

Newcastle Waters

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 CP shielding and interactions between different pipe sections.

To correlate the DCVG results to actual defects, 5 scraper stations and 5 MLV's 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.

Newcastle Waters (NCW) is the second scraper station to be excavated and assessed. This report compares the DCVG results for NCW 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 NCW 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 NCW 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 4 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 9 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	Anchor Block north	9.0 %
2	Anchor Block south	42.2 %
3	Station inlet valve south	5.6 %
4	Station main line piping south	28.9 %
5	MLV bypass valve south	2.0 %
6	MLV bypass valve north	1.8 %
7	Station blowdown line	6.7 %
8	Station blowdown line	22.2 %
9	Blowdown stack	53.3 %

The Newcastle Waters 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 3.

Table 2: Coating Defects Within Vicinity of DCVG Detected Defects

DCVG Defect Number	Section	Photo Log / Notes
1	Anchor Block north	Appendix 4, Photo 0991. No noted coating defect.
2	Anchor Block south	Appendix 4, Photo 1089. Blistering present on the coating at several locations.
3	Station inlet valve south	Appendix 4, Photos 1025, 0984 Blistering present on pipe and valve V07 coating, and small areas of uncoated surfaces of V07 several stud nuts.
4	Station main line piping south	Appendix 4, Photo 0989. Coating missing from check valve studs.
5	MLV bypass valve south	Appendix 4, Photo 0988. Small areas of uncoated surfaces of V11 including stud bolt nuts and elbow fittings of sealant injection lines.
6	MLV bypass valve north	Appendix 4, Photo 0985. Small areas of uncoated surfaces of V12 including stud bolt nuts and elbow fittings of sealant injection lines.
7	Station blowdown line	Appendix 4, Photo 1001. Coating severely cracked and pulling away from pipe at DN50 tee junction.
8	Station blowdown line	Appendix 4, Photo 1195. No noted coating defect.
9	Blowdown stack	Appendix 4, Photo 1339. No noted coating defect.



3.2 Coating Inspection

A significant portion of the coating found at Newcastle Waters was generally in poor condition. Many areas of coating were found to be blistering and the coating exhibited extensive disbondment. Recorded coating defects have been illustrated on the Newcastle Waters 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:

- Blowdown line exposed pipe (photo 0993) and coating damage (photo 0994, 0995, 0996, 0997, 0998, 0999, 1000, 1003, 1004, 1007, 1197 and 1198).
- Dirt migrated underneath the sleeves near the North MIJ (Monolithic Insulating Joint) cables (photo 1014).
- South anchor block blistering in coating (photo 1089 and 1090).
- V07 coating blistering and coating loss around the concrete support blocks and valve (photo 1023, 1024 and 1025).
- V11 and surrounding piping, coating blistering and coating loss around concrete support blocks and on valve (photo 1032, 1033 and 1034).
- V12 and nearby tee coating blistering and coating loss (photo 0985, 0986 and 1030).
- V14 coating blistering and coating loss (photo 1020, 1064 and 1066)
- Severe coating defects where the 50mm pig trap drain line tees into the blowdown line (photo 1001).

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
2	Blowdown Line	Coating was polyken wrap and holiday detection revealed holidays at several points where wrap overlapped.	N/A	N/A
5	V14-Corrosion A	A small amount of coating was missing towards the top of the pipe. Coating had lifted away from the pipe.	N/A	N/A
6	V14-Corrosion B	A small amount of coating was missing towards the top of the pipe. Coating had lifted away from the pipe.	N/A	N/A

3.3 Metal loss

There were 6 areas of metal loss found on the pipework at NCW. Of these 6 areas containing metal loss, 3 of these areas had no reported visible coating defects and passed a jeep test. The metal loss section of the coating damage assessment form was filled out for each defect – refer to Appendix 3.

Table 4: Metal Loss Reports

ID	Section	Coating Defect (Y/N)	Maximum Depth (mm)	Correlation to DCVG	DCVG Survey IR
1	Pig Receiver North	N	1.16	N/A	N/A
2	Blowdown Line	Y	1.08	N/A	N/A
3	Blowdown Line (Area #1)	N	0.60	N/A	N/A
4	Blowdown Line (Area #2)	N	0.67	N/A	N/A
5	V14-A	Y	1.69	N/A	N/A
6	V14-B	Y	1.65	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	Pig Receiver North	N	Corrosion due to possible shielding	Refer to photo 1148. 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 1002, 1132, 1143. Evidence of pitting and pattern of defects consistent with typical corrosion.
3	Blowdown Line (Area #1)	N	Corrosion	Refer to photo 1350. Evidence of pitting and pattern of defects consistent with typical corrosion.
4	Blowdown Line (Area #2)	N	Corrosion	Refer to photo 1353. Evidence of pitting and pattern of defects consistent with typical corrosion.
5	V14-A	Y	Corrosion due to possible shielding	Refer to photos 1009, 1095 and 1133. Visual examination of coating condition showed signs of shielding. Pit appearance seems consistent with pit corrosion due to shielding
6	V14-B	Y	Corrosion due to possible shielding	Refer to photos 1009, 1095 and 1133. Visual examination of coating condition showed signs of shielding. Pit appearance seems consistent with pit corrosion due to shielding



The location and details of metal loss has been included on the Newcastle Waters Metal Loss Results drawing in Appendix 1.

4 Discussion

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

DCVG and Coating Defects

The DCVG survey reported coating defects which have been referenced back to coating defects found during the dig-up as described in Table 2. However, DCVG failed to find blistering on the TEE downstream of V07, blistering on the concrete support downstream of V11, blistering on V14, and the 8 tape wrap defects located on the blowdown line.

DCVG Defect #1, 2, 8 and 9 were not related back to specific defects found in the coating during dig-up, and yet were most of the highest %IR readings. These detections were all around concrete anchor and support blocks and the assumption is there could be a defect within the concrete anchor/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. On this project LRUT surveys were used to determine whether there was a pipe wall defect (metal loss) within these concrete blocks and none were evident at this site.

DCVG and Metal Loss Defects

The DCVG survey missed almost all of the metal loss defects found at Newcastle Waters. Metal loss defects ID# 1, 5 and 6 were identified as resulting from pit corrosion due to shielding. The fact that defects #1, 5 and 6 were not found by DCVG is consistent with the shielding premise. DCVG Defect #8 and #9 may have overlapped to some extent during testing, and DCVG Defect #9 could have been caused partially by the coating defects on the blowdown line. As these are the coating defects suspected for causing the corrosion metal loss ID #3 and #4, DCVG could have detected this coating defect which led to corrosion. However, the coating defect shown in photo 1002 which likely resulted in the more severe corrosion of metal loss ID #2, was not detected by DCVG at all.

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, #3 and #4 was in areas where the coating type was tape wrapping. Coating defects were also located nearby which allows for electrolyte migration underneath the coating along the pipe metal surface. Although the pipe was wrapped circumferentially, corrosion occurred axially to the pipe in all cases, which 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 #5 and #6 are most likely to be due to very localised pit corrosion resulting from shielding. Visual examination of the coating at site on V14 (photo 1095) found the Coal Tar Enamel (CTE) coating to have areas of remaining adhesion but exhibited dis-bondment immediately adjacent to the two pits. No moisture was evident in this area. This local dis-bondment of the CTE at the pit sites is considered to have resulted in localised shielding and pit corrosion has occurred. Whilst the appearance of the pit corrosion here is not consistent with pit corrosion evident beneath yellowjacket or tape coating systems generally found elsewhere, 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.

In the case of metal loss ID #1 the appearance of coating dis-bondment and the corrosion pit at the pig receiver North (photo 1148) is similar to what was seen for the metal loss ID #5 and #6 above, therefore the same corrosion mechanisms have been assumed to be at work.

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. Were the coating not to be replaced, corrosion rates will accelerate with time given the degrading condition of the existing coating. There is reasonable evidence of shielding both in the yellow-jacket, CTE 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.

The coating at this station is in poor condition and requires replacement.

6 Conclusion

The DCVG survey has not been able to accurately detect all of the coating damage or metal loss at the NCW scraper station, with the particular example of valve V14 which has 30-40 holidays, two metal loss defects and no DCVG result/indication. The condition of the coating was generally poor and the DCVG survey indicated many CP leaks, some significant (>50%IR). 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, therefore the gradient changes which would be an expected result of a coating defect are difficult to measure and locate given the high number.



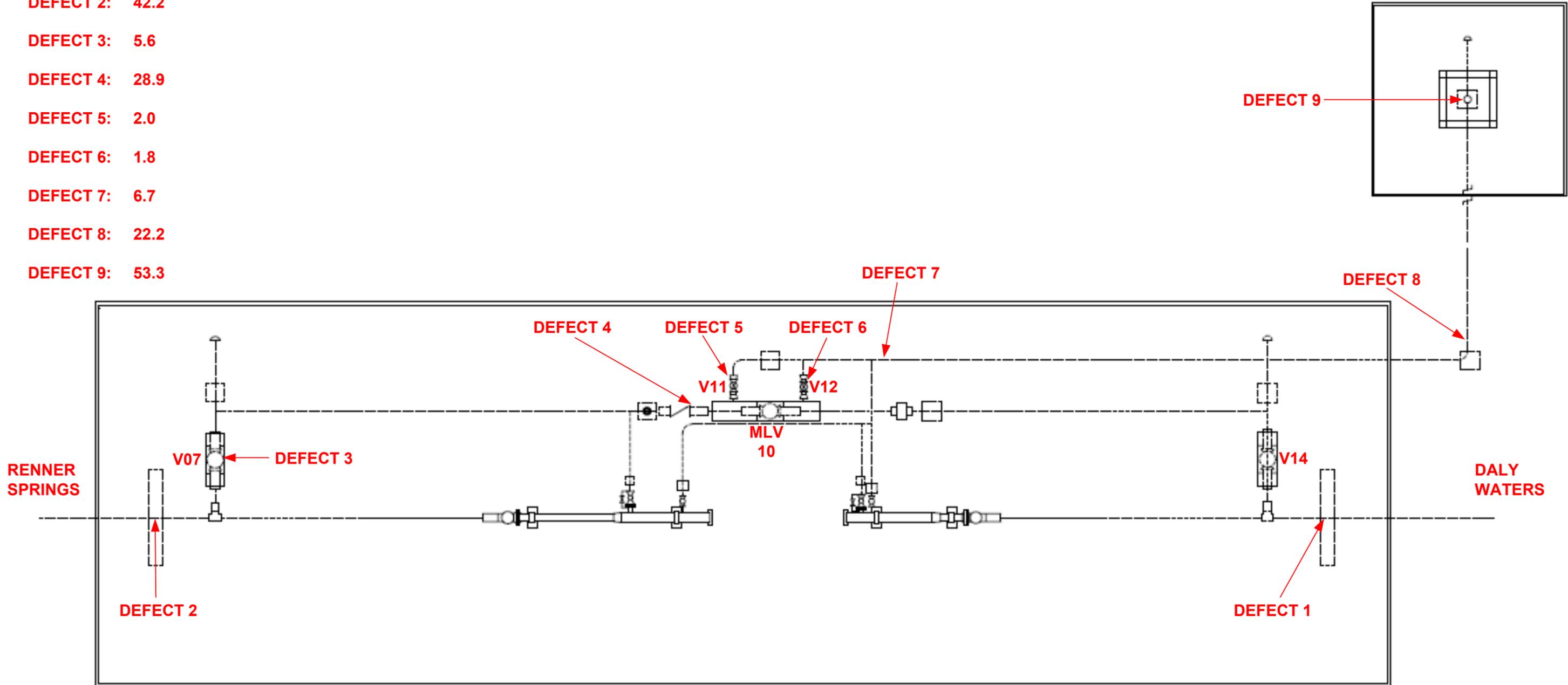
There were several areas of metal loss on the station pipework where there had been coating degradation and in areas where the coating appeared to be intact. The amount of general corrosion is low and the station cathodic protection system appears to be working as it should. However, there is evidence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



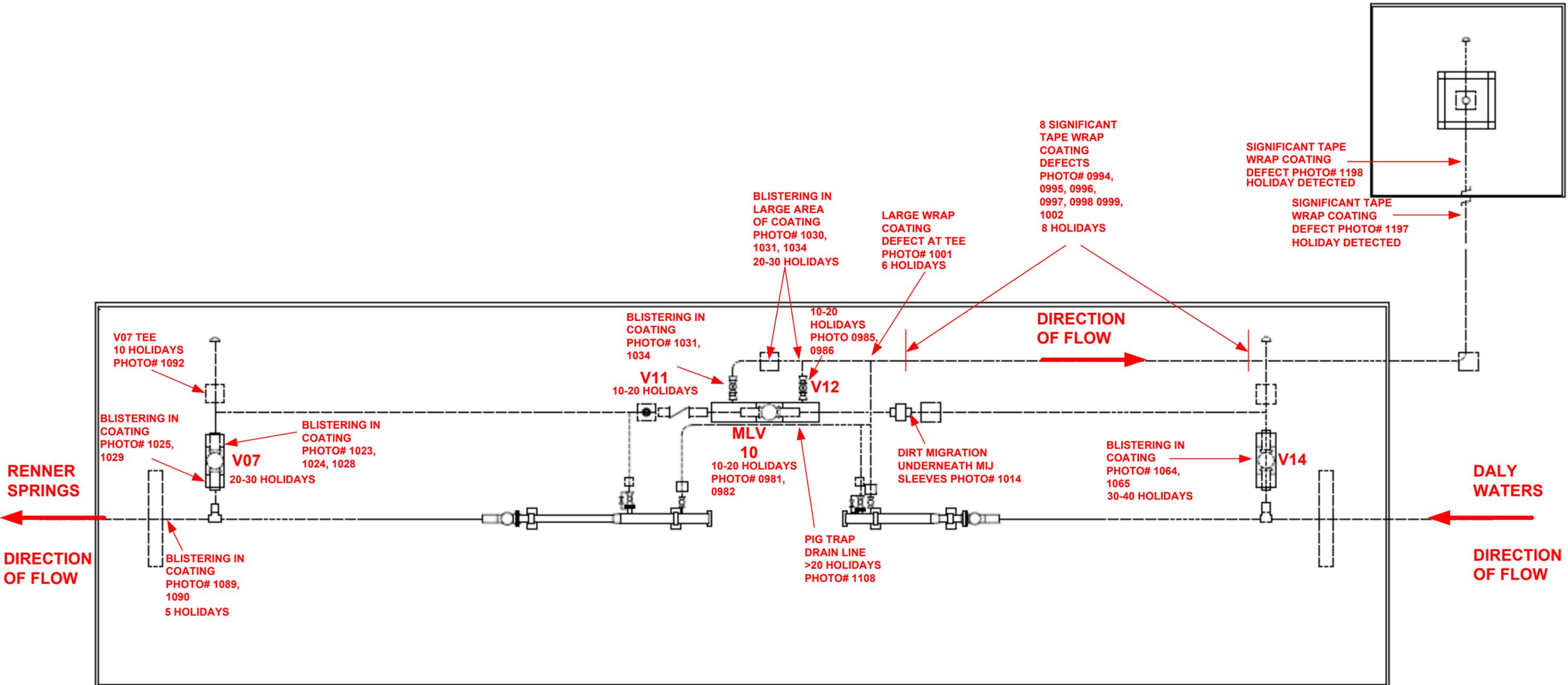
Appendix 1 Station Layout, DCVG Survey, Coating Defects and Metal Loss Results.

NEWCASTLE WATERS DCVG SURVEY

DCVG	IR (%)
DEFECT 1:	9.0
DEFECT 2:	42.2
DEFECT 3:	5.6
DEFECT 4:	28.9
DEFECT 5:	2.0
DEFECT 6:	1.8
DEFECT 7:	6.7
DEFECT 8:	22.2
DEFECT 9:	53.3

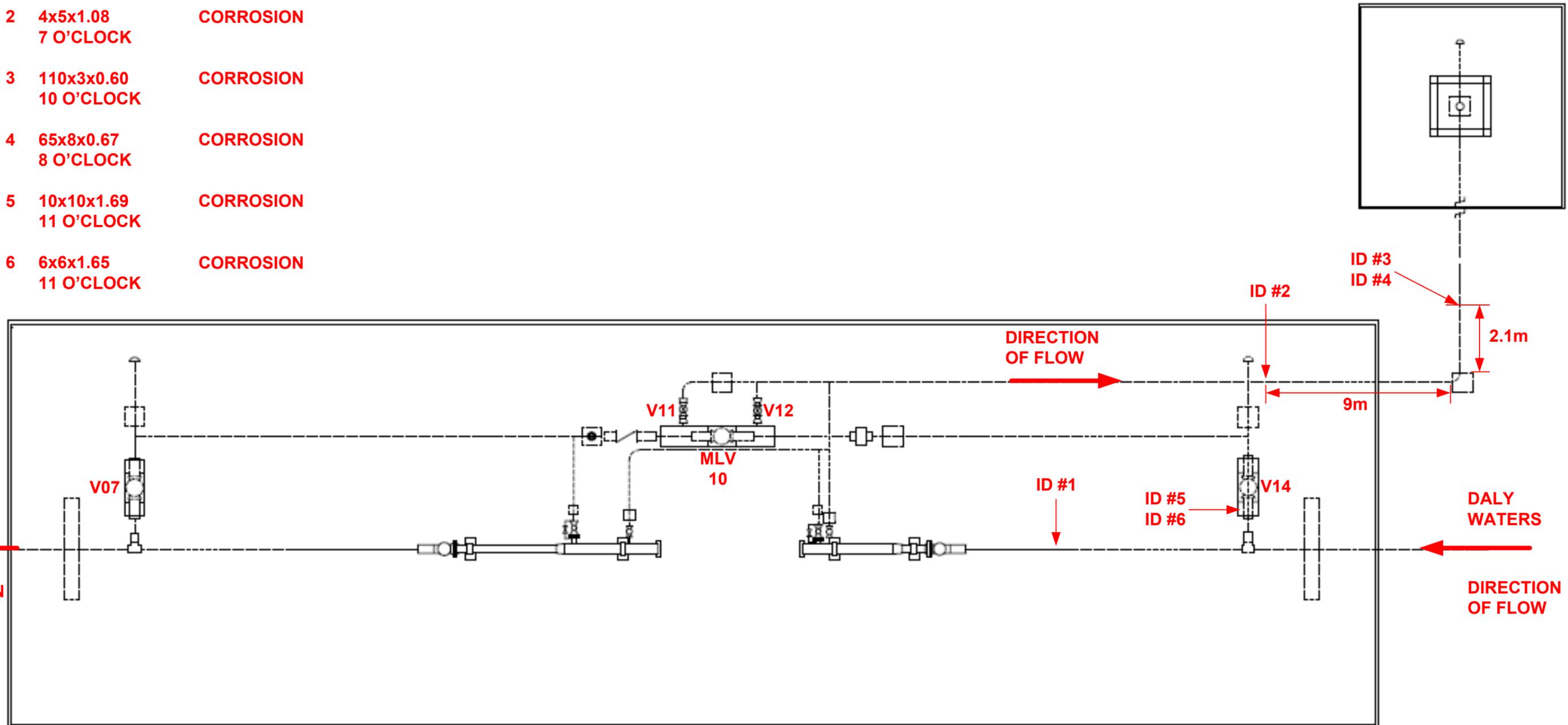


NEWCASTLE WATERS COATING DEFECT – VISUAL INSPECTION & HOLIDAY DETECTOR RESULTS



NEWCASTLE WATERS METAL LOSS RESULTS

COATING DAMAGE ASSESSMENT REPORT ID#	DEFECT DIMENSION (mm) LxWxDDEPTH O'CLOCK POSITION ON PIPE	CAUSE OF METAL LOSS
1	10x6x1.16 5:30 (O'CLOCK)	CORROSION
2	4x5x1.08 7 O'CLOCK	CORROSION
3	110x3x0.60 10 O'CLOCK	CORROSION
4	65x8x0.67 8 O'CLOCK	CORROSION
5	10x10x1.69 11 O'CLOCK	CORROSION
6	6x6x1.65 11 O'CLOCK	CORROSION





Appendix 2 Coating Damage Assessment Forms

10 #2

KP:

Work Order No:

Form created by Ben Parkin Apr 09
Approved by Henry Dupal

COATING DAMAGE ASSESSMENT

Page 1

Location

Pipeline: _____ Excavation Date: 15/10/2012
 Section: BLISS DOWN LINE Digup Reason: COATING REPAIR
 Kilometre Point: N/C W SCRAPIER DCVG Measurement: NIL
 Zone: _____ Defect Length from survey (m): _____
 Easting: _____ CMMS Work Order No: 131766
 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>1002, 1007</u>
Pipe with coating removed	<u>1132</u>
Pipe cleaned	<u>1144, 1143</u>
Pipe repaired	

Soil and CP

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

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

Pipeline Soil Cover Depth (m): 1.360 Soil pH: 5-6
 Pipe To Soil Potential (V): -0.674 Soil Resistivity (Ohms): PHOTO 0941 Pin Spacing 1.5m

Coating

Coating Description: _____ Is there a coating defect (Y/N)? Y
 Yellow Jacket Any white buildup from cathodic protection (Y/N)? N
 Sleeve Any evidence of termite damage (Y/N)? N
 Wrapping Any moisture inside the coating (Y/N)? N
 FBE Any stress corrosion cracking (Y/N)? If yes, complete APA pipeline damage report N/A
 Paint 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): SEE NOTE Coating Defect Width (mm): SEE NOTE

Coating Defect Comments:

COATING WAS POLYKLEN WRAP AND HOLIDAY DETECTION REVEALED HOLIDAYS AT SEVERAL POINTS ALONG WRAP WHERE WRAP OVERLAPPED. NO ACTUAL DEFECT IN COATING.

1D#2

KP:

Work Order No:

Page 2

Metal Loss

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

NO

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.

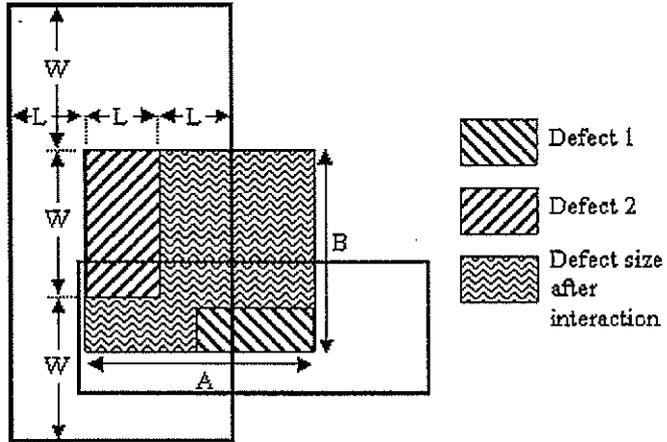


Figure 1

Maximum Depth (mm):

1.08

Wall thickness (mm):

Longitudinal dimension (A) (mm):

4

Circumferential dimension (B) (mm):

5

Clock Position (looking in direction of flow):

7

Distance from longitudinal weld (mm):

NO WELD SEAM

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

3-2

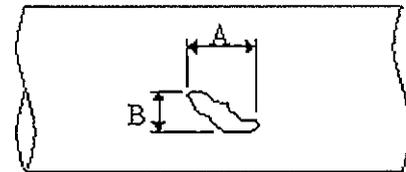


Figure 2

Repair

Length of Pipe Wrapped (mm): _____

Other Repair Information:

ENTIRE PIPE COATED WITH LUXA POXY UHB.

Dig Up Comments:

VERY ROCKY
CORROSION WAS ON LOWER SIDE OF PIPE AND IN A LINE.

Operator: [Signature]

Signature: [Signature]

Date: 29/10/2012

10#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: 15/10/2012
 Section: V14 Digup Reason: COATING INSPECTION
 Kilometre Point: NCH SS DCVG Measurement: N/A
 Zone: _____ Defect Length from survey (m): _____
 Easting: _____ CMMS Work Order No: 131766
 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>1095, 1009, 1068, 1084, 1066,</u>
Pipe with coating removed	<u>1142,</u>
Pipe cleaned	<u>1133,</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 checked="" 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 type="checkbox"/> Red Dirt		

Pipeline Soil Cover Depth (m): 1.0 Soil pH: 5-6
 Pipe To Soil Potential (V): _____ Soil Resistivity (Ohms): PHOTO 0941 Pin Spacing 1.5m

Coating

Coating Description: _____ Is there a coating defect (Y/N)? Y
 Yellow Jacket Any white buildup from cathodic protection (Y/N)? N
 Sleeve Any evidence of termite damage (Y/N)? N
 Wrapping Any moisture inside the coating (Y/N)? Y
 FBE Any stress corrosion cracking (Y/N)? If yes, complete APA pipeline damage report N/A
 Paint Has the coating lifted away from the pipe (Y/N)? Y
 If yes, how far around the pipe has it lifted (mm)? 100
 Sketch of coating / corrosion damage completed (Y/N)? N

Coating Defect Length (mm): _____ Coating Defect Width (mm): _____

Coating Defect Comments:

A SMALL AMOUNT OF COATING WAS MISSING TOWARDS THE TOP OF THE PIPE AND CORROSION AREA WAS BELOW THE MISSING COATING. THE COATING HAD LIFTED AWAY FROM THE PIPE.

11) #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.

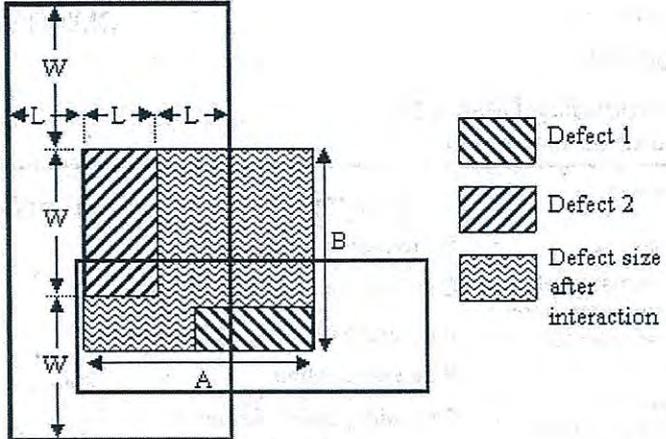


Figure 1

Maximum Depth (mm):

 1.69

Wall thickness (mm):

 10

Longitudinal dimension (A) (mm):

 10

Circumferential dimension (B) (mm):

 11

Clock Position (looking in direction of flow):

 NO SPAM

Distance from longitudinal weld (mm):

 340

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

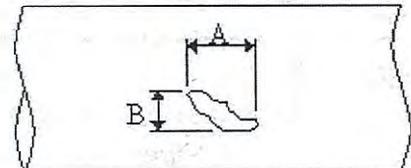


Figure 2

Repair

Length of Pipe Wrapped (mm): _____

Other Repair Information:

 ENTIRE VALVE & PIPENODES WAS COATED WITH DULUX LUXAPOXY UHP IN ACCORDANCE WITH PAINTING SPECIFICATION PC240

Dig Up Comments:

 CORROSION SPOT A 625MM UPSTREAM OF VALVE BODY V14 AT NCW SCRAPER.

Operator: WAYNE DUFFY

Signature: [Signature]

Date: 28/10/2012

10#6

KP:

Work Order No:

Form created by Ben Parkin Apr 09
Approved by Henry Dupal

COATING DAMAGE ASSESSMENT

Page 1

Location

Pipeline: _____
 Section: V14
 Kilometre Point: NEW SCRAPER
 Zone: _____
 Easting: _____
 Northing: _____

Excavation Date: 15/10/2012
 Digup Reason: COATING INSPECTION
 DCVG Measurement: N/A
 Defect Length from survey (m): _____
 CMMS Work Order No: 131766

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>1095, 1009, 1068, 1084, 1066</u>
Pipe with coating removed	<u>1142</u>
Pipe cleaned	<u>1133</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 checked="" 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 type="checkbox"/> Red Dirt		

Pipeline Soil Cover Depth (m): 1.0 Soil pH: 5-6
 Pipe To Soil Potential (V): _____ Soil Resistivity (Ohms): 1402 0941 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)? If yes, complete APA pipeline damage report N/A
 Has the coating lifted away from the pipe (Y/N)? Y
 If yes, how far around the pipe has it lifted (mm)? 100
 Sketch of coating / corrosion damage completed (Y/N)? N

Coating Defect Length (mm): _____ Coating Defect Width (mm): _____

Coating Defect Comments:

A SMALL AMOUNT OF COATING WAS MISSING TOWARDS THE TOP OF THE PIPE AND CORROSION AREA WAS BELOW THE MISSING COATING. THE COATING HAD LIFTED AWAY FROM THE PIPE.

KP:

Work Order No:

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.

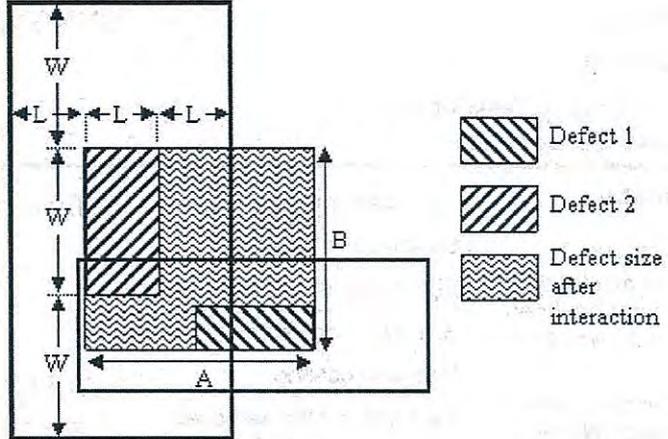


Figure 1

Maximum Depth (mm):

1.65

Wall thickness (mm):

Longitudinal dimension (A) (mm):

6

Circumferential dimension (B) (mm):

6

Clock Position (looking in direction of flow):

11

Distance from longitudinal weld (mm):

NO SEAM

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

295

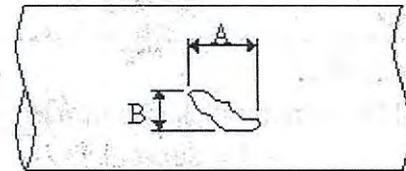


Figure 2

Repair

Length of Pipe Wrapped (mm): _____

Other Repair Information:

ENTIRE VALVE & PIPE WORK WAS COATED WITH DULUX LUXAPOXY UHB.

Dig Up Comments:

CORROSION SPOT B
670MM UPSTREAM OF VALVE BODY V14 AT NCW SCRAPER

Operator: WAYNE DUFFY

Signature: [Signature]

Date: 28/10/2012



Appendix 3 Metal Loss Assessment Forms

10 # 1

KP:

Work Order No:

Form created by Ben Parkin Apr 09
Approved by Henry Dupal

COATING DAMAGE ASSESSMENT

Page 1

Location

Pipeline: _____ Excavation Date: 14/10/2012
 Section: BIG RECEIVER (NORTH) Digup Reason: COATING INSPECTION
 Kilometre Point: NEW? DCVG Measurement: NIL
 Zone: _____ Defect Length from survey (m): _____
 Easting: _____ CMMS Work Order No: 131766
 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	
Pipe with coating removed	
Pipe cleaned	<u>1146, 1148, 1152</u>
Pipe repaired	

580 NORTH W/LED SOUTH
200 SOUTH W/LED

Soil and CP

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

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

Pipeline Soil Cover Depth (m): 0.3 Soil pH: 5
 Pipe To Soil Potential (V): 0.674 Soil Resistivity (Ohms): PHOTO 0941 Pin Spacing 1.5m

Coating

Coating Description: _____ Is there a coating defect (Y/N)? ✓
 Yellow Jacket Any white buildup from cathodic protection (Y/N)? ✓
 Sleeve Any evidence of termite damage (Y/N)? ✓
 Wrapping Any moisture inside the coating (Y/N)? ✓
 FBE Any stress corrosion cracking (Y/N)? If yes, complete APA pipeline damage report N/A
 Paint 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): _____ Coating Defect Width (mm): _____

Coating Defect Comments:

THERE WAS NO COATING DEFECT VISIABLE. METAL LOSS WAS NOTICED AFTER ABRASIVE BLASTING.

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.

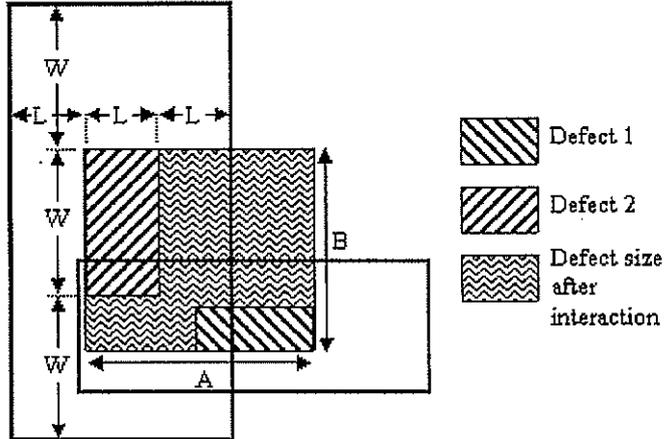


Figure 1

Maximum Depth (mm):

1.16

Wall thickness (mm):

8.74

Longitudinal dimension (A) (mm):

10

Circumferential dimension (B) (mm):

6

Clock Position (locking in direction of flow):

5:30

Distance from longitudinal weld (mm):

322

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

680 DOWN STREAM OF WELD

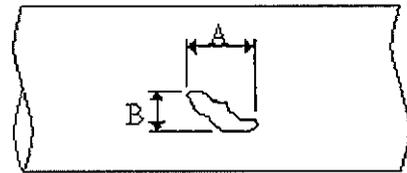


Figure 2

Repair

Length of Pipe Wrapped (mm): _____

Other Repair Information:

CORROSION AREA IS 10 MM LONG X 6MM WIDE
IT IS LOCATED 7530MM FROM SIDE OF PIG RECEIVER VALVE: V15
IT WAS TAPE WRAP ONTO YELLOW JACKET AT THIS POINT.
ENTIRE PIPE WAS COATED WITH DULUX LUXAPOXY TO 300MM ABOVE GROUND.

Dig Up Comments:

Operator: Wayne Off

Signature: Off

Date: 28/10/2012

10#3

KP:

Form created by Ben Parkin Apr 09
Approved by Henry Dupal

Work Order No:

COATING DAMAGE ASSESSMENT

Page 1

Location

Pipeline: _____ Excavation Date: 15/10/2012
 Section: BLOCK DOWN LINE CYCLO Digup Reason: COATING INSPECTION
 Kilometre Point: _____ DCVG Measurement: _____
 Zone: _____ Defect Length from survey (m): _____
 Easting: _____ CMMS Work Order No: 131766
 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	
Pipe with coating removed	
Pipe cleaned	
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 checked="" type="checkbox"/> Loam	<input type="checkbox"/> Coarse	<input checked="" type="checkbox"/> Dry
<input type="checkbox"/> Clay	<input type="checkbox"/> Gravel	<input type="checkbox"/> Damp
<input type="checkbox"/> Black	<input type="checkbox"/> Rocky	<input type="checkbox"/> Wet
<input type="checkbox"/> Red Dirt		

Pipeline Soil Cover Depth (m): 1.360 Soil pH: 5-6
 Pipe To Soil Potential (V): 0.674 Soil Resistivity (Ohms): PHOTO 0941 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)? 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): N/A Coating Defect Width (mm): N/A

Coating Defect Comments:

TAPE WRAP DIDN'T APPEAR TO BE DEFECTIVE AND DID NOT
 JEEP OUT WITH HOLIDAY DETECTOR

10#3

KP:

Work Order No:

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.

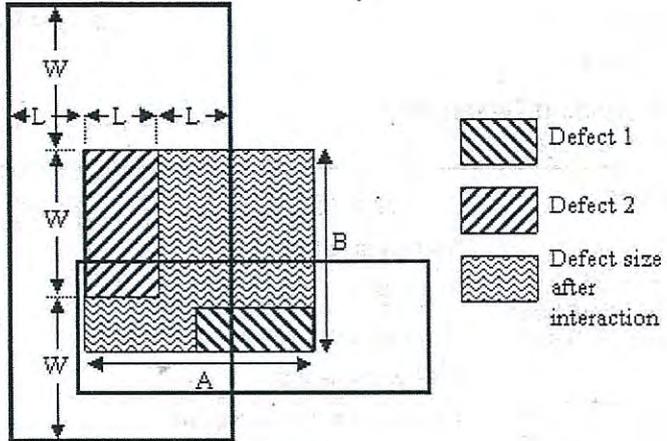


Figure 1

Maximum Depth (mm):

0.60

Wall thickness (mm):

Longitudinal dimension (A) (mm):

110

Circumferential dimension (B) (mm):

3

Clock Position (looking in direction of flow):

10'

Distance from longitudinal weld (mm):

NO SEAM WELDS

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

2600

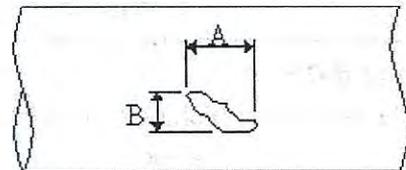


Figure 2

Repair

Length of Pipe Wrapped (mm):

PAINTED

Other Repair Information:

ENTIRE BLOW DOWN LINE WAS COATED WITH LUXAPOXY UHB

Dig Up Comments:

CORROSION #1

PIPE WAS IN SANDY LOAM WITH LARGE AMOUNT OF ROCK ON EACH SIDE

Operator:

[Signature]

Signature:

[Signature]

Date:

~~2/10/2012~~
2/12/2012

1D#4

KP:

Work Order No:

Form created by Ben Parkin Apr 09
Approved by Henry Dupal

COATING DAMAGE ASSESSMENT

Page 1

Location

Pipeline: _____ Excavation Date: 15/10/2012
 Section: B/D LOWE NCW Digup Reason: COATING INSPECTION
 Kilometre Point: _____ DCVG Measurement: _____
 Zone: _____ Defect Length from survey (m): _____
 Easting: _____ CMMS Work Order No: 131766
 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	
Pipe with coating removed	
Pipe cleaned	<u>1353, 1350, 1348</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 checked="" type="checkbox"/> Loam	<input type="checkbox"/> Coarse	<input checked="" type="checkbox"/> Dry
<input type="checkbox"/> Clay	<input type="checkbox"/> Gravel	<input type="checkbox"/> Damp
<input type="checkbox"/> Black	<input type="checkbox"/> Rocky	<input type="checkbox"/> Wet
<input type="checkbox"/> Red Dirt		

Pipeline Soil Cover Depth (m): 1.360 Soil pH: 5-6
 Pipe To Soil Potential (V): _____ Soil Resistivity (Ohms): Photo 0944 Pin Spacing 1.5m

Coating

Coating Description: _____ Is there a coating defect (Y/N)? N
 Yellow Jacket Any white buildup from cathodic protection (Y/N)? N
 Sleeve Any evidence of termite damage (Y/N)? N
 Wrapping Any moisture inside the coating (Y/N)? N
 FBE Any stress corrosion cracking (Y/N)? If yes, complete APA pipeline damage report N/A
 Paint 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): N/A Coating Defect Width (mm): N/A

Coating Defect Comments:
TAPE WRAP DIDN'T APPEAR TO BE DEFECTIVE AND DID NOT
TRIP OUT WITH HOLIDAY DETECTOR

1D#4

KP:

Work Order No:

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.

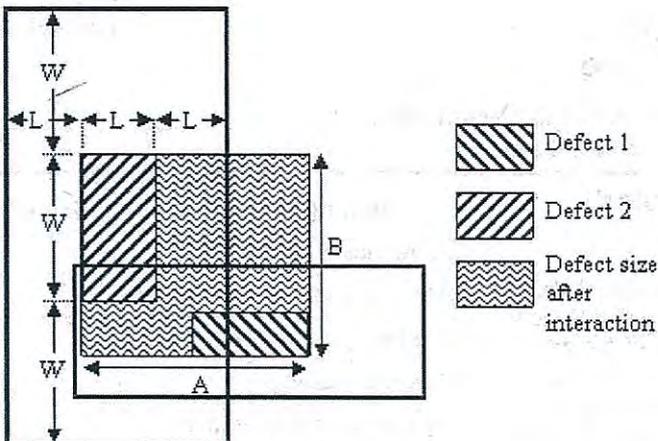


Figure 1

890

Maximum Depth (mm):

0.67

Wall thickness (mm):

Longitudinal dimension (A) (mm):

65

Circumferential dimension (B) (mm):

8

Clock Position (looking in direction of flow):

280 CCW

Distance from longitudinal weld (mm):

NO SEAM WELD

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

2600

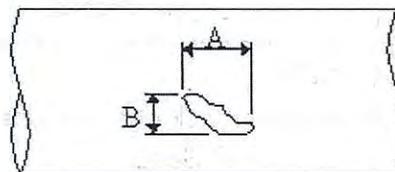


Figure 2

Repair

PAINTED

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

Other Repair Information:

ENTIRE BLOW DOWN LINE WAS COATED WITH LOXAPOXY UHB

Dig Up Comments:

CORROSION # 2
PIPE WAS IN SANDY LOAM WITH LARGE AMOUNT OF ROCK
ON EACH SIDE

Operator:

Wayne Doffy

Signature:

[Signature]

Date:

2/12/2012



Appendix 4 Photo Log

Photos:

0984

0985

0986

0988

0989

0991

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0994

0995

0996

0997

0998

0999

1000

1001

1002

1003

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1353

