ELECTROLYSIS RISK ASSESSMENT REPORT
BILLBERGIA
8 WILSON STREET, CHATSWOOD, NSW 2067

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PURPOSE AND SCOPE

This document was developed to address the following requirements:

- To outline the methodology Corrosion Control Engineering employees followed during the survey
- Present and discuss the results of the survey
- Provide recommendations

DISTRIBUTION

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TECHNICAL REVIEW

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DOCUMENT CONTROL

REVISION	DATE	REASON FOR ISSUE	PREPARED	QUALITY CHECK	TECHNICAL APPROVAL
0	26/03/2025	First Issue	N. Amaral	S. Buhora	A. Dunn

UPDATES SINCE LAST REVISION

New document

Contents

Appendices

1. Introduction

Corrosion Control Engineering (Holdings) Pty Ltd (CCE) was engaged to assess the electrolysis risk at 8 Wilson Street, Chatswood NSW 2067 prior to the construction of the proposed development. As requested, on Thursday 20 March 2025 and Friday, 21 March 2025, CCE conducted testing on-site to measure the stray traction currents due to all influencing rail lines including the T1 North Shore and Western Line and the Metro Northwest Line.

2. The Electrolysis Problem

Most of the DC current to power the electric trains (trains, metro, and light rail) returns to the railway substations via the rail lines. However, some leaks to ground (stray traction current) and in returning to the substation via this path can be picked up (and discharged) from buried metallic structures, leading to possible electrolysis-type corrosion problems. This corrosion of the metal occurs at the discharge point.

The problems can be significant if:

- The metallic structures are sufficiently large or long enough and close to the electrified railway lines.
- The stray traction current leakages to soil are of sufficient frequency and magnitude.

3. Test Method

The in-ground stray traction, causing voltage fluctuations on the development site, was monitored by data logging voltage gradients and potentials with reference to $Cu/CuSO_4$ as follows:

1. Data logging voltage gradients between steel earth stakes parallel to the T9 rail line. The earth stakes were approximately 50 m apart.

2. Data logging voltage gradients between steel earth stakes perpendicular to the T9 rail line. The earth stakes were approximately 40 m apart.

3. Data logging the potential of a guardrail at the eastern boundary of the site, adjacent to the rail corridor.

4. Data logging the potential of a water service pipe at the eastern boundary of the site, adjacent to the rail corridor.

5. Data logging the potential of a water service pipe at the western boundary of the site, adjacent to Pacific Highway.

6. Data logging the potential of a water service pipe at the northwest boundary of the site, adjacent to Pacific Highway.

7. Data logging the potential of a gas service pipe at the northwest boundary of the site, adjacent to O’Brien Street.

Note, TfNSW standard ‘THRCI 12051 ST: Development Near Rail Tunnels, Version 2.0’, and Sydney Metro Guideline ‘Sydney Metro Underground Corridor Protection Technical Guidelines, Version 2.0’, does not provide any acceptance criteria for stray current effects. The NSW Electrolysis Committee adopts acceptance criteria (low risk) of 20 mV anodic and 100 mV cathodic time weighted average shift over a period of up to 24 hours. Given there are no specified mitigation methods, the conclusions and recommendations in this report are based on CCE's experience in this field.

4. Test Results

A summary of the test results is presented in the following table. The corresponding data logger charts are presented in Appendix A.

Test Number	Data Logging Test Performed	Test Duration	Observed Fluctuations
1	Data logging voltage gradients between steel earth stakes parallel to the T9 rail line. The earth stakes were approximately 50 m apart.	20-hours	Most fluctuations within 10 mV. Maximum fluctuation of 38 mV.
2	Data logging voltage gradients between steel earth stakes perpendicular to the T9 rail line. The earth stakes were approximately 40 m apart.	20-hours	Fluctuations within 10 mV.
3	Data logging the potential of a guardrail at the eastern boundary of the site, adjacent to the rail corridor.	20-hours	Fluctuations within 5 mV.
4	Data logging the potential of a water service pipe at the eastern boundary of the site, adjacent to the rail corridor.	20-hours	Most fluctuations within 5 mV. Maximum fluctuation of 15 mV.
5	Data logging the potential of a water service pipe at the western boundary of the site, adjacent to Pacific Highway.	20-hours	Most fluctuations within 5 mV. Maximum fluctuation of 15 mV.
6	Data logging the potential of a water service pipe at the northwest boundary of the site, adjacent to Pacific Highway	20-hours	Fluctuations within 5 mV.
7	Data logging the potential of a gas service pipe at the northwest boundary of the site, adjacent to O'Brien Street.	20-hours	Fluctuations within 5 mV.

5. Discussion

The test results show that one of the test locations recorded stray current effects that exceed acceptable limits.

1. Data logging voltage gradients between steel earth stakes parallel to the rail show stray current effects are within acceptable limits but at times exceed acceptable limits.

2. Data logging voltage gradients between steel earth stakes perpendicular to the rail show stray current effects are within acceptable limits.
3. Data logging voltage gradients between the guardrail parallel to the rail show stray current effects within acceptable limits.
4. Data logging the potential of the water service pipe at the eastern boundary of the site shows stray current effects that are within acceptable limits.
5. Data logging the potential of the water service pipe at the western boundary of the site shows stray current effects are within acceptable limits.
6. Data logging the potential of the water service pipe at the northwestern boundary of the site shows stray current effects are within acceptable limits.
7. Data logging the potential of the gas service pipe at the western boundary of the site shows stray current effects are within acceptable limits.

6. Drawings & Documents Reviewed

The relevant drawings and documents provided to and reviewed by CCE are detailed below.

Table 1: Structural Drawings

Drawing Name	Drawing No.	Revision	Date
Specification Notes Sheet 1	S00010	E	11/03/2025
Specification Notes Sheet 2	S00011	E	11/05/2025
Specification Notes Sheet 3	S00013	E	11/03/2025
Specification Notes Sheet 4	S00013	C	17/01/2025
Specification Notes Sheet 5	S00013	C	17/01/2025
Cover Page Structural Drawings	S10000	E	11/03/2025
Site Retention Plan	S10001	E	11/03/2025
Splayed Ground Anchor Layout	S10002	E	11/03/2025
Typical Shoring Wall Detail	S10004	E	11/03/2025
Shoring Wall Elevation -Sw3	S10012	E	11/03/2025
Shoring Wall Elevation -Sw4	S10013	E	11/03/2025
Shoring Wall Sections -Sh4	S10019	E	11/03/2025

Table 2: Architectural Drawings

Drawing Name	Drawing No.	Revision	Date
Shoring Sections 01	A0050	P01	11/03/2025
Shoring Sections 02	A0051	P01	11/03/2025
Shoring Sections 03	A0052	P01	11/03/2025
GA Plan – Basement 7	A1001	P01	7/03/2025
GA Plan – Basement 6	A1002	P01	7/03/2025
GA Plan – Basement 5	A1003	P01	7/03/2025
GA Plan – Basement 4	A1004	P01	7/03/2025
GA Plan – Basement 3	A1005	P01	7/03/2025
GA Plan – Basement 2	A1006	P01	7/03/2025
GA Plan – Basement 1	A1007	P01	7/03/2025
GA Plan – Basement 1 Mezzanine	A1008	P01	7/03/2025
GA Plan - Ground Floor	A1009	P01	7/03/2025
Section A & B	DA300	01	1/11/2024

7. Conclusion

The test results show that the present stray current effects at the site, at times, exceeded acceptable limits. There is a corrosion risk to on-ground and in-ground metallic structures. Stray current activity can change with time and may become a higher corrosion risk.

The below recommendations should be adopted to minimise stray current effects as part of any future developments.

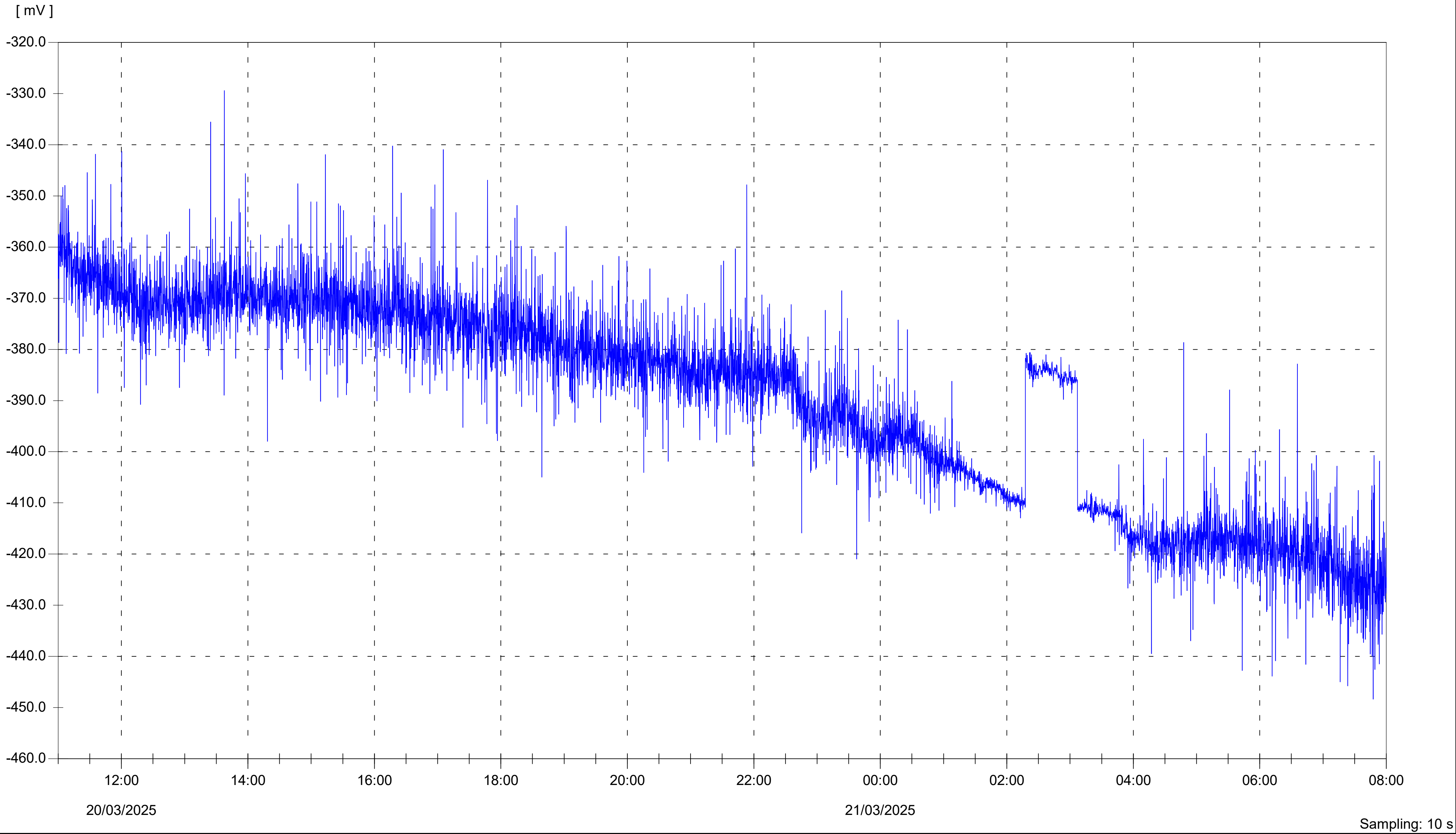
8. Recommendations

Based on the site testing and review of the available development drawings/documents, CCE recommend the following conservative protective measures, where possible/practical, to mitigate against long-term stray current corrosion at on-ground and in-ground metallic structures:

1. The installation of heavy plastic membrane (e.g. Fortecon) under (or behind) all reinforced concrete slabs, permanent retaining walls, permanent anchors, piers/piles, and metallic posts/bollards to electrically isolate from soil and stray currents. *Note, this may not always be possible/practical at piers/piles or when friction is relied upon for structural purposes.*
2. Ensure the high strength (minimum 32 MPa), high cover (minimum 50 mm) concrete is used to effectively prevent/limit soil moisture penetrating through to the steel/metal.
3. The use of plastic, rather than metallic, in-ground pipework and tanks. In the event buried metallic pipework and/or cables are installed within the site, installation within sealed non-metallic conduit is recommended. Where this is not possible (for example at metal water main feeds), insulating flanges/fittings/unions at the property boundary/meter can be used to electrically isolate the property piping.
4. A minimum of two (2-off) electrolysis test points such as an Erico Earthbridge DB12CS701, in conjunction with an Ag/AgCl permanent reference electrode installed close to the reinforcing steel, shall be provided at every at/below ground level. This is to assist with potential (stray current) monitoring (See Appendix C for details).

In order to comply with the TfNSW standard 'THRCI 12051 ST: Development Near Rail Tunnel Version 2.0, section 9.2.1' and Sydney Metro Guideline 'Sydney Metro Underground Corridor Protection Technical Guidelines, Version 2, section 9.4', CCE recommend installation of basement rebar test points to allow for future electrolysis testing of the basement rebar post-construction. This can be achieved via SS316 welded test studs that protrude from the basement walls, at approximately knee-high level. CCE recommend 2-off rebar test points be installed for each basement level, with one at each end of the basement level. Note, these welded studs can be installed relatively flush with or recessed in the concrete surface, allowing sufficient space (minimum 10 mm) for a temporary electrical connection (e.g. via alligator clip or similar). Alternatively, the Erico Earthbridge DB12CS701 can be installed for test points.

Appendix A: Data Logger Charts



—— : Volts vs Cu/CuSO4

	Min	Max	Average	Std. dev.
DC 1	-0.448 V	-0.329 V	-0.390 V	0.020 V

Electrolysis Risk Testing - Parallel
8 Wilson St, Chatswood NSW 2067
Data Logger: 6205
Parallel To The Rail

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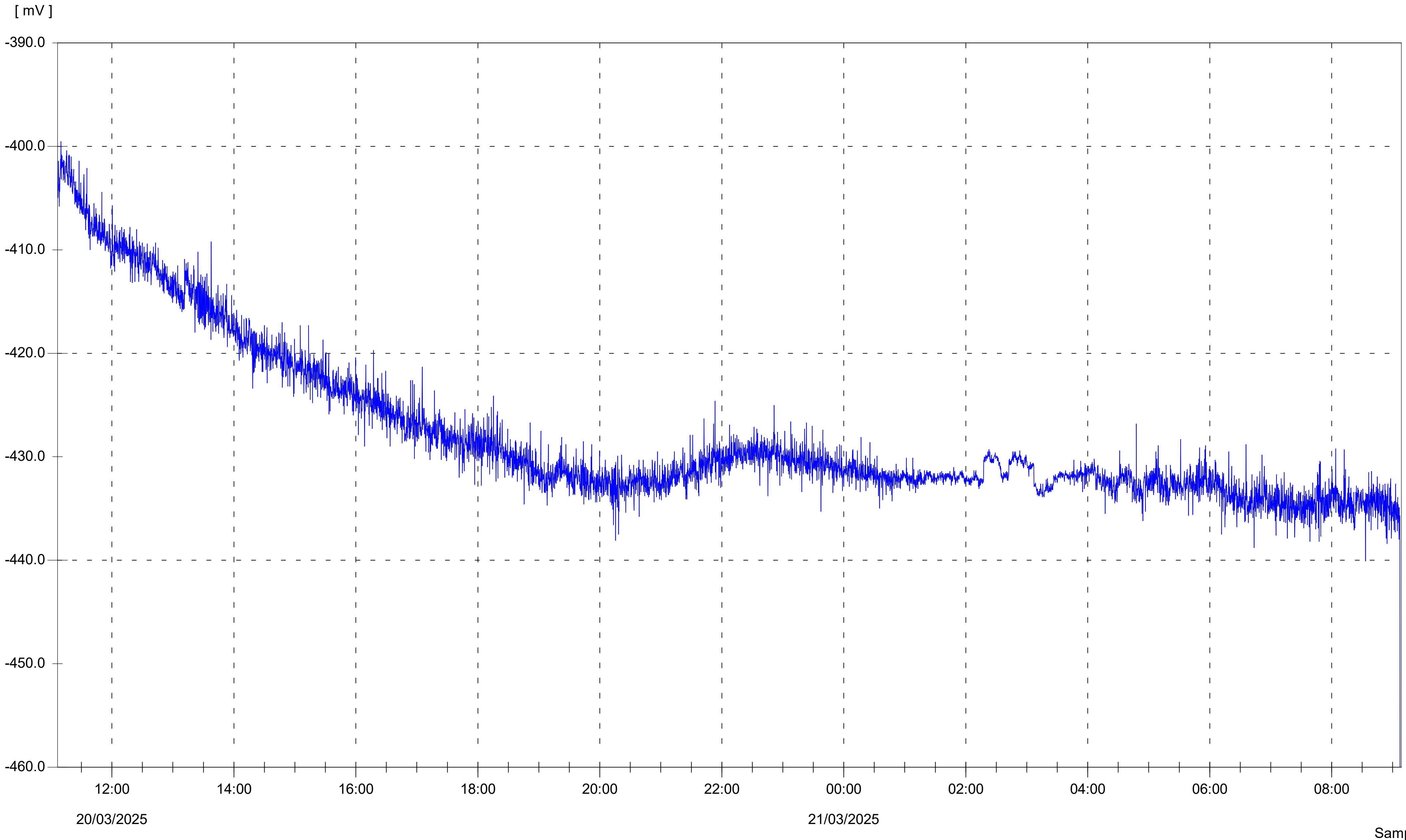
MiniLog2



Sampling: 10 s

: Volts Vs Cu/CuSO4

	Min	Max	Average	Std. dev.
DC 1	-0.470 V	-0.400 V	-0.428 V	0.008 V

Electrolysis Risk Testing - Perpendicular
8 Wilson St, Chatswood NSW 2067 Data
Logger: 6212
Perpendicular to Rail

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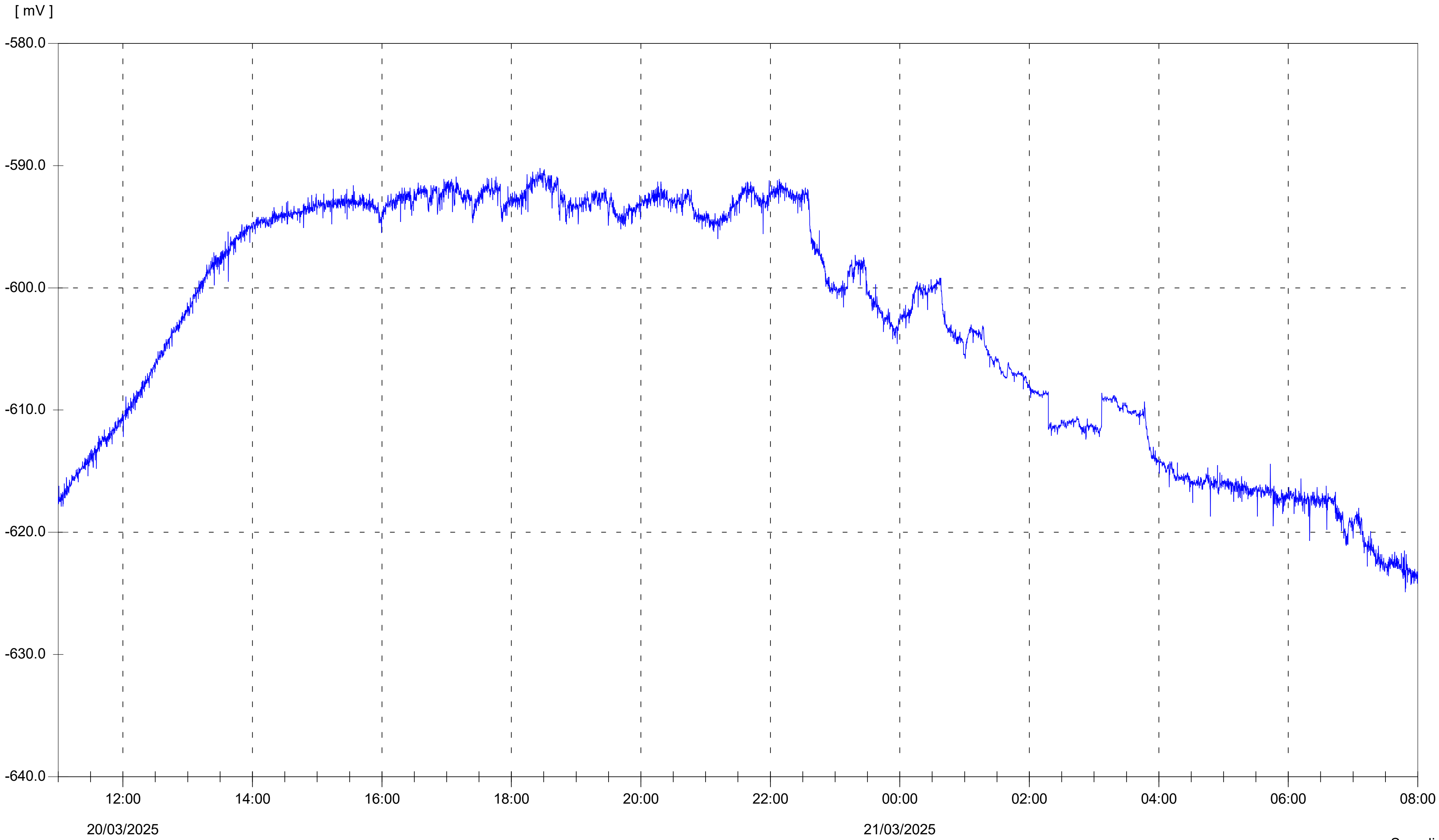
MiniLog2



Sampling: 10 s

—— : Volts vs Cu/CuSO4

	Min	Max	Average	Std. dev.
DC 2	-0.625 V	-0.590 V	-0.603 V	0.010 V

Electrolysis Risk Testing - Guardrail
8 Wilson St, Chatswood NSW 2067
Data Logger: 6205
Guardrail Parallel To The Rail

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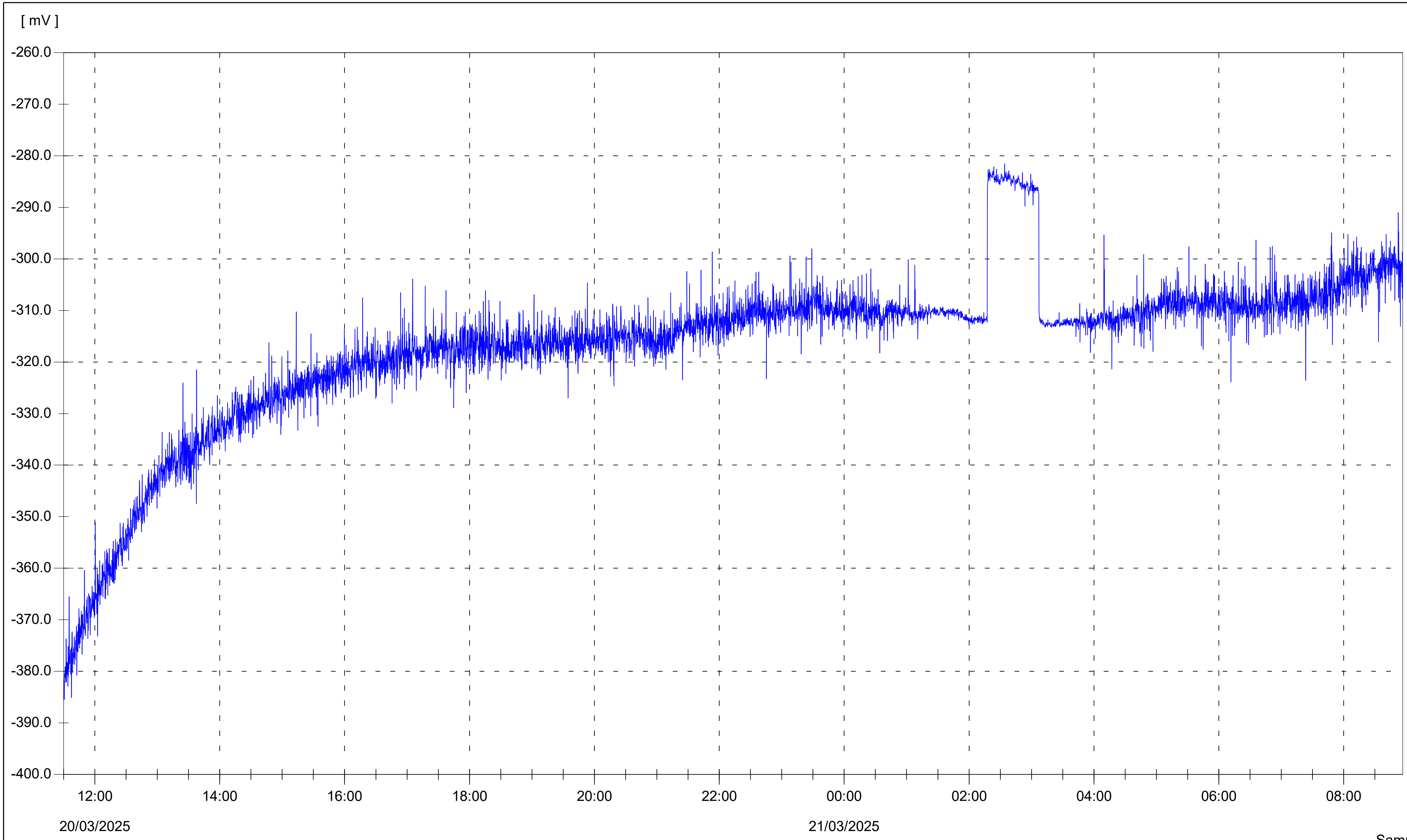

Sampling: 10 s

: DC - Measuring

	Min	Max	Average	Std. dev.
DC 1	-0.386 V	-0.282 V	-0.317 V	0.016 V

Electrolysis Risk Testing - Water Pipe
8 Wilson St, Chatswood NSW 2067
Data Logger: 2748
Water Pipe Adjacent To Rail Corridor

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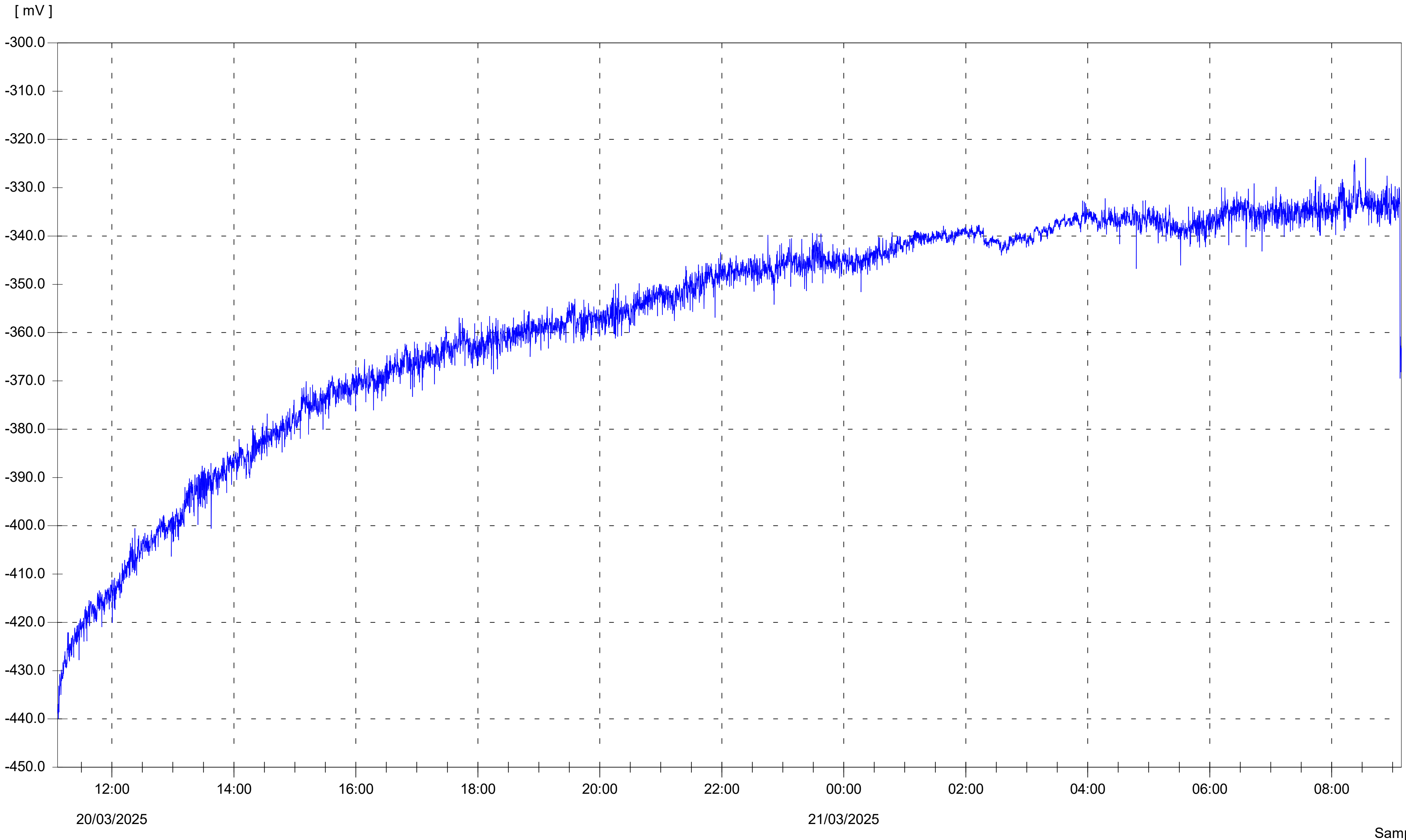
MiniLog2



Sampling: 10 s

: Volts Vs Cu/CuSO4

	Min	Max	Average	Std. dev.
DC 1	-0.440 V	-0.324 V	-0.357 V	0.024 V

Electrolysis Risk Reporting- Water Main

8 Wilson St, Chatswood NSW 2067

Data Logger: 3401

Water Main Adjacent To Pacific Highway

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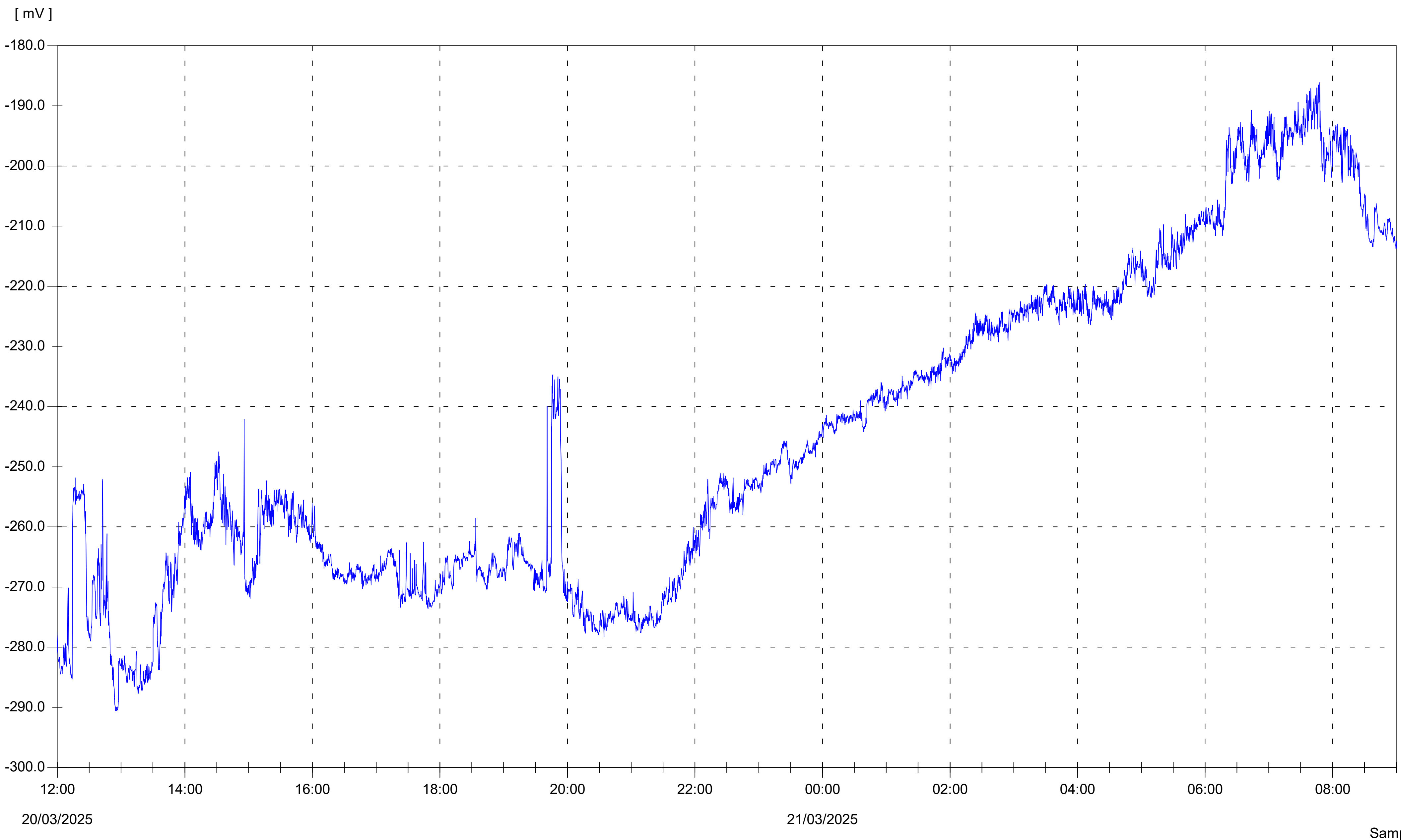
MiniLog2



Sampling: 10 s

: Volts vs Cu/CuSO4

	Min	Max	Average	Std. dev.
DC 1	-290.6 mV	-186.1 mV	-245.1 mV	26.5 mV

Electrolysis Risk Testing - Water Main
8 Wilson St, Chatswood NSW 2067
Data Logger: 3391
Water Main Adjacent to O'Brien Street

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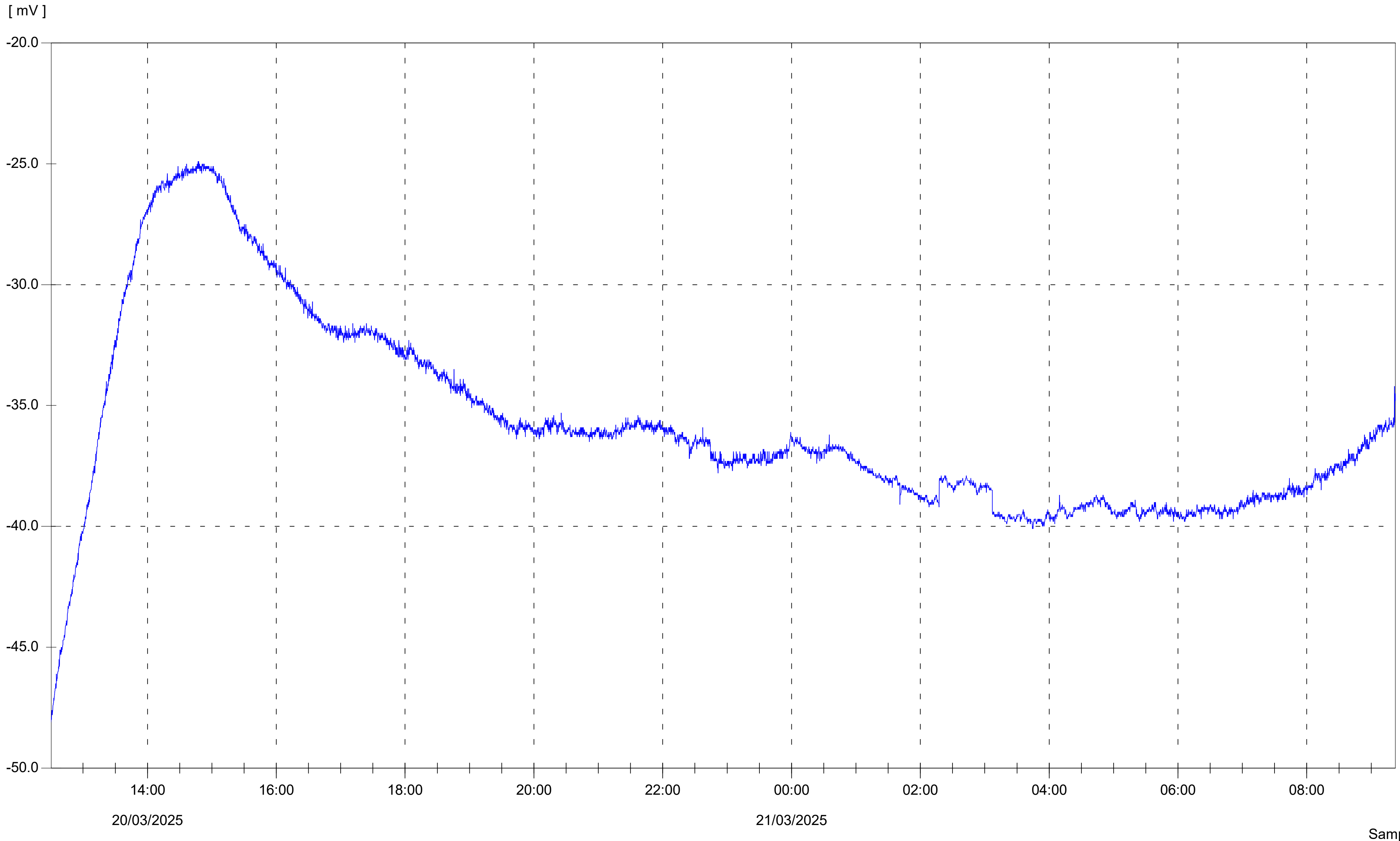

Sampling: 10 s

— : Volts vs Cu/CuSO4

	Min	Max	Average	Std. dev.
DC 1	-48.0 mV	-24.9 mV	-35.8 mV	4.1 mV

Electrolysis Risk Testing - Gas Main
8 Wilson St, Chatswood NSW 2067
Data Logger: 3396
Gas Main Pipe Adjacent To O'Brien St

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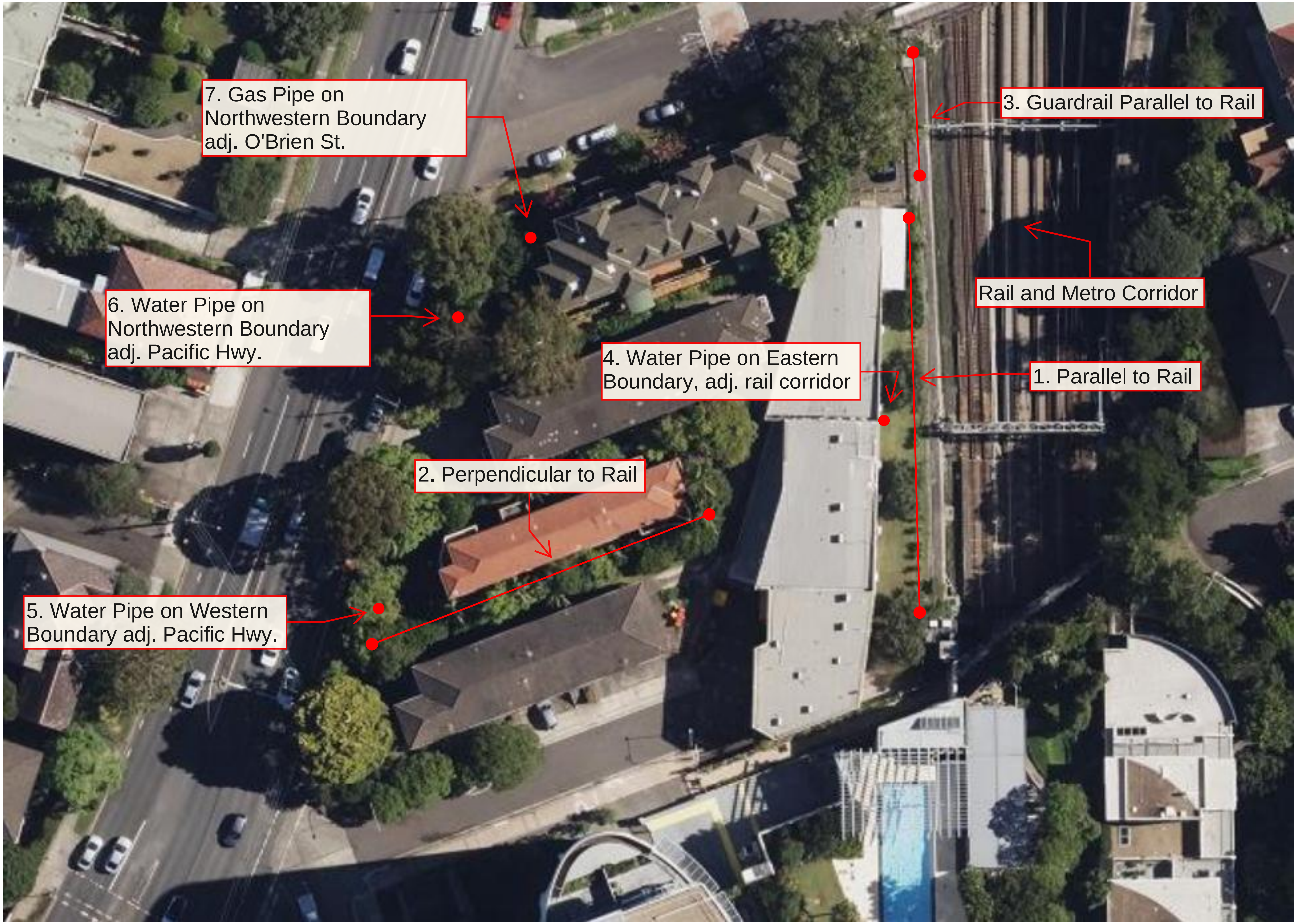
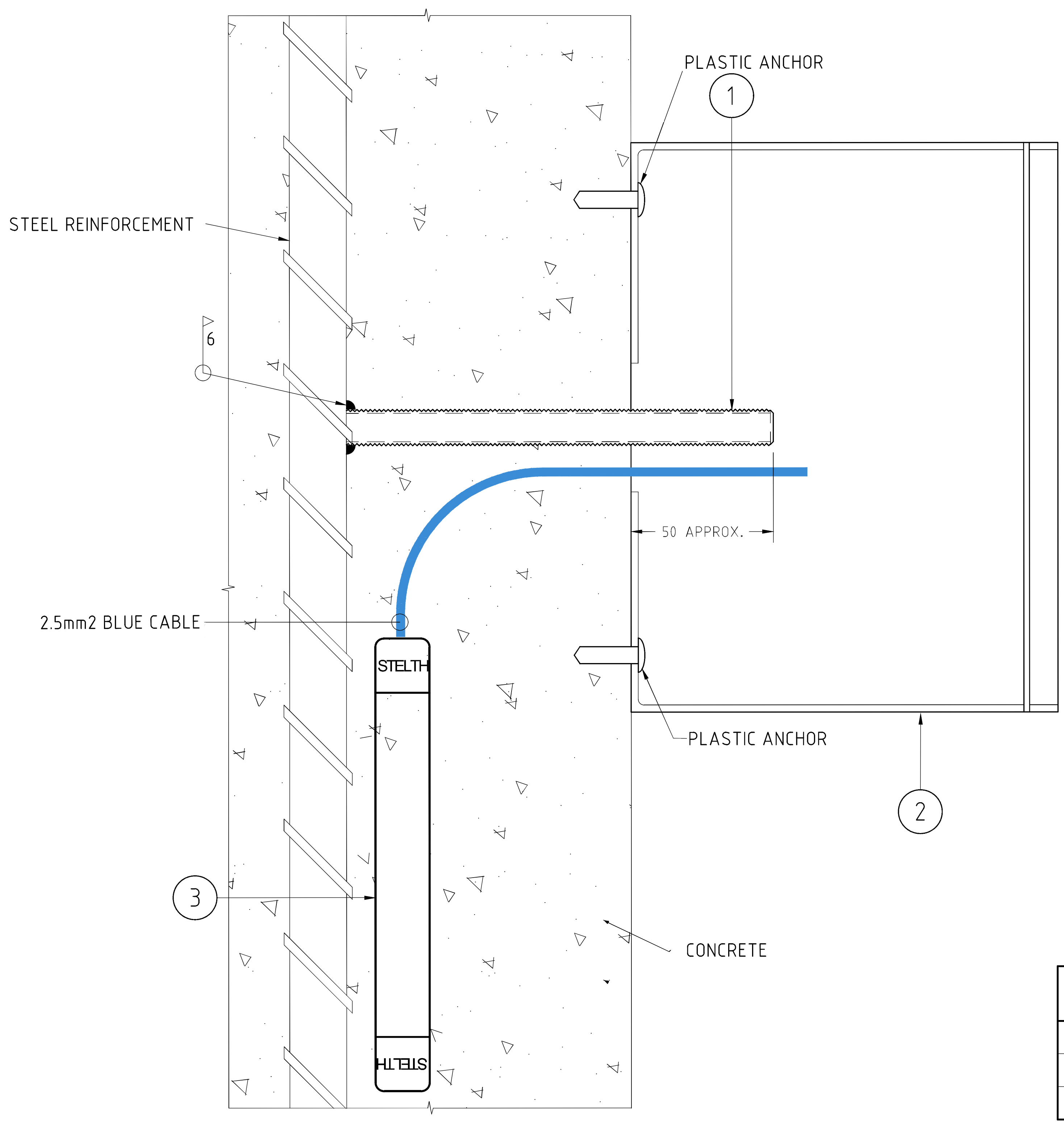
MiniLog2

Appendix B: Site Map Test Locations


7. Gas Pipe on Northwestern Boundary adj. O'Brien St.
3. Guardrail Parallel to Rail
Rail and Metro Corridor
6. Water Pipe on Northwestern Boundary adj. Pacific Hwy.
4. Water Pipe on Eastern Boundary, adj. rail corridor
1. Parallel to Rail
2. Perpendicular to Rail
5. Water Pipe on Western Boundary adj. Pacific Hwy.

Appendix C: Electrolysis Test Point Drawing



1 / - REFERENCE ELECTRODE INSTALLATION DETAIL
N.T.S

ITEM	DESCRIPTION	QTY	SUPPLIER/CODE
1	THREADED BAR	1	M12 316 S/STEEL ROD/BAR
2	JUNCTION BOX	1	200x200x150 APPROX. POLYCARBONATE/PVC OR FIBREGLASS
3	REFERENCE ELECTRODE	1	BORIN STELTH 6 - Ag/AgCl MODEL SRE-020-SCB

ALL DIMENSIONS mm UNLESS OTHERWISE NOTED

REF DWG No.	REFERENCE DRAWING TITLE	REV	DATE	REVISION DESCRIPTION	DESIGNED	DRAWN	CHECKED	APPROVED
		A	20/06/2023	ISSUED FOR REVIEW	AC	AH	AC	AC

REFERENCES — REVISION HISTORY

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Sydney | Melbourne | Brisbane | Perth | Adelaide | Townsville | Auckland | New Plymouth

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CORROSION CONTROL ENGINEERING
STANDARD DRAWING
TYPICAL ELECTROLYSIS MONITORING BOX
INSTALLATION DETAILS

CLIENT DRAWING No.	DRAWING No.	SCALE	SIZE	REV
	CSD-DES-08-001	N.T.S	A3	A