ATTACHMENT 3

WOLLONGONG COAL LTD

Russell Vale Colliery

Bellambi Creek Diversion Pipeline Assessment

December 2017

N1800_001

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N1800_001 Stormwater Pipeline Assessment					
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REV	**DESCRIPTION**	**AUTHOR**	**REVIEWER**	**APPROVED BY**	**DATE**
Rev 0	Client Issue	Tim Evans - Engeny	Susan Shield - Engeny	Susan Shield - Engeny	18 December 2017
Rev 1	Client Issue	Tim Evans - Engeny	Susan Shield - Engeny	Susan Shield - Engeny	21 December 2017
Signatures					

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1. INTRODUCTION

1.1 Background

Wollongong Coal Ltd (WCL) has been issued with a Pollution Reduction Program (PRP) (PRP 8) on their Environment Protection Licence (EPL) (EPL 12040) for the Russell Vale Colliery site. The PRP has stemmed from the observance of turbid stormwater, with a grey/brown colour, that is discharged from the premises during and after high volume rainfall events.

PRP 8 – Stormwater Turbidity Reduction Program – Part 1 – Stormwater Pipelines identified that discharge of turbid groundwater has occurred due to groundwater ingress from fractures and degraded connections in to the Bellambi Gully clean stormwater diversion pipe.

The PRP stipulates that the licensee (WCL), must arrange for inspections of the Bellambi Gully Diversion Pipe to determine the condition of the pipe network and the maintenance required to prevent ingress of turbid water. A remote closed-circuit television (CCTV) inspection of the pipeline was conducted by Interflow on 13/20 June 2017.

1.2 Scope of Work

Engeny Water Management (Engeny) has been engaged to:

- Collate and review background information.
- Prepare a report detailing:
    - The work carried out as part of the pipeline inspection program.
    - Identification of works required to minimise ingress of water
    - A suggested timeframe for rectification based on a risk analysis for the defects.
    - Order of magnitude cost estimate for the repair works.
    - Outline monitoring that can be used to assess the effectiveness of the works.

1.3 Information Sources

The following information was used for the purpose of this review:

- Interflow pipeline inspection report and inspection plan.
    - 20170613 - DN1800.pdf
    - Bellambi Creek Diversion Inspection from MHB to MHA.pdf
    - Bellambi Creek Diversion Inspection from MHB to MHC.pdf
- EPL 12040

Pipeline Description

The Bellambi Gully Pipeline is a clean water diversion pipe that conveys upslope runoff from the Bellambi Gully catchment area under the coal stockpile at the Russell Vale Colliery pit top to the creek line downstream.

The pipe is an 1800 mm diameter concrete pipe of approximately 608 metres long. Some sections of the pipe have a concrete based constructed in them, other sections are lined with corrugated pipe.

Pipeline inspection and previous work

Interflow conducted a remote CCTV inspection of the Bellambi Gully Diversion Pipeline on 16 and 20 June 2017. A total of 76 observations, including 62 defects were recorded. The Interflow report for the inspection and the plans produced can be viewed in Appendix A.

The Interflow inspection identifies defects in the pipeline, but does not provide a risk based monitoring and maintenance program to minimise water ingress into the diversion, as per the PRP.

The following types of defects were noted by Interflow from the CCTV inspection:

- Connections with poor workmanship, possibly due to displacement
- Infiltration at pipe joints
- Encrustation/scale
- Defective repairs, including major and irregular gaps in the pipe wall
- Deformation/bulging of pipe walls (in corrugated lined sections).
- Rusting of exposed reinforcing

2. RISK ASSESSMENT

A risk matrix was developed to categorise the pipe defects according to their pollution risk. Each identified pipe defect was assessed according to the probability that it would allow turbid groundwater inflows into the clean water system, as well as the estimated consequence/severity of the pollution scenario.

A risk profile for each defect was applied using the risk matrix. The risk profile, ranging from Very Low to Critical, was then used to inform the timeframes for the required rectification and pipe maintenance.

The risk matrix developed for the pipeline assessment is presented in Table 1. The descriptions of the pollution consequence and likelihood categories are presented in Table 2 and Table 3 respectively. While the suggested actions and associated timeframes for each risk category are presented in Table 4.

Table 1 - Risk matrix

		Almost certain	Likely	Moderate Likelihood	Unlikely	Rare
CONSEQUENCES	5	Critical	Critical	High	High	Moderate
	4	Critical	High	High	Moderate	Low
	3	High	High	Moderate	Low	Low
	2	High	Moderate	Low	Low	Very Low
	1	Moderate	Low	Low	Very Low	Very Low

Table 2 - Pollution consequence category description

Consequence category	Description
5	Extreme damage to pipe, total failure. Large volume of turbid water discharged off site.
4	Major damage to pipe, large volume of turbid water discharged off site.
3	Moderate damage to pipe, small to medium volume of turbid water discharged off site. Or obstruction with potential to back up pipe in large storm events to cause a small to medium volume of turbid water discharged off site.
2	Minor impact to pipe. Minor volumes of turbid water inflow into pipe.
1	Minor degradation to pipe, negligible impact on conveyance or containment. No inflow of turbid water.

Table 3 - Pollution likelihood category description

Likelihood	Description
Almost certain	Pollution is currently likely to be occurring, or will likely happen within a month.
Likely	Pollution is likely to happen within 6-12 months.
Moderate Likelihood	Pollution is likely within approximately 1-5 years without amelioration.
Unlikely	Pollution potential without amelioration within 5+ years.
Rare	Pollution potential negligible.

Table 4 - Suggested actions and timeframes by risk category

Risk Category	Timeframe and required actions.
Critical	Urgent remediation works required. Works to be implemented to reduce the risk exposure to an acceptable level (i.e. low or very low).
High	Remediation works required within 1 to 6 months. Works to be implemented to reduce the risk exposure to an acceptable level (i.e. low or very low).
Moderate	Monitor ongoing risk of pollution and deterioration of the pipe. Remediation works required within 6-18 months.
Low	Annual monitoring required. Remediation works likely to be required within 1 - 5 years
Very Low	Annual monitoring required.

3. KEY ISSUES AND RECOMMENDATIONS

Based on the review of the supplied data and the risk assessment process undertaken for the identified defects, the following summary of the suggested remediation works and associated timeframes has been developed. The full list of defects and suggested remediation method is presented in Appendix B.

Based on the risk ranking, defects assessed as being ***moderate*** to ***critical*** require remediation works, while defects assessed as having a ***low*** to very ***low*** pollution risk are unlikely to require remediation works in the next year. An ongoing monitoring program is to be implemented to regularly inspect the defects to determine the efficacy of the remediation works and any worsening of the low and very low ranked risk defects. Refer to Section 4 for details.

3.1 Location Manhole B to Manhole A

The Bellambi Gully Diversion Pipeline extends approximately 167 m from Manhole B to Manhole A. The pipeline consists of 1800 mm diameter reinforced concrete pipe or corrugated metal pipe. A summary of the observations by chainage and their assessed risk profile is presented below in Figure 1.

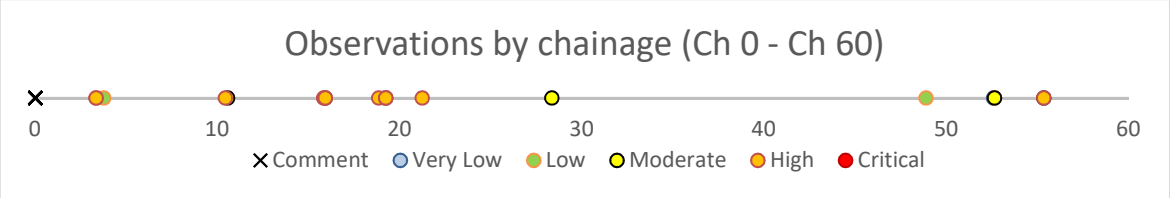

Figure 1 - Identified defects MH B to MH A

A total of 29 defects or observations were made on the Bellambi pipeline between Manhole B to Manhole A. Most of the defects occur between chainages 3 – 56 m, with an isolated observation of a wooden obstruction at Chainage 166.70 m. The risk ranking for the defects range from Very Low to High.

Structural damage to the pipeline has been identified between chainages 3 – 16 m, as indicated by exposed reinforcement and cracking. This suggests that the serviceability limit state for the pipeline has locally been exceeded, likely from an external surface loading.

A number of external connections have been identified between chainage 16 – 22 m. These external connections pose a risk of directing turbid water directly in to the pipeline. Even if the connections are redundant and blocked off, a risk exists that turbid groundwater will be able to seep around the penetration in to the clean water system.

A summary of the suggested pipeline remediation works is presented in Table 5.

Table 5 - Suggested Actions. MH B to MH A

Chainage (m) and Number of Defects	Action	Timeframe
3 – 16 (7 defects – structural)	Re-line pipe (i.e. installing CMP / Polypipe pipe and cement pressure grouting the annulus or installing an insitu reinforced concrete pipe (e.g. Tunneline system). Note the pipe invert appears to have a concrete floor. This may need to be demolished prior to relining.	1 – 6 months
16 – 22 (7 defects – external penetrations)	The source of the external connections needs to be investigated, only clean water sources are to be directed to the pipeline. Repair the external connections by either epoxy pressure grouting the annulus between the RCP and the penetration or remove the penetration, and reinstate RCP wall by scrabbling/cleaning the concrete surface, applying a bonding agent (e.g. Epirez 133) and repair with non-shrink cement mortar repair.	1 – 6 months
28 – 56 (7 defects – suspected deteriorated seals causing infiltration. Encrustation/scale present)	For infiltration and deteriorated jointing mechanisms Remediate defects by cement pressure grouting annulus behind CMP / replace band connection, or seal band / CMP gap with expanding sealant. Within the 28 m length of pipe, there are 4 pipe jointing mechanisms that are failing, some in multiple places with varying risk categories at each failure point. In total the risk ratings of the defects in the area are 1 x High, 3 x Moderate and 2 x Low. Due to the similar nature of the repairs in this area, the defects have been grouped together for remediation.	1-6 months An opportunity exists to only remediate the defects identified as presenting a High or Moderate risk. The remaining defects could be assessed through the ongoing monitoring program.
166.72	Confirm if pit and external connection are still required. If not, construct reinforced concrete plug, dowelled in to RCP/Manhole. If still required, make sure lid is adequately seals.	1-6 months

3.2 Location Manhole B to Manhole C

The Bellambi Gully Diversion Pipeline extends approximately 441 m from Manhole B to Manhole C. The pipeline consists of 1800 mm diameter reinforced concrete or corrugated iron. A summary of the observations by chainage and assessed risk profile is presented below in Figures 2 and 3.

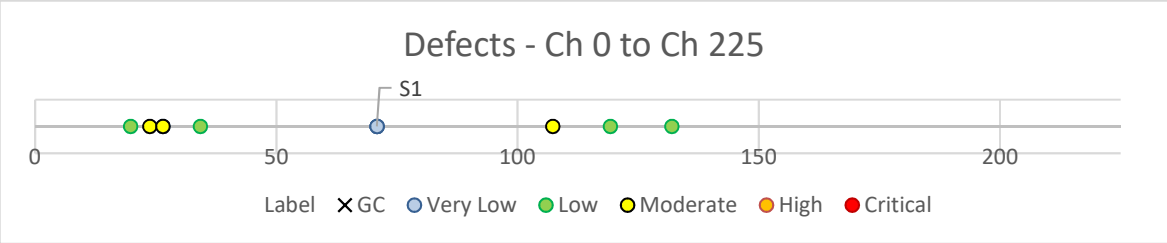

Figure 2 - Identified defects MH B to MHC, part 1

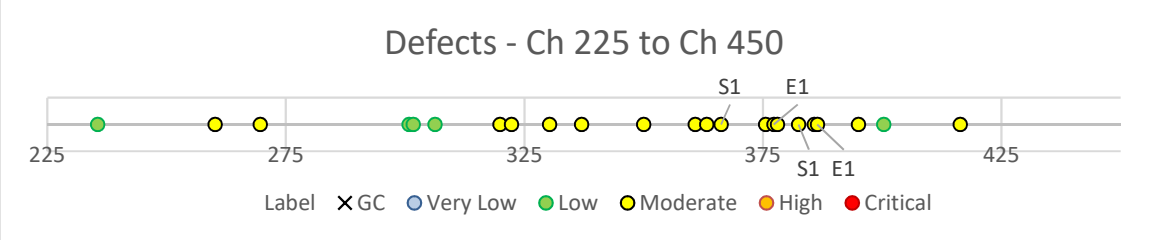

Figure 3 - Identified defects MH B to MHC, part 2

A total of 47 defects or observations were made on the Bellambi Gully pipeline between Manhole B to Manhole C. The risk ranking for the defects range from Very Low to Moderate. The majority of the moderate risk defects were recorded between chainages 320 – 395 m.

The moderate risk observations generally pertain to suspected infiltration, vertical deformations of the pipeline – likely from a dynamic surface loading, or longitudinal wall cracks, again suggesting structural damage to the pipeline.

A summary of the suggested pipeline remediation works is presented in Table 6.

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Table 6 - Suggested Actions. MH B to MH C

Chainage (m) and Number of Defects	Action	Timeframe
0 - 307 (17 defects: 5 moderate; 8 low; 4 very low)	Localised repairs and pipe cleaning required. Refer to detailed observations and suggested remediation works in Appendix B. Further investigation of some defects is required, refer to Appendix B. Suggest an ongoing pipeline monitoring program be initiated to assess the lower risk category defects. For infiltration and deteriorated jointing mechanisms Remediate defects by cement pressure grouting annulus behind CMP / replace band connection, or seal band / CMP gap with expanding sealant. Remove blockages, defective connections and clean pipe as required. Bulging of the pipe wall and bellies in the line identified. Where safe to do so, install bolted strengthening plate/ring. Cement pressure grout outside CMP to fill any voids. Within the 307 m length of pipe, there are 17 recorded defects. In total the risk ratings of the defects in the area are 5 x Moderate, 8 x Low and 4 x Very Low. It is anticipated that only the Moderate risk defects will be initially remediated, however an opportunity exists to group some of the remediation of the lower risk defects due to the similar nature of the repairs. The moderate defects in general consist of deteriorated pipe joint seals, or bulges/bellies in the corrugated metal pipe wall/floor.	6 to 18 months (As per identified risk profile for each hazard. Ranging from 6-18 months for 'Moderate' risk defects, or as identified by ongoing pipeline monitoring program.
70.84, 349.96, 375 – 386, 416.35 (10 defects, 7 moderate, 3 very low)	Re-line pipe (i.e. installing CMP / Polypipe pipe and cement pressure grouting the annulus or installing an insitu reinforced concrete pipe (e.g. Tunneline system). Note the pipe invert appears to have a concrete floor. This may need to be demolished prior to relining.	6-18 months

Chainage (m) and Number of Defects	Action	Timeframe
320 – 440 (17 defects: 16 Moderate, 1 low)	Localised repairs and pipe cleaning required. Refer to detailed observations and suggested remediation works in Appendix B. Within the 120 m length of pipe, there are 17 recorded defects. In total the risk ratings of the defects in the area are 16 x Moderate and 1 x Low. It is anticipated that only the Moderate risk defects will be initially remediated. Further investigation of the low risk defect (dropped invert) at Ch 400 is required to determine the appropriate repair method if deemed to be required. For infiltration and deteriorated jointing mechanisms Remediate defects by cement pressure grouting annulus behind CMP / replace band connection, or seal band / CMP gap with expanding sealant. Epoxy pressure grout longitudinal wall and surface cracks.	6-18 months
38.06, 306.27 (2 defects: To be determined if potential for groundwater ingress exists at the pits)	Unknown pits identified. Confirm if pit is still required. If not, construct reinforced concrete plug, dowelled in to RCP / Manhole.	As identified by ongoing pipeline monitoring program.

4. COST ESTIMATE

An order of magnitude cost estimate has been developed for the remediation works. The full costs associated with the repair of each defect can be seen in Appendix B. Table 7 presents a summary of the repair works grouped by risk category and timeframe.

Table 7 – Order of Magnitude Cost Estimate – 18 month works program

Risk Category	Total estimated cost of remediation works (ex GST)	Timeframe
Critical	$0	Immediate
High	$270,000	1 – 6 months
Moderate	$225,000	6 – 18 months
Total	$495,000	-

The cost estimate is based on two programs of work by a single contractor for each program. The cost estimates include mobilisation/demobilisation and site access estimate of $20,000 (ex GST) per works program (i.e. one for high risk category works and one for moderate risk category works).

5. MONITORING PROGRAM

A monitoring program of the Bellambi Gully Diversion Pipeline is required to be implemented as part of the PRP for the Russell Vale Colliery Site. The ongoing monitoring program is required to ascertain the efficacy of the proposed remediation works and to identify any worsening of non-remediated defects.

A yearly CCTV inspection program is to be implemented. The CCTV monitoring should be undertaken following the suggested remediation works to the pipeline. The monitoring program should address the following points:

- Investigation of the remediation works on defective areas previously identified as having a risk category of Moderate – Critical. The inspection should ascertain that the remediation has been successful and that there are no indications of further groundwater ingress from the defect.

- Investigate defects assessed as having a Very Low to Low risk category. The inspection should note if any worsening of the defect is observed to allow for reassessment of the defect's risk category.

WCL will review the yearly inspections and document in the Annual Review the following:

- All current defects on the pipeline.

- Identification of incidents or failures of all previous remediation works and necessary/adopted corrective actions.

- Any worsening of defective areas that have not been remediated, relative to previous pipeline inspections.

6. QUALIFICATIONS

a. In preparing this document, including all relevant calculation and modelling, Engeny Water Management (Engeny) has exercised the degree of skill, care and diligence normally exercised by members of the engineering profession and has acted in accordance with accepted practices of engineering principles.

b. Engeny has used reasonable endeavours to inform itself of the parameters and requirements of the project and has taken reasonable steps to ensure that the works and document is as accurate and comprehensive as possible given the information upon which it has been based including information that may have been provided or obtained by any third party or external sources which has not been independently verified.

c. Engeny reserves the right to review and amend any aspect of the works performed including any opinions and recommendations from the works included or referred to in the works if:

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   (ii) Engeny considers it prudent to revise any aspect of the works in light of any information which becomes known to it after the date of submission.

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g. This report does not provide legal advice.

APPENDIX A

Interflow Inspection Report and Plans

306000
306100
6195900
6195800
MH B
MH A
600m
1800m
3.34
3.75
10.44
10.55
15.83
15.92
18.85
19.23
20.9
21.24
21.36
23.92
28.35
34.41
46.91
48.89
52.58
52.64
55.35
163.48
166.72
Steel reinforcement is visible with little or no corrosion evident , from 11 to 1 o'clock
Suspected Surface Damage , Obstruction: 5-20%, General Comments Hole in pipe obvert has been repaired using a steel sheet, from 10 to 2 o'clock
Steel reinforcement is visible with little or no corrosion evident , from 11 to 1 o'clock
Reinforcement is exposed and corroded, General Comments possible repair of pipe hole, from 11 to 1 o'clock
Intruding connection, magnitude of intrusion: 5-20%, General Comments Protruding into line, at 10 o'clock
Intruding connection, magnitude of intrusion: 5-20%, General Comments Protruding into line with reinforcement exposed, at 11 o'clock
Intruding connection, magnitude of intrusion: 5-20%, General Comments Protruding into line with reinforcement exposed, at 12 o'clock
General Comments Multiple attachments on pipe wall to hold corrugated iron in place, rusting present throughout
Suspected Infiltration, General Comments through corrugated iron, at 2 o'clock
Infiltration, running, General Comments spurting out pipe wall, from 7 to 8 o'clock
Encrustation/Scale is attached to the wall above the water line, Obstruction: <5%, General Comments due to infiltration , from 6 to 12 o'clock
Steel reinforcement is visible with little or no corrosion evident, at 12 o'clock
Hole in wall, at joint, General Comments with reinforcement exposed, at 12 o'clock
Intruding connection, magnitude of intrusion: 5-20%, General Comments Protruding into line with reinforcement exposed, at 10 o'clock
General Comments Unknown Pit found
General Connection, The connecting pipe is damaged, magnitude of obstruction 51-75%, General Comments Collapsed 600mm junction, at 3 o'clock
New material, Corrugated Iron
General Comments Section Completed
General Comments Starts at 12.5m
Encrustation/Scale is attached to the wall above the water line, Obstruction: <5%, General Comments possibly due to infiltration, from 1 to 6 o'clock
Dropped invert, depth of drop 10mm, General Comments drop in invert of pipe uneven surface
Other Deposits on the wall, Jointing Material , Obstruction: <5% General Comments rusting/staining of joining mechanism, from 12 to 4 o'clock
Encrustation/Scale is attached to the wall above the water line , Obstruction: <5%, General Comments rusting/staining/possible infiltration of joining mechanism
New material, Concrete Pipe, General Comments returns to original pipe material
Connection, good workmanship, connection appears to be open, diameter approx 600mm , at 3 o'clock, General Comments Large wooden object wedged at pipe entrance
N
Coordinate System: GDA 1994 MGA Zone 56
Projection: Transverse Mercator
Datum: GDA 1994
WOLLONGONG COAL
WCL RUSSELL VALE COLLIERY
WOLLONGONG COAL LIMITED
7 Princes Highway, Corrimal, NSW 2518
ABN 28 111 244 896
TITLE
Bellambi Creek Diversion Pipe Inspection Plan
NAME DATE
DRN RT 20/10/2017
CKD
APP
SCALE Not in Scale @A2
DRAWING NUMBER REV
RVC-ENV-xxx 0

306200 306300 306400 306500 306600

6196000 6195900 6195800

MH3

1800m

Coordinate System: GDA 1994 MGA Zone 56
Projection: Transverse Mercator
Datum: GDA 1994

N

WOLLONGONG COAL

WCL RUSSELL VALE COLLIERY
WOLLONGONG COAL LIMITED
7 Princes Highway, Corrimal, NSW 2518
ABN 28 111 244 896

TITLE		
Bellambi Creek Diversion Pipe Inspection Plan		
	NAME	DATE
DRN	RT	20/10/2017
CKD		
APP		
SCALE	Not in Scale @A2	
DRAWING NUMBER		REV
RVC-ENV-xxx		0

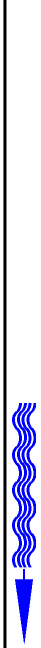
WSA assessment

Date:	Asset owner's job ref.:	Asset Owner:	Operator :	Section number:	Pipe Asset Id:
13/06/2017		**Wollongong Coal**	**A.Thoms**	**1**	**SW001 (Section 3)**
Time of inspection:	Cleaning:	Standard:	LRP	Conduit Unit Length	Method of Inspection
10:56:43	**not cleaned**	**WSA 05-2008 2.2**	**Inside Face of the Wall**		**Television Camera**

Town:		Catchment:		US MH:	**MH B**
Suburb:	**Russell Vale**	Asset Owner:	**Wollongong Coal**	Survey Dir:	**downstream**
Street:	**Wollongong Coal**	Precipitation.:		DS MH:	**MH C**
Asset Location	**Private property, industrial site**	Flow control	**No measures**	Inspect Length :	**119.21 m**

Purpose of inspection :	**Structural Condition Inspection**	Shape :	**Circular**
Use of Conduit:	**Drain**	Dia/Height:	**1800 mm**
Type of Conduit:	**Storm water drain**	Start Depth To Invert:	**1.5**
Pipe Material:	**Concrete pipe**	End Depth To Invert:	**0**

Remarks :



1:945 Position		Code	Observation
MH B			
0.00		STMS	Start node, maintenance shaft, Nodename: MH B
19.74		CNPC	Connection, poor workmanship, connection appears to be open , diameter approx 225mm , General Comments suspect a possible displacement
23.77		SWS	Wall Staining is present on the surface of the conduit, at joint, General Comments Possible infiltration is present, at 4 o'clock
26.45		IR	Infiltration, running, at joint, General Comments Wall staining also present, at 4 o'clock
26.45		DEE	Encrustration/Scale is attached to the wall above the water line, at joint, Obstruction: <5%, General Comments from infiltration , at 4 o'clock
34.20		SRV	Steel reinforcement is visible with little or no corrosion evident , at 12 o'clock
38.06		GC	General Comments Unknown Pit found
70.84		MC	New material, Corregated Iron , General Comments Reduces diameter of pipe
70.84		RXM	Defective repair, major or irregular gaps or both in the pipe wall , General Comments Packer is hanging loose
70.84	**S1**	DM	Deformation, mixed orientation , change in diameter 5-10%, length of deformation 500mm, General Comments Corregated iron causing deformed pipe shape, from 12 to 1
107.30		RXB	Defective repair, bellies in the line , General Comments dropping of corregated iron
119.21		DEW	Other Deposits on the wall, Rusting , Obstruction: <5% , at 1 o'clock
MH C			


19.74 m


23.77 m


26.45 m


26.45 m


34.2 m

STR no def	STR peak	STR mean	STR total	STR grade	SER no def	SER peak	SER mean	SER total	SER grade

Inspection Pictures

Location/Street	Town or suburb:	Date :	Section number:	Sewer Ref.:
Wollongong Coal		**13/06/2017**	**1**	**SW001 (Section 3)**

Photo: SW001 (Section 3)_MH B_MH C_20062017_110637_A.jpg
19.74m, Connection, poor workmanship, connection appears to be open , diameter approx 225mm , General Comments suspect a possible displacement

Photo: SW001 (Section 3)_MH B_MH C_20062017_110739_A.jpg
23.77m, Wall Staining is present on the surface of the conduit, at joint, General Comments Possible infiltration is present, at 4 o'clock

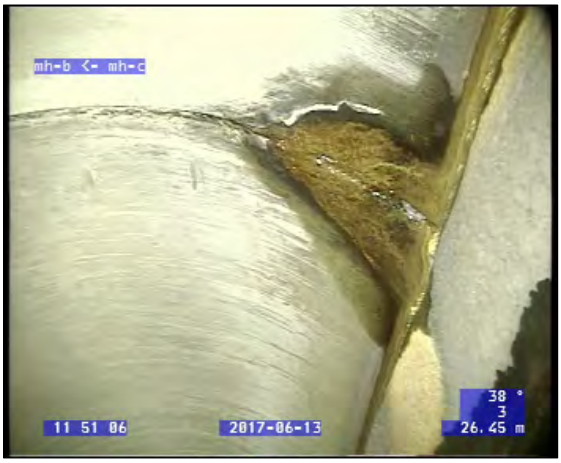


Photo: SW001 (Section 3)_MH B_MH C_20062017_111022_A.jpg
26.45m, Infiltration, running, at joint, General Comments Wall staining also present, at 4 o'clock

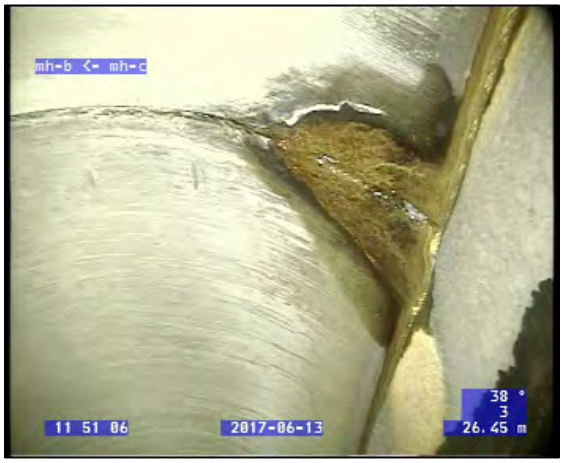


Photo: SW001 (Section 3)_MH B_MH C_20062017_111019_A.jpg
26.45m, Encrustration/Scale is attached to the wall above the water line, at joint, Obstruction: <5%, General Comments from infiltration , at 4 o'clock

Inspection Pictures

Location/Street	Town or suburb:	Date :	Section number:	Sewer Ref.:
Wollongong Coal		**13/06/2017**	**1**	**SW001 (Section 3)**

Photo: SW001 (Section 3)_MH B_MH C_20062017_111118_A.jpg
34.2m, Steel reinforcement is visible with little or no corrosion evident , at 12 o'clock

Photo: SW001 (Section 3)_MH B_MH C_20062017_111243_A.jpg
38.06m, General Comments Unknown Pit found

Photo: SW001 (Section 3)_MH B_MH C_20062017_111620_A.jpg
70.84m, New material, Corregated Iron , General Comments Reduces diameter of pipe

Photo: SW001 (Section 3)_MH B_MH C_20062017_111631_B.jpg
70.84m, New material, Corregated Iron , General Comments Reduces diameter of pipe

Inspection Pictures

Location/Street	Town or suburb:	Date :	Section number:	Sewer Ref.:
Wollongong Coal		**13/06/2017**	**1**	**SW001 (Section 3)**

Photo: SW001 (Section 3)_MH B_MH C_20062017_111827_A.jpg
70.84m, Defective repair, major or irregular gaps or both in the pipe wall , General Comments Packer is hanging loose

Photo: SW001 (Section 3)_MH B_MH C_20062017_112122_A.jpg
107.3m, Defective repair, bellies in the line , General Comments dropping of corregated iron

Photo: SW001 (Section 3)_MH B_MH C_20062017_112234_A.jpg
119.21m, Other Deposits on the wall, Rusting , Obstruction: <5% , at 1 o'clock

WSA assessment

Date:	Asset owner's job ref.:	Asset Owner:	Operator :	Section number:	Pipe Asset Id:
20/06/2017		**Wollongong Coal**	**A.Thoms**	**2**	**SW001 (Section 3A)**
Time of inspection:	Cleaning:	Standard:	LRP	Conduit Unit Length	Method of Inspection
11:25:13	**not cleaned**	**WSA 05-2008 2.2**	**Inside Face of the Wall**		**Television Camera**

Town:		Catchment:		US MH:	**MH B**
Suburb:	**Russell Vale**	Asset Owner:	**Wollongong Coal**	Survey Dir:	**downstream**
Street:	**Wollongong Coal**	Precipitation.:		DS MH:	**MH C**
Asset Location	**Private property, industrial site**	Flow control	**No measures**	Inspect Length :	**130.03 m**

Purpose of inspection :	**Structural Condition Inspection**	Shape :	**Circular**
Use of Conduit:	**Drain**	Dia/Height:	**1800 mm**
Type of Conduit:	**Storm water drain**	Start Depth To Invert:	**1.5**
Pipe Material:	**Concrete pipe**	End Depth To Invert:	**0**

Remarks :

1:1035 Position	Code	Observation	
MH B			
6.26	MC	New material, Corregated Iron	 6.26 m
12.77	RXB	Defective repair, bellies in the line , General Comments Drooping of corregated iron	 12.77 m
19.86	GC	General Comments Multiple joining mechanisms on pipe wall to hold corregated iron in place; rusting present	 19.86 m
116.29	RXZ	Defective repair , other defects: Bulging of pipe wall @ 3 o'clock	 116.29 m
130.03	GC	General Comments Full length of cable reached	
MH C			

STR no def	STR peak	STR mean	STR total	STR grade	SER no def	SER peak	SER mean	SER total	SER grade

Inspection Pictures

Location/Street	Town or suburb:	Date :	Section number:	Sewer Ref.:
Wollongong Coal		**20/06/2017**	**2**	**SW001 (Section 3A)**

Photo: SW001 (Section 3A)_MH B_MH C_20062017_112729_A.jpg
6.26m, New material, Corregated Iron

Photo: SW001 (Section 3A)_MH B_MH C_20062017_112849_A.jpg
12.77m, Defective repair, bellies in the line , General Comments Drooping of corregated iron

Photo: SW001 (Section 3A)_MH B_MH C_20062017_113011_A.jpg
19.86m, General Comments Multiple joining mechanisms on pipe wall to hold corregated iron in place; rusting present

Photo: SW001 (Section 3A)_MH B_MH C_20062017_113837_A.jpg
116.29m, Defective repair , other defects: Bulging of pipe wall @ 3 o'clock

WSA assessment

Date:	Asset owner's job ref.:	Asset Owner:	Operator :	Section number:	Pipe Asset Id:
20/06/2017		**Wollongong Coal**	**A.Thoms**	**3**	**SW001 (Section 3B)**
Time of inspection:	Cleaning:	Standard:	LRP	Conduit Unit Length	Method of Inspection
11:40:25	**not cleaned**	**WSA 05-2008 2.2**	**Inside Face of the Wall**		**Television Camera**

Town:		Catchment:		US MH:	**MH B**
Suburb:	**Russell Vale**	Asset Owner:	**Wollongong Coal**	Survey Dir:	**downstream**
Street:	**Wollongong Coal**	Precipitation.:		DS MH:	**MH C**
Asset Location	**Private property, industrial site**	Flow control	**No measures**	Inspect Length :	**129.67 m**

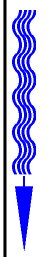
Purpose of inspection :	**Structural Condition Inspection**	Shape :	**Circular**
Use of Conduit:	**Drain**	Dia/Height:	**1800 mm**
Type of Conduit:	**Storm water drain**	Start Depth To Invert:	**1.5**
Pipe Material:	**Concrete pipe**	End Depth To Invert:	**0**

Remarks :

1:918 Position	Code	Observation	
MH B			
9.56	MC	New material, Corregated Iron	
11.92	RXZ	Defective repair , other defects: Bulging of corregated iron in invert	 11.92 m
21.35	RXZ	Defective repair , other defects: Bulging of corregated iron, General Comments on left hand side of pipe wall	 21.35 m
44.67	MC	New material, Reinforced Concrete Pipe , General Comments Returns to original pipe material	
52.60	GC	General Comments Large repair	 52.6 m
53.45	DI	Dropped invert , depth of drop 8mm, General Comments slight dip in invert	
58.03	GC	General Comments Unknown PIt found	
58.03	CLW	Longitudinal wall crack , width 2mm, General Comments on unknown pit wall, at 11 o'clock	 53.45 m
71.65	IYY	Suspected Infiltration , General Comments at pipe joint, from 4 to 6 o'clock	
74.02	IYY	Suspected Infiltration, at joint, General Comments from pipe joint, from 4 to 6 o'clock	
82.00	IYY	Suspected Infiltration, at joint, General Comments at joint, from 4 to 6 o'clock	
88.72	IYY	Suspected Infiltration, at joint , from 2 to 6 o'clock	
101.72	DV	Vertical deformation , change in diameter 5-10%, length of deformation 200mm, General Comments pipe has been squashed, at 10 o'clock	 58.03 m
112.54	IYY	Suspected Infiltration, at joint , from 6 to 9 o'clock	
114.94	IYY	Suspected Infiltration, at joint , from 6 to 9 o'clock	

Inspection Report

Date :	Job number :	Weather :	Operator :	Counter :	Pipe Asset Id :
20/06/2017			**A.Thoms**	**3**	
Present :	Vehicle :	Camera :	Preset :	Cleaned :	Rate :
				not cleaned	



1:918 Position		Code	Observation
117.98	**S1**	CLW	Longitudinal wall crack , width 2mm, General Comments runs through to pipe sections, at 12 o'clock, Start
127.22		DV	Vertical deformation , change in diameter 5-10%, length of deformation 300mm , at 12 o'clock
128.94	**E1**	CLW	Longitudinal wall crack , width 2mm, General Comments runs through to pipe sections, at 12 o'clock, End
129.67		DV	Vertical deformation , change in diameter 5-10%, length of deformation 200mm , at 12 o'clock
129.67		GC	General Comments Full length of cable has been reached again

STR no def	STR peak	STR mean	STR total	STR grade	SER no def	SER peak	SER mean	SER total	SER grade

Inspection Pictures

Location/Street	Town or suburb:	Date :	Section number:	Sewer Ref.:
Wollongong Coal		**20/06/2017**	**3**	**SW001 (Section 3B)**

Photo: SW001 (Section 3B)_MH B_MH C_20062017_120205_A.jpg
11.92m, Defective repair , other defects: Bulging of corregated iron in invert

Photo: SW001 (Section 3B)_MH B_MH C_20062017_120355_A.jpg
21.35m, Defective repair , other defects: Bulging of corregated iron, General Comments on left hand side of pipe wall

Photo: SW001 (Section 3B)_MH B_MH C_20062017_120712_A.jpg
52.6m, General Comments Large repair

Photo: SW001 (Section 3B)_MH B_MH C_20062017_120811_A.jpg
53.45m, Dropped invert , depth of drop 8mm, General Comments slight dip in invert

Inspection Pictures

Location/Street	Town or suburb:	Date :	Section number:	Sewer Ref.:
Wollongong Coal		**20/06/2017**	**3**	**SW001 (Section 3B)**

Photo: SW001 (Section 3B)_MH B_MH C_20062017_120915_A.jpg
58.03m, General Comments Unknown PIt found

Photo: SW001 (Section 3B)_MH B_MH C_20062017_121016_A.jpg
58.03m, Longitudinal wall crack , width 2mm, General Comments on unknown pit wall, at 11 o'clock

Photo: SW001 (Section 3B)_MH B_MH C_20062017_121123_A.jpg
71.65m, Suspected Infiltration , General Comments at pipe joint, from 4 to 6 o'clock

Photo: SW001 (Section 3B)_MH B_MH C_20062017_121153_A.jpg
74.02m, Suspected Infiltration, at joint, General Comments from pipe joint, from 4 to 6 o'clock

Inspection Pictures

Location/Street	Town or suburb:	Date :	Section number:	Sewer Ref.:
Wollongong Coal		**20/06/2017**	**3**	**SW001 (Section 3B)**

Photo: SW001 (Section 3B)_MH B_MH C_20062017_121227_A.jpg
82m, Suspected Infiltration, at joint, General Comments at joint, from 4 to 6 o'clock

Photo: SW001 (Section 3B)_MH B_MH C_20062017_121306_A.jpg
88.72m, Suspected Infiltration, at joint , from 2 to 6 o'clock

Photo: SW001 (Section 3B)_MH B_MH C_20062017_121447_A.jpg
101.72m, Vertical deformation , change in diameter 5-10%, length of deformation 200mm, General Comments pipe has been squashed, at 10 o'clock

Photo: SW001 (Section 3B)_MH B_MH C_20062017_121530_A.jpg
112.54m, Suspected Infiltration, at joint , from 6 to 9 o'clock

Inspection Pictures

Location/Street	Town or suburb:	Date :	Section number:	Sewer Ref.:
Wollongong Coal		**20/06/2017**	**3**	**SW001 (Section 3B)**

Photo: SW001 (Section 3B)_MH B_MH C_20062017_121553_A.jpg
114.94m, Suspected Infiltration, at joint , from 6 to 9 o'clock

Photo: SW001 (Section 3B)_MH B_MH C_20062017_121637_A.jpg
117.98m, Longitudinal wall crack , width 2mm, General Comments runs through to pipe sections, at 12 o'clock, Start

Photo: SW001 (Section 3B)_MH B_MH C_20062017_121722_A.jpg
127.22m, Vertical deformation , change in diameter 5-10%, length of deformation 300mm , at 12 o'clock

Photo: SW001 (Section 3B)_MH B_MH C_20062017_121827_A.jpg
129.67m, Vertical deformation , change in diameter 5-10%, length of deformation 200mm , at 12 o'clock

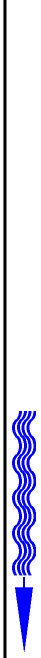
WSA assessment

Date:	Asset owner's job ref.:	Asset Owner:	Operator :	Section number:	Pipe Asset Id:
20/06/2017		**Wollongong Coal**	**A.Thoms**	**4**	**SW001 (Section 3C)**
Time of inspection:	Cleaning:	Standard:	LRP	Conduit Unit Length	Method of Inspection
12:18:48	**not cleaned**	**WSA 05-2008 2.2**	**Inside Face of the Wall**		**Television Camera**

Town:		Catchment:		US MH:	**MH B**
Suburb:	**Russell Vale**	Asset Owner:	**Wollongong Coal**	Survey Dir:	**downstream**
Street:	**Wollongong Coal**	Precipitation.:		DS MH:	**MH C**
Asset Location	**Private property, industrial site**	Flow control	**No measures**	Inspect Length :	**129.50 m**

Purpose of inspection :	**Structural Condition Inspection**	Shape :	**Circular**
Use of Conduit:	**Drain**	Dia/Height:	**1800 mm**
Type of Conduit:	**Storm water drain**	Start Depth To Invert:	**1.5**
Pipe Material:	**Concrete pipe**	End Depth To Invert:	**0**

Remarks :



1:1020 Position		Code	Observation
66.58		GC	General Comments Unknown starting meterage
71.04	**S1**	CLW	Longitudinal wall crack , width 2mm , at 12 o'clock, Start
74.34		DV	Vertical deformation , change in diameter 5-10%, length of deformation 200mm , at 11 o'clock
74.96	**E1**	CLW	Longitudinal wall crack , width 2mm , at 12 o'clock, End
83.61		CLS	Longitudinal surface crack , width 2mm , at 12 o'clock
88.95		DI	Dropped invert , depth of drop 10mm, General Comments dip in pipe invert
105.02		DV	Vertical deformation , change in diameter 5-10%, length of deformation 500mm , at 12 o'clock
128.77		GC	General Comments Unknown Pit found
128.82		LR	The conduit curves to the right, length of curved section 500mm
129.50		FHO	Finish node, outfall or culvert headwall, Nodename: MH C


71.04 m


74.34 m


74.96 m


83.61 m


88.95 m

STR no def	STR peak	STR mean	STR total	STR grade	SER no def	SER peak	SER mean	SER total	SER grade
4	129.50	0.22	27.95	5	0	0	0	0	1

Inspection Pictures

Location/Street	Town or suburb:	Date :	Section number:	Sewer Ref.:
Wollongong Coal		**20/06/2017**	**4**	**SW001 (Section 3C)**

Photo: SW001 (Section 3C)_MH B_MH C_20062017_122312_A.jpg
71.04m, Longitudinal wall crack , width 2mm , at 12 o'clock, Start

Photo: SW001 (Section 3C)_MH B_MH C_20062017_122345_A.jpg
74.34m, Vertical deformation , change in diameter 5-10%, length of deformation 200mm , at 11 o'clock

Photo: SW001 (Section 3C)_MH B_MH C_20062017_122402_A.jpg
74.96m, Longitudinal wall crack , width 2mm , at 12 o'clock, End

Photo: SW001 (Section 3C)_MH B_MH C_20062017_122457_A.jpg
83.61m, Longitudinal surface crack , width 2mm , at 12 o'clock

Inspection Pictures

Location/Street	Town or suburb:	Date :	Section number:	Sewer Ref.:
Wollongong Coal		**20/06/2017**	**4**	**SW001 (Section 3C)**

Photo: SW001 (Section 3C)_MH B_MH C_20062017_122557_A.jpg
88.95m, Dropped invert , depth of drop 10mm, General Comments dip in pipe invert

Photo: SW001 (Section 3C)_MH B_MH C_20062017_122614_B.jpg
88.95m, Dropped invert , depth of drop 10mm, General Comments dip in pipe invert

Photo: SW001 (Section 3C)_MH B_MH C_20062017_122831_A.jpg
105.02m, Vertical deformation , change in diameter 5-10%, length of deformation 500mm , at 12 o'clock

Photo: SW001 (Section 3C)_MH B_MH C_20062017_123342_A.jpg
129.5m, Finish node, outfall or culvert headwall, Nodename: MH C

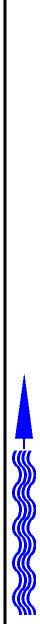
WSA assessment

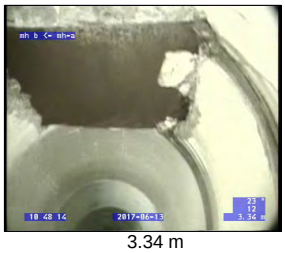
Date:	Asset owner's job ref.:	Asset Owner:	Operator :	Section number:	Pipe Asset Id:
20/06/2017		**Wollongong Coal**	**A.Thoms**	**5**	**SW001 (U/S Part 1)**
Time of inspection:	Cleaning:	Standard:	LRP	Conduit Unit Length	Method of Inspection
12:34:56	**not cleaned**	**WSA 05-2008 2.2**	**Inside Face of the Wall**		**Television Camera**

Town:		Catchment:		US MH:	**MH A**
Suburb:	**Russell Vale**	Asset Owner:	**Wollongong Coal**	Survey Dir:	**upstream**
Street:	**Wollongong Coal**	Precipitation.:		DS MH:	**MH B**
Asset Location	**Private property, industrial site**	Flow control	**No measures**	Inspect Length :	**34.41 m**

Purpose of inspection :	**Structural Condition Inspection**	Shape :	**Circular**
Use of Conduit:	**Drain**	Dia/Height:	**1800 mm**
Type of Conduit:	**Storm water drain**	Start Depth To Invert:	**0**
Pipe Material:	**Concrete pipe**	End Depth To Invert:	**1.5**

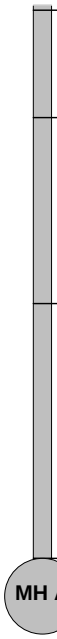
Remarks :



1:180 Position	Code	Observation	
MH B			
3.34	SRV	Steel reinforcement is visible with little or no corrosion evident , from 11 to 1 o'clock	 3.34 m
3.34	SYY	Suspected Surface Damage , Obstruction: 5-20%, General Comments Hole in pipe obvert has been repaired using a steel sheet, from 10 to 2 o'clock	
3.75	SRV	Steel reinforcement is visible with little or no corrosion evident , from 11 to 1 o'clock	 3.34 m
10.44	SRC	Reinforcement is exposed and corroded , General Comments possible repair of pipe hole, from 11 to 1 o'clock	
10.55	DEE	Encrustration/Scale is attached to the wall above the water line , Obstruction: <5%, General Comments Possibly caused by infiltration , at 10 o'clock	 3.75 m
15.83	SRV	Steel reinforcement is visible with little or no corrosion evident , at 12 o'clock	
15.92	SH	Hole in wall, at joint, General Comments with reinforcement exposed, at 12 o'clock	
15.92	CI	Intruding connection, magnitude of intrusion: 5-20%, General Comments protruding into line with reinforcment exposed, at 10 o'clock	 10.44 m
15.92	CI	Intruding connection, magnitude of intrusion: 5-20%, General Comments Protruding into line, at 10 o'clock	
18.85	CI	Intruding connection, magnitude of intrusion: 5-20%, General Comments Protruding into line, at 10 o'clock	
19.23	CI	Intruding connection, magnitude of intrusion: 5-20%, General Comments Protruding into line with reinforcement exposed, at 11 o'clock	
19.23	CI	Intruding connection, magnitude of intrusion: 5-20%, General Comments Protruding into line with reinforcement exposed, at 12 o'clock	 10.55 m
19.23	CI	Intruding connection, magnitude of intrusion: 5-20%, General Comments Protruding into line with reinforcement exposed, at 12 o'clock	
20.90	GC	General Comments Unknown Pit found	
21.24	CXD	Defective Connection - The connecting pipe is damaged, magnitude of obstruction 51-75%, General Comments Collapsed 600mm junction, at 3 o'clock	

Inspection Report

Date :	Job number :	Weather :	Operator :	Counter :	Pipe Asset Id :
20/06/2017			**A.Thoms**	**5**	
Present :	Vehicle :	Camera :	Preset :	Cleaned :	Rate :
				not cleaned	



1:180 Position	Code	Observation
21.36	MC	New material, Corregated Iron
23.92	GC	General Comments Multiple attatchments on pie wall to hold corregated iron in place; rusting present throughout
28.35	IYY	Suspected Infiltration , General Comments through corregated iron, at 2 o'clock
34.41	GC	General Comments Section completed

STR no def	STR peak	STR mean	STR total	STR grade	SER no def	SER peak	SER mean	SER total	SER grade

Inspection Pictures

Location/Street	Town or suburb:	Date :	Section number:	Sewer Ref.:
Wollongong Coal		**20/06/2017**	**5**	**SW001 (U/S Part 1)**

Photo: SW001 (US Part 1)_MH A_MH B_20062017_123939_A.jpg
3.34m, Steel reinforcement is visible with little or no corrosion evident , from 11 to 1 o'clock

Photo: SW001 (US Part 1)_MH A_MH B_20062017_124126_A.jpg
3.34m, Suspected Surface Damage , Obstruction: 5-20%, General Comments Hole in pipe obvert has been repaired using a steel sheet, from 10 to 2 o'clock

Photo: SW001 (US Part 1)_MH A_MH B_20062017_124203_A.jpg
3.75m, Steel reinforcement is visible with little or no corrosion evident , from 11 to 1 o'clock

Photo: SW001 (US Part 1)_MH A_MH B_20062017_124258_A.jpg
10.44m, Reinforcement is exposed and corroded , General Comments possible repair of pipe hole, from 11 to 1 o'clock

Inspection Pictures

Location/Street	Town or suburb:	Date :	Section number:	Sewer Ref.:
Wollongong Coal		**20/06/2017**	**5**	**SW001 (U/S Part 1)**

Photo: SW001 (US Part 1)_MH A_MH B_20062017_124444_A.jpg
10.55m, Encrustration/Scale is attached to the wall above the water line , Obstruction: <5%, General Comments Possibly caused by infiltration , at 10 o'clock

Photo: SW001 (US Part 1)_MH A_MH B_20062017_124517_A.jpg
15.83m, Steel reinforcement is visible with little or no corrosion evident , at 12 o'clock

Photo: SW001 (US Part 1)_MH A_MH B_20062017_124615_A.jpg
15.92m, Hole in wall, at joint, General Comments with reinforcement exposed, at 12 o'clock

Photo: SW001 (US Part 1)_MH A_MH B_20062017_124734_A.jpg
15.92m, Intruding connection, magnitude of intrusion: 5-20%, General Comments protruding into line with reinforcment exposed, at 10 o'clock

Inspection Pictures

Location/Street	Town or suburb:	Date :	Section number:	Sewer Ref.:
Wollongong Coal		**20/06/2017**	**5**	**SW001 (U/S Part 1)**

Photo: SW001 (US Part 1)_MH A_MH B_20062017_124808_A.jpg
15.92m, Intruding connection, magnitude of intrusion: 5-20%, General Comments Protruding into line, at 10 o'clock

Photo: SW001 (US Part 1)_MH A_MH B_20062017_124838_A.jpg
18.85m, Intruding connection, magnitude of intrusion: 5-20%, General Comments Protruding into line, at 10 o'clock

Photo: SW001 (US Part 1)_MH A_MH B_20062017_124943_A.jpg
19.23m, Intruding connection, magnitude of intrusion: 5-20%, General Comments Protruding into line with reinforcement exposed, at 11 o'clock

Photo: SW001 (US Part 1)_MH A_MH B_20062017_125011_A.jpg
19.23m, Intruding connection, magnitude of intrusion: 5-20%, General Comments Protruding into line with reinforcement exposed, at 12 o'clock

Inspection Pictures

Location/Street	Town or suburb:	Date :	Section number:	Sewer Ref.:
Wollongong Coal		**20/06/2017**	**5**	**SW001 (U/S Part 1)**

Photo: SW001 (US Part 1)_MH A_MH B_20062017_125036_A.jpg
19.23m, Intruding connection, magnitude of intrusion: 5-20%, General Comments Protruding into line with reinforcement exposed, at 12 o'clock

Photo: SW001 (US Part 1)_MH A_MH B_20062017_125105_A.jpg
20.9m, General Comments Unknown Pit found

Photo: SW001 (US Part 1)_MH A_MH B_20062017_125115_B.jpg
20.9m, General Comments Unknown Pit found

Photo: SW001 (US Part 1)_MH A_MH B_20062017_125206_A.jpg
21.24m, Defective Connection - The connecting pipe is damaged, magnitude of obstruction 51-75%, General Comments Collapsed 600mm junction, at 3 o'clock

Inspection Pictures

Location/Street	Town or suburb:	Date :	Section number:	Sewer Ref.:
Wollongong Coal		**20/06/2017**	**5**	**SW001 (U/S Part 1)**

Photo: SW001 (US Part 1)_MH A_MH B_20062017_125234_A.jpg
21.36m, New material, Corregated Iron

Photo: SW001 (US Part 1)_MH A_MH B_20062017_125504_A.jpg
28.35m, Suspected Infiltration , General Comments through corregated iron, at 2 o'clock

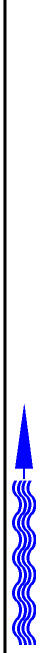
WSA assessment

Date:	Asset owner's job ref.:	Asset Owner:	Operator :	Section number:	Pipe Asset Id:
20/06/2017		**Wollongong Coal**	**A.Thoms**	**6**	**SW001 (U/S Part 2)**
Time of inspection:	Cleaning:	Standard:	LRP	Conduit Unit Length	Method of Inspection
13:15:42	**not cleaned**	**WSA 05-2008 2.2**	**Inside Face of the Wall**		**Television Camera**

Town:		Catchment:		US MH:	**MH A**
Suburb:	**Russell Vale**	Asset Owner:	**Wollongong Coal**	Survey Dir:	**upstream**
Street:	**Wollongong Coal**	Precipitation.:		DS MH:	**MH B**
Asset Location	**Private property, industrial site**	Flow control	**No measures**	Inspect Length :	**132.31 m**

Purpose of inspection :	**Structural Condition Inspection**	Shape :	**Circular**
Use of Conduit:	**Drain**	Dia/Height:	**1800 mm**
Type of Conduit:	**Storm water drain**	Start Depth To Invert:	**0**
Pipe Material:	**Concrete pipe**	End Depth To Invert:	**1.5**

Remarks :



1:1050 Position	Code	Observation
MH B		
12.50	GC	General Comments Starts at 12.5m
14.48	DEE	Encrustration/Scale is attached to the wall above the water line , Obstruction: <5%, General Comments possibly due to infiltration , from 2 to 6 o'clock
18.17	DI	Dropped invert , depth of drop 10mm, General Comments drop in inevrt of pipe- uneven surface
18.23	DEW	Other Deposits on the wall, Jointing Material , Obstruction: <5%, General Comments rusting/staining of joining mechanism, from 12 to 4 o'clock
18.23	DEE	Encrustration/Scale is attached to the wall above the water line , Obstruction: <5%, General Comments rusting/staining/possible infiltration of joining mechanism , fr
20.94	IR	Infiltration, running , General Comments spurting out pipe wal, from 7 to 8 o'clock
20.94	DEE	Encrustration/Scale is attached to the wall above the water line , Obstruction: <5%, General Comments due to infiltration , from 6 to 12 o'clock
129.42	MC	New material, Concrete Pipe , General Comments returns to original pipe material
132.29	CNGO	Connection, good workmanship, connection appears to be open, diameter approx 600mm , at 3 o'clock, General Comments Large wooden object wedged at pipe entrance
MH A		
132.31	GC	General Comments Unknown pit found

14.48 m

18.17 m

18.23 m

18.23 m

20.94 m

STR no def	STR peak	STR mean	STR total	STR grade	SER no def	SER peak	SER mean	SER total	SER grade

Inspection Pictures

Location/Street	Town or suburb:	Date :	Section number:	Sewer Ref.:
Wollongong Coal		**20/06/2017**	**6**	**SW001 (U/S Part 2)**

Photo: SW001 (US Part 2)_MH A_MH B_20062017_132300_A.jpg
14.48m, Encrustration/Scale is attached to the wall above the water line , Obstruction: <5%, General Comments possibly due to infiltration , from 2 to 6 o'clock

Photo: SW001 (US Part 2)_MH A_MH B_20062017_132436_A.jpg
18.17m, Dropped invert , depth of drop 10mm, General Comments drop in inevrt of pipe- uneven surface

Photo: SW001 (US Part 2)_MH A_MH B_20062017_132535_A.jpg
18.23m, Other Deposits on the wall, Jointing Material , Obstruction: <5%, General Comments rusting/staining of joining mechanism, from 12 to 4 o'clock

Photo: SW001 (US Part 2)_MH A_MH B_20062017_132632_A.jpg
18.23m, Encrustration/Scale is attached to the wall above the water line , Obstruction: <5%, General Comments rusting/staining/possible infiltration of joining mechanism , from 7 to 12 o'clock

Inspection Pictures

Location/Street	Town or suburb:	Date :	Section number:	Sewer Ref.:
Wollongong Coal		**20/06/2017**	**6**	**SW001 (U/S Part 2)**

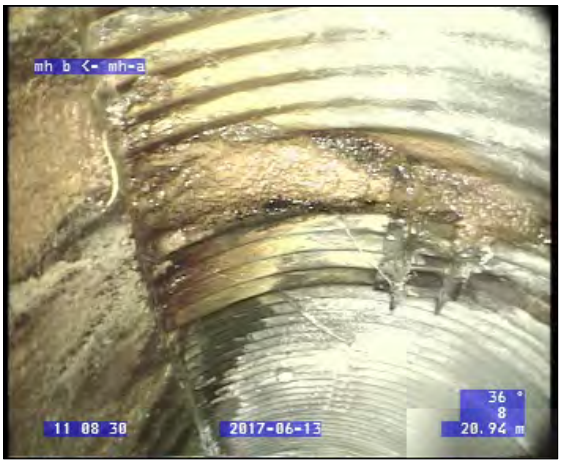


Photo: SW001 (US Part 2)_MH A_MH B_20062017_132806_A.jpg
20.94m, Infiltration, running , General Comments spurting out pipe wal, from 7 to 8 o'clock

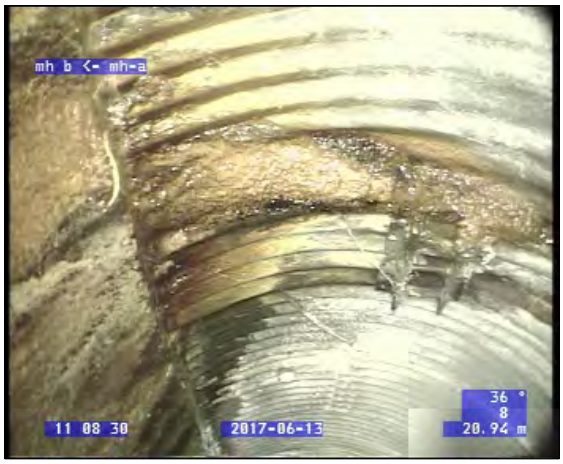


Photo: SW001 (US Part 2)_MH A_MH B_20062017_132803_A.jpg
20.94m, Encrustration/Scale is attached to the wall above the water line , Obstruction: <5%, General Comments due to infiltration , from 6 to 12 o'clock

Photo: SW001 (US Part 2)_MH A_MH B_20062017_133200_A.jpg
129.42m, New material, Concrete Pipe , General Comments returns to original pipe material

Photo: SW001 (US Part 2)_MH A_MH B_20062017_133414_A.jpg
132.29m, Connection, good workmanship, connection appears to be open, diameter approx 600mm , at 3 o'clock, General Comments Large wooden object wedged at pipe entrance

Inspection Pictures

Location/Street	Town or suburb:	Date :	Section number:	Sewer Ref.:
Wollongong Coal		**20/06/2017**	**6**	**SW001 (U/S Part 2)**

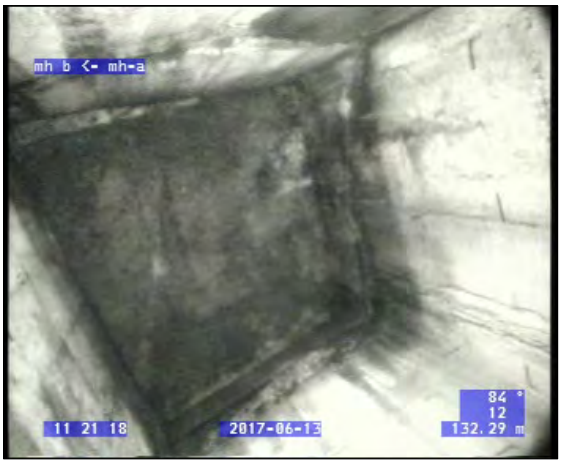


Photo: SW001 (US Part 2)_MH A_MH B_20062017_133306_A.jpg
132.31m, General Comments Unknown pit found

WSA assessment

Date:	Asset owner's job ref.:	Asset Owner:	Operator :	Section number:	Pipe Asset Id:
20/06/2017		**Wollongong Coal**	**A.Thoms**	**7**	**SW001 (U/S Part 3)**
Time of inspection:	Cleaning:	Standard:	LRP	Conduit Unit Length	Method of Inspection
13:36:29	**not cleaned**	**WSA 05-2008 2.2**	**Inside Face of the Wall**		**Television Camera**

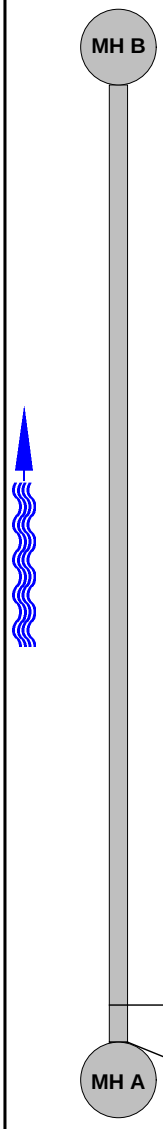
Town:		Catchment:		US MH:	**MH A**
Suburb:	**Russell Vale**	Asset Owner:	**Wollongong Coal**	Survey Dir:	**upstream**
Street:	**Wollongong Coal**	Precipitation.:		DS MH:	**MH B**
Asset Location	**Private property, industrial site**	Flow control	**No measures**	Inspect Length :	**125.29 m**

Purpose of inspection :	**Structural Condition Inspection**	Shape :	**Circular**
Use of Conduit:	**Drain**	Dia/Height:	**1800 mm**
Type of Conduit:	**Storm water drain**	Start Depth To Invert:	**0**
Pipe Material:	**Concrete pipe**	End Depth To Invert:	**1.5**

Remarks :

1:990 **Position** **Code** **Observation**

125.29 m



120.48	GC	General Comments starting at 120.48m
125.29	FHO	Finish node, outfall or culvert headwall, Nodename: , General Comments Unable to completely reach end

STR no def	STR peak	STR mean	STR total	STR grade	SER no def	SER peak	SER mean	SER total	SER grade
0	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**1**

Inspection Pictures

Location/Street	Town or suburb:	Date :	Section number:	Sewer Ref.:
Wollongong Coal		**20/06/2017**	**7**	**SW001 (U/S Part 3)**

Photo: SW001 (US Part 3)_MH A_MH B_20062017_134032_A.jpg
125.29m, Finish node, outfall or culvert headwall, Nodename: , General Comments Unable to completely reach end

APPENDIX B

Detailed pipeline observations, risk profile and proposed remediation

Bellambi Gully Pipeline MHB to MHA

Total Chainage	Listed Chainage	Code	Observation	Consequence rating	Likelihood	Risk category	Remediation	Qty	Unit	Rate	Cost
3.34		SRV	Steel reinforcement is visible with little or no corrosion evident, from 11 to 1 o'clock	4	Moderate Likelihood	High	Re-line pipe (i.e. installing CMP / Polypipe pipe and cement pressure grouting the annulus or installing an insitu reinforced concrete pipe (e.g. Tunneline system). Note the pipe invert appears to have a concrete floor. This may need to be demolished prior to relining.	13	m	$ 15,000	$ 195,000
3.34		SYY	Suspected Surface Damage, Obstruction: 5-20%, General Comments Hole in pipe obvert has been repaired using a steel sheet, from 10 to 2 o'clock	4	Likely	High	Re-line pipe (i.e. installing CMP / Polypipe pipe and cement pressure grouting the annulus or installing an insitu reinforced concrete pipe (e.g. Tunneline system). Note the pipe invert appears to have a concrete floor. This may need to be demolished prior to relining.	0	m	$ 15,000	$ -
3.75		SRV	Steel reinforcement is visible with little or no corrosion evident, from 11 to 1 o'clock	3	Rare	Low	Re-line pipe (i.e. installing CMP / Polypipe pipe and cement pressure grouting the annulus or installing an insitu reinforced concrete pipe (e.g. Tunneline system). Note the pipe invert appears to have a concrete floor. This may need to be demolished prior to relining.	0	m	$ 15,000	$ -
10.44		SRC	Reinforcement is exposed and corroded, General Comments possible repair of pipe hole, from 11 to 1 o'clock	4	Moderate Likelihood	High	Re-line pipe (i.e. installing CMP / Polypipe pipe and cement pressure grouting the annulus or installing an insitu reinforced concrete pipe (e.g. Tunneline system). Note the pipe invert appears to have a concrete floor. This may need to be demolished prior to relining.	0	m	$ 15,000	$ -
10.55		DEE	Encrustation/Scale is attached to the wall above the waterline, Obstruction: <5%, General Comments Possibly caused by infiltration, at 10 o'clock	1	Almost certain	Moderate	Clean pipe.	0	Item	$ 1,000	$ -
15.83		SRV	Steel reinforcement is visible with little or no corrosion evident, at 12 o'clock	4	Moderate Likelihood	High	Re-line pipe (i.e. installing CMP / Polypipe pipe and cement pressure grouting the annulus or installing an insitu reinforced concrete pipe (e.g. Tunneline system). Note the pipe invert appears to have a concrete floor. This may need to be demolished prior to relining.	0	m	$ 15,000	$ -
15.92		SH	Hole in wall, at joint, General Comments with reinforcement exposed, at 12 o'clock	4	Moderate Likelihood	High	Re-line pipe (i.e. installing CMP / Polypipe pipe and cement pressure grouting the annulus or installing an insitu reinforced concrete pipe (e.g. Tunneline system). Note the pipe invert appears to have a concrete floor. This may need to be demolished prior to relining.	0	m	$ 15,000	$ -
15.92		CI	Intruding connection, magnitude of intrusion: 5-20%, General Comments protruding into line with reinforcement exposed, at 10 o'clock	3	Likely	High	Investigate source of connection, only clean water sources to be directed to pipeline. Either epoxy pressure grout annulus between RCP and penetration or remove penetration, and reinstate RCP wall by scrabbling/cleaning the concrete surface, applying a bonding agent (e.g. Epirez 133) and repair with non-shrink cement mortar repair.	1	Item	$ 5,200	$ 5,200
15.92		CI	Intruding connection, magnitude of intrusion: 5-20%, General Comments Protruding into line, at 10 o'clock	3	Likely	High	Investigate source of connection, only clean water sources to be directed to pipeline. Either epoxy pressure grout annulus between RCP and penetration or remove penetration, and reinstate RCP wall by scrabbling/cleaning the concrete surface, applying a bonding agent (e.g. Epirez 133) and repair with non-shrink cement mortar repair.	1	Item	$ 5,200	$ 5,200
18.85		CI	Intruding connection, magnitude of intrusion: 5-20%, General Comments Protruding into line, at 10 o'clock	3	Likely	High	Investigate source of connection, only clean water sources to be directed to pipeline. Either epoxy pressure grout annulus between RCP and penetration or remove penetration, and reinstate RCP wall by scrabbling/cleaning the concrete surface, applying a bonding agent (e.g. Epirez 133) and repair with non-shrink cement mortar repair.	1	Item	$ 5,200	$ 5,200
19.23		CI	Intruding connection, magnitude of intrusion: 5-20%, General Comments Protruding into line with reinforcement exposed, at 11 o'clock	3	Likely	High	Investigate source of connection, only clean water sources to be directed to pipeline. Either epoxy pressure grout annulus between RCP and penetration or remove penetration, and reinstate RCP wall by scrabbling/cleaning the concrete surface, applying a bonding agent (e.g. Epirez 133) and repair with non-shrink cement mortar repair.	1	Item	$ 5,200	$ 5,200
19.23		CI	Intruding connection, magnitude of intrusion: 5-20%, General Comments Protruding into line with reinforcement exposed, at 12 o'clock	3	Likely	High	Investigate source of connection, only clean water sources to be directed to pipeline. Either epoxy pressure grout annulus between RCP and penetration or remove penetration, and reinstate RCP wall by scrabbling/cleaning the concrete surface, applying a bonding agent (e.g. Epirez 133) and repair with non-shrink cement mortar repair.	1	Item	$ 5,200	$ 5,200
19.23		CI	Intruding connection, magnitude of intrusion: 5-20%, General Comments Protruding into line with reinforcement exposed, at 12 o'clock	3	Likely	High	Investigate source of connection, only clean water sources to be directed to pipeline. Either epoxy pressure grout annulus between RCP and penetration or remove penetration, and reinstate RCP wall by scrabbling/cleaning the concrete surface, applying a bonding agent (e.g. Epirez 133) and repair with non-shrink cement mortar repair.	1	Item	$ 5,200	$ 5,200
20.90		GC	General Comments Unknown Pit found	0	N/A	Comment	Confirm if pit is still required. If not, construct reinforced concrete plug, dowelled in to RCP / Manhole.	1	Item	$ 10,500	$ 10,500
21.24		CXD	Defective Connection - The connecting pipe is damaged, magnitude of obstruction 51-75%, General Comments Collapsed 600mm junction, at 3 o'clock	3	Likely	High	Construct reinforced concrete plug, dowelled in to connecting RCP.	1	Item	$ 10,500	$ 10,500
21.36		MC	New material, Corrugated Iron	0	N/A	Comment					
23.92		GC	General Comments Multiple attachments on pipe wall to hold corrugated iron in place; rusting present throughout	0	N/A	Comment					
28.35		IYY	Suspected Infiltration, General Comments through corrugated iron, at 2 o'clock	1	Almost certain	Moderate	Cement pressure grout annulus behind CMP / replace band connection, or seal band / CMP gap with expanding sealant.	1	Item	$ 10,500	$ 10,500
34.41		GC	General Comments Section completed	0	N/A	Comment					
46.91	12.50	GC	General Comments Starts at 12.5m	0	N/A	Comment					
48.89	14.48	DEE	Encrustation/Scale is attached to the wall above the waterline, Obstruction: <5%, General Comments possibly due to infiltration, from 2 to 6 o'clock	1	Likely	Low	Cement pressure grout annulus behind CMP / replace band connection, or seal band / CMP gap with expanding sealant.	1	Item	$ 10,500	$ 10,500
52.58	18.17	DI	Dropped invert, depth of drop 10mm, General Comments drop in invert of pipe- uneven surface	1	Unlikely	Very Low	Is this due to displacement of a pipe joint or erosion of the concrete floor or something else? Requires further inspection to determine appropriate repair.	1	Item	Investigate	
52.64	18.23	DEW	Other Deposits on the wall, Jointing Material, Obstruction:<5%, General Comments rusting/staining of joining mechanism, from 12 to 4 o'clock	1	Likely	Low	Cement pressure grout annulus behind CMP / replace band connection, or seal band / CMP gap with expanding sealant.	1	Item	$ 10,500	$ 10,500
52.64	18.23	DEE	Encrustation/Scale is attached to the wall above the waterline, Obstruction: <5%, General Comments rusting/staining/possible infiltration of joining mechanism, from 7 to 12 o'clock	1	Almost certain	Moderate	Cement pressure grout annulus behind CMP / replace band connection, or seal band / CMP gap with expanding sealant.	1	Item	$ 10,500	$ 10,500
55.35	20.94	IR	Infiltration, running, General Comments spurting out pipe wall, from 7 to 8 o'clock	2	Almost certain	High	Cement pressure grout annulus behind CMP / replace band connection, or seal band / CMP gap with expanding sealant.	1	Item	$ 10,500	$ 10,500
55.35	20.94	DEE	Encrustation/Scale is attached to the wall above the waterline, Obstruction: <5%, General Comments due to infiltration, from 6 to 12 o'clock	1	Almost certain	Moderate	Cement pressure grout annulus behind CMP / replace band connection, or seal band / CMP gap with expanding sealant.	1	Item	$ 10,500	$ 10,500
163.48	129.07	MC	New material, Concrete Pipe, General Comments returns to original pipe material	0	N/A	Comment					
166.70	132.29	CNGO	Connection, good workmanship, connection appears to be open, diameter approx. 600mm, at 3 o'clock, General Comments Large wooden object wedged at pipe entrance	1	Rare	Very Low	Remove blockage	1	Item	$ 4,000	$ 4,000
166.72	132.31	GC	General Comments Unknown pit found	0	N/A	Comment	Confirm if pit is still required. If not, construct reinforced concrete plug, dowelled in to RCP / Manhole.	1	Item	$ 10,500	$ 10,500

Bellambi Gully Pipeline MHB to MHC

Total Chainage	Listed Chainage		Code	Observation	Consequence rating	Likelihood	Risk category	Remediation	Qty	Unit	Rate	Cost
0.00	0.00		STMS	Start node, maintenance shaft, Node name: MH B	0	N/A	Comment					
19.74	19.74		CNPC	Connection, poor workmanship, connection appears to be open, diameter approx. 225mm, General Comments suspect a possible displacement	1	Likely	Low	Penetration appears to have been capped. Potential for seepage around annulus. Either epoxy pressure grout annulus between RCP and penetration or remove penetration, and reinstate RCP wall by scrabbling/cleaning the concrete surface, applying a bonding agent (e.g. Epirez 133) and repair with non-shrink cement mortar repair.	1	Item	$ 10,500	$ 10,500
23.77	23.77		SWS	Wall Staining is present on the surface of the conduit, at joint, General Comments Possible infiltration is present, at 4 o'clock	1	Almost certain	Moderate	Likely a deteriorated pipe joint seal. Either epoxy pressure grout joint (more permanent) or install internal expanding seal to joint (e.g. Trellborg).	1	Item	$ 5,200	$ 5,200
26.45	26.45		IR	Infiltration, running, at joint, General Comments Wall staining also present, at 4 o'clock	1	Almost certain	Moderate	Likely a deteriorated pipe joint seal. Either epoxy pressure grout joint (more permanent) or install internal expanding seal to joint (e.g. Trellborg).	1	Item	$ 5,200	$ 5,200
26.45	26.45		DEE	Encrustation/Scale is attached to the wall above the waterline, at joint, Obstruction: <5%, General Comments from infiltration, at 4 o'clock	1	Unlikely	Very Low	Clean pipewall during repair of pipe joint seal	0	N/A	$ -	$ -
34.20	34.20		SRV	Steel reinforcement is visible with little or no corrosion evident, at 12 o'clock	2	Moderate Likelihood	Low	Non cracking noted. Likely local concrete spalling. Repair by scrabbling/cleaning the concrete surface, applying a bonding agent (e.g. Epirez 133) and repair with non-shrink cement mortar repair.	1	Item	$ 10,500	$ 10,500
38.06	38.06		GC	General Comments Unknown Pit found	0	N/A	Comment	Confirm if pit is still required. If not, construct reinforced concrete plug, dowelled in to RCP / Manhole.	1	Item	$ 10,500	$ 10,500
70.84	70.84		MC	New material, Corrugated Iron, General Comments Reduces diameter of pipe	2	Rare	Very Low	Confirm if the annulus between the CMP and RCP has been cement pressure grouted. If not, cement pressure grout the annulus.	1	Item	$ 10,500	$ 10,500
70.84	70.84		RXM	Defective repair, major or irregular gaps or both in the pipe wall, General Comments Packer is hanging loose	1	Unlikely	Very Low	Cement pressure grout annulus.	1	Item	$ 10,500	$ 10,500
70.84	70.84	S1	DM	Deformation, mixed orientation, change in diameter 5-10%,length of deformation 500mm, General Comments Corrugated iron causing deformed pipe shape, from 12 to 1	1	Unlikely	Very Low	Re-line pipe (i.e. installing CMP / Polypipe pipe and cement pressure grouting the annulus or installing an insitu reinforced concrete pipe (e.g. Tunneline system). Note the pipe invert appears to have a concrete floor. This may need to be demolished prior to relining.	1	m	$ 15,000	$ 15,000
107.30	107.30		RXB	Defective repair, bellies in the line, General Comments dropping of corrugated iron	3	Moderate Likelihood	Moderate	Possible multiple causes. Where safe to do so, cut out bulge and install bolted strengthening plate/ring. Cement pressure grout outside CMP to fill any voids.	1	Item	$ 10,500	$ 10,500
119.21	119.21		DEW	Other Deposits on the wall, Rusting, Obstruction: <5%, at 1 o'clock	2	Moderate Likelihood	Low	Where safe to do so, install bolted strengthening plate/ring. Cement pressure grout outside CMP to fill any voids.	1	Item	$ 10,500	$ 10,500
125.47	6.26		MC	New material, Corrugated Iron	0	N/A	Comment					
131.98	12.77		RXB	Defective repair, bellies in the line, General Comments Drooping of corrugated iron	2	Moderate Likelihood	Low	Where safe to do so, install bolted strengthening plate/ring. Cement pressure grout outside CMP to fill any voids.	1	Item	$ 10,500	$ 10,500
139.07	19.86		GC	General Comments Multiple joining mechanisms on pipe wall to hold corrugated iron in place; rusting present	0	N/A	Comment	Consider re-lining pipe (i.e. installing CMP / Polypipe pipe and cement pressure grouting the annulus or installing an insitu reinforced concrete pipe (e.g. Tunneline system). Note the pipe invert appears to have a concrete floor. This may need to be demolished prior to relining.	0	m	$ 10,500	$ -
235.50	116.29		RXZ	Defective repair, other defects: Bulging of pipe wall @ 3 o'clock	2	Moderate Likelihood	Low	Possible multiple causes. Where safe to do so, cut out bulge and install bolted strengthening plate/ring. Cement pressure grout outside CMP to fill any voids.	1	Item	$ 10,500	$ 10,500
249.24	130.03		GC	General Comments Full length of cable reached	0	N/A	Comment					
258.80	9.56		MC	New material, Corrugated Iron	0	N/A	Comment					
260.16	11.92		RXZ	Defective repair, other defects: Bulging of corrugated iron in invert	3	Moderate Likelihood	Moderate	Possible multiple causes. Where safe to do so, cut out bulge and install bolted strengthening plate/ring. Cement pressure grout outside CMP to fill any voids.	1	Item	$ 10,500	$ 10,500
269.59	21.35		RXZ	Defective repair, other defects: Bulging of corrugated iron, General Comments on left hand side of pipe wall	3	Moderate Likelihood	Moderate	Possible multiple causes. Where safe to do so, cut out bulge and install bolted strengthening plate/ring. Cement pressure grout outside CMP to fill any voids.	1	Item	$ 10,500	$ 10,500
292.91	44.67		MC	New material, Reinforced Concrete Pipe, General Comments Returns to original pipe material	0	N/A	Comment					
300.84	52.60		GC	General Comments Large repair	2	Moderate Likelihood	Low	Non cracking noted. Likely local concrete spalling. Repair by scrabbling/cleaning the concrete surface, applying a bonding agent (e.g. Epirez 133) and repair with non-shrink cement mortar repair.	1	Item	$ 10,500	$ 10,500
301.69	53.45		DI	Dropped invert, depth of drop 8mm, General Comments slight dip in invert	2	Moderate Likelihood	Low	Is this due to displacement of a pipe joint or erosion of the concrete floor or something else? Requires further inspection to determine appropriate repair.	1	Item	Investigate	
306.27	58.03		GC	General Comments Unknown Pit found	0	N/A	Comment	Confirm if pit is still required. If not, construct reinforced concrete plug, dowelled in to RCP / Manhole.	1	Item	$ 10,500	$ 10,500
306.27	58.03		CLW	Longitudinal wall crack, width 2mm, General Comments on unknown pit wall, at 11 o'clock	2	Unlikely	Low	Epoxy pressure grout crack.	1	Item	$ 5,200	$ 5,200
319.89	71.65		IYY	Suspected Infiltration, General Comments at pipe joint, from 4 to 6 o'clock	1	Almost certain	Moderate	Likely a deteriorated pipe joint seal. Either epoxy pressure grout joint (more permanent) or install internal expanding seal to joint (e.g. Trellborg).	1	Item	$ 5,200	$ 5,200
322.26	74.02		IYY	Suspected Infiltration, at joint, General Comments from pipe joint, from 4 to 6 o'clock	1	Almost certain	Moderate	Likely a deteriorated pipe joint seal. Either epoxy pressure grout joint (more permanent) or install internal expanding seal to joint (e.g. Trellborg).	1	Item	$ 5,200	$ 5,200
330.24	82.00		IYY	Suspected Infiltration, at joint, General Comments at joint, from 4 to 6 o'clock	1	Almost certain	Moderate	Likely a deteriorated pipe joint seal. Either epoxy pressure grout joint (more permanent) or install internal expanding seal to joint (e.g. Trellborg).	1	Item	$ 5,200	$ 5,200
336.96	88.72		IYY	Suspected Infiltration, at joint, from 2 to 6 o'clock	1	Almost certain	Moderate	Likely a deteriorated pipe joint seal. Either epoxy pressure grout joint (more permanent) or install internal expanding seal to joint (e.g. Trellborg).	1	Item	$ 5,200	$ 5,200
349.96	101.72		DV	Vertical deformation, change in diameter 5-10%, length of deformation 200mm, General Comments pipe has been squashed, at 10 o'clock	3	Moderate Likelihood	Moderate	Re-line pipe (i.e. installing CMP / Polypipe pipe and cement pressure grouting the annulus or installing an insitu reinforced concrete pipe (e.g. Tunneline system). Note the pipe invert appears to have a concrete floor. This may need to be demolished prior to relining.	1	m	$ 15,000	$ 15,000
360.78	112.54		IYY	Suspected Infiltration, at joint, from 6 to 9 o'clock	1	Almost certain	Moderate	Likely a deteriorated pipe joint seal. Either epoxy pressure grout joint (more permanent) or install internal expanding seal to joint (e.g. Trellborg).	1	Item	$ 5,200	$ 5,200
363.18	114.94		IYY	Suspected Infiltration, at joint, from 6 to 9 o'clock	1	Almost certain	Moderate	Likely a deteriorated pipe joint seal. Either epoxy pressure grout joint (more permanent) or install internal expanding seal to joint (e.g. Trellborg).	1	Item	$ 5,200	$ 5,200
366.22	117.98	S1	CLW	Longitudinal wall crack, width 2mm, General Comments runs through to pipe sections, at 12 o'clock, Start	3	Moderate Likelihood	Moderate	Epoxy pressure grout crack.	1	Item	$ 5,200	$ 5,200
375.56	127.22		DV	Vertical deformation, change in diameter 5-10%, length of deformation 300mm, at 12 o'clock	3	Moderate Likelihood	Moderate	Re-line pipe (i.e. installing CMP / Polypipe pipe and cement pressure grouting the annulus or installing an insitu reinforced concrete pipe (e.g. Tunneline system). Note the pipe invert appears to have a concrete floor. This may need to be demolished prior to relining.	1	m	$ 15,000	$ 15,000
377.28	128.94	E1	CLW	Longitudinal wall crack, width 2mm, General Comments runs through to pipe sections, at 12 o'clock, End	3	Moderate Likelihood	Moderate	Epoxy pressure grout crack.	1	Item	$ 5,200	$ 5,200
378.01	129.67		DV	Vertical deformation, change in diameter 5-10%, length of deformation 200mm, at 12 o'clock	3	Moderate Likelihood	Moderate	Re-line pipe (i.e. installing CMP / Polypipe pipe and cement pressure grouting the annulus or installing an insitu reinforced concrete pipe (e.g. Tunneline system). Note the pipe invert appears to have a concrete floor. This may need to be demolished prior to relining.	1	m	$ 15,000	$ 15,000
378.01	129.67		GC	General Comments Full length of cable has been reached again	0	N/A	Comment					
378.01	66.58		GC	General Comments Unknown starting meterage	0	N/A	Comment					
382.47	71.04	S1	CLW	Longitudinal wall crack, width 2mm, at 12 o'clock, Start	3	Moderate Likelihood	Moderate	Epoxy pressure grout crack.	1	Item	$ 5,200	$ 5,200
385.77	74.34		DV	Vertical deformation, change in diameter 5-10%, length of deformation 200mm, at 11 o'clock	3	Moderate Likelihood	Moderate	Re-line pipe (i.e. installing CMP / Polypipe pipe and cement pressure grouting the annulus or installing an insitu reinforced concrete pipe (e.g. Tunneline system). Note the pipe invert appears to have a concrete floor. This may need to be demolished prior to relining.	1	m	$ 15,000	$ 15,000
386.39	74.96	E1	CLW	Longitudinal wall crack, width 2mm, at 12 o'clock, End	3	Moderate Likelihood	Moderate	Epoxy pressure grout crack.	1	Item	$ 5,200	$ 5,200
395.04	83.61		CLS	Longitudinal surface crack, width 2mm , at 12 o'clock	3	Moderate Likelihood	Moderate	Epoxy pressure grout crack.	1	Item	$ 5,200	$ 5,200
400.28	88.95		DI	Dropped invert, depth of drop 10mm, General Comments dip in pipe invert	2	Moderate Likelihood	Low	Is this due to displacement of a pipe joint or erosion of the concrete floor or something else? Requires further inspection to determine appropriate repair.	1	Item	Investigate	

Total Chainage	Listed Chainage		Code	Observation	Consequence rating	Likelihood	Risk category	Remediation	Qty	Unit	Rate	Cost
416.35	105.02		DV	Vertical deformation, change in diameter 5-10%, length of deformation 500mm, at 12 o'clock	3	Moderate Likelihood	Moderate	Re-line pipe (i.e. installing CMP / Polypipe pipe and cement pressure grouting the annulus or installing an insitu reinforced concrete pipe (e.g. Tunneline system). Note the pipe invert appears to have a concrete floor. This may need to be demolished prior to relining.	1	m	$ 15,000	$ 15,000
440.10	128.77		GC	General Comments Unknown Pit found	0	N/A	Comment	Confirm if pit is still required. If not, construct reinforced concrete plug, dowelled in to RCP / Manhole.	1	Item	$ 10,500	$ 10,500
440.78	128.82		LR	The conduit curves to the right, length of curved section 500mm	0	N/A	Comment					
441.46	129.50		FHO	Finish node, outfall or culvert headwall, Node name: MH C	0	N/A	Comment					