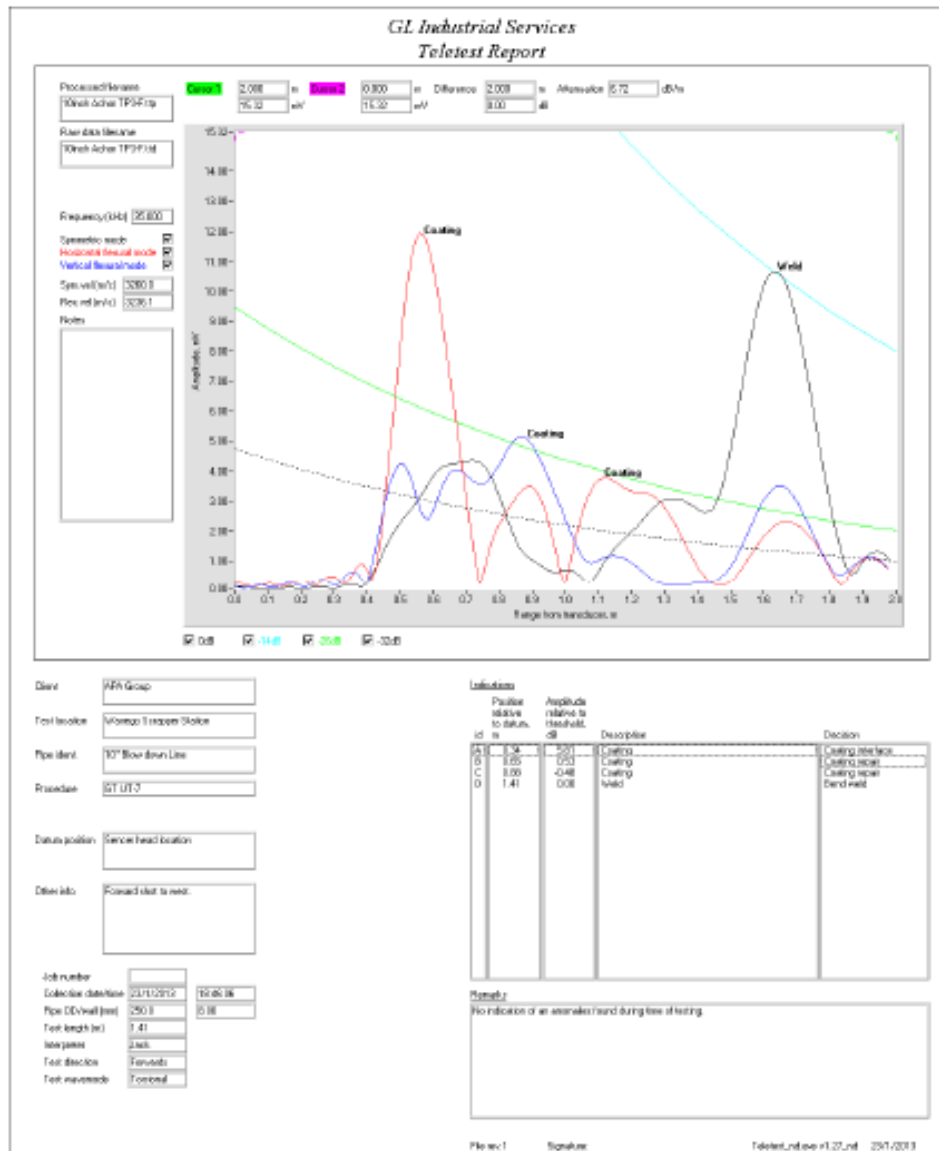


**Test Point 2 Line ID: 10" Warrego Scraper station Blow Down line (Forward Shot only)**

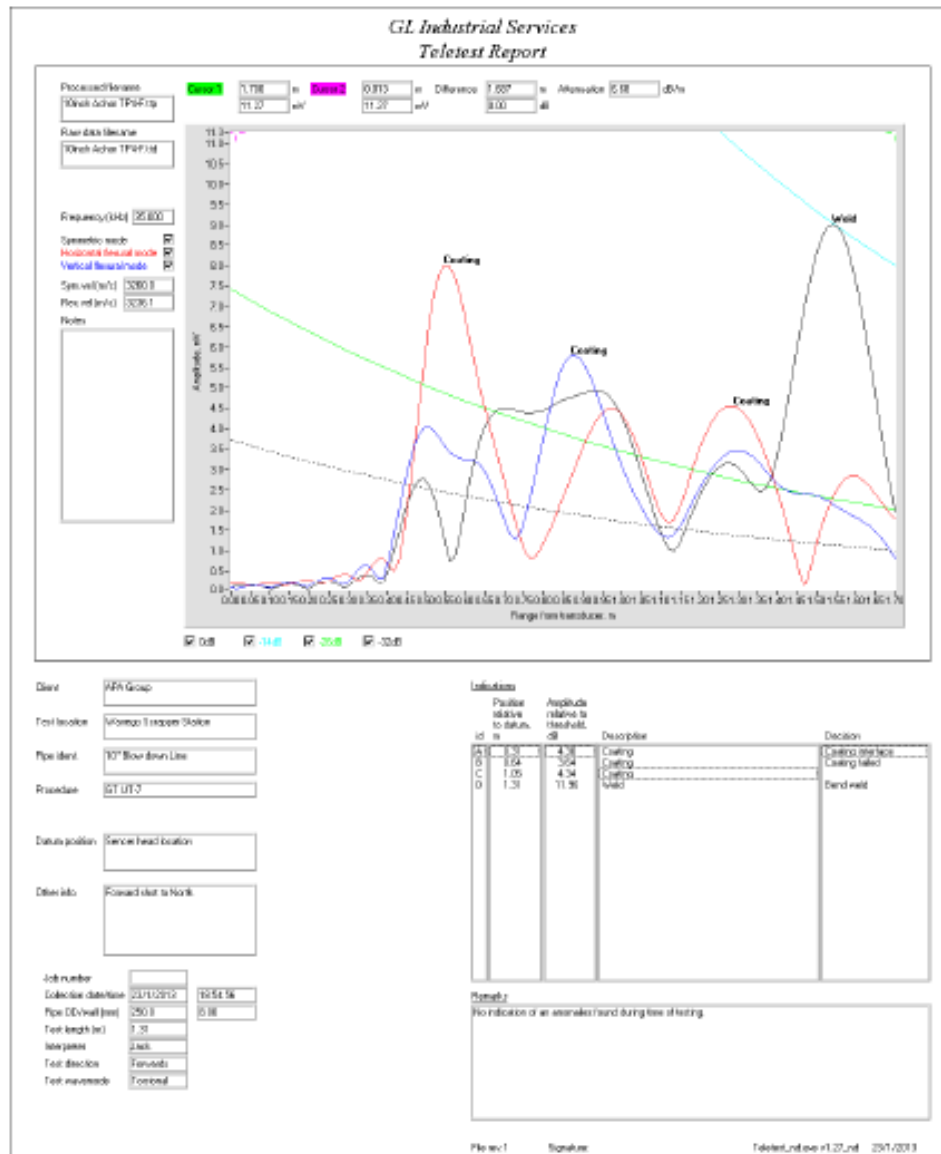




**Test Point 3 Line ID: 10" Warrego Scraper station Blow Down line (Forward Shot only)**



**Test Point 4**    **Line ID: 10" Warrego Scrapper station Blow Down line**    **(Forward Shot only)**



**Test Point 5 Line ID: 10" Warrego Scraper station Blow Down line (Forward Shot only)**

