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22nd May 2003

OPERATING MANUAL FOR:

TARINGA to ENOGGERA TRUNK MAIN

S48 TRUNK MAINS

CATHODIC PROTECTION SYSTEM

CLIENT:

BRISBANE WATER
WATER SYSTEM SERVICES

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DRAWINGS

486/6/25-AA1C0021E	Standard Rectifier Wiring Diagram
(No Number)	Bimonthly 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: 1530 mm Dia mild steel cement lined.

Coating: Enamel Coated.

Length: Appox 9.0 Km.

Location: From Valve 100 corner Lloyd and Girton Streets Enoggera, to Valve 928 Woodstock Ave. Taringa.

Construction Drawings:

486/1/22-CC0024E	Cathodic Protection Standard Switchboard Cabinet
486/1/22-AA1T0001E	Cathodic Protection Test Points

(4.0) CATHODIC PROTECTION DETAILS

(4.1) Type of Cathodic Protection: Impressed Current.

(4.2) Rectifier: Standard 30 Volt, 30 amp direct current output enclosed in a stainless steel switchboard. This system has 1 rectifier installed. The rectifier is in the park, beside the Transport Toilet, near bus stop No.30 in Dawn St. Bardon and has a 240V supply from Energex pillar box adjacent the bus stop.

(4.3) Cathode: The cathode point is located on the 1530 mm dia mains adjacent the creek crossing near the corner of Dawn and Kamber Streets Bardon. The cathode point is where the cabling from the rectifier is attached to the structure under cathodic protection.

(4.4) Anodes: Four 1500 x 50mm silicone iron anodes were installed approximately 70 metres from the trunk mains, in a vertical bed 4 metres deep, in the park at Dawn St. approx 12 metres from bus stop No.30. The anodes are backfilled with cokebreeze thereby improving anode - ground resistance. The anodes are identified by a marker post and label. See layout drawing.

(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 sixteen test points have been installed on the trunk main which can be identified from the layout drawing.

(4.6) Associated Drawings:

Cathodic Protection Test Point Details	- 486/1/22-AA1T0001E
Standard Rectifier Wiring Diagram	- 486/6/25-AA1C0021

(4.7) Associated Standards:

AS 3000 1991 Australia Wiring Rules

AS 2832.1 1991 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 Electrical Safety Office, Department of Mines and Energy, and has approval to operate.

(7.0) MAINTENANCE

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

22nd May, 2003.
Cathodic Protection Unit.

CPS Bimonthly 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.

22nd May. 2003.
Cathodic Protection Unit

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.

22nd May, 2003.
Cathodic Protection Unit

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

Brisbane Water

CP Form No. 23

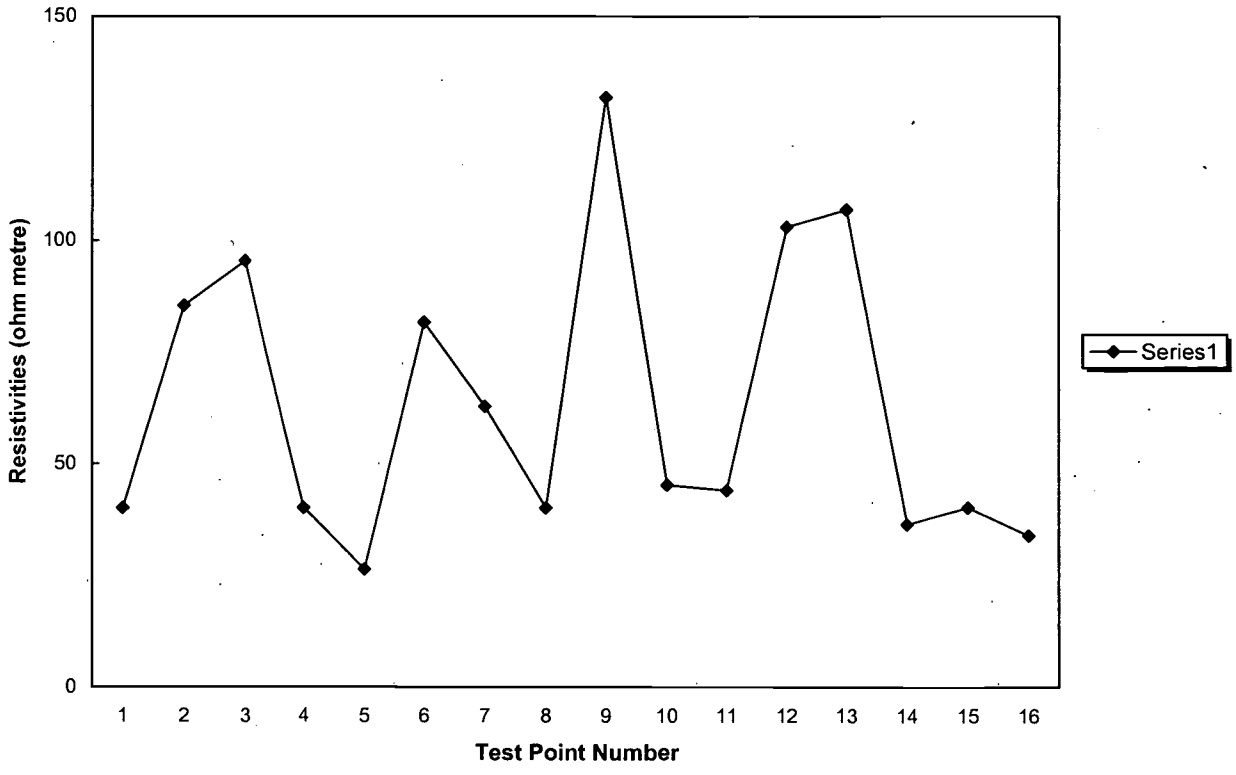
Network Services

Cathodic Protection System Resistivities Recording Form

Project S48 Trunk Main.Taringa to Enoggera **Date** 22nd May 2003

Test Point number	Distances to T.P. (metres)	Resistivities at 2 metres ohm metres
1	0	40.19
2	500	85.4
3	1200	95.4
4	1800	40.19
5	2400	26.37
6	3200	81.64
7	3450	62.8
8	3900	40.1
9	4200	131.88
10	5100	45.21
11	5800	43.96
12	6600	102.95
13	7600	106.76
14	8200	36.4
15	9000	40.19
16	9000	33.9

Graph of resistivities vs pipelength



Revision 22/05/2003

Brisbane Water CP Form No. 23

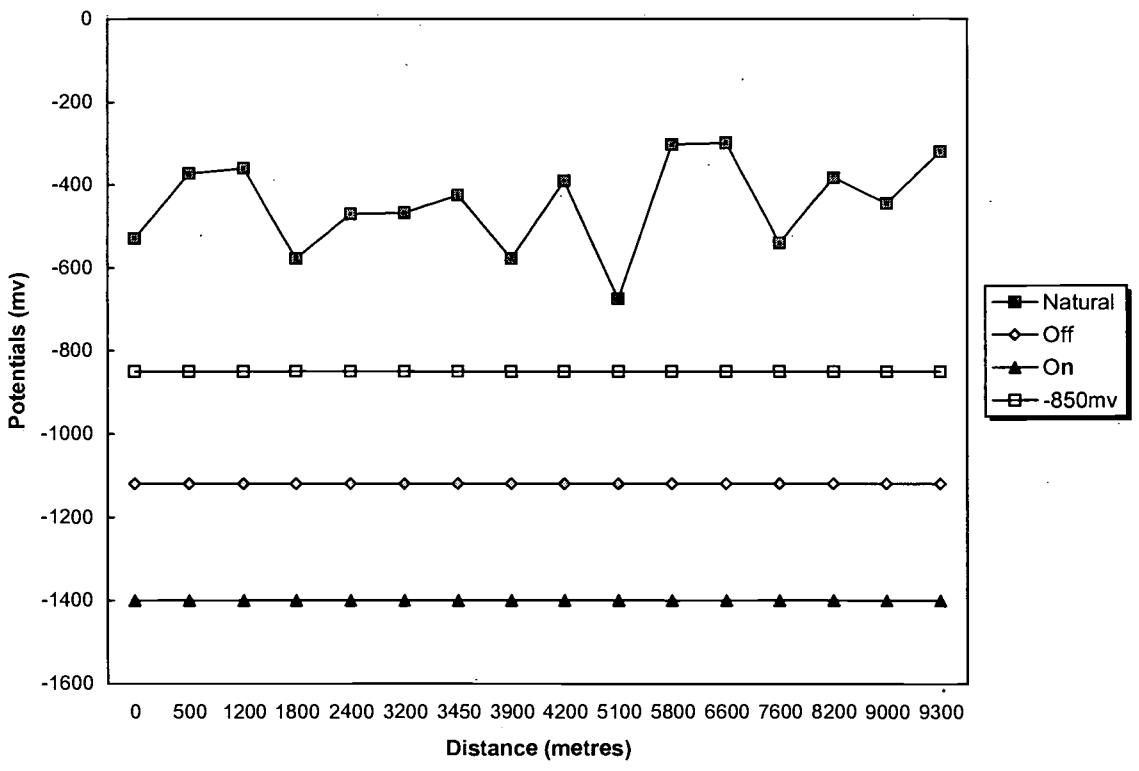
Network Services

Cathodic Protection System Potential Recording Form

Project S48 Trunk Main.Taringa to Enoggera **Date** 22nd May 2003

Test Point number	Distances to T.P.	Potentials to CuSO4			
		Natural	Off	On	
	(metres)	(mV)	(mV)	(mV)	(mV)
1	0	-529	-1120	-1400	-850
2	500	-372	-1120	-1400	-850
3	1200	-360	-1120	-1400	-850
4	1800	-577	-1120	-1400	-850
5	2400	-470	-1120	-1400	-850
6	3200	-467	-1120	-1400	-850
7	3450	-425	-1120	-1400	-850
8	3900	-577	-1120	-1400	-850
9	4200	-390	-1120	-1400	-850
10	5100	-675	-1120	-1400	-850
11	5800	-302	-1120	-1400	-850
12	6600	-298	-1120	-1400	-850
13	7600	-539	-1120	-1400	-850
14	8200	-382	-1120	-1400	-850
15	9000	-444	-1120	-1400	-850
16	9300	-320	-1120	-1400	-850

Graph of potentials vs pipelength



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