Brisbane Water
Engineering Services

□ Electrical □ Mechanical □ Water Meters
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OPERATING MANUAL FOR:

MEDOWLANDS RD SUBMERSIBLE PUMP STATION

CATHODIC PROTECTION SYSTEM

CLIENT:

DEPARTMENT OF WATER SUPPLY AND SEWERAGE
SEWERAGE OPERATIONS BRANCH

30 MAY 1996.

MANUAL CONTENTS

DRAWINGS

486/6/25-AA1C0023E	Standard Rectifier Wiring Diagram
2/14.213	Cathodic Protection Details
(No Number)	Monthly Maintenance Program

(1.0) INTRODUCTION

Steel when buried or immersed has a tendancy to corrode (rust) as the oxidised form is more stable than the metal.

Because of this, precautions must be taken to stop or minimise 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 practicable to expect a perfect coating during construction and coating damage will also occur with time. Because of this, corrosion may occur at imperfections.

(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 low 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 and is generally measured against a standard reference electrode, which permits a reproducible potential at which corrosion does not occur to be quoted.

(3.0) STRUCTURE DETAILS

Size: 2 x 4KW Submersible Sewerage Pumps

Coating: Tar Epoxy Coating

Length: N.A.

Location: **MEDOWLANDS RD CARINA UBD 161 N20**

Drawings:

Construction:

486/5/7-PE09RC	Pump Station Reinforcement

Included Drawings:

486/7/7-GD1T190E REV.B TO	Submersible Pump Station General Layout
486/7/7-GD1T203E REV.B	Rectifier Unit With Data Logging Facilities,Wiring Diagram
486/6/25-AA1C0023E	Standard Cathodic Protection Submersible Pump Station

(4.0) CATHODIC PROTECTION DETAILS

4.1 Type of Cathodic Protection: Impressed Current

4.2 Rectifier: Standard 32 Volt, 10 Amp direct current output enclosed in a poly carbonate enclosure, installed in the main switchboard. Rectifier has a 240VAC supply from within the Switchboard of pump station SP 263.

4.3 Cathode: The cathode point is made directly to each pump as indicated on the diagrams

4.4 Anodes: One 1000 x 50 silicon iron anode was installed suspended from the top of the wetwell from a suspension bar,cast into the roof of the well.

4.5 Testpoints: Testpoints are installed on cathodically protected structures to enable testing to confirm that full cathodic protection of the structure is maintained. On this structure 2 testpoints have been installed on the pumps and connected via disconnect plugs to terminals on the C.P. unit.

4.6 Associated Drawings:
Nil

4.7 Associated Standards:

AS 2832.1 1985 Pipes,Cables,Ducts, Guide to Cathodic Protection. Part 1.

AS 3000 1991 Australian Wiring Rules

4.8 Government Regulations:

Queensland Electricity Acts and Regulations

(5.0) PERFORMED TESTING

(1) Natural Potential Survey

(2) Testing of Insulated Flanges, Joints

(3) Current Drain Survey

(4) Rectifier Loop Resistance

(5) Foreign Structure Interference Survey and Mitigation.

(6) Final Potential Survey and Commissioning.

NOTE: Details of above testing have not been included in this manual but are available upon request.

(6.0) CONCLUSION

Full cathodic protection has been achieved on these sewerage pumps.

The cathodic protection system is to be registered with the Queensland Electricity Commission 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 pump to electroyte potentials. Monthly, Six momthly and sixty monthly maintenance procedures are detailed as attached below.

(7.1) 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.

(7.2) 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.

(7.3) 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 for "continue to operate" permit if applicable.

Brisbane Water Engineering Services

Electrical Engineering Unit

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5 Bunya Street
Eagle Farm Q 4009

Cathodic Protection System Potentials

Date: 20th JUNE 1996

Cathodic Protection System: Meadowlands Rd Sub Pump Stn.

System Operating Volts: 7 System Operating amps: 0.01

		Natural Potential	On Potential	Off Potential
	All Potentials to CuCuso4 Reference Cell in millivolts			
Pump 1	Pump	-610	-1250	-950
	Zn Ref 1	-1079	-1124	-1090
	Zn Ref 2	-1091	-1146	-1105
	All Potentials to Zn Reference Cells in millivolts			
	Pump Zn Ref 1	472	-177	50
	Pump Zn Ref 2	443	89	300
	All Potentials to CuCuso4 Reference Cell in millivolts			
Pump 2	Pump	-611	-1138	-923
	Zn Ref 1	-1074	-1155	-965
	Zn Ref 2	-1065	-1147	-943
	All Potentials to Zn Reference Cells in millivolts			
	Pump Zn Ref 1	476	71	250
	Pump Zn Ref 2	465	-33	200
	All Potentials to CuCuso4 Reference Cell in millivolts			
Pump 3	Pump	NA		
	Zn Ref 1	NA		
	Zn Ref 2	NA		
	All Potentials to Zn Reference Cells in millivolts			
	Pump Zn Ref 1	NA		
	Pump Zn Ref 2	NA		
Ladder		-490	-850	-760

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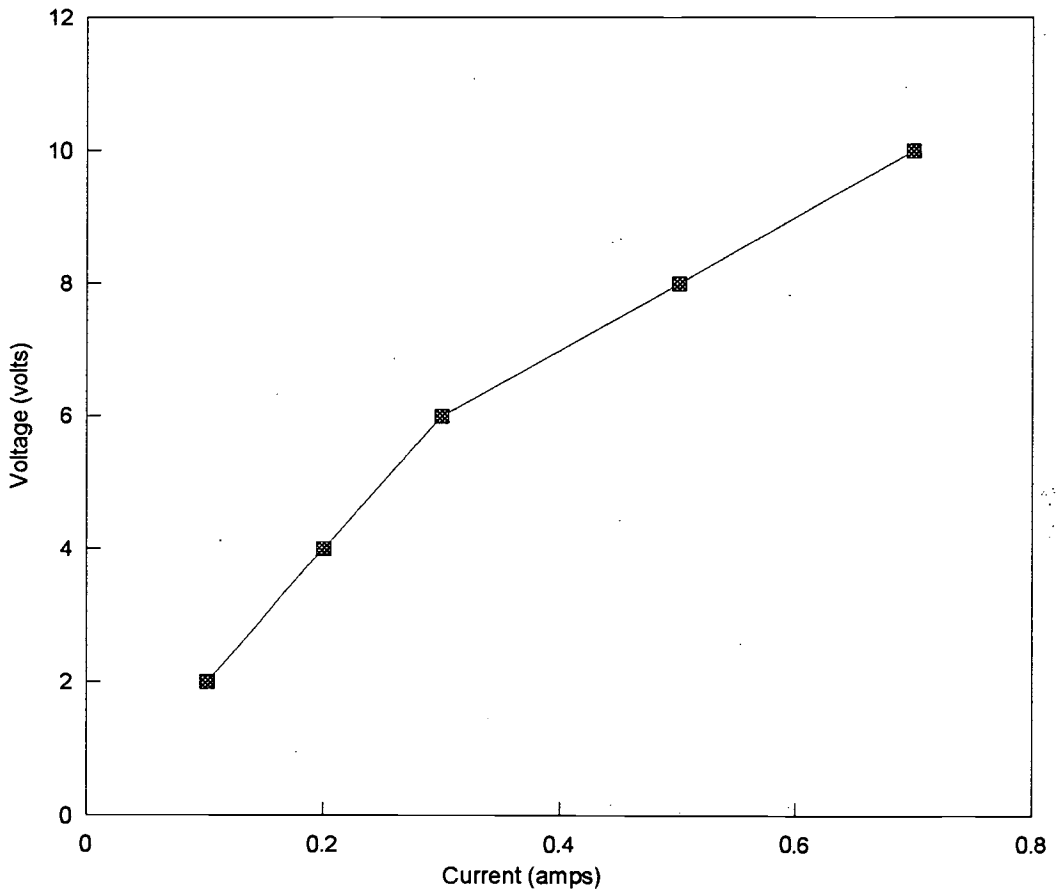
Cathodic Protection System Loop Resistance

Date: 20th JUNE 1996
Cathodic Protection System: Medowlands Rd Sub. Pump Stn.
System Operating Volts: 6 System Operating amps 0.3

Test Voltage: (volts)		Test Current: (amps)	
2		0.1	
4		0.2	
6		0.3	
8		0.5	
10		0.7	

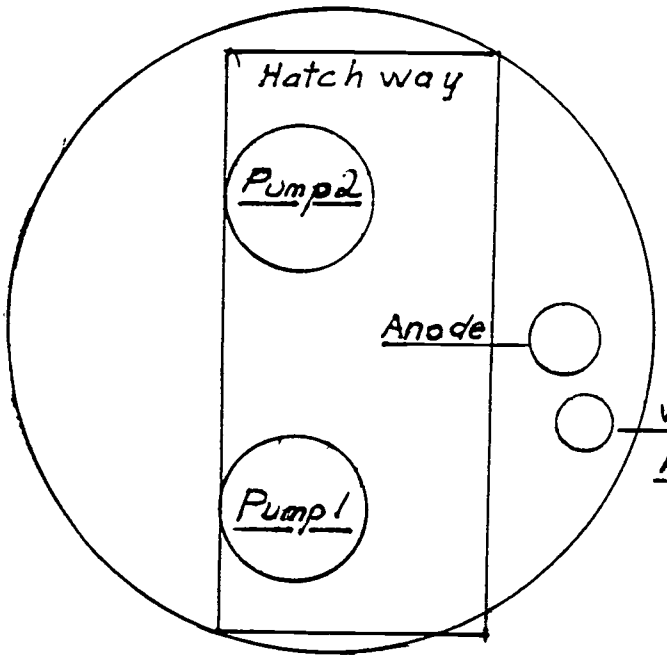
Loop Resistance (ohms)
10

Graph of System voltage vs current.

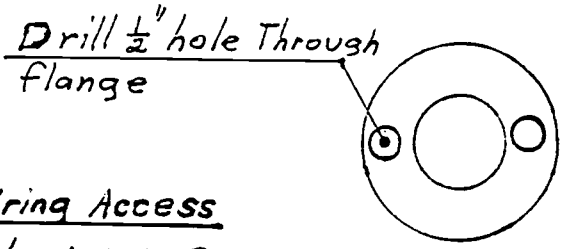


09/23/96

LOOPMEDO.WK4



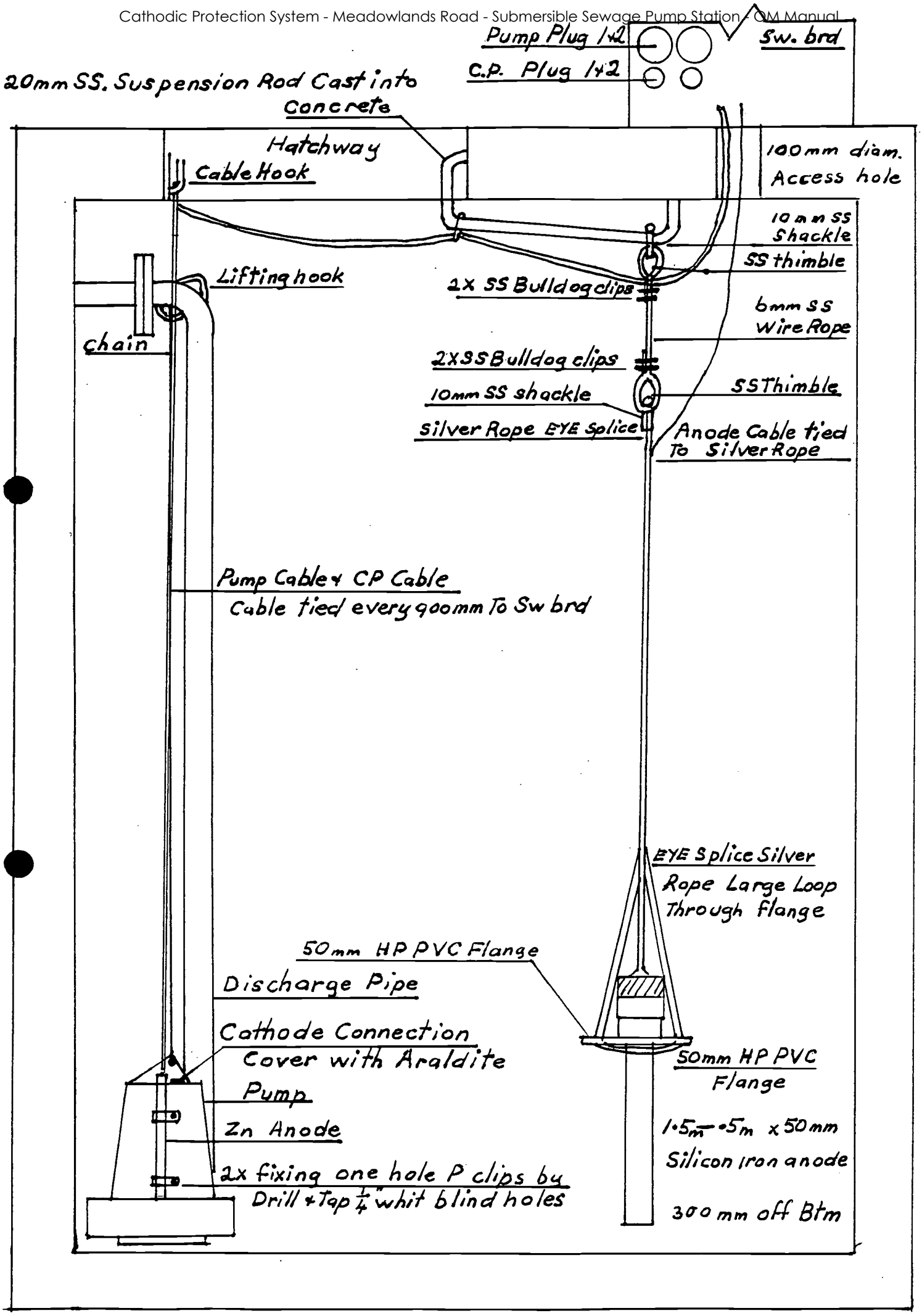
Plan View of Well

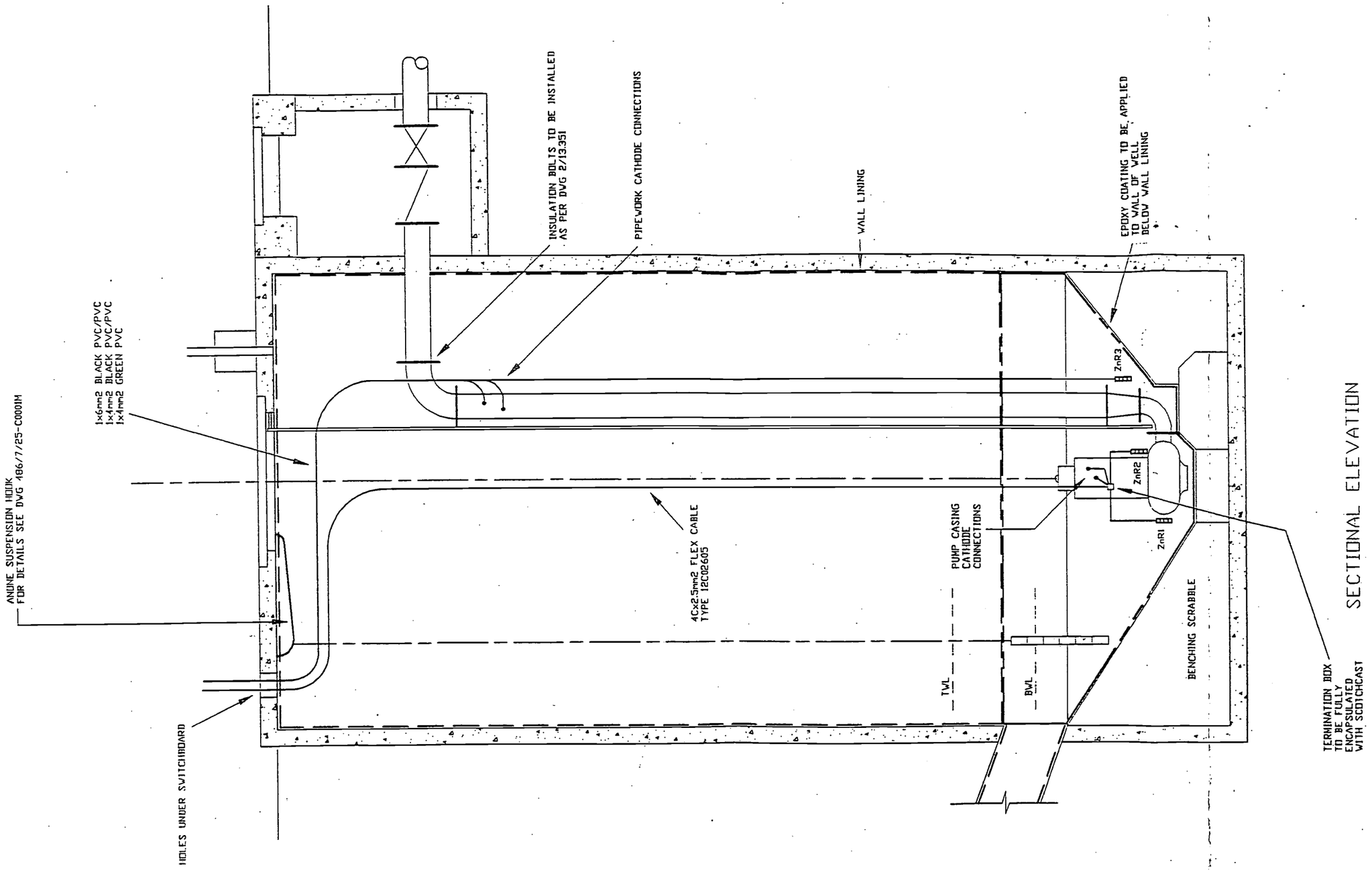


Plan View Anode Suspension Ring
Water Pipe High Preasure PVC 50mm flange

BILL OF Materials

ITEM Description	Code	Quantity	Purchase from
6mm SS wire Rope	N/A	1 m	Bulivants
10mm S S. D shackles	N/A	2	"
6mm S.S. wire thimbols	N/A	2	"
6 mm S.S Buldog clamps	N/A	4	"
Anode Silicon iron 1·5m x 50mm	357	1	STore
Cable 4 core 2·5 Neoprene	21920	20 mtrs	"
Cable Ties 200 mm	20801	1 Pkt.	"
Nylon Rope	11778	8 mtrs	"
Scotchcast Resin		1	"
Water Pipe 50mm H.P. PVC flange	N/A	1	Plumbers Supl
Zn Anode		2	Wilson + Walton


Pump Plug 1/2
Sw. brd
C.P. Plug 1/2
20mm SS. Suspension Rod Cast into Concrete
Hatchway
Cable Hook
100mm diam. Access hole
10mm SS Shackle
SS thimble
Lifting hook
2x SS Bulldog clips
6mm SS Wire Rope
chain
2X SS Bulldog clips
10mm SS shackle
SS Thimble
Silver Rope EYE Splice
Anode Cable tied To Silver Rope
Pump Cable & CP Cable
Cable tied every 900mm To Sw brd
EYE Splice Silver Rope Large Loop Through Flange
50mm HP PVC Flange
Discharge Pipe
Cathode Connection Cover with Araldite
Pump
Zn Anode
2x fixing one hole P clips by Drill & Tap 1/4" whit blind holes
50mm HP PVC Flange
1.5m - .5m x 50mm Silicon iron anode
300 mm off Btm



MANAGER DATE:	DIRECTOR OF PLANNING & DESIGN DATE:		
DIRECTOR OF CONSTRUCTION	DIRECTOR OF M & E SERVICES	DIRECTOR OF SEW. OPERATIONS/W.S. DISTRIBUTION	
ENGINEER IN CHARGE			
SUPERVISING			

DESIGN		
DRAWN	R.LISTON	16.12.93
CHECKED		

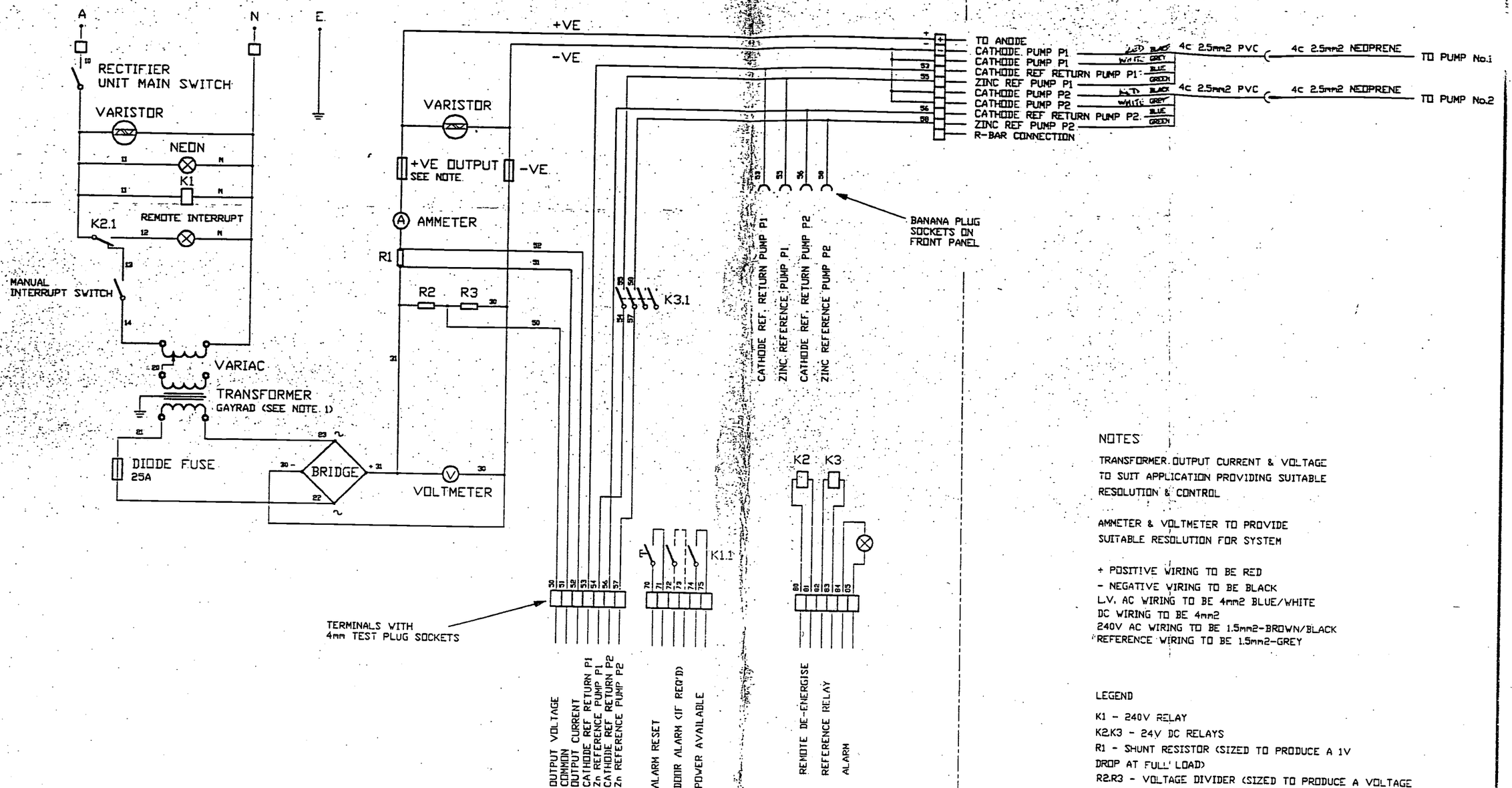
PROJECT
OXLEY ARCHERFIELD
CATHODIC PROTECTION

TITLE
SUBMERSIBLE PUMP STATION
GENERAL LAYOUT

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

SCALE: NTS	No. 1 OF 1 SHEETS		
DRAWING No. 486/7/7-PE1C0051E		AMEND. 0	

0	16.12.93	ISSUED FOR CONSTRUCTION	R.L.	



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 - 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 1V ACROSS R2 AT MAX. OUTPUT VOLTAGE)
+VE AND -VE DC FUSES TO BE SIZED APPROX. 5AMPS ABOVE NORMAL OUTPUT CURRENT

No.	BY	DATE	REVISION	CHECK	APPR
B	R.L.	16.1.95	WIRE NUMBERS ADDED		
A	R.L.	22.12.94	CIRCUIT CHANGES		
0	R.L.	25.8.93	ISSUED FOR CONSTRUCTION		

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

PROJECT: STANDARD CATHODIC PROTECTION SUBMERSIBLE PUMP STATION

TITLE: RECTIFIER UNIT WITH DATA LOGGING FACILITIES WIRING DIAGRAM

	NAME	DATE		NAME	DATE	SCALE	SIZE
DRAWN	R.L.	19.10.93	SUPER ENG.	M.J.	1.11.93		A3
DESIGN	J.S.	15.10.93	SENIOR ENG.				
CHECKED	J.S.	22.10.93	ELECT. ENG.				AMEND

DRAWING No. 486/6/25-AA1C0023E

ACADR12 FILE No. A625C23

AMEND B