



# BRISBANE CITY COUNCIL

## ***CATHODIC PROTECTION SYSTEM***

### **OPERATIONS MANUAL**

## **PARADISE ROAD TRUNK MAIN EXTENSIONS**

**CONTRACT No. 94519**

WWI Reference Number:  
WWI Document Number:

Q5929  
320608

Prepared by. S.BLACKLER  
Approved by. W.A.R.BURNS



## CONTENTS

1.0	<b>INTRODUCTION</b>
2.0	<b>DESCRIPTION OF STRUCTURES</b>
3.0	<b>DESCRIPTION OF SYSTEM</b> 3.1      Sacrificial Cathodic Protection Unit
4.0	<b>OPERATION OF SYSTEM</b> 4.1      Sacrificial Cathodic Protection System 4.2      Monitoring System 4.3      Measurement of ON & INSTANTANEOUS OFF Potentials 4.4      Digital Synchronous Interrupters
5.0	<b>MAINTENANCE</b> 5.1      Monthly Inspection 5.2      Six Monthly Inspection
6.0	<b>MAINTENANCE PARTS, SERVICE.</b>
<b>APPENDIX</b>	<b>I      Technical Specification</b>
	<b>II      Drawings</b>
	<b>III      Cathodic Protection Commissioning Report</b>



**WILSON WALTON**

## **1.0 INTRODUCTION**

**This manual covers the operation of the cathodic protection systems installed for the corrosion protection of the buried steel pipeline that is installed at Paradise Road.**

**This section of pipeline is an extension of the existing trunk water main in Paradise Road to service the Ridgewood Residential Estate at Parkinson. The extension runs between the Sheep Station Creek and Ridgewood Residential Estate.**



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## 2.0 DESCRIPTION OF STRUCTURE

The pipeline is of mild steel construction and cement lined internally. The overall length of the pipeline is 1826 metres, but it can be divided into two sections due to a change in the pipeline diameter. Section One is 1547 meters in length and 755mm in diameter, Section Two is 279 meters in length and 525mm in diameter.

The externals of the pipeline are coated with a sintered low density polyethylene coating system in order to provide it with primary corrosion protection. The pipeline is a fully welded structure over its entire length. Field welded joints are wrapped in a proprietary commercially available two tape Butyl System. Construction joints and swabbing pits are bridged out with bond cable installations in the pits. Further details are provided on the construction drawings and as per Brisbane City Council standard construction drawings.

The cathodic protection system comprises of two sacrificial (galvanic) anode installations. These installations provide a complementary protection system to the coating system in order to prevent corrosion at areas of coating damage (holidays).

In conjunction with the installation of the cathodic protection system, test points have been installed at several air and scour valves in above ground structures. Corrosion coupons have been installed at both anode bed locations adjacent to the pipeline. Permanent zinc monitoring electrodes have also been installed at these two locations.

Earthing of the pipeline has been achieved by utilising the zinc anode beds as earthing installations at each end of their section of the pipeline.



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### 3.0 DESCRIPTION OF SYSTEM

#### **3.1 Sacrificial Cathodic Protection**

The cathodic protection system installed for the protection of the pipeline is of the sacrificial anode (galvanic) type. This system utilises two separate zinc ground bed installations which have been installed generally as shown on the construction drawings attached.

The anode beds each comprise of four only type WZ25 zincoline zinc alloy anodes. Both groundbeds have been terminated in post mounted stainless steel cabinets. The anodes are installed to protect the pipeline over it's entire buried length. Refer to the 'as constructed' drawings for detail.

The system includes permanent stabilised reference electrodes that are buried adjacent to the pipeline at both of the ground bed sites. These electrodes are installed to monitor the performance of the cathodic protection system. Test points are installed along the length of the pipeline generally as detailed in the specification and as shown on the construction drawings attached.

A corrosion coupon is installed adjacent to the pipeline at both ground bed locations. At these locations the coupon is interconnected to the system to allow the coupon to be cathodically protected in a similar nature to a defect associated with the pipeline coating system (Refer to Drawing Number 00108011).

Central Plastics type E-NEO-DW insulating flange gasket kits have been installed at each extremity of the pipeline, in addition to all air and scour valve installations. At the extremity of this pipeline an IJP 230 type insulating surge diverter has been installed between the underground section relative to this contract and the pipeline downstream of this contract.



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## 4.0 OPERATION OF SYSTEM

**4.1 Sacrificial Anode Cathodic Protection**

As previously described, the cathodic protection system is of the sacrificial anode type. This system utilises the galvanic bonding of dissimilar metals to achieve the production of cathodic protection current. In this case zinc anodes have been connected to the pipeline via stainless steel above ground termination boxes. Anode voltages and output current are measured by disconnecting the bond within the termination boxes.

Whilst these systems are very reliable due to the fact that all connections are bolted connections, monitoring is still important. The system should be monitored on a regular basis. These tests should be conducted by a qualified corrosion technician or engineer at least on a six monthly basis.

**4.2 Monitoring System**

The protection potentials of the buried sections of the pipeline are monitored at each of the locations where the permanent zinc reference electrodes have been installed. The protection potential is a function of the location of the reference electrode, not the point at which electrical contact is made with the structure. Each of the zinc reference cells can be tested in turn by monitoring the DC voltage between each of the permanent reference cell wires located in each of the anode termination installations.

The soils on the pipe route vary in nature. The majority of soils along the route are high resistivity sandy loam. The positioning of the anode bed/s is aimed at allowing an even distribution of the cathodic protection current to the pipeline along its route with minimal interference, if any being caused to the foreign structures.



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## 4.0 OPERATION CONT'D

**Note:** Instant OFF potentials more negative than -1.200 volts (-1200 mV WRT Cu/CuSO<sub>4</sub>) can cause disbonding for certain types of coatings in normal operating conditions. This is of less significance in this installation as the pipeline's coating resistance to coating disbonding is good.

Precautions should be taken to minimise the overall structure potentials wherever possible. The system should, wherever possible, always be adjusted within the limitation specified.

#### 4.3 Measurement of ON & INSTANTANEOUS OFF Potentials

It is well documented and recognised that the "ON" potential readings most often contain a degree of error in the reading due to the current flowing through the soil between the anode bed and the pipeline under protection.

In order to remove this error, (referred to as IR ERROR or IR Component) it is normal practice to switch the cathodic protection system/s off. At the instant that the cathodic protection system/s are switched off, one records the "INSTANT OFF" polarised potential of the structure.

If the technologist conducting the testing does not have access to a data logging type instrument, it is normal practice to record the "INSTANT OFF" potential within one second of the system/s switching off.

It needs to be understood that the potentials that are relevant when conducting a survey of the pipeline are the maximum "ON" potentials and the "INSTANT OFF" potential voltage. The OFF readings will continue to decay once the system is deactivated. Readings made seconds or more after the transformer rectifiers or sacrificial anodes are switched off are of little value as any record of corrosion protection of the pipeline unless the pipeline in question has an extremely poor coating system.



4.0 OPERATION CONT'D

#### 4.4 Digital Synchronous Interrupters

For normal testing of the Paradise Road section of pipeline only, it is necessary to use two interrupters of the synchronously switched type. Such units would be MC Miller Type JR1 or JR1Y units. A copy of the data sheet on these units is attached.



## 5.0 MAINTENANCE

The cathodic protection system should be reliable in operation and require only minimal maintenance. However, we would recommend the following preventative maintenance program to ensure the satisfactory operation of the system.

### **5.1 Monthly Inspection**

- (a) Check and record pipeline potentials against the permanent zinc reference electrode at each of the electrode installation test point facilities.

### **5.2 Six Monthly Inspection**

- (a) Carry out a visual inspection of components installed within the system.
- (b) Check pipeline potentials at the test point nearest the groundbeds and calibrate the permanent zinc reference electrodes at the two groundbed test points with a portable copper/copper sulphate reference electrode before installing the synchronised JR1 Interrupters.
- (c) Monitor the potentials of the pipeline using a portable copper/copper sulphate electrode and a MC MILLER type LC4 variable input resistance corrosion meter or equivalent. If practical, the electrode should be located centrally over the top of the pipeline. Ideally six monthly inspections should be conducted by an independent corrosion consultant, but on a maximum of 12 monthly intervals.
- (d) We suggest that the results of 5.1 and 5.2 above be sent to Wilson Walton International (Qld) Pty Ltd on a monthly basis to permit an appraisal of the system operation and to provide a history of protection maintained on the structures. This will enable recommendations to be made where considered necessary to ensure continued safe operation of the system/s.



## 6.0 MAINTENANCE PARTS, SERVICE

Maintenance parts and service for the complete system are available from the nearest office of Wilson Walton International.

Queensland: 30 Chetwynd Street,  
Loganholme, Brisbane, 4129  
Ph. (07) 801 4077  
Fax (07) 801 1044



## APPENDIX I

### *Technical Specification*

**CONSTRUCTION OF MILD STEEL WELDED PIPELINE  
PARADISE ROAD TRUNK MAIN EXTENSION  
FOR STOCKLAND (CONSTRUCTORS) PTY LIMITED**

**SECTION 9 – SPECIFICATION FOR THE DESIGN, SUPPLY, INSTALLATION,  
COMMISSIONING AND MAINTENANCE OF CATHODIC PROTECTION**

**TABLE OF CONTENTS**

<b>Clause No</b>	<b>Description</b>	
1.0	SCOPE	9-2
2.0	RELEVANT STANDARDS AND CODES	9-2
3.0	TRUNK MAIN REQUIREMENTS FOR C.P. APPLICATION	9-2
4.0	GENERAL MAIN REQUIREMENTS	9-2
5.0	DESCRIPTION OF WORK	9-3
6.0	CONTRACTORS RESPONSIBILITIES	9-3
7.0	EQUIPMENT SPECIFICATIONS	9-4
8.0	TESTS	9-5
9.0	OPERATIONAL MANUALS	9-5
10.0	MAINTENANCE	9-5

## 1.0 SCOPE

This specification covers the design, supply, installation, commissioning and maintenance for the defects liability period, of an impressed current cathodic protection system.

## 2.0 RELEVANT STANDARDS AND CODES

All work shall comply with the regulations and requirements of relevant Authorities and in accordance to the relevant Australian Standards. In particular the installation and equipment shall comply with the following standards.

AS 1020	The control of undesirable static electricity
AS 1768	Lightning protection
AS 2239	Galvanic (Sacrificial) Anodes for Cathodic Protection
AS 2832.1/2/3	Guide to Cathodic Protection of Metals
AS 3000	SAA Wiring Rules
CP1021:1973	Code of Practice for Cathodic Protection (British Standard Institution)

## 3.0 TRUNK MAIN REQUIREMENTS FOR C.P. APPLICATION

To obtain an effective and efficient cathodic protection system, the trunk main must be electrically continuous for length of main requiring protection.

The main must be electrically isolated from all other pipework such as distribution branches and must have in line insulation at the limits of the system.

To reduce current required to protect the structure and reduce the possible resultant interference problems, the main must be isolated from electrical earth. This requires all bare metal in contact with ground, concrete or water, as is likely to occur in valve pits, to be electrically insulated. It is also extremely important that no reinforcing bars in concrete make contact with pipework.

## 4.0 GENERAL MAIN REQUIREMENTS

- 4.1 All air valves and scour valves to have insulating bolts or insulation kits installed as per drawing 2/13.351.
- 4.2 Insulating bolts or insulation kits to be installed at the in-line valves (both flanges of valve).
- 4.3 Full gaskets are to be installed on all flanges. Gasket material shall exhibit suitable insulating properties.
- 4.4 Any bare metal, flanges or deadplates are to be coated with a high build epoxy coating similar to Taubmans Intertuf 954 or an equivalent brand approved by the Superintendent.

- 4.5 External coatings are not to be removed when pipework or fittings are surrounded or covered in concrete (for example, where trunk main passes through valve pit walls or anchor blocks).
- 4.6 No reinforcement is to be welded to or make electrical contact with the pipework.
- 4.7 For cathodic protection test point details refer to drawing no. 2/14.199.
- 4.8 When installing insulating bolts, a thread die should be used to strip excess coating on thread, preventing nut being fouled when installing.
- 4.9 The contractor will electrically test all insulating flanges and supply results to the Superintendent for approval.

## 5.0 DESCRIPTION OF WORK

The impressed current cathodic protection system and associated works are to be installed to protect the new section of mild steel cement lined water trunk main between insulated flanges.

The cathodic protection system designed to achieve a uniform electrode potential of -0.86 to -1.1 volts instantaneous off, along the entire length of main with respect to a Cu/CuSO<sub>4</sub> reference electrode.

The work will be performed to the Council's drawings wheré supplied.

Cathode connections shall be made to each section of trunk main (both new and old sections) as well as at each test point location and shall consist of 1 x 16mm sq. black for the cathode connection, 1 x 6 mm sq. black for the reference return connection.

Above ground Test Point shall be installed at approximately 500 meter intervals and located at convenient accessible locations adjacent to R.P. boundaries.

The anode bed shall be suitably located to minimise any interference problems which may occur, as well as being an effective anode site. The anode cable shall be minimum 16mm sq. pvc/pvc to a test point adjacent to the anode location with poly cable to the anode.

## 6.0 CONTRACTORS RESPONSIBILITIES

The Contractor shall be responsible for the design and satisfactory performance of the C.P. System including workmanship to an acceptable engineering standard, ensuring the system performance and equipment complies with the relevant standards and requirements.

Detail drawings of the proposed Cathodic Protection System shall be prepared by the Contractor and submitted to the Superintendent for his review, and approval at least four (4) weeks prior to commencement of work.

The drawings shall indicate the location of proposed anode bed, power connection, reference electrodes if required, any test points locations in addition to these shown on the drawings and any other necessary details.

All specified surveys and tests shall be performed by the contractor and results to be submitted to the Superintendent for approval.

Permits to install and operates the system shall be obtained from the Queensland Electricity Commission by the contractor and submitted to the Superintendent for his information.

Interference testing and mitigating with all foreign structures, including witnessing of tests where required, shall be conducted by the contractor as required by Q.E.C. regulations.

The contractor shall be responsible for installation and connection to S.E.Q.E.B. supply including S.E.Q.E.B. meter to be installed in rectifier cubicle.

## **7.0 EQUIPMENT SPECIFICATIONS**

### **7.1 Switchboard Cubicle**

For roadside location (footpath)

Cabinet Type – Plinth mounting, lockable with SEQEB lock lockwood 201 series (for meter reading).

### **7.2 Wiring**

Similar to drawing JE02/104.A, including interrupter Sw. Standard 4 pin interrupter socket, voltage and current indicators.

### **7.3 Transformer Rectifier Unit**

Output as required, providing suitable resolution and capacity.

### **7.4 Control Cabinet**

Rectifier unit and SEQEB meter to be housed in cabinet. The cabinet shall also provide sufficient space to allow future telemetry equipment to be mounted on escutcheon. Minimum space: length – 300mm, width – 300mm, height – 200mm.

### **7.5 Anodes**

Type – impressed current anodes

Composition – silicon iron chrome

Life – in excess of 15 years

## 7.6 Test Points Junction Boxes

- Location - above ground type junction box (on post)
- Material - galvanised iron
- Connections - external connections on junction box required.

## 7.7 Reference Electrodes

- Material - stabilised zinc.

## 8.0 TESTS

The following tests will be conducted:

- 8.1 Soil resistivity tests. At min. 500m intervals and at anode location (4 pin soil resistivity tester).
- 8.2 A natural potential survey along the pipeline. (Structure to soil – to Cu/CuSO<sub>4</sub>) at max. 50m intervals.
- 8.3 Determine anode loop resistance for system. (Voltage and current readings for 5 rectifier outputs).
- 8.4 Conduct an 'on/off' potential survey of system. (Ensure all instantaneous off readings range between neg. 860mV and neg. 1100 mv – to Cu/CuSO<sub>4</sub>) at max. 50m intervals.
- 8.5 Conduct interference tests with all foreign structures. (Ensure readings comply with electrical regulations 1989 Clause 97.).
- 8.6 Conduct interference mitigation if required.

## 9.0 OPERATIONAL MANUALS

- Details of system to be included in operational manuals including as constructed drawings both electrical and mechanical, including test and survey results shall be submitted to the Superintendent within four weeks after practical completion.

## 10.0 MAINTENANCE

The Contractor shall be responsible for the system during the maintenance period and shall repair or replace defective parts of workmanship during this six month period after practical completion.

Q5917  
21903  
GK:jb

11 November, 1993.

Fondside Pty Ltd,  
Fax No. 847 3068

**Attention: Mr John Brennan**

Dear Sir,

RE: PARADISE ROAD TRUNK WATER MAIN  
CATHODIC PROTECTION

---

We refer to the above project and submit a revised proposal for the design of the cathodic protection system.

A major consideration of the design is the interference effects expected from the Moonie Pipeline cathodic protection system. Due to the high operating output of their system and the location of the water main between the Moonie anode bed and Moonie Pipeline, a resistance bond between the two pipelines will be required to mitigate against interference, effectively providing the water main with a 'default' impressed current system.

Based on the relatively low design current requirement, a sacrificial cathodic protection system is proposed. Design calculations confirm adequate cathodic protection can be provided by such a system due to the low soil resistivities along the pipeline route. (See Appendix I).

The system will be comprised of two anode bed installations, one at each end of the pipeline consisting of magnesium anodes.

These magnesium anodes are intended as an alternative to provide earthing as per the revised specification requirements. (Refer LTR NGS:ML 15/9/93, Section 7.9). If zinc anodes are required, two magnesium anodes shall be substituted with equivalent zinc anodes. The system design life is in excess of 15 years.

--2--

A resistive crossbond between the Moonie Pipeline and Trunk Main will be installed at approximate Chainage 0m to alleviate the interference of the Moonie Pipeline cathodic protection system on the Water Trunk Main. All necessary equipment and cable terminations will be housed within a test point upstand.

Test point details are shown on the attached drawings (Appendix II).

We trust this proposal meets with your approval. However, in the event you have any queries, please do not hesitate to contact us.

Yours faithfully,  
WILSON WALTON INTERNATIONAL (QLD) PTY LTD

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W. A. R. Burns,  
GENERAL MANAGER.

**APPENDIX 1****DESIGN CALCULATIONS****CURRENT REQUIREMENT:**

Pipeline Length	= 1546
Pipeline Diameter	= 760mm
Pipeline Surface Area	= $3960\text{m}^2$
Current Density	= 0.01 mA / $\text{m}^2$
Total Current Required	= (0.01) (3610) = 37mA

Assume Design Current = 100mA

**CALCULATION OF NUMBER OF ANODES:**

$$I = \frac{Ec - Ep}{Ra}$$

I	=	Design Current
Ec	=	Design Closed Circuit Potential of Anode
Ep	=	Design Protective Potential
Ra	=	Loop Resistance.

$$Ra = \frac{1.5 - 0.85}{0.1} = 6.5\Omega$$

NOTE: Magnesium anodes utilised for design.

$$\text{Circuit Loop Resistance} = R (\text{Anode/Soil}) + R (\text{Pipe/Soil}) + R (\text{Cables})$$

ANODE BED 1

Approximate Chainage	= 5
Soil Resistivity	= 30 Ω.m
Anode Type	= Magnesium Anode
Anode Length	= 1.5m
Anode Diameter (effective)	= 50m
Resistance of One Anode	= 14.26 Ω
Resistance of Four Anodes	= 4.7 Ω (ie < 10 Ω)

ANODE BED 2

Approximate Chainage	= 1540
Soil Resistivity	= 7 Ω.m
Anode Type	= Magnesium Anode
Anode Length	= 1.5m
Anode Diameter (effective)	= 50m
Resistance of One Anode	= 3.33 Ω
Resistance of Four Anodes	= 1.09 Ω (ie < 10 Ω)

R (Anode/soil)	= 0.88 Ω
R (Pipe/soil)	= 5 Ω
R (Cables)	= 0.01 Ω
Circuit Loop Resistance	= 5.89 Ω (< 6.5 Ω)
Expected Current Output	= $\frac{1.5 - 0.85}{5.89} = 110\text{mA}$

Contact Name: Mr. N. Stevens  
Telephone: 225 4392  
Fax: 225 6329  
Your Ref:  
Our Ref: (3)394/38-QA600  
NGS:LNS



Brisbane City Council  
GPO Box 1434  
Brisbane Qld 4001  
Facsimile 229 1168

Brisbane City

30 November 1993

The Manager  
ETS Engineers  
184 Moggill Road  
TARINGA Q 4066

Attention: Mr. D. Polden

Dear Sir,

### Paradise Road Trunk Water Main

I refer to your fax dated 15 November 1993 regarding a revised proposal for cathodic protection from Wilson Walton of the above trunk water main and advise that the proposal is satisfactory.

However, the Council requires the following items to be included to isolate the water main from the Moonie Oil pipeline in the event of a power failure.

- (a) Blocking Diode Circuit 800 P.I.U.
- (b) Current Shunt c/wth external monitoring terminals

Also I wish to confirm that your design of the water main has not been approved by Council and will not be approved until approval of your construction report for the 525mm diameter main is obtained from the Council's Environment Management Branch.

Yours faithfully

(N.G. Stevens)

Supervising Engineer  
Development and Services Section  
Department of Water Supply and Sewerage



## APPENDIX II

### *Construction Drawings*

PARADISE ROAD TRUNK WATER MAIN  
EXTENSION  
FOR

STOCKLAND (CONSTRUCTORS) PTY LIMITED

CONTRACT No. 94519

DRAWING SCHEDULE

SHEET No.	SHEET TITLE	CAD FILE No.
94519 - 01	LOCALITY AND SITE PLANS	94519-01
94519 - 02	PLAN & LONG. SECTION - 755mm Dia. WATER MAIN	94519-02
94519 - 03	CHGE. 00 - 241.214 PLAN AND LONGITUDINAL SECTION	94519-03
94519 - 04	CHGE. 241.214 - 450.683 PLAN AND LONGITUDINAL SECTION	94519-04
94519 - 05	CHGE. 450.683 - 678.670 PLAN & LONGITUDINAL SECTION	94519-05
94519 - 06	CHGE. 678.670 - 894.650 PLAN & LONGITUDINAL SECTION	94519-06
94519 - 07	CHGE. 894.650 - 1140.050 PLAN & LONGITUDINAL SECTION	94519-07
94519 - 08	CHGE. 1140.050 - 1355.880 PLAN & LONGITUDINAL SECTION	94519-08
94519 - 09	CHGE. 1355.880 - 1546.672 PLAN & LONGITUDINAL SECTION	94519-09
94519 - 10	525mm DIA. T.W.M. PLAN & LONGITUDINAL SECTION	94519-10
94519 - 11	SCOUR PIT AND GENERAL DETAILS	94519-11
94519 - 12	AIR VALVE AND MANHOLE PIT DETAILS	94519-12
94519 - 13	ANCHOR BLOCK & MISCELLANEOUS DETAILS	94519-13
94519 - 14	-	
94519 - 15	VALVE PIT DETAILS FOR 450mm dia. VALVE	94519-15
94519 - 16	VALVE PIT DETAILS FOR 600mm dia. VALVE	94519-16

BCC STANDARD DRAWINGS

DRAWING No.	DRAWING TITLE
2/13.314 E	STEEL TRUNK MAINS - DETAILS OF PIPES , SPECIALS , ETC.
2/13.339	MANHOLE FOR USE WITH WELDED DEADPLATE
2/13.351 C	STEEL WATER MAINS - INSULATED BOLT COATING REQUIREMENT
2/13.369 B	VALVE SURFACE BOX FOR DEWATERING PITS (166mm high)
2/13.370 A	ONE SEGMENT C.I. COVER & FRAME FOR W.S. VALVE PIT
2/13.373 A	COVER & FRAME FOR WATER SUPPLY AIR VALVE PIT
2/13.378 B	C.I. RETIC. VALVE COVER & BOX : CIRC. TYPE - LONG (229mm High)
2/13.383 B	AIR VALVE INSTALLATION - GENERAL ARRANGEMENT
2/13.385	STANDARD VALVE PIT COUPLINGS
2/13.387	MILD STEEL PLATES FOR 450mm AIR VALVE BRANCHES
2/14.199 C	MILD STEEL TRUNK WATER MAINS - CATHODIC PROTECTION SYSTEM , TEST POINT DETAILS
WMS 59A	STONEPITCHED INLETS AND OUTLETS
3018/4000 A	STD. MS LADDER,LADDER CAGES,STAIRWAYS,GUARDRAILS AND ASSOCIATED FITTINGS
3018/4013 A	ALUMINIUM ALLOY MANHOLE STEP IRON

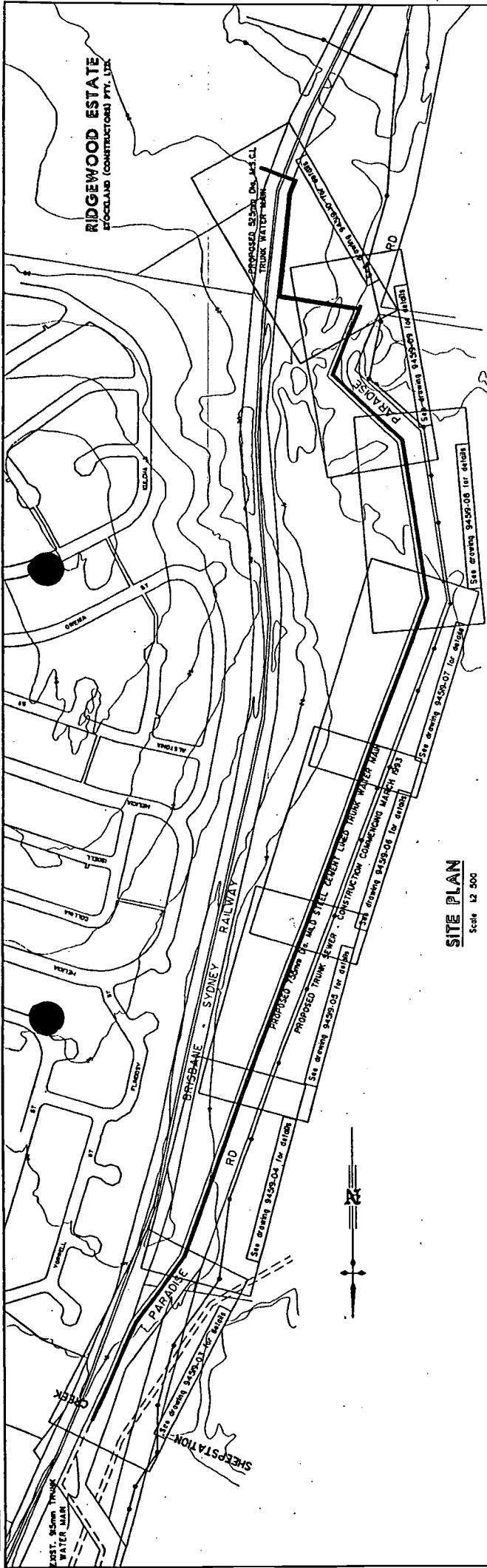
~~As Constructed~~ Dwg 8.

~~Works As Constructed~~

E.T.S. Engineering Consultants Pty. Ltd.

  
E.T.S.  
G R O U P

  
Stockland



REVISIONS		LAST	
REV.	DATE	REV.	DATE

151 after a house construction was undertaken by the authority to carry out the requirements of the Occupied Dwellings Health & Safety Act 1995 and in particular to Part 13 of the Guidance Note on Health & Safety Requirements (Domestic, Residential, Commercial, and Industrial) (Approved Document L).

E.T.S. Engineering

Civil and Structural Engineers  
Development Consultants  
A member of the E.T.G. Group of Consultants

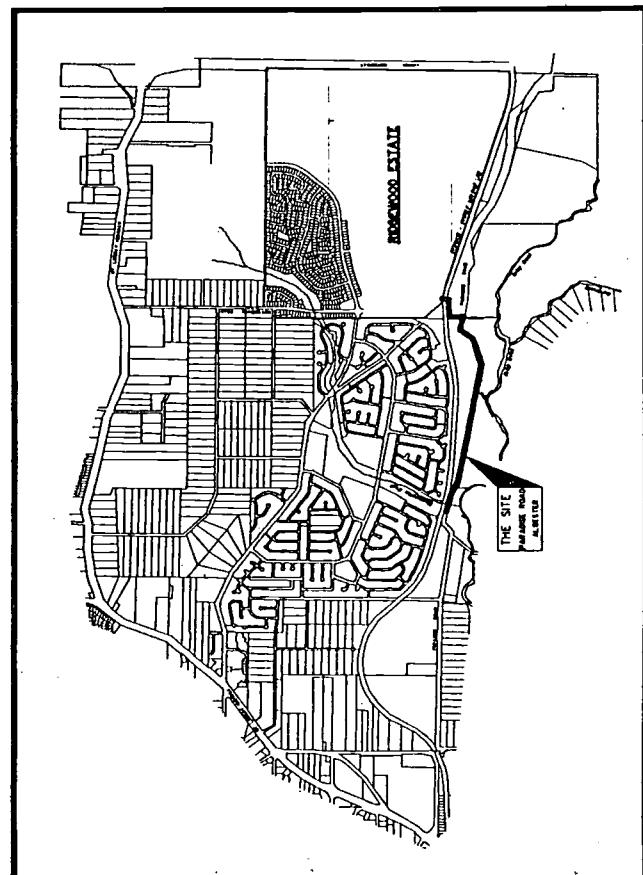
**CLIENT** STOCKLAND (CONSTRUCTORS) PTY LTD  
**PROJECT** 755 mm dia. TRUNK WATER MAIN  
**LOCATION** LOGGIE

**PARADISE ROAD - ALCESTER  
SHEET  
THE  
LOCALITY AND SITE PLANS**

ASSOCIATED CONSULTANT  
PINE WOOD WOODCUTTER PTY LTD

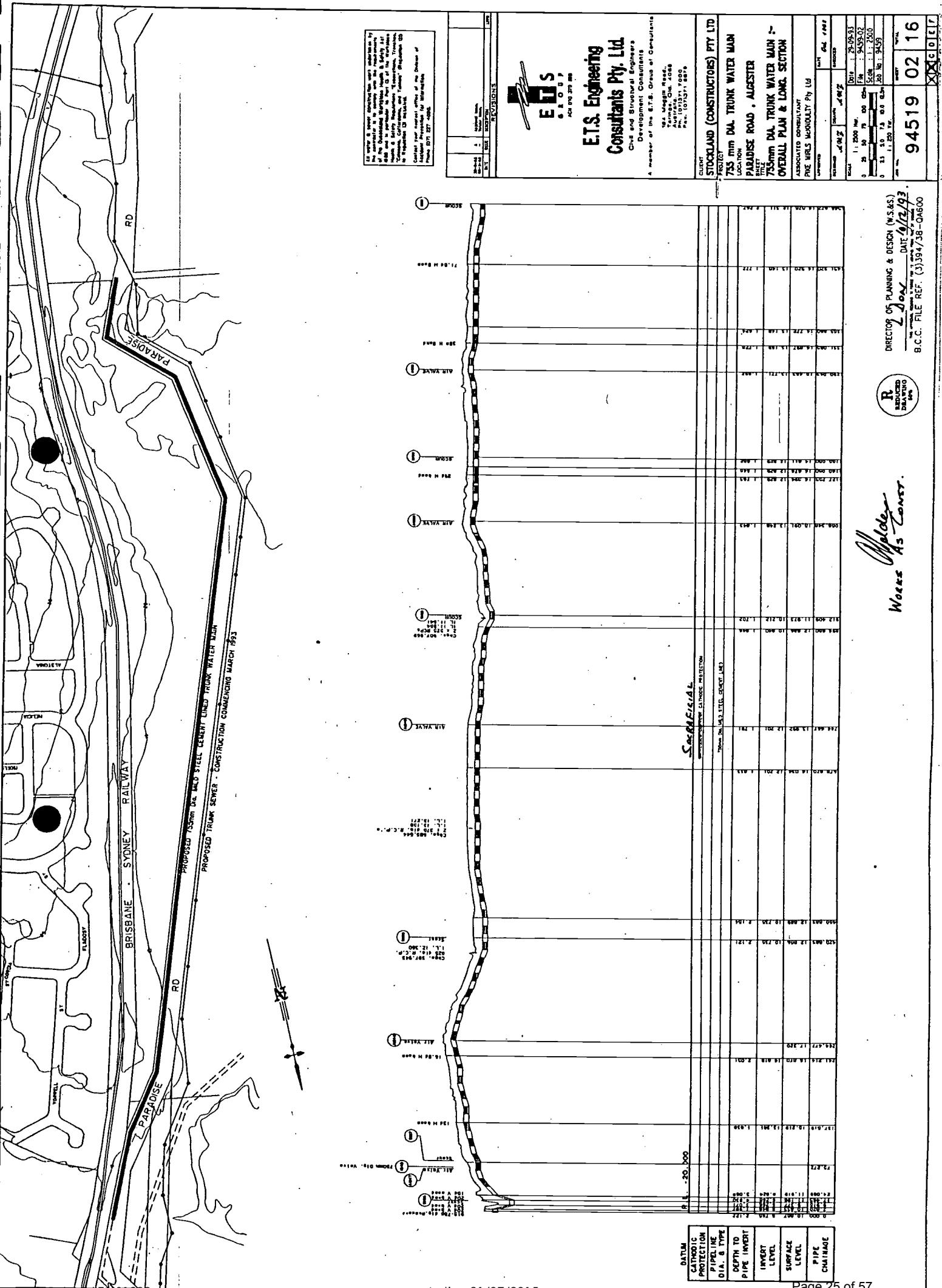
A circular price tag with a black border. Inside, the letter 'R' is at the top left, followed by the words 'REDUCED PRICE' stacked vertically, and '40%' at the bottom right.

DIRECTOR OF PLANNING & DESIGN (M.S.A.S.)  
J. DOW DATE 10/2/91  
B.C.C. FILE REF. (3) 3594-38-QA600



### CONTROL POINTS DATA

CONTROL POINTS DATA					
	STATION No.	EASTING	NORTHING	R.L.	DESCRIPTION
304	2155.400	4500.930	13.220	Iron Pin	
305	2199.237	4495.558	13.155	Iron Pin	
307	1854.930	4480.700	13.200	Neal in Cen.	
318	1976.700	4496.558	14.303	Iron Pin	
319	1864.670	44722.55	17.235	-	
321	1921.530	44765.449	15.200	-	
603	2253.718	45327.150	14.376	Temp. Box	



PIPING  
P1 INSULATED PIPES SHALL BE USED ON ALL  
PLANT AND PROCESS EQUIPMENT EXCEPT  
THERMOCOUPLE LEADS AND VACUUM LINES.  
P2 QUALITY OF PIPING IS NOT RELATED TO ANCHOR BLOCKS  
P3 COTTER COATS CAN NOT BE PLACED  
ON PIPE SUPPORTS AS THEY ARE SUSPENDED ON  
ANCHOR BLOCKS IN CONCRETE.  
P4 NO PLATE GASKETS ARE TO BE USED ON  
PIPE CONNECTIONS WITH THE EXCEPTION  
OF THE E-CONNECTIONS WHICH ARE PLATE  
GASKETED. PLATE GASKETS ARE TO BE USED  
WHERE CHAMFER PROTECTION TEST POINTS ARE  
TO BE INSTALLED.  
P5 ALL COTTER ADDED PIECES TO HAVE A THIN ORANGE  
PAINT FINISH ON PIPES.

**GENERAL**

61 THIS DRAWING SHALL BE READ IN CONJUNCTION WITH OTHER CONTRACT DOCUMENTATION AND DRAWINGS.

62 ALL MATERIALS AND WORKMANSHIP SHALL BE IN ACCORDANCE WITH THE REQUIREMENTS OF THE CONTRACT, S.A., CODES AND BY-LAWS OR CONTRACTOR'S BUILDING AUTHORITY.

63 THE CONTRACTOR SHALL NOTIFY ALL DIRECTORIES ON SITE TWO (2) DAYS PRIOR TO CONSTRUCTION THAT SHE/HE WILL BE CONDUCTING A TEST.

- 84 ANY DISCREPANCY SHALL BE REFERRED TO THE SUPERINTENDENT BEFORE PROCEEDING WITH WORK.
- 85 NO SUBSTITUTE MATERIALS SHALL BE USED WITHOUT THE APPROVAL OF THE SUPERINTENDENT.
- 86 THE CONTRACTOR SHALL MAINTAIN FULLY

ALL WORK SHALL BE CARRIED OUT IN CONFORMITY WITH THE GOVERNMENTAL, WORKPLACE, HEALTH AND SAFETY, AND ENVIRONMENTAL STANDARDS AND REQUIREMENTS OF THE STATE AND FEDERAL GOVERNMENT.

**SAFETY ACT - REGULATIONS AND NOTICES**

Regulation 8 from Part 10 of the Safety Act Regulations, dated 10 January 1997, relating to the carriage of dangerous goods by road in the United Kingdom, has been amended by the addition of new Schedule 1A to the regulations. The new Schedule 1A contains a list of dangerous goods which may be carried in accordance with Part C of the regulations. The new Schedule 1A replaces Schedule 1 of the regulations.

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A small black and white illustration of a spiral spring or coil, positioned to the right of the vertical column of text.

**EFS** THE GULF REGION

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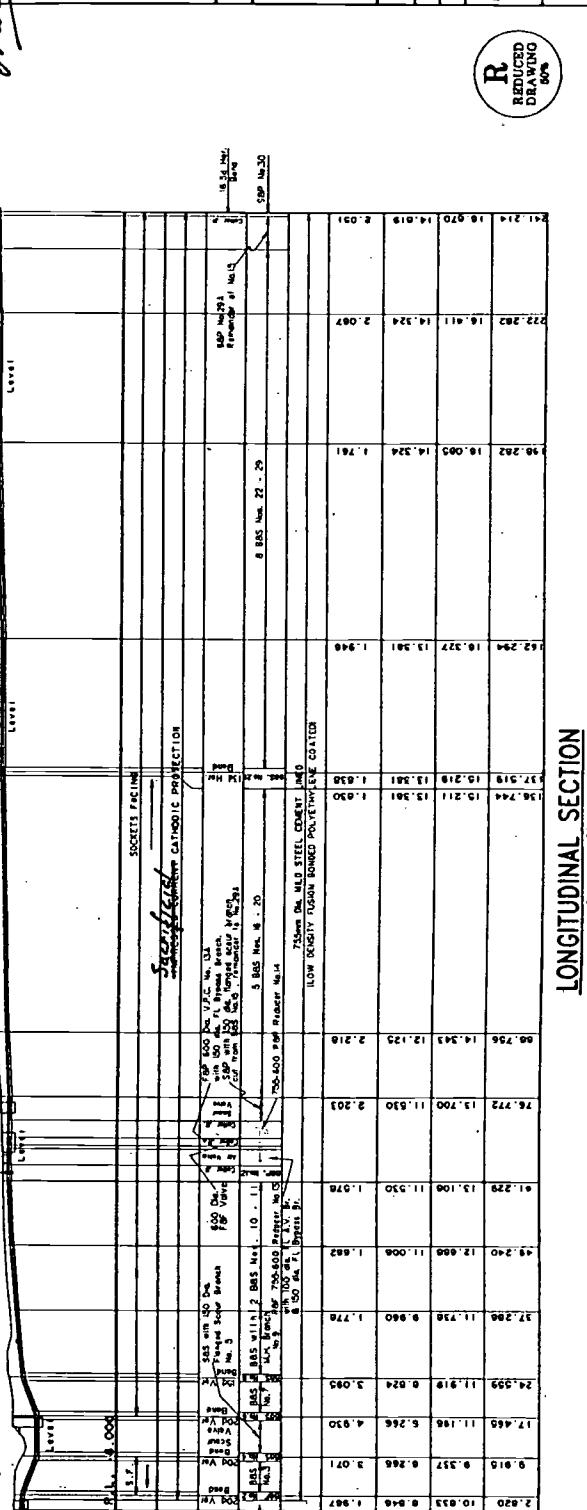
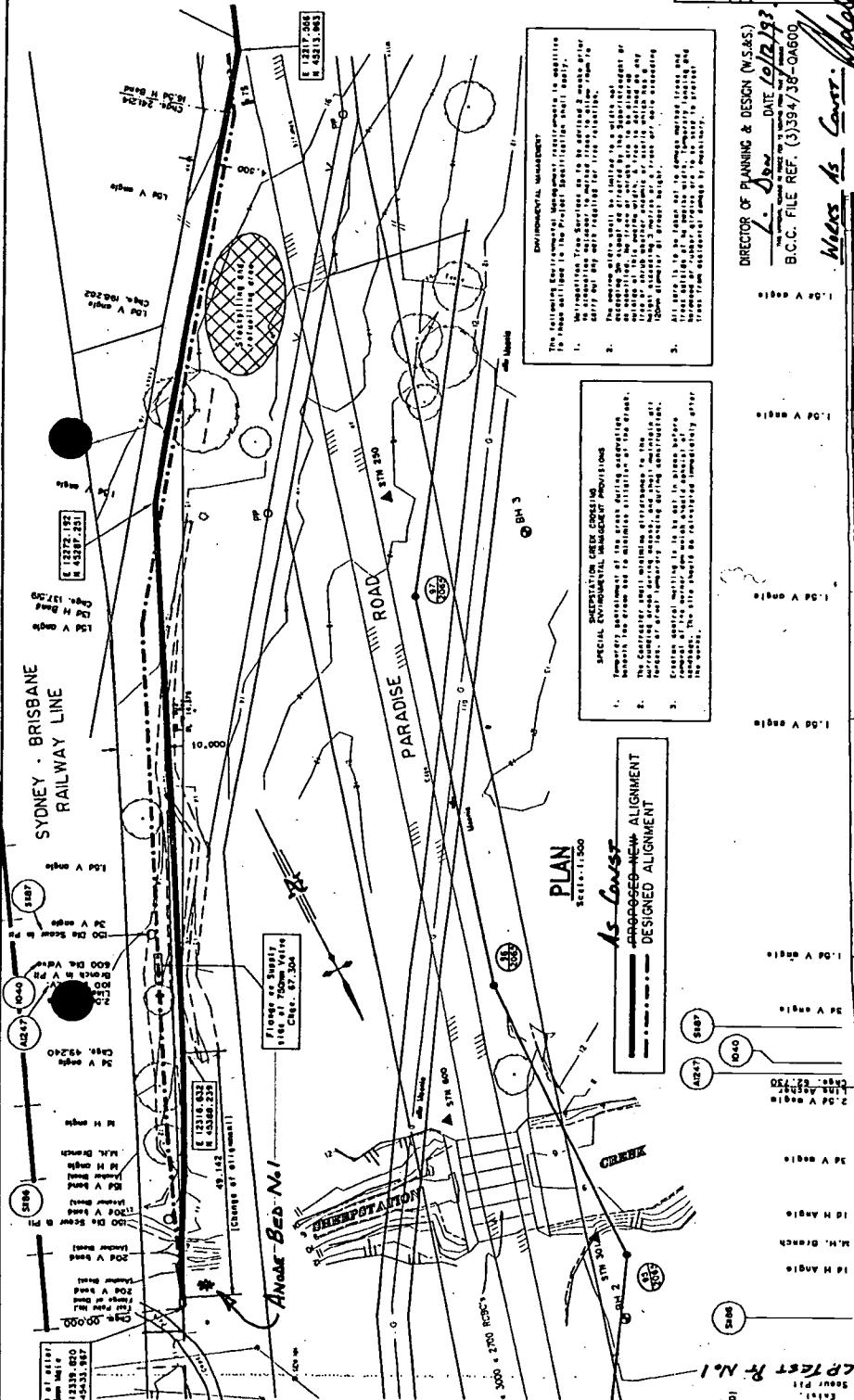
**CLIENT** **STOCKLAND (CONSTRUCTORS) PTY LTD** **PROJECT** **THE TOWER**  
**ADDRESS** **1000 Lonsdale Street, Southbank VIC 3006**

**33 mm dia. TRUNK WATER MAIN**  
**LOCATION: PARADISE ROAD • ALCESTER**  
**SECTION: PLAN & LONGITUDINAL SECTION**

CHG# 00 - 241.214  
ASSOCIATED CONSULTANT  
PRIDE GIRLS WORKOUT PTY LTD  
LAWRENCE

GENERAL INFORMATION										EDUCATION	
GENERAL INFORMATION										EDUCATION	
NAME:										GRADE:	YEAR:
Mr.	John	Smith	1	1	1	1	1	1	1	1	1
Address:	123 Main Street	City:	New York	State:	NY	Zip:	100-00	Country:	USA	Phone:	(555) 123-4567
Employment:	Software Engineer	Employer:	ABC Corporation	Employment Status:	Full-time	Start Date:	2022-01-01	End Date:	Present	Salary:	\$100,000 per year
Spouse:	Jane	Relationship:	Spouse	Employment Status:	Part-time	Start Date:	2022-02-01	End Date:	Present	Salary:	\$50,000 per year
Children:	2	Gender:	Male	Age:	10	Grade:	5th	Age:	8	Grade:	3rd
Education:	High School Diploma	Year:	2015	Score:	90	Subject:	Math	Score:	95	Subject:	Math
Education:	Bachelor's Degree	Year:	2018	Score:	95	Subject:	Computer Science	Score:	98	Subject:	Computer Science
Total Years:	13	Total Score:	93.5	Total Score:	96.5	Total Score:	96.5	Total Score:	97.5	Total Score:	97.5

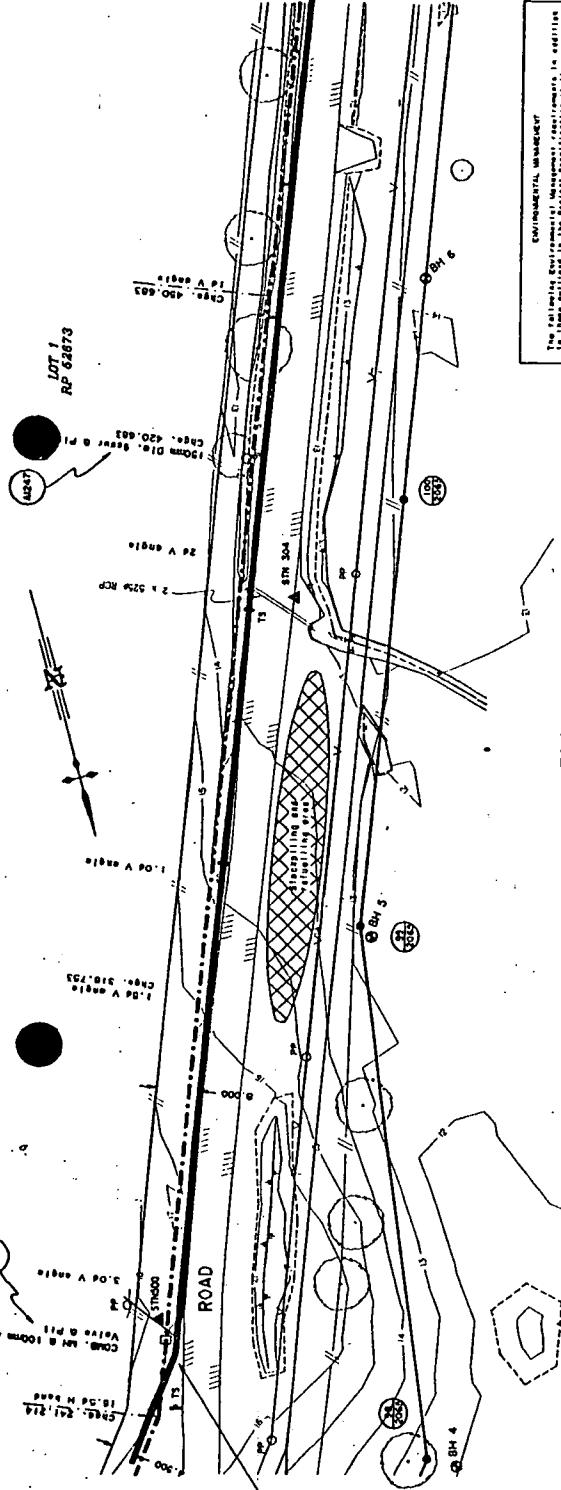
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## LONGITUDINAL SECTION

**NOTES:-**

1. All joints shall be made with all insulated joints to be included in the insulation system. Insulated anchor blocks shall be used.
2. Insulated joints shall be used on all joints.
3. External cathodes are not to be applied to the pipe or pipe supports or concrete structures.
4. It is important to be certain to do the cathodic protection work before the pipe is installed.
5. All insulating joints shall be held in construction until the pipe is fully protected.
6. All insulation and insulating walls shall be removed prior to the application of the cathodic protection system.
7. All insulation and insulating walls shall be removed prior to the application of the cathodic protection system.
8. Any discrepancy shall be referred to the supervisor for resolution with him.
9. No substitute materials shall be used without the supervisor's approval.
10. The contractor shall make himself fully familiar with the cathodic protection system and its operation and shall be responsible for the correct application of the system.
11. All work shall be carried out in accordance with safe working practices.



**LEGEND**

- FENCE LINE
- GASOIL PIPELINE
- ELECTRICITY & POWER POLE (OVERHEAD)
- UTILITY POLE (UNDERGROUND)
- WATER MAIN
- SEWER LINE & MANHOLE
- GAZOLEIN WARNING SIGN
- TRAFFIC SIGN
- SURVEY STATION

**PLAN**  
Scale 1:500

*As Constructed*

PROPOSED NEW ALIGNMENT  
DESIGNED ALIGNMENT

CUTTEST NO. 2

CUTTEST NO. 1

CUTTEST NO. 3

CUTTEST NO. 4

CUTTEST NO. 5

CUTTEST NO. 6

CUTTEST NO. 7

CUTTEST NO. 8

CUTTEST NO. 9

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CUTTEST NO. 35

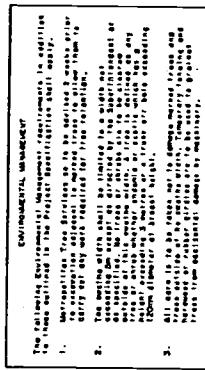
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CUTTEST NO. 37

CUTTEST NO. 38

CUTTEST NO. 39

CUTTEST NO. 40



**PLAN**  
Scale 1:500

*As Constructed*

PROPOSED NEW ALIGNMENT  
DESIGNED ALIGNMENT

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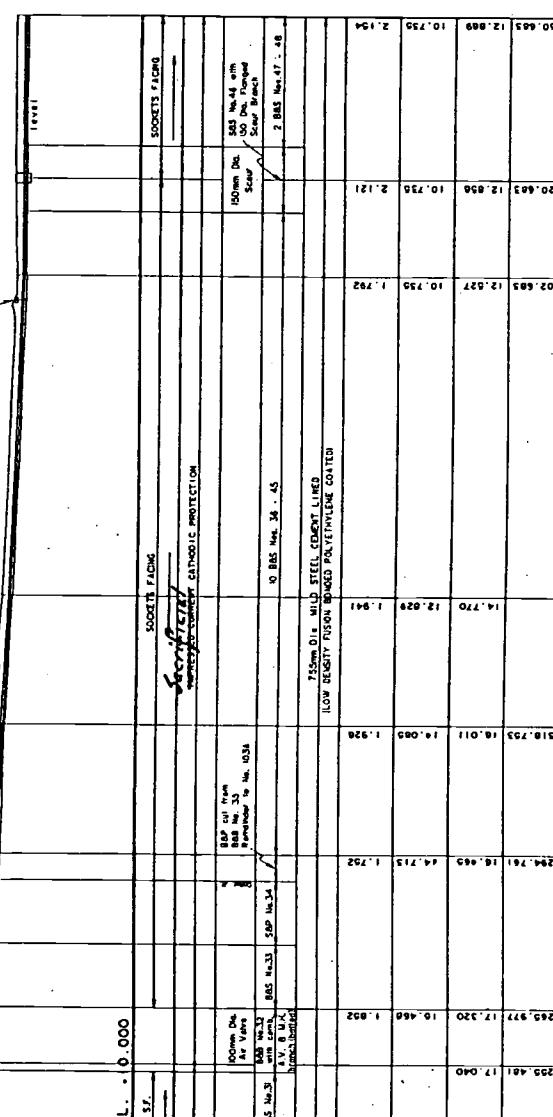
CUTTEST NO. 26

CUTTEST NO. 27

CUTTEST NO. 28

CUTTEST NO. 29

CUTTEST NO. 30



DATE	PIPE DIRECTION	PIPE LINE	CATHODIC PROTECTION	FITTINGS	PIPE NO. & JOINT	PIPELINE dia. & TYPE	DEPTH TO PIPE INVERT	INVERT LEVEL	SURFACE LEVEL	PIPE CHAMFER
14.07.15	S.E.	255mm Dia. Mild Steel Coated Lined Pipe	Low Density Polyethylene Coating	255mm Dia. Mild Steel Coated Lined Pipe	10.750	2.174	1.750	1.750	1.750	1.750
15.07.15	S.E.	255mm Dia. Mild Steel Coated Lined Pipe	Low Density Polyethylene Coating	255mm Dia. Mild Steel Coated Lined Pipe	10.750	2.174	1.750	1.750	1.750	1.750
16.07.15	S.E.	255mm Dia. Mild Steel Coated Lined Pipe	Low Density Polyethylene Coating	255mm Dia. Mild Steel Coated Lined Pipe	10.750	2.174	1.750	1.750	1.750	1.750
17.07.15	S.E.	255mm Dia. Mild Steel Coated Lined Pipe	Low Density Polyethylene Coating	255mm Dia. Mild Steel Coated Lined Pipe	10.750	2.174	1.750	1.750	1.750	1.750
18.07.15	S.E.	255mm Dia. Mild Steel Coated Lined Pipe	Low Density Polyethylene Coating	255mm Dia. Mild Steel Coated Lined Pipe	10.750	2.174	1.750	1.750	1.750	1.750
19.07.15	S.E.	255mm Dia. Mild Steel Coated Lined Pipe	Low Density Polyethylene Coating	255mm Dia. Mild Steel Coated Lined Pipe	10.750	2.174	1.750	1.750	1.750	1.750
20.07.15	S.E.	255mm Dia. Mild Steel Coated Lined Pipe	Low Density Polyethylene Coating	255mm Dia. Mild Steel Coated Lined Pipe	10.750	2.174	1.750	1.750	1.750	1.750
21.07.15	S.E.	255mm Dia. Mild Steel Coated Lined Pipe	Low Density Polyethylene Coating	255mm Dia. Mild Steel Coated Lined Pipe	10.750	2.174	1.750	1.750	1.750	1.750
22.07.15	S.E.	255mm Dia. Mild Steel Coated Lined Pipe	Low Density Polyethylene Coating	255mm Dia. Mild Steel Coated Lined Pipe	10.750	2.174	1.750	1.750	1.750	1.750
23.07.15	S.E.	255mm Dia. Mild Steel Coated Lined Pipe	Low Density Polyethylene Coating	255mm Dia. Mild Steel Coated Lined Pipe	10.750	2.174	1.750	1.750	1.750	1.750
24.07.15	S.E.	255mm Dia. Mild Steel Coated Lined Pipe	Low Density Polyethylene Coating	255mm Dia. Mild Steel Coated Lined Pipe	10.750	2.174	1.750	1.750	1.750	1.750
25.07.15	S.E.	255mm Dia. Mild Steel Coated Lined Pipe	Low Density Polyethylene Coating	255mm Dia. Mild Steel Coated Lined Pipe	10.750	2.174	1.750	1.750	1.750	1.750
26.07.15	S.E.	255mm Dia. Mild Steel Coated Lined Pipe	Low Density Polyethylene Coating	255mm Dia. Mild Steel Coated Lined Pipe	10.750	2.174	1.750	1.750	1.750	1.750
27.07.15	S.E.	255mm Dia. Mild Steel Coated Lined Pipe	Low Density Polyethylene Coating	255mm Dia. Mild Steel Coated Lined Pipe	10.750	2.174	1.750	1.750	1.750	1.750
28.07.15	S.E.	255mm Dia. Mild Steel Coated Lined Pipe	Low Density Polyethylene Coating	255mm Dia. Mild Steel Coated Lined Pipe	10.750	2.174	1.750	1.750	1.750	1.750
29.07.15	S.E.	255mm Dia. Mild Steel Coated Lined Pipe	Low Density Polyethylene Coating	255mm Dia. Mild Steel Coated Lined Pipe	10.750	2.174	1.750	1.750	1.750	1.750
30.07.15	S.E.	255mm Dia. Mild Steel Coated Lined Pipe	Low Density Polyethylene Coating	255mm Dia. Mild Steel Coated Lined Pipe	10.750	2.174	1.750	1.750	1.750	1.750

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24.07.15	S.E.	255mm Dia. Mild Steel Coated Lined Pipe	Low Density Polyethylene Coating	255mm Dia. Mild Steel Coated Lined Pipe	10.750	2.174	1.750	1.750	1.750	1.750
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24.07.15	S.E.	255mm Dia. Mild Steel Coated Lined Pipe	Low Density							





# Cathodic Protection System - Paradise Road - Trunk Main - Extension - OM Manual

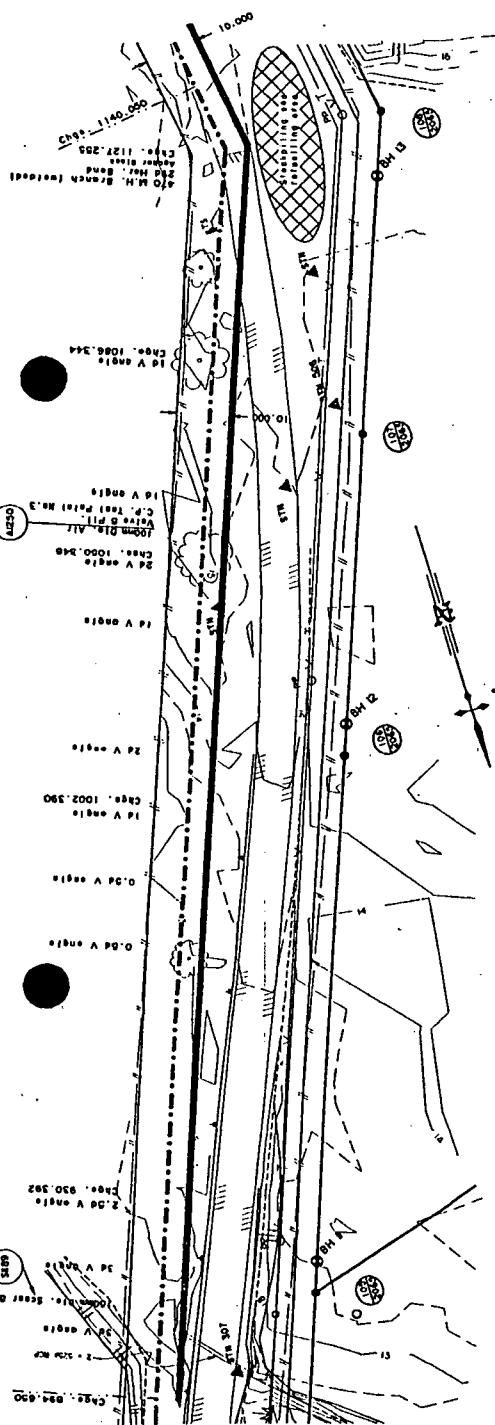
## NOTES:-

- P1 PIPELINE SHALL BE MADE OF IRON OR ALLIUM PLATE AND SHALL BE PROTECTED BY ALL CONNECTIONS, STANCHIONS AND AIR VENTS.  
 P2 UNLESS OTHERWISE AGREED, ANCHOR BLOCKS SHALL BE USED.  
 P3 CATHODIC PROTECTION SYSTEMS, WHETHER THEY ARE INTEGRATED OR SEPARATE, SHALL BE PROVIDED.  
 P4 NO INTERFERENCE, IS TO BE CAUSED TO OR WATER CONTACT WITH THE PIPELINE.  
 P5 THE CONTRACTOR SHALL PROVIDE A TEST PLAN WHICH SHOULDN'T AFFECT THE EXISTING CATHODIC PROTECTION SYSTEMS WHICH WERE INSTALLED. CATHODIC PROTECTION TEST POINTS ARE TO BE INSTALLED.

REMARKS  
 1. THIS DRAWING SHALL BE READ IN CONJUNCTION WITH THE CONTRACT DOCUMENTATION AND THE DRAWINGS THEREIN.  
 2. ALL MATERIALS SHALL BE INSPECTED BY THE CONTRACTOR AND THE RELEVANT BUILDING AUTHORITY. CURRENT S.A.T. CODE AND THE P.T. LAD OF THE RELEVANT BUILDING AUTHORITY.  
 3. THE CONTRACTOR SHALL VERIFY ALL PIPELINE MATERIALS ON SITE PRIOR TO CONSTRUCTION. DRAWINGS SHALL NOT BE SOLD.  
 4. ALL DISCREPANCIES SHALL BE REFERRED TO THE SUPERINTENDENT BEFORE PROCEEDS WITH WORKS.  
 5. NO SUBSTITUTE MATERIALS SHALL BE USED WITHOUT THE APPROVAL OF THE SUPERINTENDENT.

6. THE CONTRACTOR SHALL MAKE HUNDREDS DAILY CONVENTION WITH ALL EXISTING EQUIPMENT AND CONSIDER THE POSSIBLE CONSEQUENCES OF DAMAGE TO THESE EQUIPMENT AND REPAIRS THEREFOR. THE CONTRACTOR SHALL NOT BE HELD RESPONSIBLE FOR ANY DAMAGE TO THESE EQUIPMENT DURING THE COURSE OF THE CONTRACT.

67. ALL WORKS SHALL BE CARRIED OUT IN COMPLIANCE WITH THE OCCUPATIONAL WORKPLACE HEALTH AND SAFETY ACT - REGULATIONS AND APPENDIXES.



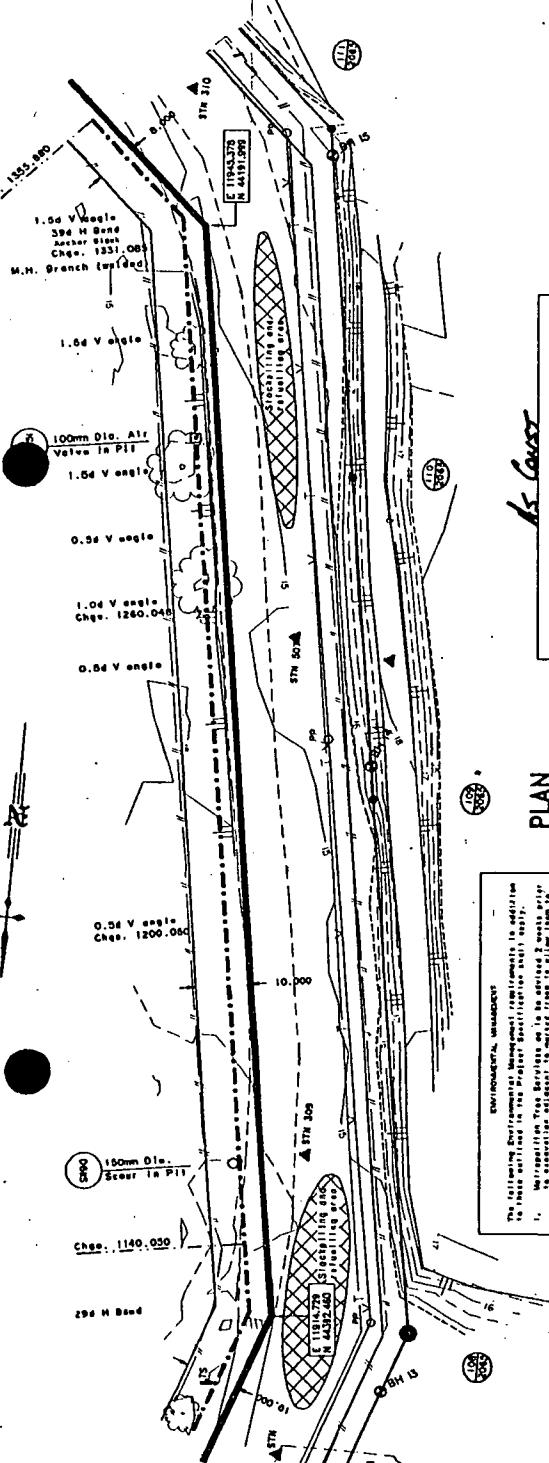
## PLAN

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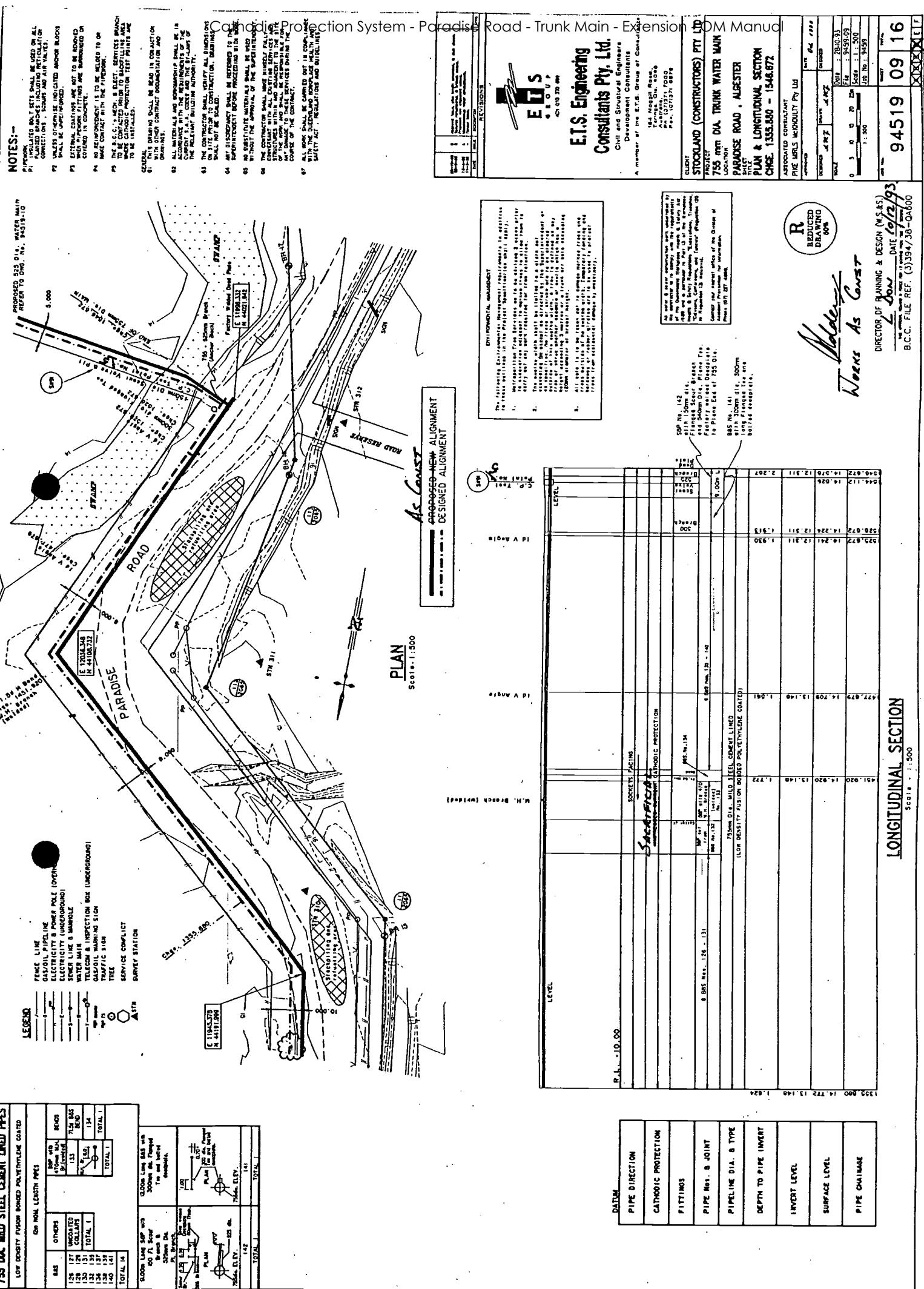
LEGEND  
 1. FENCE LINE  
 2. GAS PIPELINE & POWER POLE (OVERHEAD)  
 3. ELECTRICITY (UNDERGROUND)  
 4. GAS PIPELINE  
 5. SEWER LINE & MANHOLE  
 6. WATER MAIN  
 7. TELECOM INSPECTION BOX (UNDERGROUND)  
 8. TRAFFIC SIGN  
 9. SURVEY STATION  
 10. OTHERS  
 11. CALCULATED CALL OUT  
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**NOTES:-**

- P1 Isolated box sets shall be used on all cables, pipes and valves.
- P2 Unless otherwise indicated anchor blocks shall be cast iron.
- P3 External coatings are not to be removed on cables, pipes, fittings and valves.
- P4 Coatings must be applied in a continuous coating.
- P5 Any discrepancy is to be referred to the Project Manager.
- P6 The E.C.C. which is a Client Services Branch of the Queensland Government, shall be responsible for the design and supply of all services required to be installed.
- P7 External coatings shall be read in conjunction with Q14.2 Contract Declaration and with Q14.3.
- P8 All materials and workmanship shall be to the satisfaction of the Project Manager.
- P9 The Client's Building Authority.
- P10 On site major construction work shall not be scaled.
- P11 Any discrepancy shall be referred to the Project Manager.
- P12 No substitute materials shall be used without the approval of the Project Manager.
- P13 On the contract shall make available, convenient with all existing services and structures within and adjacent to the site new plans to meet such site changes during the course of the contract.
- P14 All work shall be carried out in compliance with the Queensland Workplace Health and Safety Act - Regulations and Guidelines.

**750 MM. WLD STEEL CEMENT LINED PIPES**

LOW DENSITY FUSION BONDED POLYETHYLENE COATED					
PIPE NO.	LENGTH	DIA.	WALL THICKNESS	SDR	BLADES
SDS 100	100	119	12.2	121	121
SDS 110	100	133	13.0	132	132
SDS 120	100	148	13.8	131	131
SDS 130	100	163	14.6	120	122
SDS 140	100	178	15.4	117	120
SDS 150	100	193	16.2	112	119
SDS 160	100	208	17.0	108	124
SDS 170	100	223	17.8	103	131
SDS 180	100	238	18.6	98	137
SDS 190	100	253	19.4	93	144
SDS 200	100	268	20.2	88	151
SDS 210	100	283	21.0	83	158
SDS 220	100	298	21.8	78	165
SDS 230	100	313	22.6	73	172
SDS 240	100	328	23.4	68	179
SDS 250	100	343	24.2	63	186
SDS 260	100	358	25.0	58	193
SDS 270	100	373	25.8	53	200
SDS 280	100	388	26.6	48	207
SDS 290	100	403	27.4	43	214
SDS 300	100	418	28.2	38	221
SDS 310	100	433	29.0	33	228
SDS 320	100	448	29.8	28	235
SDS 330	100	463	30.6	23	242
SDS 340	100	478	31.4	18	249
SDS 350	100	493	32.2	13	256
SDS 360	100	508	33.0	8	263
SDS 370	100	523	33.8	3	270
SDS 380	100	538	34.6	-	277
SDS 390	100	553	35.4	-	284
SDS 400	100	568	36.2	-	291
SDS 410	100	583	37.0	-	298
SDS 420	100	598	37.8	-	305
SDS 430	100	613	38.6	-	312
SDS 440	100	628	39.4	-	319
SDS 450	100	643	40.2	-	326
SDS 460	100	658	41.0	-	333
SDS 470	100	673	41.8	-	340
SDS 480	100	688	42.6	-	347
SDS 490	100	703	43.4	-	354
SDS 500	100	718	44.2	-	361
SDS 510	100	733	45.0	-	368
SDS 520	100	748	45.8	-	375
SDS 530	100	763	46.6	-	382
SDS 540	100	778	47.4	-	389
SDS 550	100	793	48.2	-	396
SDS 560	100	808	49.0	-	403
SDS 570	100	823	49.8	-	410
SDS 580	100	838	50.6	-	417
SDS 590	100	853	51.4	-	424
SDS 600	100	868	52.2	-	431
SDS 610	100	883	53.0	-	438
SDS 620	100	898	53.8	-	445
SDS 630	100	913	54.6	-	452
SDS 640	100	928	55.4	-	459
SDS 650	100	943	56.2	-	466
SDS 660	100	958	57.0	-	473
SDS 670	100	973	57.8	-	480
SDS 680	100	988	58.6	-	487
SDS 690	100	1003	59.4	-	494
SDS 700	100	1018	60.2	-	501
SDS 710	100	1033	61.0	-	508
SDS 720	100	1048	61.8	-	515
SDS 730	100	1063	62.6	-	522
SDS 740	100	1078	63.4	-	529
SDS 750	100	1093	64.2	-	536
SDS 760	100	1108	65.0	-	543
SDS 770	100	1123	65.8	-	550
SDS 780	100	1138	66.6	-	557
SDS 790	100	1153	67.4	-	564
SDS 800	100	1168	68.2	-	571
SDS 810	100	1183	69.0	-	578
SDS 820	100	1198	69.8	-	585
SDS 830	100	1213	70.6	-	592
SDS 840	100	1228	71.4	-	599
SDS 850	100	1243	72.2	-	606
SDS 860	100	1258	73.0	-	613
SDS 870	100	1273	73.8	-	620
SDS 880	100	1288	74.6	-	627
SDS 890	100	1303	75.4	-	634
SDS 900	100	1318	76.2	-	641
SDS 910	100	1333	77.0	-	648
SDS 920	100	1348	77.8	-	655
SDS 930	100	1363	78.6	-	662
SDS 940	100	1378	79.4	-	669
SDS 950	100	1393	80.2	-	676
SDS 960	100	1408	81.0	-	683
SDS 970	100	1423	81.8	-	690
SDS 980	100	1438	82.6	-	697
SDS 990	100	1453	83.4	-	704
SDS 1000	100	1468	84.2	-	711
SDS 1010	100	1483	85.0	-	718
SDS 1020	100	1498	85.8	-	725
SDS 1030	100	1513	86.6	-	732
SDS 1040	100	1528	87.4	-	739
SDS 1050	100	1543	88.2	-	746
SDS 1060	100	1558	89.0	-	753
SDS 1070	100	1573	89.8	-	760
SDS 1080	100	1588	90.6	-	767
SDS 1090	100	1603	91.4	-	774
SDS 1100	100	1618	92.2	-	781
SDS 1110	100	1633	93.0	-	788
SDS 1120	100	1648	93.8	-	795
SDS 1130	100	1663	94.6	-	802
SDS 1140	100	1678	95.4	-	809
SDS 1150	100	1693	96.2	-	816
SDS 1160	100	1708	97.0	-	823
SDS 1170	100	1723	97.8	-	830
SDS 1180	100	1738	98.6	-	837
SDS 1190	100	1753	99.4	-	844
SDS 1200	100	1768	100.2	-	851
SDS 1210	100	1783	101.0	-	858
SDS 1220	100	1798	101.8	-	865
SDS 1230	100	1813	102.6	-	872
SDS 1240	100	1828	103.4	-	879
SDS 1250	100	1843	104.2	-	886
SDS 1260	100	1858	105.0	-	893
SDS 1270	100	1873	105.8	-	900
SDS 1280	100	1888	106.6	-	907
SDS 1290	100	1903	107.4	-	914
SDS 1300	100	1918	108.2	-	921
SDS 1310	100	1933	109.0	-	928
SDS 1320	100	1948	109.8	-	935
SDS 1330	100	1963	110.6	-	942
SDS 1340	100	1978	111.4	-	949
SDS 1350	100	1993	112.2	-	956
SDS 1360	100	2008	113.0	-	963
SDS 1370	100	2023	113.8	-	970
SDS 1380	100	2038	114.6	-	977
SDS 1390	100	2053	115.4	-	984
SDS 1400	100	2068	116.2	-	991
SDS 1410	100	2083	117.0	-	998
SDS 1420	100	2098	117.8	-	1005
SDS 1430	100	2113	118.6	-	1012
SDS 1440	100	2128	119.4	-	1019
SDS 1450	100	2143	120.2	-	1026
SDS 1460	100	2158	121.0	-	1033
SDS 1470	100	2173	121.8	-	1040
SDS 1480	100	2188	122.6	-	1047
SDS 1490	100	2203	123.4	-	1054
SDS 1500	100	2218	124.2	-	1061
SDS 1510	100	2233	125.0	-	1068
SDS 1520	100	2248	125.8	-	1075
SDS 1530	100	2263	126.6	-	1082
SDS 1540	100	2278	127.4	-	1089
SDS 1550	100	2293	128.2	-	1096
SDS 1560	100	2308	129.0	-	1103
SDS 1570	100	2323	129.8	-	1110
SDS 1580	100	2338	130.6	-	1117
SDS 1590	100	2353	131.4	-	1124
SDS 1600	100	2368	132.2	-	1131
SDS 1610	100	2383	133.0	-	1138
SDS 1620	100	2398	133.8	-	1145
SDS 1630	100	2413	134.6	-	1152
SDS 1640	100	2428	135.4	-	1159
SDS 1650	100	2443	136.2	-	1166
SDS 1660	100	2458	137.0	-	1173
SDS 1670	100	2473	137.8	-	1180
SDS 1680	100	2488	138.6	-	1187
SDS 1690	100	2503	139.4	-	1194
SDS 1700	100	2518	140.2	-	1201
SDS 1710	100	2533	141.0	-	1208
SDS 1720	100	2548	141.8	-	1215
SDS 1730	100	2563	142.6	-	1222
SDS 1740	100	2578	143.4	-	1229
SDS 1750	100	2593	144.2	-	1236
SDS 1760	100	2608	145.0	-	1243
SDS 1770	100	2623	145.8	-	1250
SDS 1780	100	2638	146.6	-	1257
SDS 1790	100	2653	147.4	-	1264
SDS 1800	100	2668	148.2	-	1271
SDS 1810	100	2683	149.0	-	1278
SDS 1820	100	2698	149.8	-	1285
SDS 1830	100	2713	150.6	-	1292
SDS 1840	100	2728	151.4	-	1299
SDS 1850	100	2743	152.2	-	1306
SDS 1860	100	2758	153.0	-	1313
SDS 1870	100	2773	153.8	-	1320
SDS 1880	100	2788	154.6	-	1327
SDS 1890	100	2803	155.4	-	1334
SDS 1900	100	2818	156.2	-	1341
SDS 1910	100	2833	157.0	-	1348
SDS 1920	10				



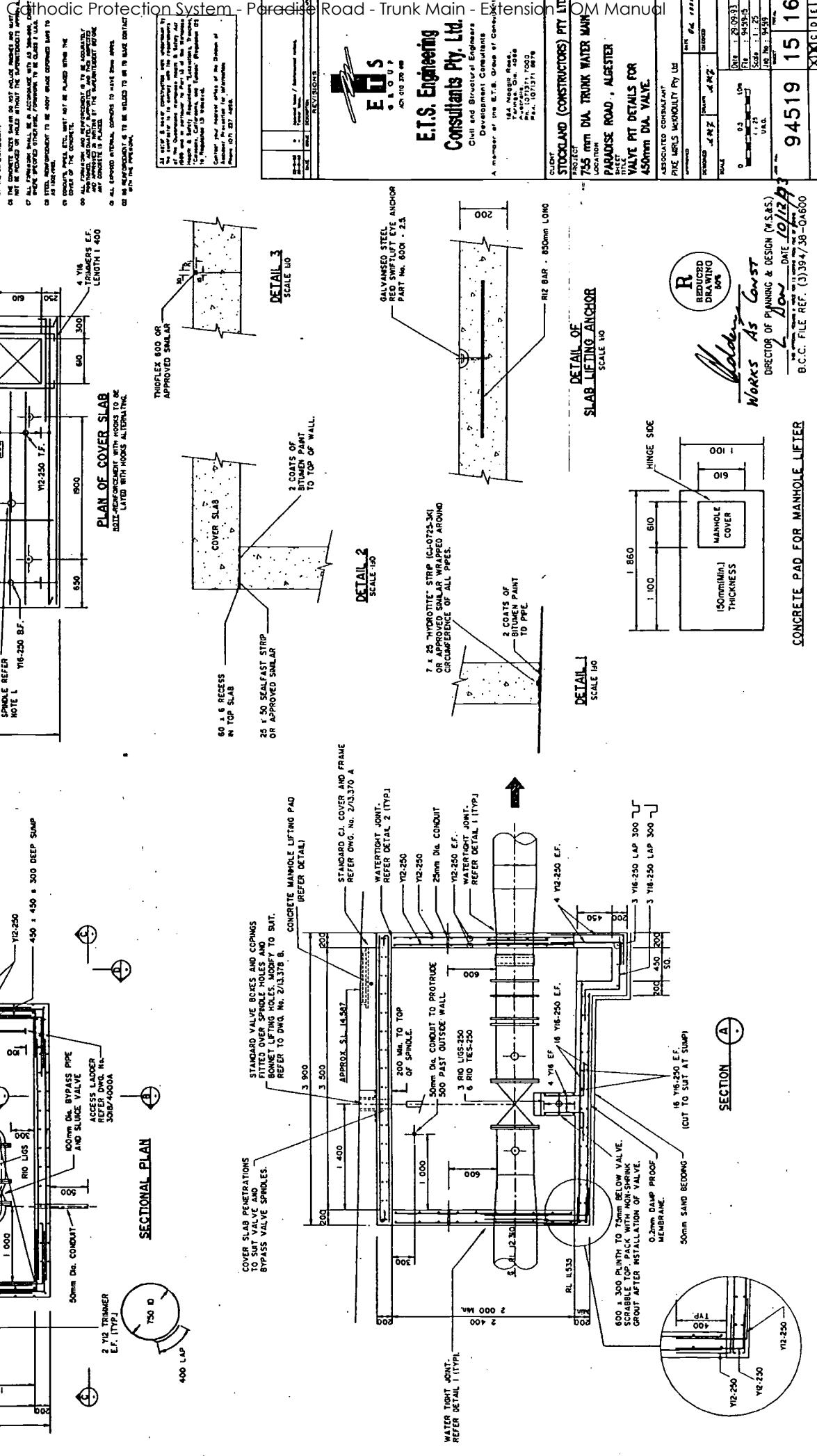




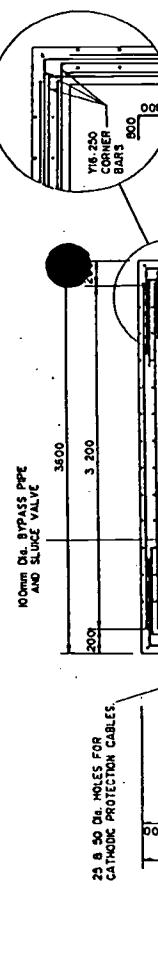




NOTES  
1. Dimensions in top left of the drawing are in mm.  
2. Dimensions in top right of the drawing are in inches.  
3. All dimensions are to be taken from the outer face of the pipe.  
4. All dimensions shown are net dimensions.  
5. All dimensions are to be taken from the outer face of the pipe.  
6. Dimensions are to be taken from the outer face of the pipe.  
7. Dimensions are to be taken from the outer face of the pipe.  
8. Dimensions are to be taken from the outer face of the pipe.



NOTES:  
1. INDIVIDUAL PIPES ARE TO BE SUPPORTED BY BRACE TIE-UPS AND CABLE TIES.  
2. ALL CONCRETE WORK SHALL COMPLY WITH THE LOCAL SPECIFICATION.  
3. ALL CONCRETE WORK MUST NOT EXCEED 600mm IN LENGTH OR 1000mm  
IN VARIOUS SPOTS. LOAD TO MAXIMUM STRENGTH.



SPECIAL ENVIRONMENTAL MANAGEMENT REQUIREMENTS	
1. Temperature monitoring to indicate deflection of the creek.	
2. The setting of creek protection points to indicate deflection of the creek.	
3. • Setting of creek protection points to indicate deflection of the creek.	

ENVIRONMENTAL MANAGEMENT	
The following environmental management measures will be adopted:	
1. Monitoring of creek protection points to indicate deflection of the creek.	
2. The setting of creek protection points to indicate deflection of the creek.	
3. All work to be carried out by experienced workers.	

ENVIRONMENTAL MANAGEMENT	
The following environmental management measures will be adopted:	
1. Monitoring of creek protection points to indicate deflection of the creek.	
2. The setting of creek protection points to indicate deflection of the creek.	
3. All work to be carried out by experienced workers.	

REV	DATE	REVISIONS
1.0	01/07/2015	



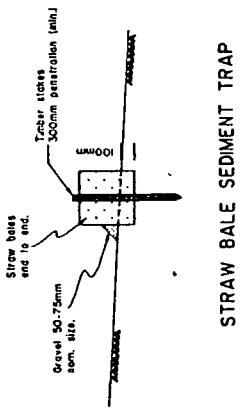
**Consultants Pty. Ltd.**  
Civil and Structural Engineers  
A member of the E.T.S. Group of Consultants

16, Weirage Road,  
Tennyson, Tasmania,  
Australia 7008  
Ph: (03) 6251 7000

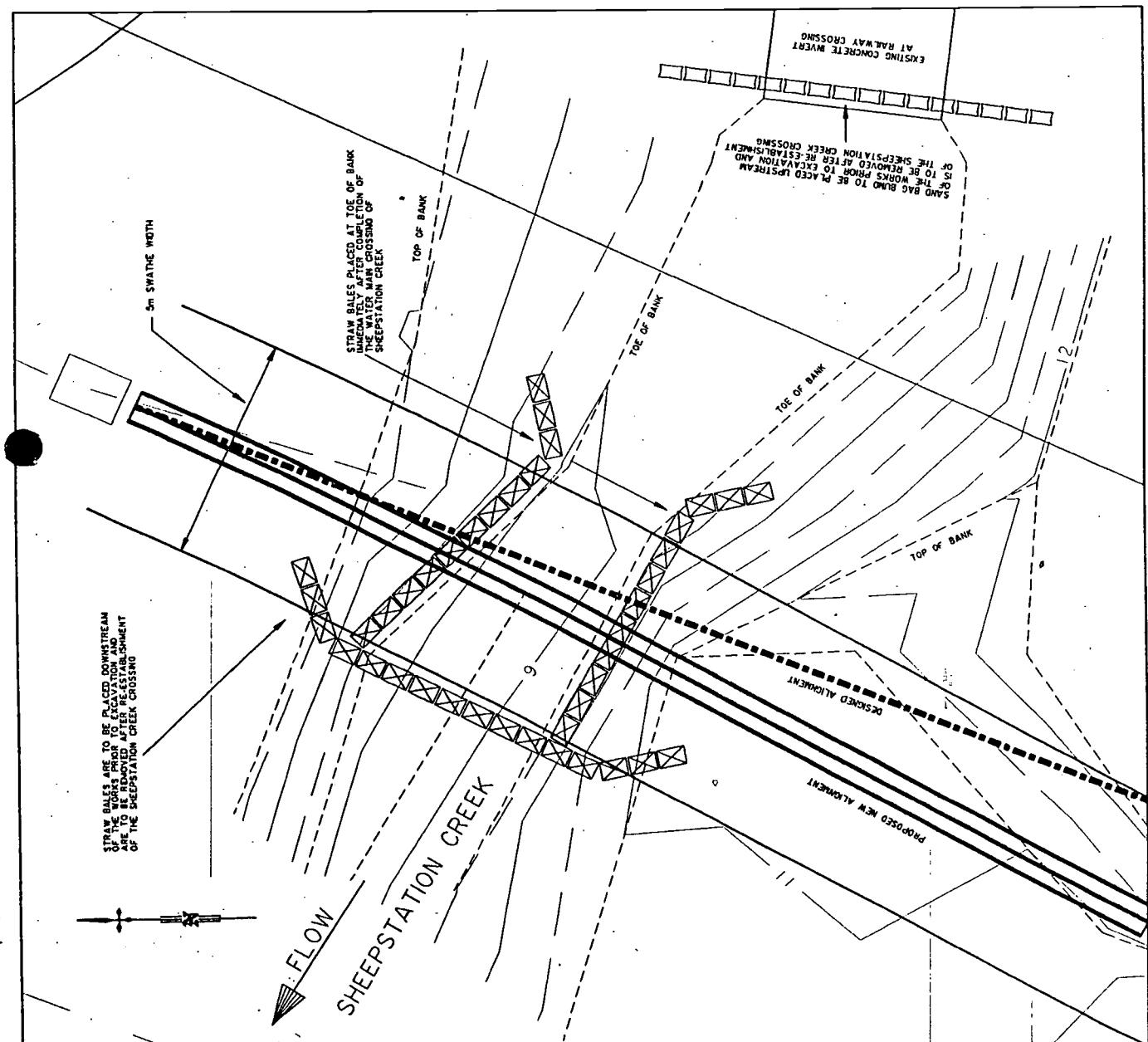
CLOUDLAND (CONSTRUCTORS) PTY LTD  
Project  
755 mm dia. TRUNK WATER MAIN  
LOCATION  
PARADISE ROAD - ALGESTER  
TITLE  
SHEEPSTATION CREEK CROSSING  
ENVIRONMENTAL PROTECTION SCHEME  
ASSOCIATED CONSULTANT  
PINE MULCH MULCHING PTY LTD



DIRECTOR OF PLANNING & DESIGN (NSW)  
DATE 07/12/93  
B.C.C. FILE REF. (3)394/38-QAB00  
Handwritten notes:  
Baldey  
works as owner

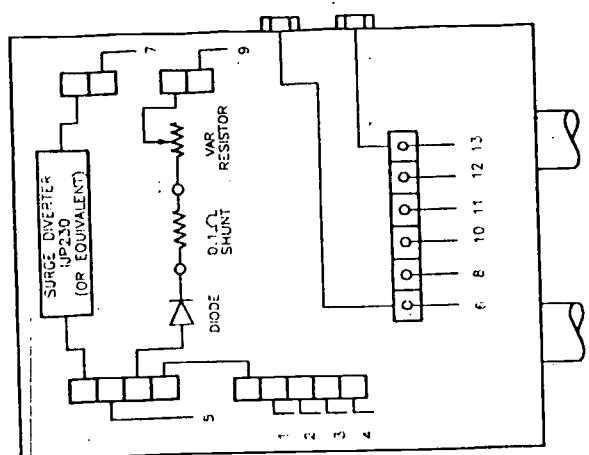


STRAW BALE SEDIMENT TRAP  
Scale 1:20



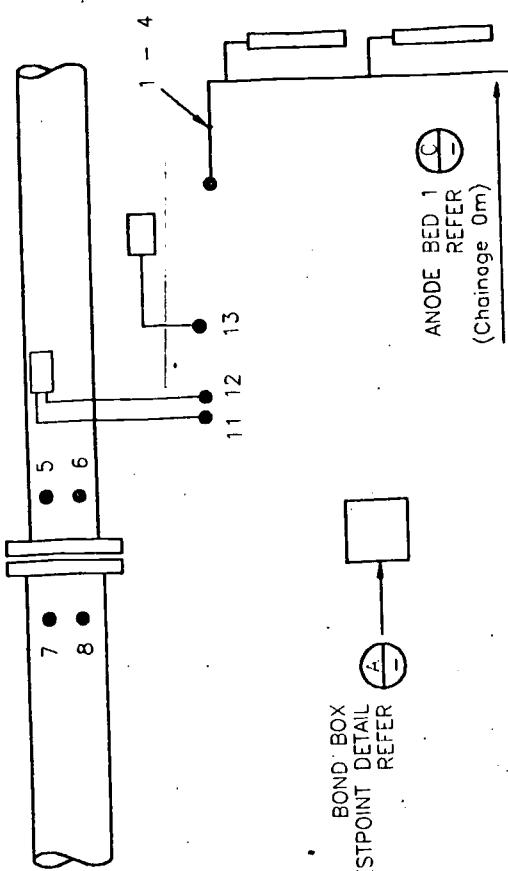
SHEEPSTATION CREEK CROSSING  
EROSION CONTROL SCHEME

**BOND BOX TEST POINT CONNECTION DIAGRAM**

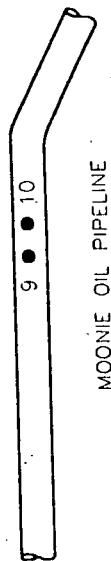


EXISTING DIA. 915  
TRUNK MAIN

DIA. 755 TRUNK MAIN



DETAIL

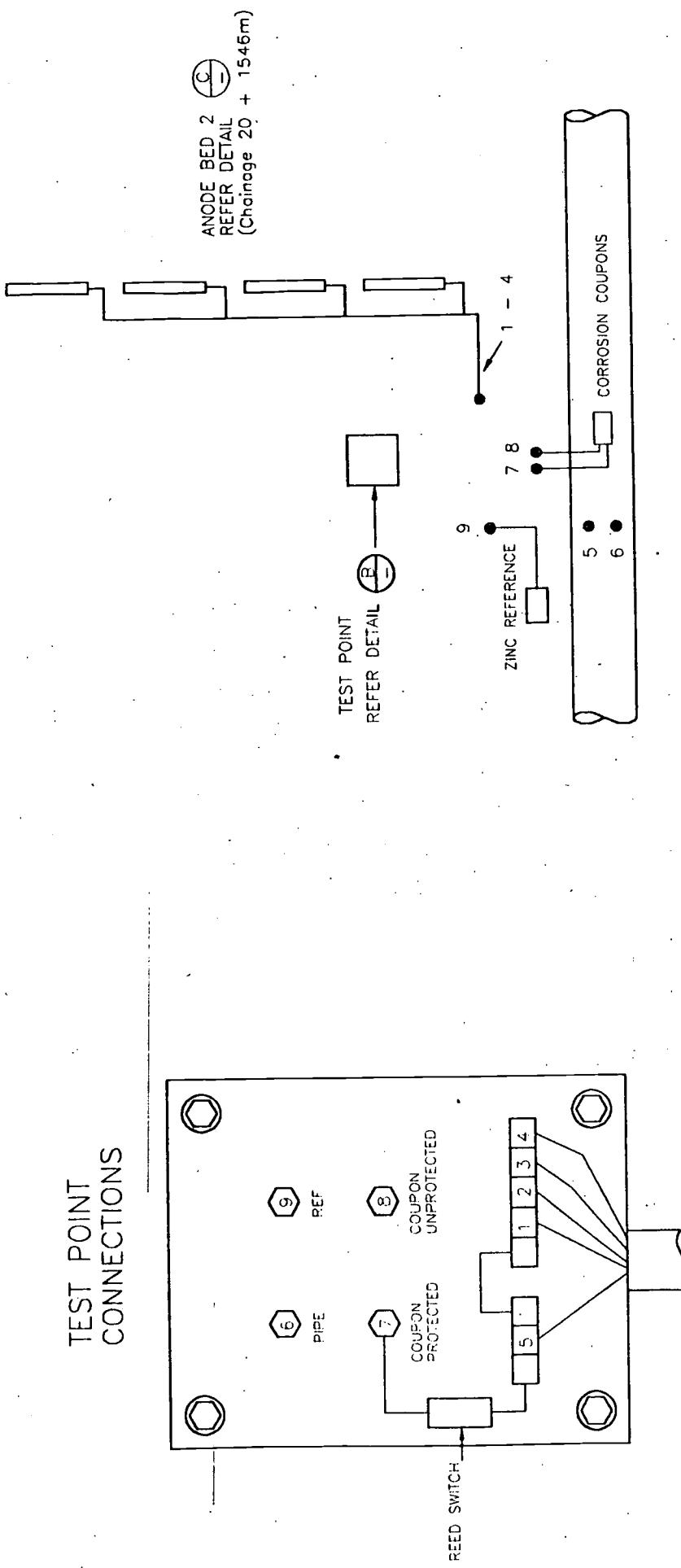


MOONIE OIL PIPELINE

CABLE SCHEDULE (Chainage 0m)				
CABLE No	SIZE (mm²)	COLOUR	TYPE	DETAILS
1	10	GREY/RED	PVC/PVC	ANODE/EARTHING ELECTRODE
2	10	GREY/RED	PVC/PVC	ANODE/EARTHING ELECTRODE
3	10	GREY/RED	PVC/PVC	ANODE/EARTHING ELECTRODE
4	10	GREY/RED	PVC/PVC	ANODE/EARTHING ELECTRODE
5	32	GREY/BLACK	B.D.C.	PIPELINE CONNECTION/ B.D.C. WIRE
6	6	GREY/BLACK	PVC/PVC	PIPELINE POTENTIAL WIRE (B.D.C.)
7	32	GREY/BLACK	B.D.C. WIRE	PIPELINE BONDING WIRE (B.D.C.)
8	6	GREY/BLACK	PVC/PVC	PIPELINE POTENTIAL WIRE (B.D.C.)
9	16	GREY/BLACK	PVC/PVC	PIPELINE BONDING WIRE (MOONIE)
10	6	GREY/BLACK	PVC/PVC	PIPELINE POTENTIAL WIRE (MOONIE)
11	6	BLACK	B.D.C. WIRE	CORROSION COATING
12	6	WHITE	B.D.C. WIRE	CORROSION COATING
13	6	BLACK	B.D.C. WIRE	SAC ELECTRODE

PARADISE ROAD TRUNK WATER MAIN			
PARADISE ROAD PTY LTD	GATE AND VALVE	DATE	REVISIONS
FOUNDSIDE PTY LTD	00108G/1	1 OF 3	A

## TEST POINT CONNECTIONS

DETAIL **B**

## CABLE SCHEDULE (Chainage 20+1546)

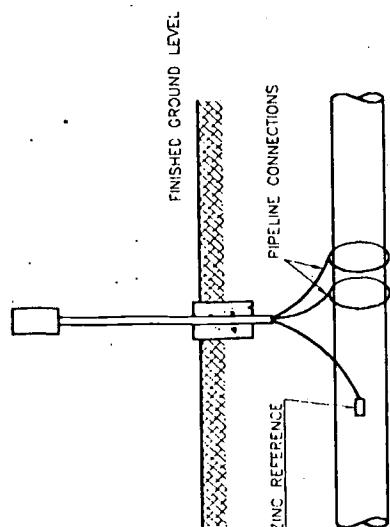
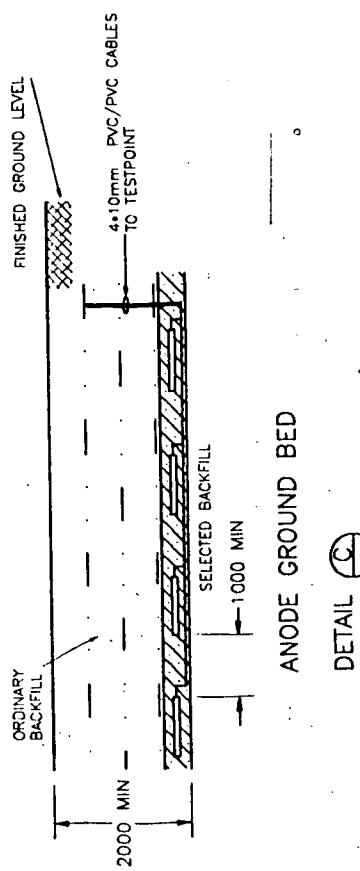
CABLE NO	SIZE (SO IN)	TYPE	COLOUR	DETAIL
1	1G	PVC/PVC	GREY/RED	ANODE/LAMPING ELECTRODE
2	1G	PVC/PVC	GREY/RED	ANODE/LAMPING ELECTRODE
3	1G	PVC/PVC	GREY/RED	ANODE/LAMPING ELECTRODE
4	1G	PVC/PVC	GREY/RED	ANODE/LAMPING ELECTRODE
5	35	BLDG WIRE	GREEN/YELLOW	SHIELD GROUND CONNECTION
6	6	PVC/PVC	GREY/BLACK	SIGNAL POTENTIAL WIRE
7	2.5	BLDG WIRE	BLUE	CORROSION COUPON (CONNECTED)
8	2.5	BLDG WIRE	WHITE	CORROSION COUPON (CONNECTED)
9	4	BLDG WIRE	BLACK	CORROSION COUPON (CONNECTED)

**CATHODIC PROTECTION INSTALLATION SYSTEM DETAILS**

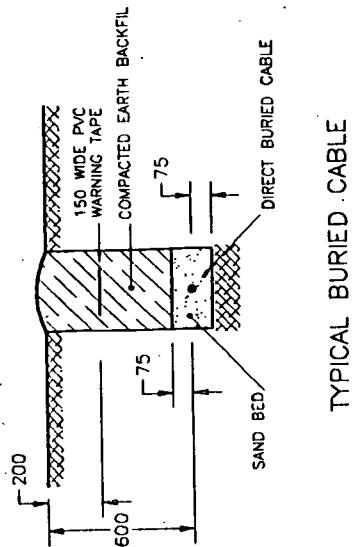
**W.W.W. PARADISE ROAD TRUNK WATER MAIN**

**W.W.W. PARADISE ROAD TRUNK WATER MAIN**

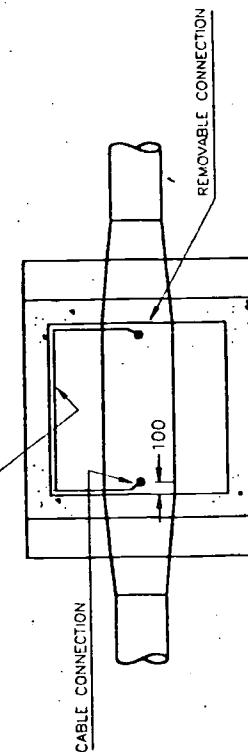
PROJECT	DESIGNER	DATE APPROVED	REVISION	ISSUE	DATE
FONDSIDE PTY LTD		00/08/2015	2	OF 3	A



POTENTIAL TESTPOINT (TYPICAL)



TYPICAL BURIED CABLE



VALVE PIT BOND CABLE

POTENTIAL TEST POINT SCHEDULE				
TEST POINT No	LOCATION	CHAINAGE	DWG.No (REF)	
1	SECR VALV	0	94519-03	
2	M. BRANCH	540	94519-05	
3	AF VALV	1296	94519-07	
4	SC. T.F. VALV	2614-1445	94519-15	
5	SC. T.C. VALV	2714-1445	94519-15	

CATHODIC PROTECTION INSTALLATION SYSTEM DETAILS				
PARADISE ROAD TRUNK WATER MAIN	Conctr:	Struct. Attn. Sh.	Permit No.	Date
FONDSIDE PTY LTD	Drawn:	001080/3	3 OF 3	A



**APPENDIX III**

**BRISBANE CITY COUNCIL**

**PARADISE ROAD TRUNK MAIN EXTENSIONS**

**CONTRACT No. 94519**

**COMMISSIONING REPORT**

**CATHODIC PROTECTION**

WWI Reference Number: Q5917  
WWI Document Number: 320608

Prepared by: W. A. R. Burns  
Approved by: S. BLACKLER



## CONTENTS

### 1.0 SUMMARY

### 2.0 INTRODUCTION

### 3.0 COMMISSIONING TESTS

- 3.1 Pipeline Potentials
- 3.2 Insulating Flanges
- 3.3 Groundbed/Permanent Earth Resistance
- 3.4 Foreign Structure

### 4.0 TEST INSTRUMENTATION

- 4.1 Pipeline to Soil Potentials
- 4.2 Earth Resistance Measurement

### 5.0 RESULTS OF COMMISSIONING TESTING

### 6.0 DISCUSSION OF RESULTS

- 6.1 Pipeline to Soil Potentials
- 6.2 Insulating Fittings
- 6.3 Groundbed/Permanent Earth Resistance
- 6.4 Foreign Structures
- 6.5 General

### 7.0 CONCLUSIONS AND RECOMMENDATIONS

### 8.0 APPENDIX



## 1.0 SUMMARY

The cathodic protection system installed under Contract No. 94519 is operating satisfactorily with pipeline potential levels being maintained within the specified range of -0.86 to 1.1 volts versus a copper/copper sulphate reference electrode.

The cathodic protection current from the two sacrificial anode installations combined was 25.9mA. This current has achieved an average potential of 1.1 volts across the pipeline. No adverse effects on adjacent structures was found as a result of commissioning this system.

It was found however, that the impressed current cathodic protection system operated by Santos/Moonie Pipeline Company in this area had an adverse effect on the trunk main. Testing showed that a bleed current of 94mA corrected all of the interference effects. Therefore this interference mitigation bleed has been permanently installed with the agreement of Santos Ltd (Refer letter attached).



## 2.0 INTRODUCTION

As part of the Contract No. 94519, Wilson Walton International (QLD) Pty Ltd conducted commissioning works associated with the sacrificial cathodic protection system installed on the Paradise Road Section of the Water Supply Pipeline Extensions to Ridgewood Residential Estate.

Final system commissioning was undertaken during April, 1995 following the installation of the sacrificial cathodic protection system in conjunction with interference testing.

The purpose of the survey was to establish the following:

- (i) Carry out testing of the cathodic protection system and associated equipment.
- (ii) Determine the degree of cathodic protection being maintained on the buried sections of the pipeline and note any requirements for adjustments, modifications or repairs to the system considered necessary to maintain an adequate degree of protection on the pipeline.
- (iii) Carry out confirmatory testing to ensure that the pipeline was electrically isolated at the extremities of buried sections.



**2.0 INTRODUCTION CONT'D**

- (iv) Report on any abnormalities relating to corrosion protection and general operation and safety of the pipeline/s and make recommendations, where required, for the continued satisfactory operation of the cathodic protection system.




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### **3.0 COMMISSIONING TESTS**

#### **3.1 Pipeline Potentials**

Prior to energising the cathodic protection systems, a pipeline to soil potential survey was conducted to monitor the natural potentials along the pipeline/s route.

Following energisation of the system, the output of the cathodic protection system was adjusted to levels considered suitable to permit the pipeline to soil potentials to fall within the as specified limits as nominated in the specification. An "instant off" potential of -0.86V (min) -1.1V (max) versus a copper/copper sulphate reference electrode was used.

#### **3.2 Insulating Flanges**

During on/off potential testing, integrity of all insulating flanges was confirmed by measuring the potential swing on each side of the insulating fittings.

#### **3.3 Groundbed/Permanent Earth - Resistance to Earth**

The groundbed/permanent earth on the pipeline was subject to earth resistance testing as required. Testing was conducted via the 3 pin meggar earth test instrument (to remote earth) in accordance with AS 1768-1983.

#### **3.4 Foreign Structure**

No foreign structure interference is occurring as a result of the installation of this system on either Telecom cables or SEQEB earth. Telecom Australia have no metal sheathed cable in the area. No interference effect was found on SEQEB M.E.N. earthing.



## 4.0 TEST INSTRUMENTATION

### 4.1 Pipeline to Soil Potentials

All pipeline to soil potentials were monitored using an M.C. Miller LC-4 digital corrosion voltmeter with a variable input resistance of 10-200 megohm in conjunction with an M.C. Miller RE5C copper/copper sulphate reference electrode.

### 4.2 Earth Resistance Measurement

Permanent Earth bed earth resistance measurements were conducted using a Nilsson 400 megger 4 pin null balance earth resistance meter.



## 5.0 RESULTS OF COMMISSIONING TESTING

Refer to Appendices 1 and 2 for commissioning results.

WWI Reference Number: Q5929

WWI Document Number: 320608

BRISBANE CITY COUNCIL  
PARADISE ROAD TRUNK MAIN  
CATHODIC PROTECTION COMMISSIONING REPORT  
MAY 1995

Date: 5/5/95

.....8



## 6.0 DISCUSSION OF RESULTS

### **6.1 Pipeline to Soil Potentials**

As shown by Appendix 1, full cathodic protection of the pipeline within the range of the intended protection levels is provided with potentials being more negative than -0.86V and less than -1.1V versus a copper/copper sulphate reference electrode.

### **6.2 Insulating Fittings**

Potential measurements across insulating fittings confirm that satisfactory electrical isolation of the protected pipeline from structures not requiring protection has been achieved.

### **6.3 Groundbed/Permanent Earth Installation - Resistance**

As shown by Appendix 2, the resistance to remote earth of the two permanent earth beds is below the nominated 2.0 ohms.

### **6.4 Foreign Structures**

As previously mentioned no interference effects from this system were evident on any foreign structures in the vicinity of the Paradise Road Trunk Main. There was however, interference being experienced on the trunk main from the Moonie Oil Line which runs parallel to the trunk main for most of it's length. Interference mitigation testing was performed and resulted in a 12ohm bleed resistor being installed in test point 1. The results of this testing can be found in the Appendix of Results.

Testing was conducted on low voltage power earths as well as the Moonie Oil Pipeline in the vicinity of the water pipeline. No adverse effects were monitored on any of the other structures nominated in the area as a consequence of the new pipelines' cathodic protection system/s.



#### **6.0 DISCUSSION OF RESULTS CONT'D**

### **6.5 General**

#### **6.7.1 Pipeline Electrical Isolation.**

The electrical isolation of the pipeline from structures not required to be protected (including scour and air valves) is achieved by the installation of approved flange insulating gasket kits in all circumstances.

#### **6.7.2. Permanent Reference Cell Installations.**

As shown in Appendix 1, the permanent zinc reference electrodes show some small variation when monitored against a standard copper/copper sulphate reference electrode. However, since the permanent cells are used purely as a reference to monitor protection levels on the pipeline, such variation is not unacceptable providing a consistent potential level is maintained.

Similarly, the permanent zinc reference electrodes at each end of the pipeline are used to monitor the potential levels on the pipeline. However, the potential variation in cells relative to a portable copper/copper sulphate reference electrode allows the cells to be calibrated and in a pure sense, then allows for the variation to be accounted for in interpretation of the overall readings.

#### **6.7.3 Corrosion Coupons**

The potential testing of the corrosion coupons with the cathodic protection system connected to the coupon and switching on and off indicates polarisation occurring on the coupons soon after the system was commissioned.



**WILSON WALTON**

## **7.0 CONCLUSIONS AND RECOMMENDATIONS**

The commissioning works indicate that the cathodic protection system is operating satisfactorily with potential levels maintained within the specified limits of -0.86 to -1.1 volts versus a copper/copper sulphate reference electrode.

Potential testing also confirms that insulating flanges fitted to all of the branches and extremities of the pipeline contract are performing satisfactorily and as such isolating the pipeline from poorly coated sections of associated fittings and/or attachments.



## 8.0 APPENDIX CONTENTS

**TABLE 1            4 PIN SOIL RESISTIVITY TESTING**

**TABLE 2            NATURAL POTENTIAL SURVEY**

**TABLE 3            PROTECTED POTENTIAL SURVEY**

**TABLE 4            INTERFERENCE TESTING (FROM MOONIE OIL PIPELINE)**

**TABLE 5            INTERFERENCE MITIGATION RESULTS**

**TABLE 6            PERMANENT ZINC REFERENCE ELECTRODE POTENTIALS**

**TABLE 1: SOIL RESISTIVITY RESULTS**

<b>Test Location</b>	<b>Pin Spacing (in metres)</b>	<b>Measured Results in Ohms</b>	<b>Calculated Result in Ohms/cm</b>
1 ON	0.5	34.0	10,676
	1.0	12.4	7,787
	2.0	2.18	2,738
	4.0	0.62	1,557
2 Approximately 400m	0.5	5.1	1,601
	1.0	2.32	1,457
	2.0	1.08	1,356
	4.0	0.3	753
3 Approximately 900m	0.5	36.0	11,304
	1.0	34.5	21,666
	2.0	19.2	24,115
	4.0	9.0	22,608
4 Approximately 1300m	0.5	4.0	1,256
	1.0	3.4	2,135
	2.0	1.4	1,758
	4.0	0.8	2,010
5 Approximately 1550m	0.5	2.2	690
	1.0	1.0	628
	2.0	0.5	628
	4.0	0.1	251

**TABLE 2: NATURAL POTENTIAL SURVEY**

<b>Test Point No.</b>	<b>Location</b>	<b>Potential</b>
1 (Anode)	Start of Line	0.620
2	Air Valve 1248	0.595
3	Air Valve 1250	0.672
4	Scour Valve 1193	0.625
5 (Anode)	Scour Valve 1191	0.606

**NOTE:** 1. All potentials are expressed as 'volts negative' with reference to a standard copper/copper sulphate reference electrode.

**TABLE 3: ON/OFF PROTECTED POTENTIAL SURVEY**

Test Point No.	Location	ON Potential	OFF Potential
1 (Anode)	Start of Line	1.285	1.120
2	Air Valve 1248	1.180	1.038
3	Air Valve 1250	1.122	0.980
4	Scour Valve 1193	0.980	0.880
5 (Anode)	Scour Valve 1191	1.087	0.952

**TABLE 4: INTERFERENCE TESTING FROM MOONIE OIL PIPELINE TO B.C.C. TRUNK MAIN**

- \* Moonie Oil Transformer Operating at 25 volts and 26 amps
- \* Interrupter cycle 'ON' 20 seconds and 'OFF' 10 seconds

Test Point No.	Location	Line Potential with Moonie Current ON	Line Potential with Moonie Current OFF	Resulting Swing (mV)
1	Start of Line	1.020	1.027	+ 7.0
2	Air Valve 1248	1.070	0.016	- 54.0
3	Air Valve 1250	1.005	1.052	+ 47.0
4	Scour Valve 1193	0.898	0.930	+ 32.0
5	Scour Valve 1191	0.997	0.127	+ 30.0

**NOTE:** 1. Potentials are expressed as 'volts negative' with reference to a standard copper/copper sulphate reference electrode.

**TABLE 5: RESISTANCE BLEED (12ohms/94mA) OF CURRENT**

Test Point No.	Location	Moonie 'OFF'	Moonie 'ON'	Result (mV)
1	Start of Line	1.099	1.199	-100.0
2	Air Valve 1248	1.070	1.170	-100.0
3	Air Valve 1250	1.010	1.105	-95.0
4	Scour Valve 1193 ✓	0.902	0.940	-38.0
5	Scour Valve 1191	1.002	1.062	-60.0

NOTE: 1. Potentials are expressed as 'volts negative' with reference to a standard copper/copper sulphate reference electrode.

**TABLE 6: PERMANENT ZINC REFERENCE ELECTRODE POTENTIALS**

Test Point No.	Location	Potentials	
		To Cu/CuSO <sub>4</sub>	To Structure
1	Testpoint 1	1.070	0.210
2	Testpoint 5	1.032	0.053

NOTE: 1. Potentials are expressed as 'volts negative' with reference to a standard copper/copper sulphate reference electrode.