

Electrical Mechanical Water Meters

25 Bunya Street Eagle Farm Q4009

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20th June 1997.

Brisbane Water Engineering Services

OPERATING MANUAL FOR:

EDMONSTONE STREET RISING SEWER MAIN

CATHODIC PROTECTION SYSTEM

CLIENT:

BRISBANE WATER
SEWERAGE UTILITIES SERVICES

MANUAL CONTENTS

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DRAWINGS

486/6/25-AA1C0021E Standard Rectifier Wiring Diagram

(No Number) Monthly Maintenance Program

(1.0) INTRODUCTION

Steel when immersed or covered in water has a tendency to corrode (or rust) as the oxidized form is more stable than the metal.

Because of this, precaution must be taken to stop or minimize the corrosion reaction to an acceptable level consistent with the design life of the structure. This is normally achieved by the use of protective coatings which control the corrosion reaction by isolating the steel from its surrounding environment.

However, it is not practical to achieve a perfect coating and coating damage will always occur with time. Because of this, corrosion may occur at imperfections in the paint coating, causing further deterioration in the coating as well as loss of metal.

As a result of this, the coating defects must be rectified by periodic maintenance or an additional method of protection used to prevent this deterioration and corrosion occurring. This additional protection is achieved by the cathodic protection system.

(2.0) CORROSION AND CATHODIC PROTECTION

Corrosion is an electrochemical process in that it is accompanied by a flow of electrical current.

Corrosion occurs on the surface of metals at active areas known as anodes, which are electrically continuous with less active or passive areas known as cathodes. The electric current flows from the anode through the electrolyte to the cathode, with the circuit being completed by the electrical continuity between the cathode and anode. In practice anodes and cathodes are generally part of the same metallic surface and individual anodic areas may be small.

In applying cathodic protection an external current is applied to the surface so that the entire surface to be protected acts as a cathode. This involves the use of an auxiliary anode and when the current flow from this anode is sufficient, no part of the structure acts as an anode.

An external source of direct current such as a transformer rectifier is used in conjunction with an anode consisting of material with a very slow corrosion rate.

While it is the flow of current which achieves the cathodic protection of the surface it is impractical to measure these currents over individual anodic areas to determine when cathodic protection has been achieved. However, with the flow of cathodic protection current, the structure becomes more negative with respect to the surrounding electrolyte. Because of this, it is possible to state values of metal/electrolyte potential at which corrosion does not occur. This metal/electrolyte potential is generally measured against a standard reference electrode which allows a reproducible potential at which corrosion does not occur to be quoted.

(3.0) MAINS DETAILS:

Size: Dia: 600 mm mild steel.

Coating: Tar Epoxy

Length: 0.8 km

Location: From Edmonstone St Pump Stn to cnr Vale & Olney Sts.

Construction: 3007/600 Breakfast Ck Diversion Sewer

Drawings:

(4.0) CATHODIC PROTECTION DETAILS

- (4.1) Type of Cathodic Protection: Impressed Current.
- (4.2) Rectifier: Special 32 Volt, 10 amp direct current output enclosed in a stainless steel switchboard. Rectifier has a 240V supply from the nearby Sandgate Rd. Submersible Sewerage Pumping Station SP 23.
- (4.3) Cathode: The cathode point is located in the valve pit adjacent to the pump station. The cathode point is where the cabling from the rectifier is attached to the structure under cathodic protection.
- (4.4) Anodes: Two 1500 x 75mm silicone iron anodes were installed 1.5 meters in front of the gate and the second anode 4 meters in front of that, in a vertical bed. The anodes were firstly packaged with coke breeze thereby improving anode - ground resistance. The anodes are identified by a marker post and label.
- (4.5) Test Points: Test points are installed on cathodically protected structures to enable testing to ensure full protection of the mains. On these mains three test points have been installed for details see dwg no.3007/600 Breakfast Creek Diversion Sewer.
- (4.6) Associated Drawings:
 Cathodic Protection Details - 2/14.213
 Cathodic Protection Test Point Details - 486/1/22-AA1T0001E
 Standard Rectifier Wiring Diagram - 486/6/25-AA1C0021E
 Vertical Ground bed Details - 486/6/25-AA1C0024E
- (4.7) Associated Standards:
 AS 3000 1986 Australia Wiring Rules
 AS 2832.1 1985 Pipes, Cables, Ducts, Guide to Cathodic Protection, Part One.
- (4.8) Government Regulations:
 Queensland Electricity Acts and Regulations.

(5.0) PERFORMED TESTING:

- (1) Natural Potential Survey.
- (2) Testing of Insulated Flanges, Joints.
- (3) Soil Resistance Testing.
- (4) Current Drain Survey.
- (5) Pipe Coating Anomaly Survey.
- (6) Rectifier Loop Resistance.
- (7) Foreign Structure Interference Survey and Mitigation.
- (8) Final Potential Survey and Commissioning.

(6.0) CONCLUSION:

Full Cathodic protection has been achieved on this section of trunk mains. The cathodic protection system is registered with the Electricity Regulator Department of Minerals and Energy and has approval to operate.

(7.0) MAINTENANCE

The cathodic protection system is maintained on a monthly basis after commissioning. These checks involve testing rectifier operation and recording of pipe to soil potentials.

20th June 1997,

Electrical Engineering Unit:

Cathodic Protection

CPS Monthly Maintenance Details..

Required:

- 1/ Notify plant operator and/or sign entry logs where necessary.
- 2/ Have appropriate keying.

Labour:

One tradesperson; one vehicle. 20 minutes per site.

Procedure:

- 1/ Identify installation.
- 2/ Check system for operation.
- 3/ Record voltmeter.
- 4/ Record ammeter.
- 5/ Comments.
- 6/ Log entry.

20th June 1997,

Electrical Engineering Unit
Cathodic Protection

CPS 6 Monthly Maintenance Details

Required:

- 1/ Notify plant operator and/or sign entry logs where necessary..
- 2/ Have appropriate keying.
- 3/ Set of tools. (Electricians)
- 4/ Multimeter.
- 5/ DC clampmeter.
- 6/ Copper sulphate reference cell and leads.
- 7/ Cleaning equipment.
- 8/ Gatic cover lifters.

Labour:

One tradesperson electrical, one laborer, one vehicle.

Two hours per site.

Procedure:

- 1/ Identify system.
- 2/ Check system for operation.
- 3/ Record voltmeter.
- 4/ Record ammeter.
- 5/ Record "on" potentials for all test points.
- 6/ Record "instant off" potentials for all test points.
- 7/ Record "off" potentials for all test points.
- 8/ Perform loop resistance and record.
- 9/ Check and record anode string currents.
- 10/ Comments.
- 11/ Log entry.

20th June 1997,

Electrical Engineering Unit

Cathodic Protection

CPS 60 Monthly Maintenance Details

Required:

- 1/ Notify plant operator and/or sign entry logs where necessary.
- 2/ Have appropriate keying.
- 3/ Set of tools: (Electricians)
- 4/ Multimeter.
- 5/ DC clampmeter.
- 6/ Copper sulphate reference cell and leads.
- 7/ Cleaning equipment.
- 8/ Gatic cover lifters.
- 9/ Rectifier load bank.
- 10/ PCS2000 Detection Equipment.

Labour:

One tradesperson electrical, one laborer, one vehicle.

Eight hours per site.

Procedure:

- 1/ Identify system.
- 2/ Check system for operation.
- 3/ Record voltmeter.
- 4/ Record ammeter.
- 5/ Record "on" potentials for all test points.
- 6/ Record "instant off" potentials for all test points.
- 7/ Record "off" potentials for all test points.
- 8/ Perform loop resistance and record.
- 9/ Check and record anode string currents.
- 10/ Load test rectifier for 10 minutes.
- 11/ Check all switchboard and testpoint terminals for tightness.
- 12/ Check all switchboard and testpoints are labelled and I.D. tags attached.
- 13/ Check plans are correctly drawn and modify if necessary.
- 14/ Remove and inspect anodes.
- 15/ Recheck all interference (CPS) bleeds.
- 16/ Pipecamp structure if applicable.
- 17/ Apply to reregister system, if applicable.

Electrical Engineering Unit

Standard Cathodic Protection Test Point Data Gathering Form

Project: Edmonstone St.

Date: 27-6-97

T.P. Location: Vale St.

T.P. No.: 3

Mains Size: 24"

T.P. Type:

POTENTIAL TESTING

CATHODE TO CATHODE RETURN (RESISTANCE)

• 2 Ω

ZINC REFERENCE TO PIPE

+55 +380

CuSo₄ REFERENCE TO PIPE

-1155 -715

ZINC TO CuSo₄

1100

EARTH TESTING

TEST NO. 1

PIN SPACING

2 m

RESISTIVITY

17.5 Ω

MEGGER READING

1.4 Ω

TEST NO. 2

PIN SPACING

5m

RESISTIVITY

31.4 Ω

MEGGER READING

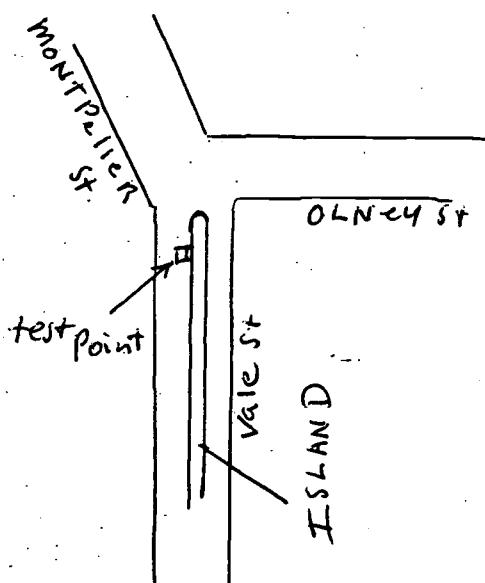
1 Ω

TEST NO. 3

PIN SPACING

RESISTIVITY

MEGGER READING

COMMENTS / LOCATION DRAWING

INSTALLED BY

P SMYTH

Brisbane Water Engineering Services

CP Form No. 18

Electrical Engineering Unit**Standard Cathodic Protection Test Point Data Gathering Form**

Project: Edmonstone St SP 23

Date: 27-6-97

T.P. Location: Pump Station

T.P. No.: 1

Mains Size: 24"

T.P. Type: Rectifier

POTENTIAL TESTING

CATHODE TO CATHODE RETURN (RESISTANCE)

• 2 Ω

ZINC REFERENCE TO PIPE

+90 +30.5

CuSo₄ REFERENCE TO PIPE

-1150 -730

ZINC TO CuSo₄

1130

EARTH TESTING

TEST NO. 1

PIN SPACING

2 m

MEGGER READING

1.3 Ω

RESISTIVITY 16.3 Ω

TEST NO. 2

PIN SPACING

5 m

MEGGER READING

1.2 Ω

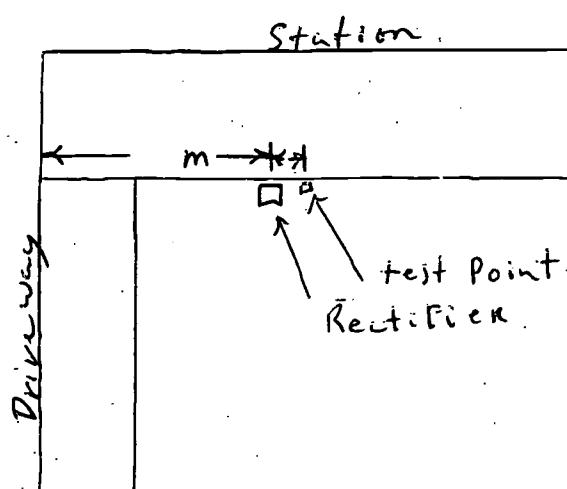
RESISTIVITY 37.6 Ω

TEST NO. 3

PIN SPACING

MEGGER READING

RESISTIVITY

COMMENTS / LOCATION DRAWING

INSTALLED BY P. SMYTH

Brisbane Water Engineering Services

CP Form No.18

Electrical Engineering Unit

Standard Cathodic Protection Test Point Data Gathering Form

Project...Edmonstone St

Date ...27-6-97

TP Location...WILSTON Pde

TP No. ...2

Mains Size...24"

TP Type.....

POTENTIAL TESTING

CATHODE TO CATHODE RETURN (RESISTANCE)

-1.5

ZINC REFERENCE TO PIPE

+111

+346

CuSo₄ REFERENCE TO PIPE

-12.00

-790

ZINC TO CuSo₄

13.00

EARTH TESTINGTEST NO. 1

PIN SPACING

2m

RESISTIVITY

18.8

MEGGER READING

1.5

TEST NO. 2

PIN SPACING

5m

RESISTIVITY

34.5

MEGGER READING

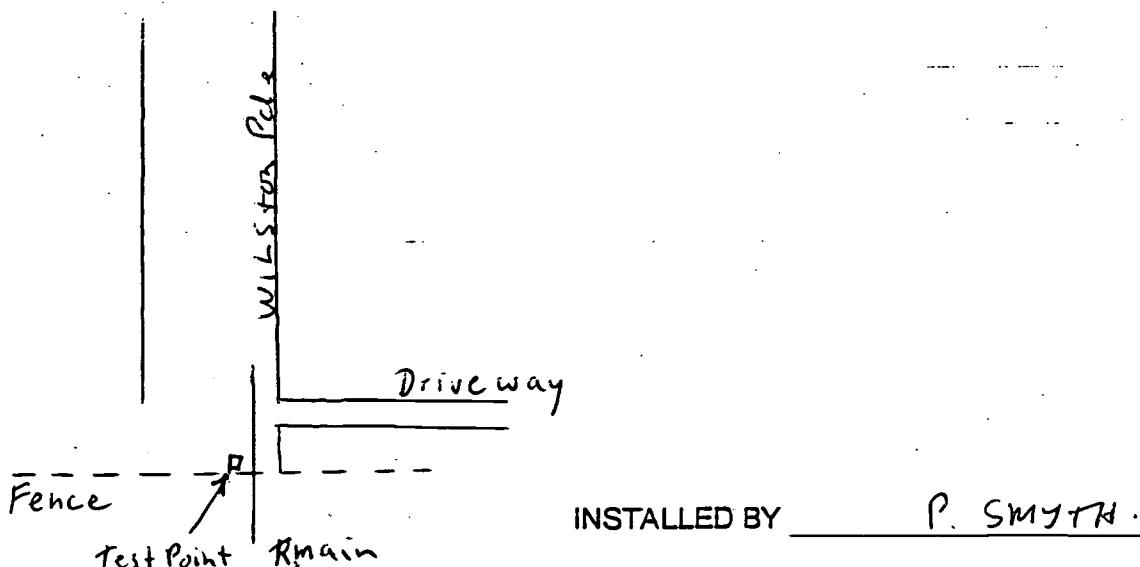
1.1

TEST NO. 3

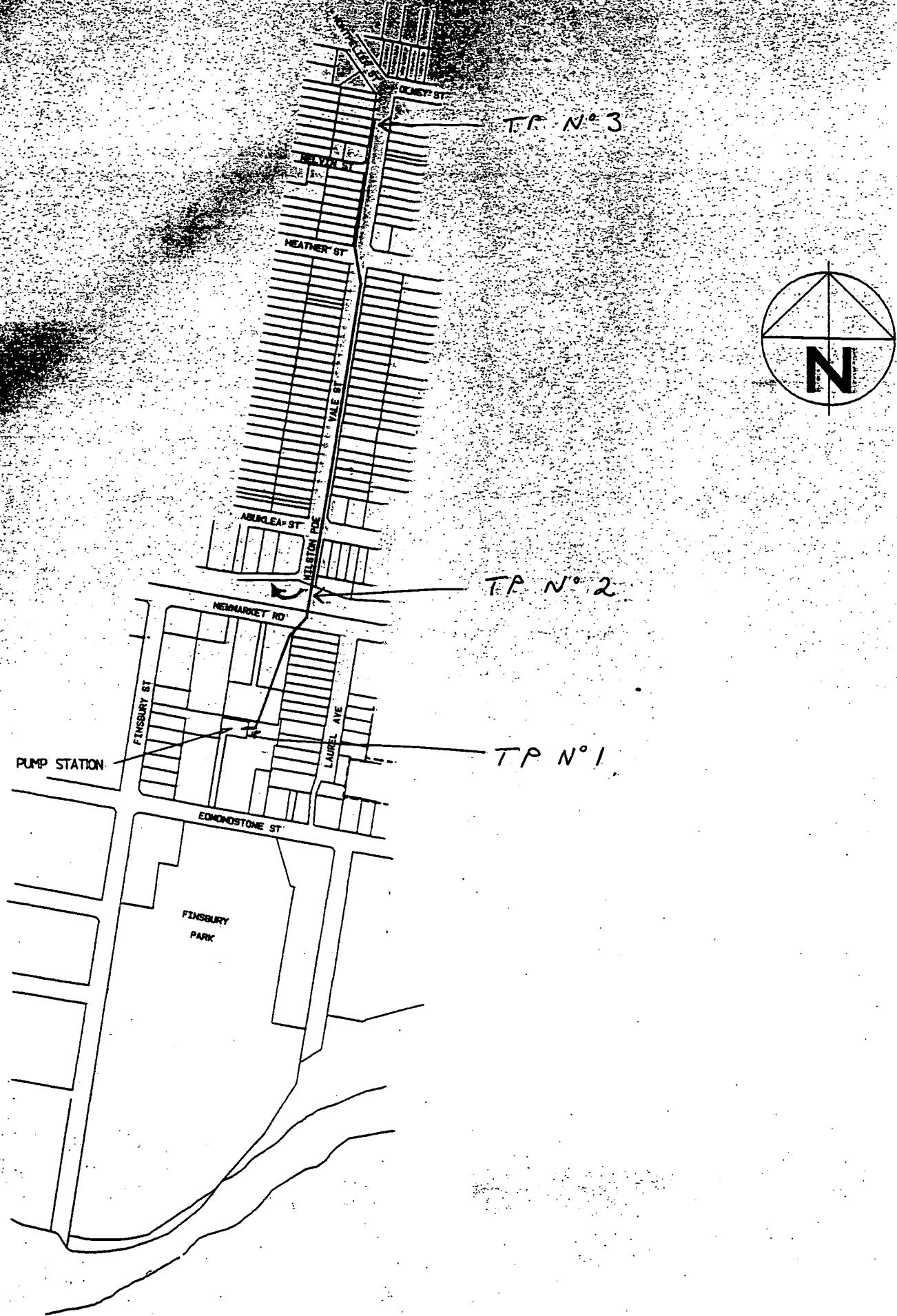
PIN SPACING

RESISTIVITY

MEGGER READING

COMMENTS / LOCATION DRAWING

Revision 09/28/95



Electrical Engineering Unit**Insulated Joint Testing Details Form**

Project: EDMONSTONE ST NEWMARKET Date: 17-1-97

DESCRIPTION:

MAINS DETAILS:

EDMONSTONE ST.

LOCATIONS:

EDMONSTONE ST. VALVE PIT

SIZE:

15"

MATERIAL:

MILD STEEL CEMENT LINED

COATING:

NIL

VALVE No.:

IN GROUND TESTING:

BOLT TO FLANGE RESISTANCE:

NUMBER OF BOLTS:

FLANGE TO FLANGE RESISTANCE:

INSULATION CHECKER MODEL 702:

POTENTIAL DIFFERENCE TO REFERENCE CELL:

PROTECTED SIDE:

UNPROTECTED SIDE:

ABOVE TESTING:

BOLT TO FLANGE RESISTANCE:

5.6 mV average

NUMBER OF BOLTS:

12

FLANGE TO FLANGE RESISTANCE:

40.0 mV**COMMENTS / LOCATION DRAWING**TESTED BY G. PRATT

Brisbane Water Engineering Services

CP Form No. 21

Electrical Engineering Unit**Insulated Joint Testing Details Form**Project: EDMONSTONE ST NEW MARKETDate: 17-1-97**DESCRIPTION**

MAINS DETAILS:

EDMONSTONE ST

LOCATIONS:

EDMONSTONE ST VALVE PIT

SIZE:

MILD STEEL CEMENT LINED

MATERIAL:

NIL

COATING:

BY-PASS VALVE

VALVE NO.:

IN-GROUND TESTING

BOLT TO FLANGE RESISTANCE:

NUMBER OF BOLT:

FLANGE TO FLANGE RESISTANCE:

INSULATION CHECKER MODEL 702:

POTENTIAL DIFFERENCE TO REFERENCE CELL:

PROTECTED SIDE:

UNPROTECTED SIDE:

ABOVE TESTING

BOLT TO FLANGE RESISTANCE:

8.2 mV average

NUMBER OF BOLTS:

8

FLANGE TO FLANGE RESISTANCE:

16.0 mV**COMMENTS / LOCATION DRAWING**TESTED BY G. PRATT

Brisbane Water Engineering Services**Electrical Engineering Unit****Insulated Joint Testing Details Form**Project EDMONSTONE ST NEW MARKETDate 17-1-97**DESCRIPTION:**

MAINS DETAILS:

EDMONSTONE ST

LOCATIONS:

EDMONSTONE ST VALVE PIT

SIZE:

24" MAIN LINE

MATERIAL:

MILD STEEL CEMENT LINED

COATING:

NIL

VALVE No.:

IN GROUND TESTING:

BOLT TO FLANGE RESISTANCE:

NUMBER OF BOLTS:

FLANGE TO FLANGE RESISTANCE:

INSULATION CHECKER MODEL 702:

POTENTIAL DIFFERENCE TO REFERENCE CELL:

PROTECTED SIDE:

UNPROTECTED SIDE:

ABOVE TESTING

BOLT TO FLANGE RESISTANCE:

2.6 mV average

NUMBER OF BOLTS:

16

FLANGE TO FLANGE RESISTANCE:

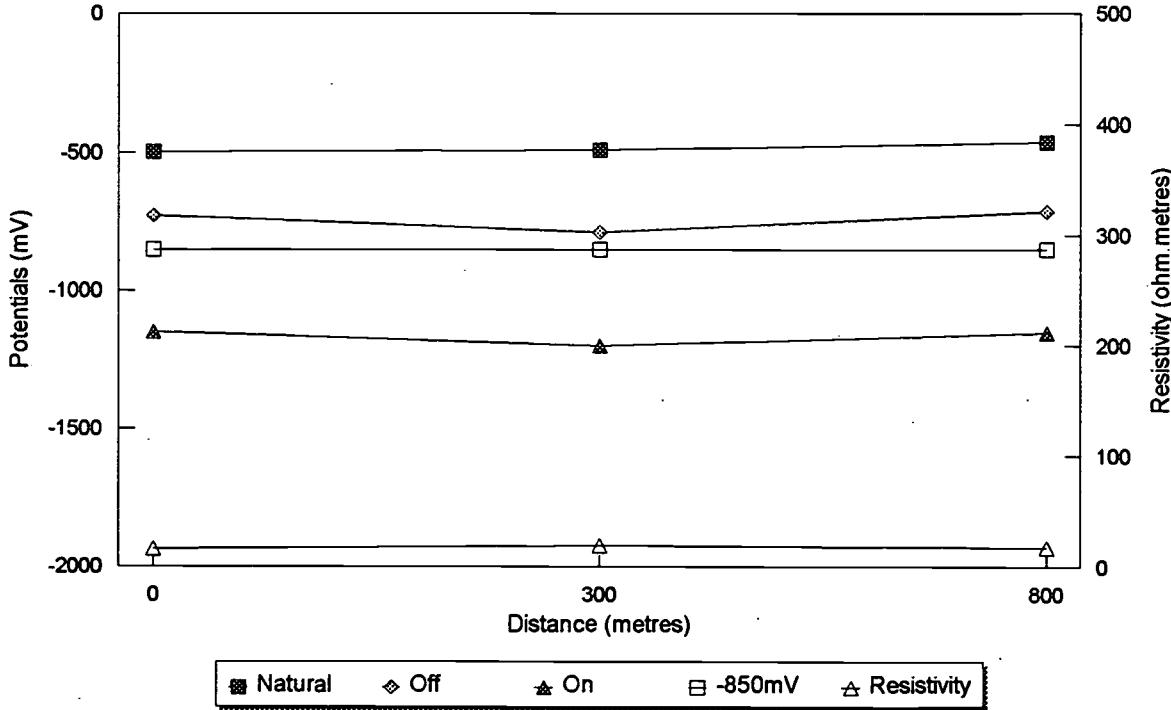
16.0 mV**COMMENTS / LOCATION DRAWING**TESTED BY G. PRATT

Brisbane Water Engineering Services

CP Form No. 23

Electrical Engineering Unit:**Cathodic Protection System Potential Recording Form**Project: Edmonstone St Rising MainDate: 20th June 1997

Test Point number	Distances to T.P. (metres)	Potentials to CuSO ₄			Resistivities at 2 metres (ohm.metres)
		Natural (mV)	Off (mV)	On (mV)	
1	0	-499	-730	-1150	16.3
2	300	-491	-790	-1200	18.8
3	800	-465	-715	-1155	17.5
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					

Graph of potentials and resistivity vs pipelength

Brisbane Water Engineering Services

CP Form No. 24

Electrical Engineering Unit:**Cathodic Protection System Loop Resistance**

Date: 20th JUNE 1997

Cathodic Protection System:

Edmonstone St. Rising Main New Market

System Operating Volts:

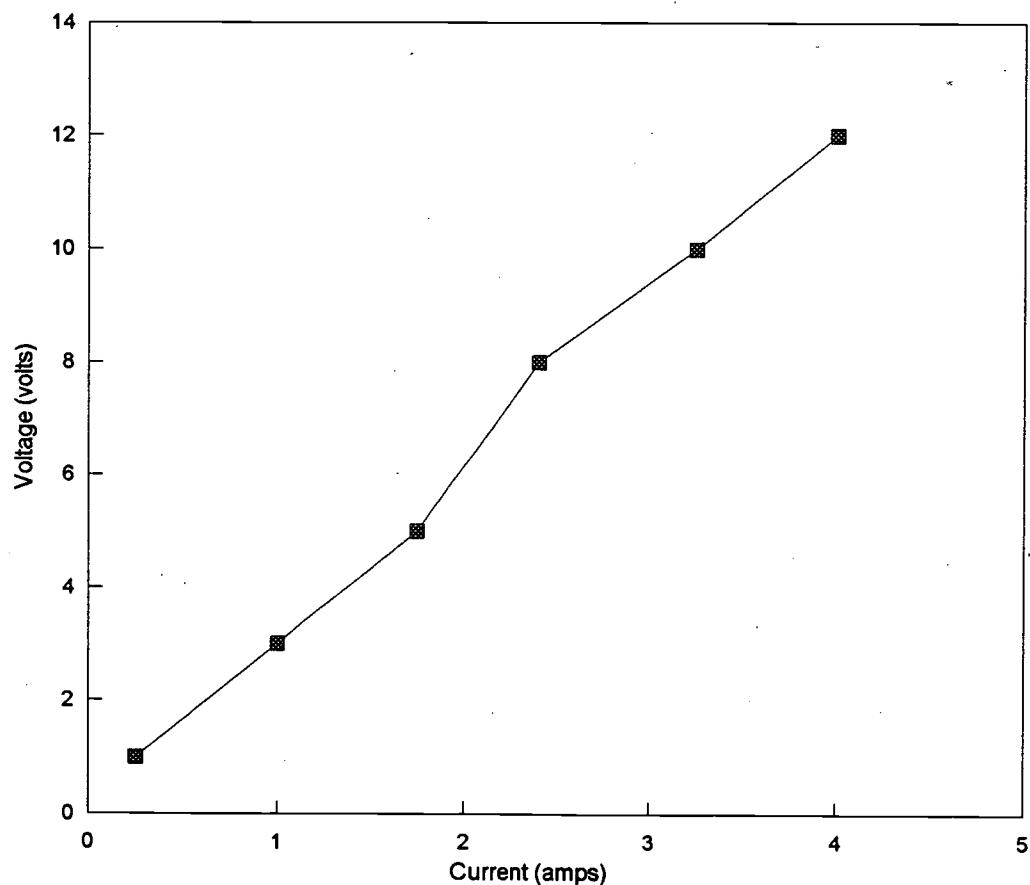
6

System Operating amps

2

Test Voltage: (volts)	Test Current: (amps)
1	0.25
3	1
5	1.75
8	2.4
10	3.25
12	4

Loop Resistance: (ohms)
3.111111

Graph of System voltage vs current.

Electrical Mechanical Water Meters
25 Bunya Street Eagle Farm Q 4009
Ph. (07) 3403 1849
Fx. (07) 3403 1898

Brisbane Water Engineering Services

5th July 1997

Subject: Coating defect survey for Edmonstone St rising sewer main.

Equipment used: Pipcamp PCS-2000 coating anomaly equipment.

Length Of Mains: Aprox. 800 Metres.

Size of mains: 680 mm. Dia mild steel cement lined.

Operator: John Taylor

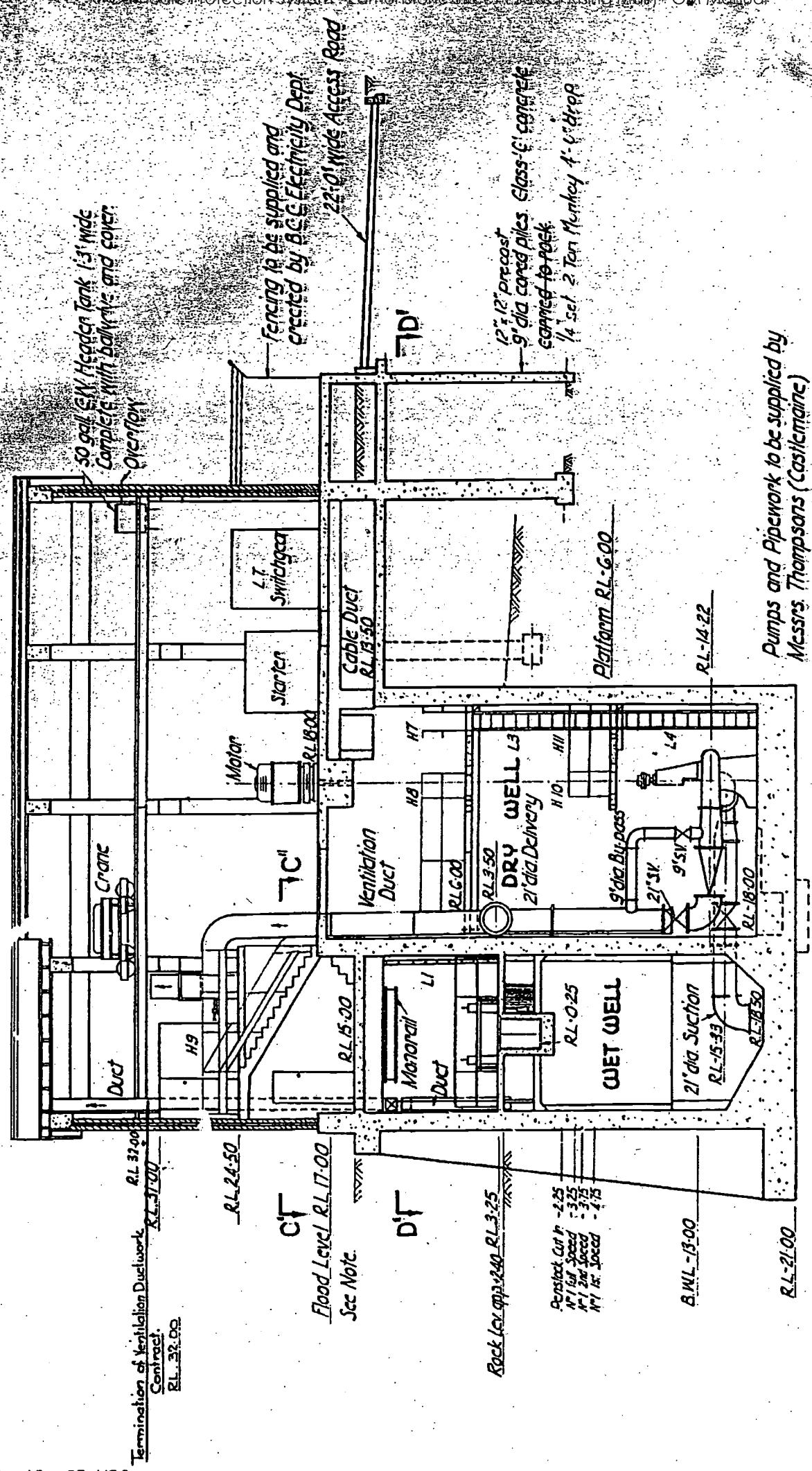
Date of survey: 4th, July 1997.

Procedure: Equipment was set up as per operation manual while operator traversed Pipeline route. Potentials were measured at each test point and no defects were noted.

Evaluation: Over the length of the main no notable defects were found.

Conclusion: The coating is still of reasonable condition and no further action is needed other than the CP System.

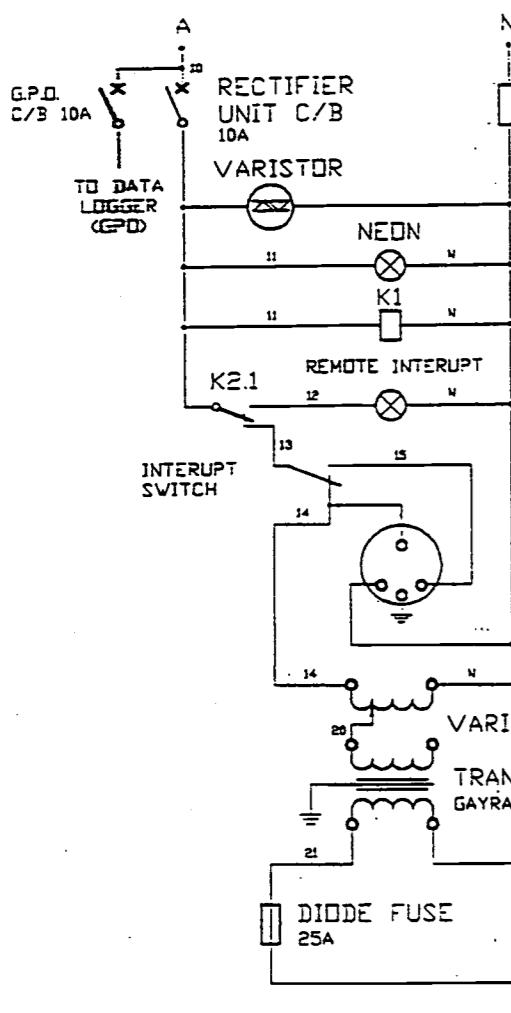
John Taylor
Electrical Engineering Unit



1	2	3	4	5	6	7	8																								
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<p>TP3</p> <p>Bleed.</p> <p>TP2</p> <p>TP1 Rectifier</p> <p>PUMP STATION</p> <p>EDMONSTONE ST</p> <p>FINSBURY PARK</p>						<p>N</p>																									
						AMENDMENT & ISSUE REGISTER <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%;">MANAGER</td> <td style="width: 50%;">DIRECTOR OF TECHNOLOGY SERVICES</td> </tr> <tr> <td>DATE:</td> <td>DATE:</td> </tr> <tr> <td style="width: 50%;">DIRECTOR OF PLANNING & DESIGN</td> <td style="width: 50%;">DIRECTOR OF WATER SUPPLY</td> </tr> <tr> <td>DATE:</td> <td>DATE:</td> </tr> <tr> <td>DESIGN</td> <td>J.S.</td> <td>9.9.96</td> <td>ENGINEER IN CHARGE</td> </tr> <tr> <td>DRAWN</td> <td>O.L.P.</td> <td>12.9.96</td> <td>SUPERVISING ENGINEER</td> </tr> <tr> <td>TRACED</td> <td></td> <td></td> <td></td> </tr> <tr> <td>CHECKED</td> <td></td> <td>A2</td> <td>REDUCED</td> </tr> </table> <p>REFERENCES</p> <p>CADD FILE No. 76T00060</p> <p>THIS DRAWING WAS PRODUCED USING QIDRAW</p> <p>COPYRIGHT © 1996 No reproduction is permitted in whole or in part without the express consent of BRISBANE CITY COUNCIL BRISBANE WATER</p> <p> Brisbane Water Brisbane City ASSET MANAGEMENT PROFESSIONAL SERVICES</p> <p>PROJECT: CATHODIC PROTECTION EDMONSTONE STREET 680 DIA. RISING MAIN</p> <p>TITLE: CATHODIC PROTECTION SYSTEM DETAILS</p> <p>SCALE: N.T.S. No. 1 OF 1 SHEETS</p> <p>DRAWING No. 486/7/6-M01T00060 AMEND. 0</p>		MANAGER	DIRECTOR OF TECHNOLOGY SERVICES	DATE:	DATE:	DIRECTOR OF PLANNING & DESIGN	DIRECTOR OF WATER SUPPLY	DATE:	DATE:	DESIGN	J.S.	9.9.96	ENGINEER IN CHARGE	DRAWN	O.L.P.	12.9.96	SUPERVISING ENGINEER	TRACED				CHECKED		A2	REDUCED
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RECTIFIER UNIT

FIELD



NOTES

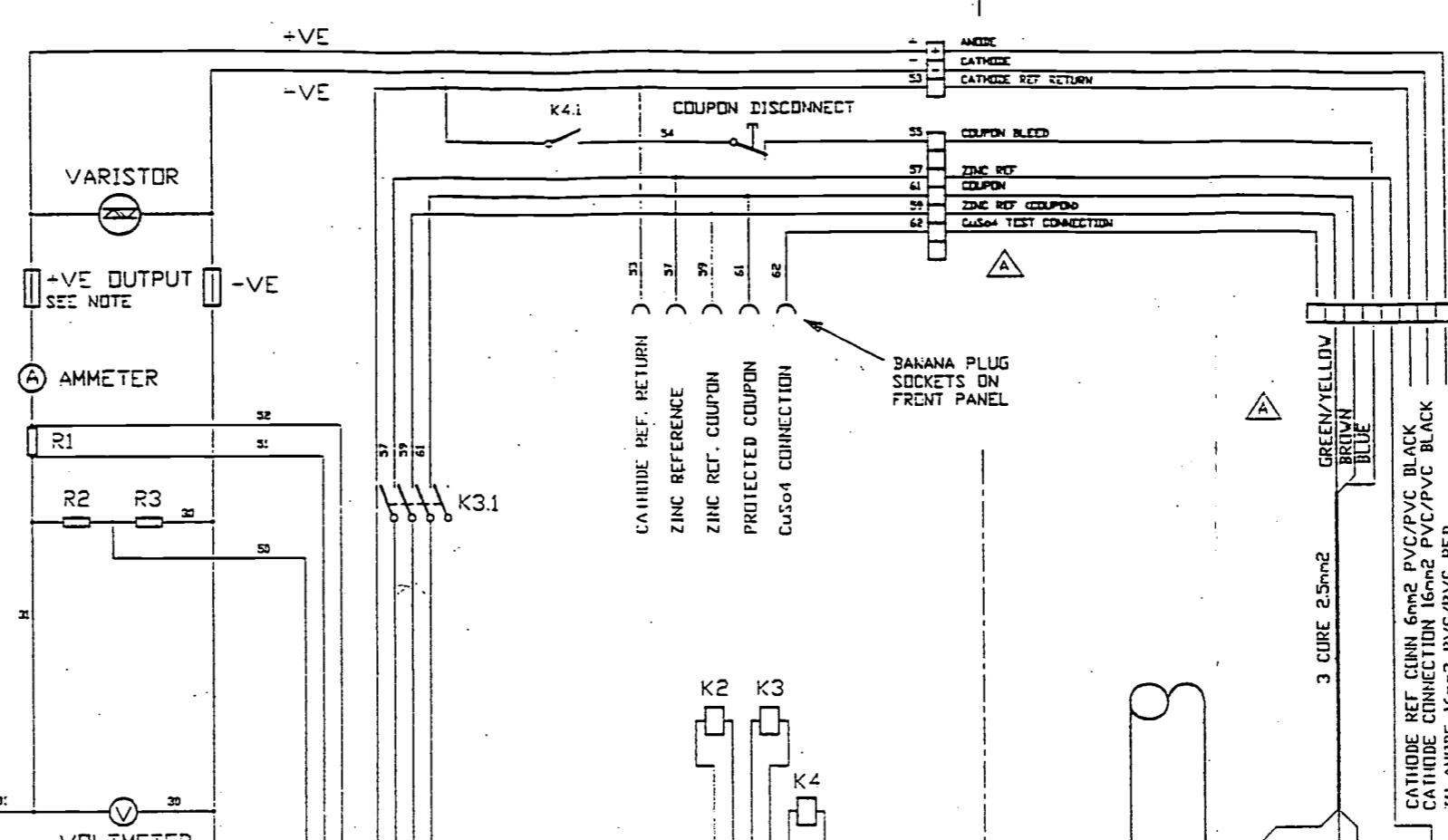
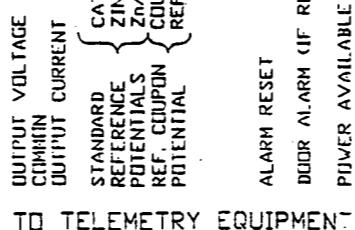
TRANSFORMER OUTPUT CURRENT & VOLTAGE
TO SUIT APPLICATION PROVIDING SUITABLE
RESOLUTION & CONTROL

AMMETER & VOLTMETER TO PROVIDE
SUITABLE RESOLUTION FOR SYSTEM

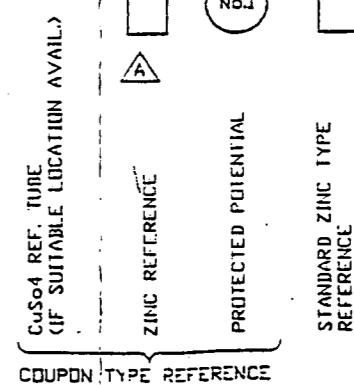
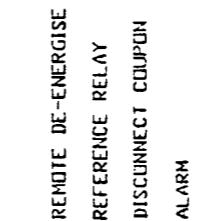
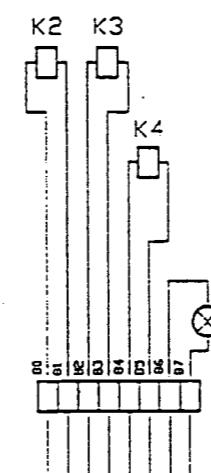
- + POSITIVE WIRING TO BE RED
- NEGATIVE WIRING TO BE BLACK
- L.V. AC WIRING TO BE 4mm² BLUE/WHITE
- DC WIRING TO BE 4mm²
- 240V AC WIRING TO BE 1.5mm²-BROWN/BLACK
- REFERENCE WIRING TO BE 1.5mm²-GREY

LEGEND

- K1 - 240V RELAY
K2,K3, & K4 - 24V DC RELAYS
R1 - SHUNT RESISTOR (SIZED TO PRODUCE A 1V DROP AT FULL LOAD)
R2,R3 - VOLTAGE DIVIDER (SIZED TO PRODUCE A VOLTAGE OF 10V ACROSS R2 AT MAX. OUTPUT VOLTAGE)
+VE AND -VE DC FUSES TO BE SIZED APPROX. 5AMPS ABOVE NORMAL OUTPUT CURRENT

TERMINALS WITH
4mm TEST PLUG SOCKETS

TO TELEMETRY EQUIPMENT



A	R.L.	18.10.93	CHANGES AS SHOWN
B	R.L.	25.8.93	ISSUED FOR CONSTRUCTION
C	BY	DATE	REVISION
			CHECK APPR



BRISBANE
CITY COUNCIL
DEPARTMENT OF WATER
SUPPLY & SEWERAGE
MECHANICAL & ELECTRICAL SERVICES

PROJECT
STANDARD
CATHODIC PROTECTION
TITLE
RECTIFIER UNIT
WITH DATA LOGGING FACILITIES
WIRING DIAGRAM

DRAWN	NAME	DATE	SUPER ENG.	NAME	DATE	SCALE
DESIGN	J.S.	3.8.93	SENIOR ENG.			
CHECKED	J.S.	25.8.93	ELECT. ENG.			
DRAWING NO.						ACAD92 FILE NO.
486/6/25-AA1C0021E						A625C21

3007/600

25th October 1950
Piloted RAH 25.10.50
Checked RAH 25.10.50

Scale 6 chains - 1inch

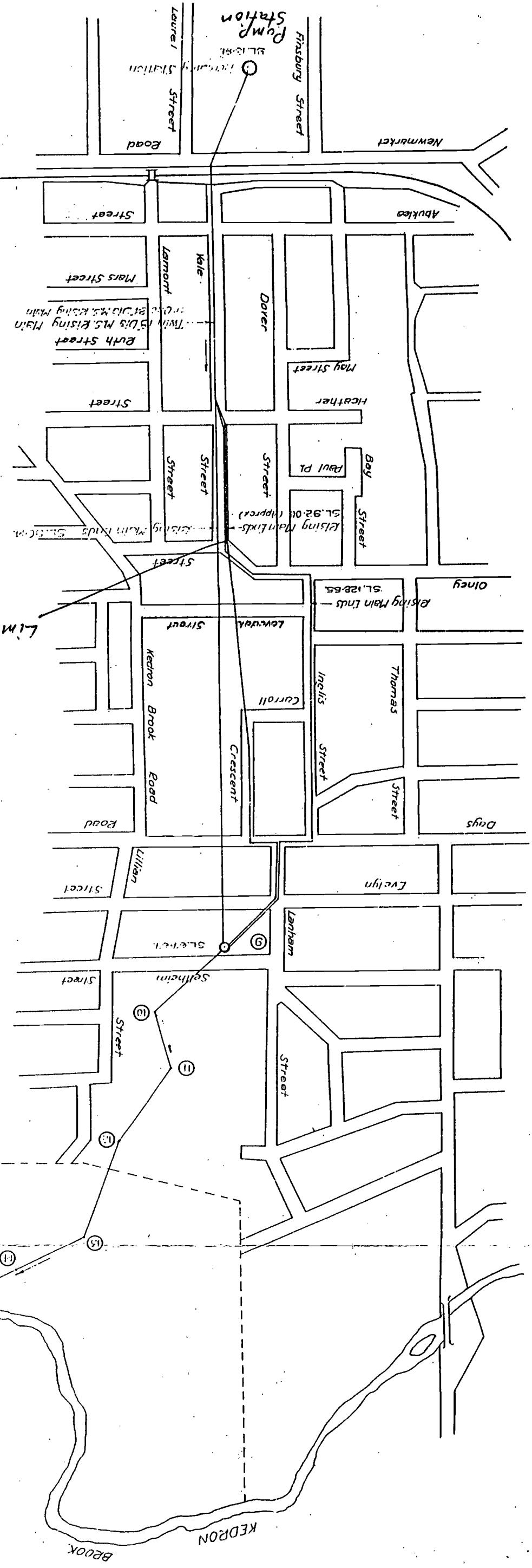
ALTERNATIVE TRAVERSSES FROM PUMPING STATION TO NORTH KEDRON BROOK SEWER

BREAKFAST Ck DIVERSION SEWER

Comparative Estimates are from Pumping Station

Limit of Run.

- Traverse C
- Traverse B (Recommended route)
- Traverse A
- Combination to all Traverses



NOTES	1. HOT DIP GALVANISE AFTER FABRICATION
3 FILLET WELD ON CAP PLATE	IN RHS THREADED HOLES
160 X 120 PERSPEX WINDOW	BOLTED onto RHS WITH 6 X M6 HEX HEAD BOLTS
ON CAP PLATE	GASKET BETWEEN PERSPX & RHS
125 X 75 GALV. (OD)	M.S. RHS
INSULATED STUDS	140 X 80 HOLE CUT INTO RHS
6 X M6 HEX HEAD BOLTS	25
140 X 80 HOLE	125
1. AMENDMENT & ISSUE REGISTER	INITIALS
MANAGER DIRECTOR OF TECHNOLOGY SERVICES	DATE: 04.96
AMENDMENT DATE: 04.96	AMENDMENT DATE: 04.96
AMENDMENT & ISSUE REGISTER	DATE: 04.96
MANAGER DIRECTOR OF TECHNOLOGY SERVICES	DATE: 04.96
AMENDMENT & ISSUE REGISTER	DATE: 04.96
PLANNING & DESIGN DIRECTOR OF WATER SUPPLY	DATE: 04.96
DIRECTOR OF CONSTRUCTION	DATE: 04.96
DATE:	DESIGNER IN CHARGE
DRMN 15.01.96	ENGINEER SPINNING ENGINEER
TRACED	DATE:
RECHECKED	DATE:
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SCALE: N.T.S.	NO. 1 OF 1 SHEETS
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