



New Gas-Fired Co-Generation Plant, Shoalhaven Starches (MOD23)

Stability Assessment – Bomaderry Creek
Bank

Manildra Group

2 July 2021

→ The Power of Commitment



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1. Introduction

1.1 General

Manildra Group Pty Ltd (Manildra) was previously granted Project Approval (MP06_0228, dated 28 January 2009) by the Minister of Planning for the proposed Shoalhaven Starches Expansion project, which encapsulated previous approvals for the general site.

Currently, Manildra proposes to construct a new gas-fired co-generation plant ('Co-Gen Plant') which will consist of two natural gas turbines that will generate an anticipated power output each of 30 MW, providing total power to the site of 60 MW. The new gas fired Co-Gen Plant will replace the approved gas fired and coal fired co-generators. In addition, Manildra also proposes to convert their existing coal fired boilers to gas. It is proposed to submit a Modification Application (Mod 23) to the NSW Department of Planning, Industry and Environment (DPIE) seeking approval for these proposed works.

Neither the approved gas nor coal fired co-generation plants have been constructed to date. It is understood that the new gas fired Co-Gen Plant will comprise a structure with a footprint of 2,160 m² and a height above ground level of 20 m.

To proceed with these proposed changes Manildra has requested the NSW DPIE to supply them with the requirements for the preparation of a Modification Application to the current approval. Those DPIE requirements have not yet been received by Manildra.

In support of the Modification Application for the proposed works noted above (Modification No. 23) Manildra has requested a creek bank stability assessment to be undertaken in respect to the nearby Bomaderry Creek. Based on the proximity of the structures to the creek bank, a creek bank stability assessment was requested to consider the effects of the proposed development on the stability of this bank.

Cowman Stoddart Pty Ltd is acting on behalf of Manildra in submitting the Modification Application to the NSW DPIE and has engaged GHD Pty Ltd (GHD) to undertake this assessment of creek bank stability.

This assessment has been carried out in general accordance with GHD's proposal ref: 12548413-66814-9, dated 5 March 2021.

1.2 Purpose of this report

The purpose of this report is to document the findings of the assessment, which will support the Modification Application and address anticipated requirements from the NSW DPIE. The requirements anticipated for the Modification Application are listed in a letter from Cowman Stoddart Pty Ltd (letter reference: MP06_0228, dated 2 March 2021, pp. 13).

1.3 Objectives

The objectives of the creek bank stability assessment are as follows:

- Provide geotechnical advice on the anticipated ground conditions with respect to the proposed development works.
- Provided geotechnical advice in relation to the proximity of the various structures proposed for the Co-Gen Plant to the eastern bank of Bomaderry Creek and potential effects of the proposed modifications (Mod 23) to the plant on the stability of the nearby creek bank.

In response to these objectives, a limited creek bank stability assessment was carried out by a GHD senior geotechnical engineer and technical director with local knowledge of the site. The assessment included a desktop review of subsurface conditions based on earlier geotechnical investigations, and observations of site surface conditions for the various structures proposed and condition of the eastern bank of the creek nearest the proposed Co-Gen Plant.

1.4 Scope of work

The scope of work undertaken by GHD included the following:

- Desktop study including a review of:
 - Existing subsurface information in the vicinity of the proposed Co-Gen Plant structures. We also reviewed previous reporting/advice by Coffey on geotechnical, creek bank stability in the plant area.
 - Published information (e.g., topographic, geological, soil landscape).
- Site visit and observations by a GHD Geotechnical Director, Jon Thompson.
- Review previous numerical modelling and assessment of the effects of the proposed modifications on the creek bank stability, taking into account the proximity of the existing structures, existing loads and additional loads applied by the proposed modification/s. This was based on existing subsurface information from previous investigations. Survey information was provided to Manildra by Allen Price and Scarratts Pty Ltd. including site levels and provision of two sections extending from the site of the Co-Gen Plant down to the bed of Bomaderry Creek. This survey information for the two sections was used in the stability analysis of the bank of Bomaderry Creek. The sections are shown in Appendix B, drawing number N28665-01.
- Report on desktop study and review, our site observations, and recommendations in accordance with the objectives as outlined above.

1.5 Limitations

This report has been prepared by GHD for Manildra Group Pty Ltd and may only be used and relied on by Manildra Group Pty Ltd for the purpose agreed between GHD and Manildra Group Pty Ltd as set out in section 1.2 of this report. General notes presented in Appendix A should be read in conjunction with this report.

GHD otherwise disclaims responsibility to any person other than Manildra Group Pty Ltd arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.

The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. GHD has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared.

The opinions, conclusions and any recommendations in this report are based on assumptions made by GHD described in this report. GHD disclaims liability arising from any of the assumptions being incorrect.

GHD has prepared this report on the basis of information provided by Manildra Group Pty Ltd and others who provided information to GHD (including Government authorities), which GHD has not independently verified or checked beyond the agreed scope of work. GHD does not accept liability in connection with such unverified information, including errors and omissions in the report which were caused by errors or omissions in that information.

The opinions, conclusions and any recommendations in this report are based on information obtained from, and testing undertaken at or in connection with, specific sample points. Site conditions at other parts of the site may be different from the site conditions found at the specific sample points.

Investigations undertaken in respect of this report are constrained by the particular site conditions, such as the location of buildings, services and vegetation. As a result, not all relevant site features and conditions may have been identified in this report.

Site conditions (including the presence of hazardous substances and/or site contamination) may change after the date of this Report. GHD does not accept responsibility arising from, or in connection with, any change to the site conditions. GHD is also not responsible for updating this report if the site conditions change.

This report is to be read in conjunction with document titled “General Notes” (Ref: DS5.5.1 Issue 0 Date: 05/10/2018), located in Appendix A of this report.

2. Project setting

2.1 Proposed development

The proposed changes under Modification Application (Modification 23) are indicated by red polygons and labels in Figure 2.1 below, which has been supplied to GHD by Cowman Stoddart.

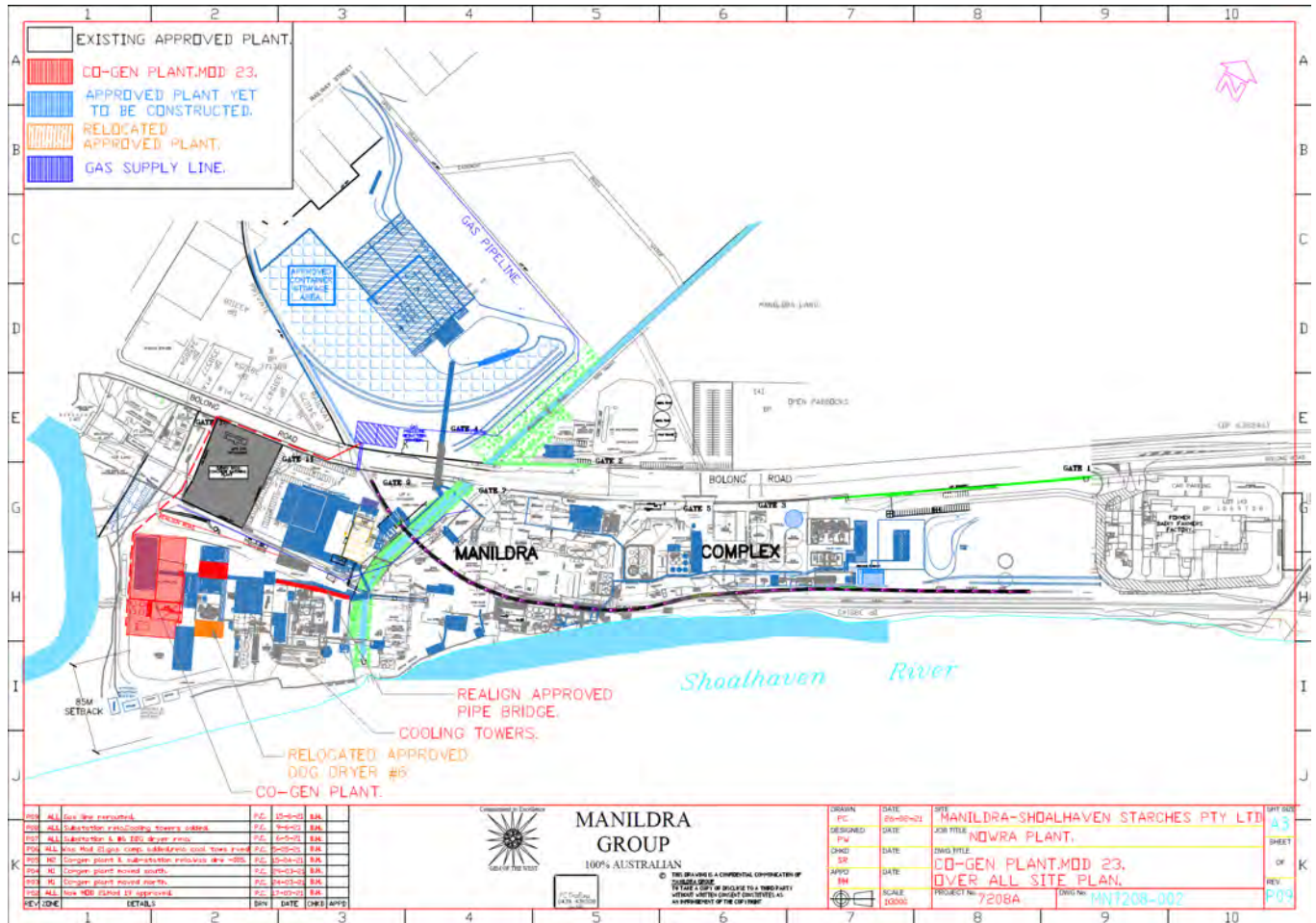


Figure 2.1 Shoalhaven Starches Overall Site Plan, Co-Gen Plant Mod 23 Proposal (Manildra Group Ref: Project 7208A, DWG No. MN7208-002 rev. P09)

A closer view of the proposed Co-Gen Plant, showing approximate plant dimensions, location of the existing weighbridge, and setback from Bomaderry Creek is shown in Appendix B, drawing number MN7208-005 and MN7208-002.

The proposed new gas fired Co-Gen Plant is located at the western part of the factory site and is set back from Bomaderry Creek approximately 29 metres. It is expected that the larger structures will be supported on piles socketed into bedrock occurring below the fill and alluvial soils. Lighter structures will be founded on shallow footing terminated in compacted fill.

2.2 Site observations

The site for the Co-Gen Plant is located at the western end of Manildra's Shoalhaven Starches Plant in Bomaderry. The site for the plant is currently occupied by a shipping container storage area, where containers are stacked up to three containers high.

The site is located to the east of the existing weighbridge which will remain in its current position close to the western boundary fence. A stacked concrete mass block has been constructed within the property parallel to the fence and weighbridge alignment. A section of the concrete block wall adjacent to stacked containers is tilted and the adjacent containers are also tilted. The tilting of the concrete block wall and containers is likely due to settlement of fill and poor drainage behind the wall.

The container storage area is paved with an asphalt wearing course and appears to be performing satisfactorily under heavy vehicle loads. Some localised damage to the pavement was observed at the edges of the asphalt. At the time of our site observations, multiple heavy vehicles were entering and leaving the site and passing over the weighbridge.

Beyond the boundary fence, the area between the fence and Bomaderry Creek is a riparian corridor and has a medium to thick cover of vegetation including many small to medium trees and a few large trees. Areas of thick grass and undergrowth were also evident. The ground surface is initially near level to gently sloping close to the fence, then steepens at the top of the creek bank with slopes ranging from about 30 to 50 degrees, with some near vertical sections close to the shoreline of the creek. Local slumping or collapse of the lower steep parts of the bank have occurred, and some trees have fallen into the creek. The banks are locally undulating likely due to previous erosion and instability of the bank; however, no evidence of any recent significant slope instability was observed. The survey sections, where they extend into the creek, indicate a gradual fall over the creek bed towards the centre of the creek, with the depth of water approximately 1.0 m to 1.2 m at the end point of the sections (Appendix B).

Significant surface water runoff occurs towards the grass covered shallow gully or drainage swale near the fence line to the northwest of the proposed plant. No permanent wet areas were observed within the riparian area and grass covered drainage swale. It is understood that heavy rain and flooding in March 2021 resulted in water levels in the Shoalhaven River and Bomaderry Creek rising by approximately 1.5 m.

Photos showing the general site conditions described above are presented in Appendix D.

3. Desktop review

3.1 Topography and drainage

Google Earth indicates the Co-Gen Plant site has an approximate elevation of 5 m to 7 m above Australian Height Datum (AHD). Based on a limited survey of the eastern bank of Bomaderry Creek, near the existing weighbridge, the site elevation drops from 5 m at the top of creek bank to the lowest point of -2.15 m AHD. The site and surrounding areas form part of an alluvial plain.

The closest waterbody to the Co-Gen Plant site is Bomaderry Creek which is approximately 29 m to the west of the site.

Stormwater is expected to follow the surface topography and flow or be directed into on-site stormwater drains. Stormwater from the current site flows to the north-west into a drainage swale which then discharges the collected water into a drainage pit near the site boundary near the top of the eastern bank of Bomaderry Creek.

3.2 Soil landscape

Reference to the 1:100,000 Kiama Soil Landscape Series Sheet (9028, First Edition) (DECCW, 2010) indicates that the site is located on Shoalhaven Soils. These soils are described as moderately deep Prairie Soils on levees, Red Earths and Yellow and Red Podzolic Soils on terraces and Alluvial Soils and Gleyed Podzolic soils on the floodplains. The soil landscape map also indicates that this group is subject to flood hazard, seasonal water logging, permanently high water table, hardsetting, acid sulphate potential (subsoil), strongly acidic and moderate shrink-swell potential.

3.3 Geology

3.3.1 Regional

Reference to the 1:250,000 Wollongong Geological Series Sheet (S1 56-9, Second Edition) (NSW Department of Mines, 1966) indicates the site is likely to be underlain by Quaternary Alluvium, gravel, swamp deposits and sand dunes. West of site towards Princes Highway, the ground is underlain by rocks identified as part of the Shoalhaven Group, comprising Nowra Sandstone (Psn) and undifferentiated Berry Formation (Psb). The Nowra sandstone is described as quartz sandstone. The undifferentiated Berry Formation is described as siltstone, shale and sandstone.

3.3.2 Subsurface conditions at site

Geotechnical investigations on-site were conducted in 2007 (Coffey, 2007) and 2008 (Coffey, 2008) and are used as reference on the subsurface conditions at site. Due to the high degree of variation in the subsurface conditions along the Shoalhaven River floodplain, subsurface interpretation included a number of previous boreholes: CBH100, CBH23, CBH1 to CBH5, and MGP4 to MGP8. Figure 12A showing these reference boreholes is included in Appendix B. The subsurface conditions observed at this borehole locations are summarised below:

- Fill: No fill was encountered at CBH100, MGP8 and other boreholes located near Bomaderry Creek during the investigation in 2007 and 2008. However, various earthworks followed by pavement construction were conducted from 2008, including preparation and construction of the current pavement and container storage. It is estimated that a nominal 0.5 m thick pavement underlain by controlled fill up to 1.0 m is present below the current container storage area. Topsoil is likely to have been stripped from the site but where present, previous borehole logs indicate the topsoil comprised silty clay / clayey silt, firm to stiff.
- Alluvium and estuarine soils were encountered in previous boreholes, comprising silty clay/clayey silt, firm to hard and medium dense sand, at depths of 1.5 m (based on CBH100 and CBH23).
- Residual soils and extremely weathered rock comprising silty clay with fine grained sand, stiff to very stiff, were encountered at depths of 3.5 m (CBH100) and 5.8 m (CBH23).
- Sandstone: Fine to coarse grained, pale white/grey to pale yellow was encountered at depths of 4.9 m (CBH100) and 8.0 m (CBH23).

3.4 Groundwater

Groundwater inflow was observed in CBH23 at 4.00 m bgl. The standing water level was not established. Several monitoring wells are currently installed east of Abernathy's Creek, approximately 220 m away from the site; however, these wells are most likely not representative of the groundwater condition on site.

Water levels in the Shoalhaven River and Bomaderry Creek are tidal with water levels due to tides varying by about 0.6m. During flood event (in the last 5 years) water levels in the river and creek have risen up to 2.5 m AHD.

Based on the Bomaderry Creek survey, the water level in the creek at the time of survey was 0.59 m AHD.

Based on topography, groundwater is generally expected to flow in a southerly direction towards the Shoalhaven River in the overall Manildra sites. For this particular site, groundwater is expected to flow in a westerly direction towards Bomaderry Creek.

4. Slope stability analysis

4.1 Objective

A slope stability analysis was carried out to assess the potential influence of the proposed Co-Gen Plant, located approximately 29 m from the eastern bank of Bomaderry Creek, on the stability of the creek bank. This analysis included current vehicle loads for vehicles approaching the weighbridge and proposed light structures founded at high level for the Co-Gen Plant. Heavy structures are assumed to be supported on piles with all building loads transferred to the underlying rock.

4.2 Methodology

The slope stability analysis has been conducted using Slope/W (GeoStudio 2019 R2, version 10.1.1.18) and adopting the Morgenstern – Price method of stability analysis. The analysis was carried out based on the following methodology:

- Develop the analysis geometry based on the available survey of the eastern bank of Bomaderry Creek. Two sections were developed, Section A-A' near the northern end of the weighbridge, and Section B-B' near the southern end of the weighbridge. The sections extend from the nearest part of the Co-Gen Plant to the bed of Bomaderry Creek. A copy of the survey output is provided in Appendix B.
- Develop the geological model and geotechnical parameters based on our interpretation of previous geotechnical investigations carried out by Coffey in 2007 and 2008
- Perform analysis iterations and assess factor of safety based on both rapid drawdown and normal groundwater conditions

The following reports were used as reference in building the slope stability models.

- Coffey (2007) and Coffey (2008) reports as reference on the subsurface conditions on site
- GHD (2018) report as reference on the geotechnical parameters of the geotechnical units present on site

4.3 Assumptions

Assumptions made in undertaking the slope stability analyses are as follows:

- Subsurface condition at Section A-A' is based on CBH100 and MGP7. Subsurface condition at Section B-B' is based on CBH23 and MGP8 in the 2008 Coffey report (Coffey, 2008). These historical boreholes were located within or close to the proposed Co-Gen Plant footprint at positions nearest to the creekbank of the available borehole logs.
- A carriageway for heavy vehicles will remain between the proposed Co-Gen Plant and the existing weighbridge. It is understood the roadway will service heavy vehicles; hence, a surcharge pressure of 44 kPa was adopted to represent the traffic loading condition.
- The proposed Co-Gen Plant will have heavy structures supported on piles. Minimal load transfer from the structure to the surface is expected for minor structures. A surcharge pressure of 17 kPa was applied for the Co-Gen Plant footprint, up to 40 m from the top of Bomaderry Creek bank.
- The flooding scenario followed by rapid drawdown transient loads is based on raised creek level during a flood event. This scenario assumes that the water level within the soil matrix temporarily remains at a higher elevation while the creek level recedes to its pre-flood level.
- If the creek bank profile changes significantly (e.g., by collapse or undercutting of bank, formation of a steeper profile below water occurs, or significant loss of vegetation over the bank occurs), then the stability of the bank should be re-assessed.

4.4 Results

The results of the stability analyses undertaken are summarised in Table 4.1 below, including resulting Factors of Safety (FoS) for a range of groundwater levels. Slope /W models and analysis results are included in Appendix C.

Table 4.1 *Summary of slope stability analyses*

Scenario No.	Groundwater condition	Section A-A' FoS	Section B-B' FoS
1	Normal condition	5.34	3.72
2	Raised water level (flood)	5.34	3.78
3	Rapid drawdown	5.34	3.72

4.5 Conclusion

The analyses show that the failure scenarios are driven by slope instability approximately between the wire mesh fence and the top of the creek bank as shown in Section A-A'. The failure scenarios at Section B-B' extend to the weighbridge and edge of carriageway. A minimum FoS of 3.72 was achieved for all slope stability scenarios, indicating currently stable conditions and a very low risk of slope instability under current and recent flood conditions.

Based on the above stability assessment, it is concluded that the construction of the proposed Co-Gen Plant has little or no influence on slope instability for the assessed model. Hence, we conclude that the proposed Co-Gen Plant, founded on piles, will not adversely affect the stability of the eastern bank of Bomaderry Creek.

The slope stability analyses are based on the assumptions outlined above. If any aspects of the assumptions made are incorrect or significant changes occur to the current site conditions or proposed development, then GHD should be notified and the analyses should be re-assessed.

5. References

- Coffey. (2007). *Preliminary Contamination Assessment, Proposed Starches Product Dryer Manildra, Bomaderry, NSW. (Report reference GEOTUNAN02584AA-AD, dated 20 April 2007).* Coffey Geotechnics Pty Ltd.
- Coffey. (2008). *Preliminary Environmental Site Assessment and Geotechnical Investigation, Proposed Ethanol Expansion, Shoalhaven Starches Plant, Bolong Road, Bomaderry, NSW. (Report reference: ENVIWOLL00111AA-R02, dated 25 June 2008).* Coffey Environments Pty Ltd.
- DECCW. (2010). *1:100,000 Kiama Soil Landscape Series Sheet 9028, 1st Ed.* Department of Environment, Climate Change and Water.
- DLWC. (1997). *Acid Sulfate Soil Risk Map - Burrier-Berry 1:25,000, 2nd Ed.* Department of Land and Water Conservation.
- GHD. (2018). *River Bank Stability - Slope Stability Assessment, South-East Container Storage Area, Manildra Plant, Bolong Road, Bomaderry.* GHD Pty Ltd.
- NSW Department of Mines. (1966). *1:250,000 Wollongong Geological Series Sheet (S1 56-9, 2nd Edition) .* NSW Department of Mines.

Appendices

Appendix A

General Notes

GENERAL NOTES



GHD

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The report contains the results of a geotechnical investigation or study conducted for a specific purpose and client. The results may not be used or relied on by other parties, or used for other purposes, as they may contain neither adequate nor appropriate information. In particular, the investigation does not cover contamination issues unless specifically required to do so by the client.

To the maximum extent permitted by law, all implied warranties and conditions in relation to the services provided by GHD and the report are excluded unless they are expressly stated to apply in the report.

TEST HOLE LOGGING

The information on the test hole logs (boreholes, test pits, exposures etc.) is based on a visual and tactile assessment, except at the discrete locations where test information is available (field and/or laboratory results). The test hole logs include both factual data and inferred information. Moreover, the location of test holes should be considered approximate, unless noted otherwise (refer report). Reference should also be made to the relevant standard sheets for the explanation of logging procedures (Soil and Rock Descriptions, Core Log Sheet Notes etc.).

GROUNDWATER

Unless otherwise indicated, the water depths presented on the test hole logs are the depths of free water or seepage in the test hole recorded at the given time of measuring. The actual groundwater depth may differ from this recorded depth depending on material permeabilities (i.e. depending on response time of the measuring instrument). Further, variations of this depth could occur with time due to such effects as seasonal, environmental and tidal fluctuations or construction activities such as a change in ground surface level. Confirmation of groundwater levels, phreatic surfaces or piezometric pressures can only be made by appropriate surveys, instrumentation techniques and monitoring programmes.

INTERPRETATION OF RESULTS

The discussion or recommendations contained within this report normally are based on a site evaluation from discrete test hole data, often with only approximate locations (e.g. GPS). Generalised, idealised or inferred subsurface conditions (including any geotechnical cross-sections) have been assumed or prepared by interpolation and/or extrapolation of these data. As such these conditions are an interpretation and must be considered as a guide only.

CHANGE IN CONDITIONS

Local variations or anomalies in ground conditions do occur in the natural environment, particularly between discrete test hole locations or available observation sites. Additionally, certain design or construction procedures may have been assumed in assessing the soil-structure interaction behaviour of the site. Furthermore, conditions may change at the site from those encountered at the time of the geotechnical investigation through construction activities and constantly changing natural processes.

Any change in design, in construction methods, or in ground conditions as noted during construction, from those assumed or reported should be referred to GHD for appropriate assessment and comment.

GEOTECHNICAL VERIFICATION

Verification of the geotechnical assumptions and/or model is an integral part of the design process - investigation, construction verification, and performance monitoring. Variability is a feature of the natural environment and, in many instances, verification of soil or rock quality, or foundation levels, is required. There may be a requirement to extend foundation depths, to modify a foundation system and/or to conduct monitoring as a result of this natural variability. Allowance for verification by appropriate geotechnical personnel must be recognised and programmed for construction.

FOUNDATIONS

Where referred to in the report, the soil or rock quality, or the recommended depth of any foundation (piles, caissons, footings etc.) is an engineering estimate. The estimate is influenced, and perhaps limited, by the fieldwork method and testing carried out in connection with the site investigation, and other pertinent information as has been made available. The material quality and/or foundation depth remains, however, an estimate and therefore liable to variation. Foundation drawings, designs and specifications should provide for variations in the final depth, depending upon the ground conditions at each point of support, and allow for geotechnical verification.

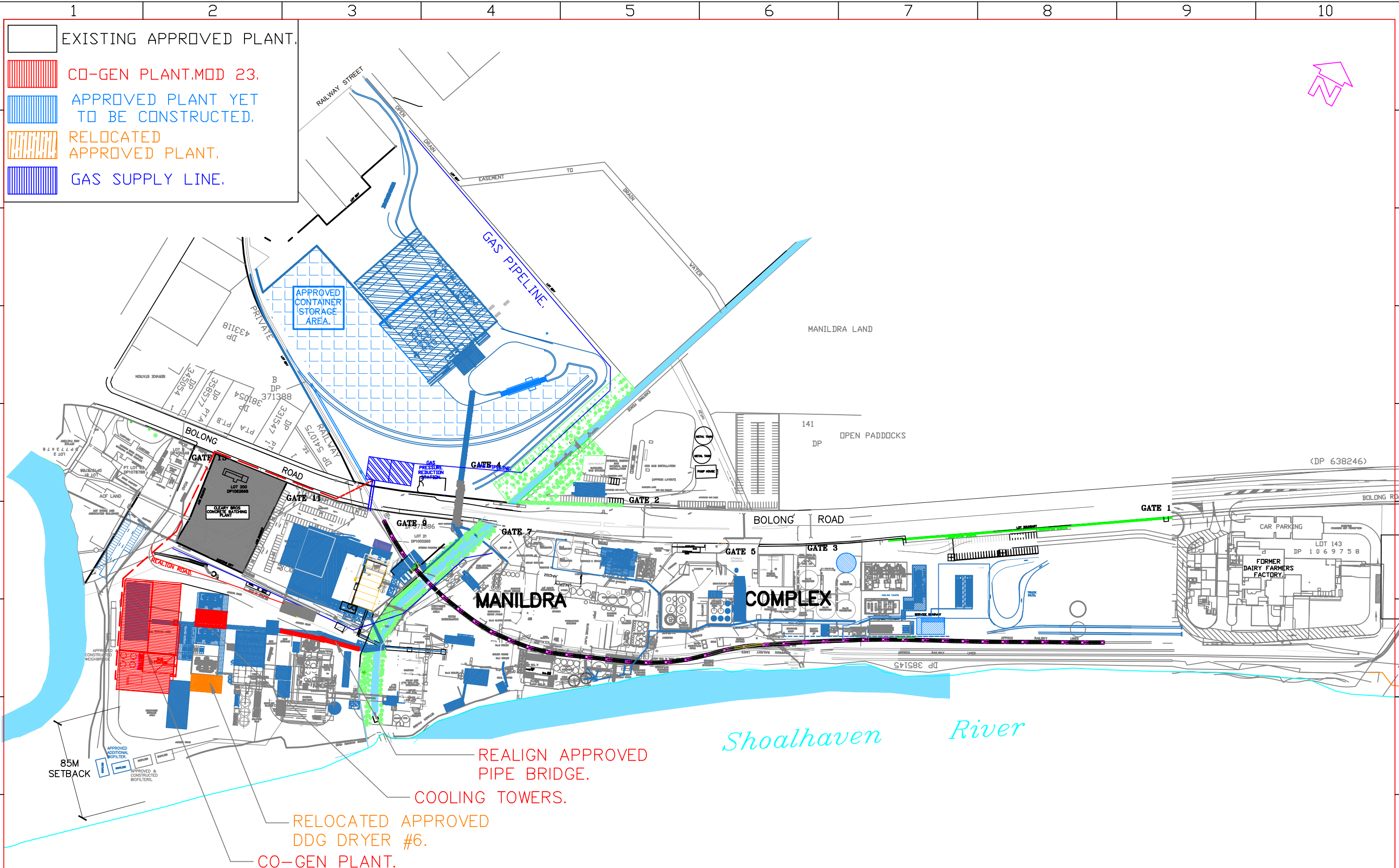
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Where it is desired to reproduce the information contained in our geotechnical report, or other technical information, for the inclusion in contract documents or engineering specification of the subject development, such reproductions must include at least all of the relevant test hole and test data, together with the appropriate Standard Description sheets and remarks made in the written report of a factual or descriptive nature.

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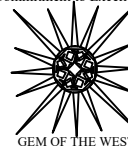
Appendix B

Figures



P09	ALL	Gas line rerouted.	P.C.	15-6-21	B.H.	
P08	ALL	Substation relo.Cooling towers added.	P.C.	9-6-21	B.H.	
P07	ALL	Substation & #6 DDG dryer relo.	P.C.	6-5-21	B.H.	
P06	ALL	Was Mod 21,gas comp. added,relo cool tows rved	P.C.	5-05-21	B.H.	
P05	H2	Co-gen plant & sub-station relo.Was drw -005.	P.C.	15-04-21	B.H.	
P04	H1	Co-gen plant moved south.	P.C.	29-03-21	B.H.	
P03	H1	Co-gen plant moved north.	P.C.	24-03-21	B.H.	
P02	ALL	Now MOD 21,Mod 19 approved.	P.C.	17-03-21	B.H.	
REV	ZONE	DETAILS	DRN	DATE	CHKD	APPD

Commitment to Excellence



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DATE
26-02-21

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SCALE
1:3000

SITE
MANILDRA-SHOALHAVEN STARCHES PTY LTD

JOB TITLE
NOWRA PLANT.

DWG TITLE
CO-GEN PLANT.MOD 23.
OVER ALL SITE PLAN.

PROJECT No.
7208A

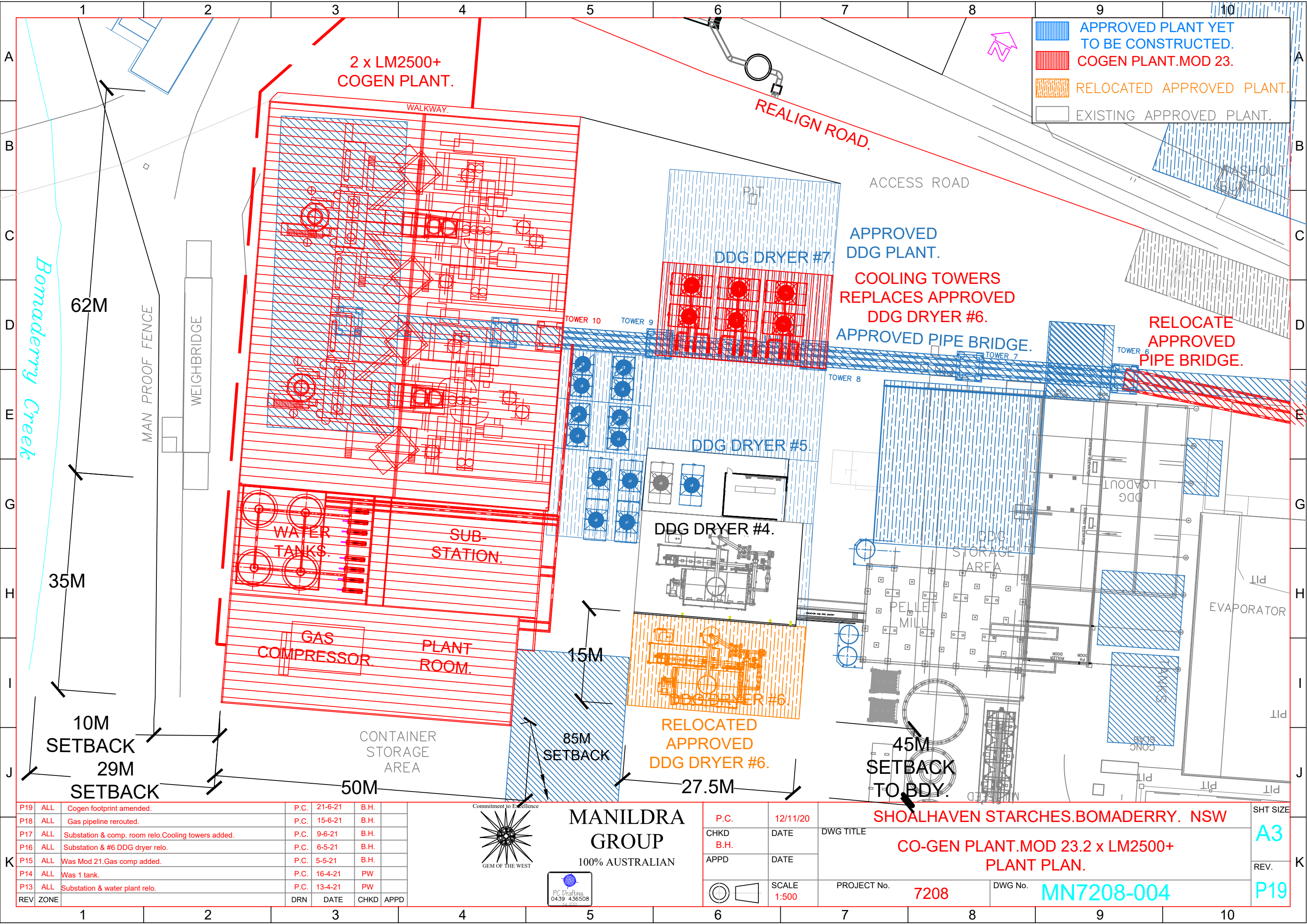
DWG No.
MN7208-002

SHT SIZE
A3

SHEET

OF

REV.
P09



Bomaderry Creek

MAN PROOF FENCE

WEIGHBRIDGE

REALIGN ROAD

ACCESS ROAD

62M

35M

10M
SETBACK
29M
SETBACK

2 x LM2500+
COGEN PLANT.

WALKWAY

WATER
TANKS.

SUB-
STATION.

GAS
COMPRESSOR

PLANT
ROOM.

CONTAINER
STORAGE
AREA

TOWER 10 TOWER 9

DDG DRYER #7.

APPROVED
DDG PLANT.

COOLING TOWERS
REPLACES APPROVED
DDG DRYER #6.

APPROVED PIPE BRIDGE.

RELOCATE
APPROVED
PIPE BRIDGE.

DDG DRYER #5.

DDG DRYER #4.

RELOCATED
APPROVED
DDG DRYER #6.

15M
85M
SETBACK

27.5M

45M
SETBACK
TO BDY.

DDG
STORAGE
AREA

PELLET
MILL

EVAPORATOR

P19	ALL	Cogen footprint amended.	P.C.	21-6-21	B.H.	
P18	ALL	Gas pipeline rerouted.	P.C.	15-6-21	B.H.	
P17	ALL	Substation & comp. room relo.Cooling towers added.	P.C.	9-6-21	B.H.	
P16	ALL	Substation & #6 DDG dryer relo.	P.C.	6-5-21	B.H.	
P15	ALL	Was Mod 21.Gas comp added.	P.C.	5-5-21	B.H.	
P14	ALL	Was 1 tank.	P.C.	16-4-21	PW	
P13	ALL	Substation & water plant relo.	P.C.	13-4-21	PW	
REV	ZONE		DRN	DATE	CHKD	APPD



MANILDRA
GROUP
100% AUSTRALIAN

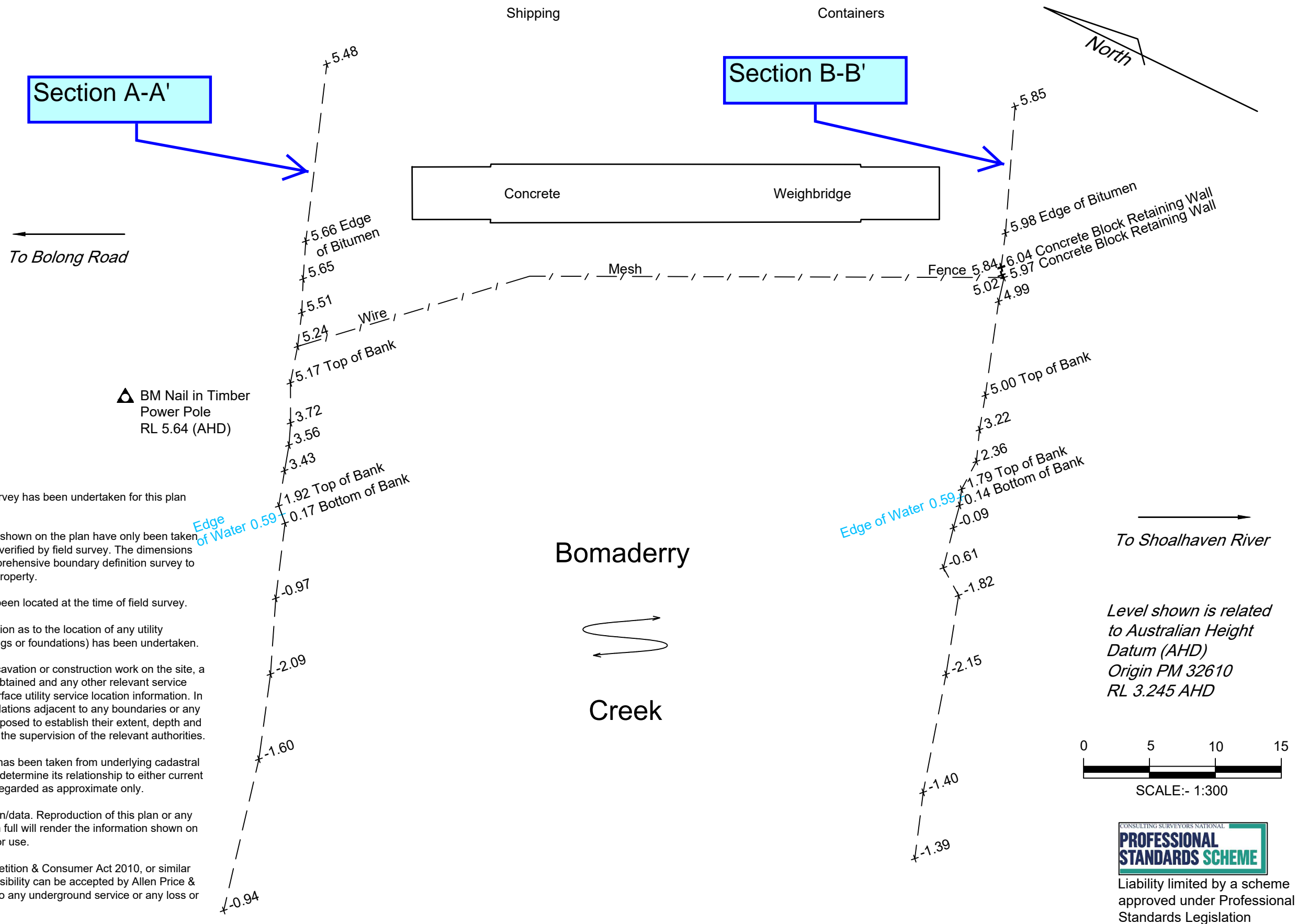


P.C.	12/11/20
CHKD	DATE
B.H.	
APPD	DATE
	SCALE
	1:500

DWG TITLE		PROJECT No.		DWG No.	
SHOALHAVEN STARCHES.BOMADERRY. NSW		7208		MN7208-004	
CO-GEN PLANT.MOD 23.2 x LM2500+ PLANT PLAN.					

SHT SIZE	A3
REV.	P19

M:\Projects\20000\28000s\N28665 Drawings\N28665-01 Creek Cross Section.dwg

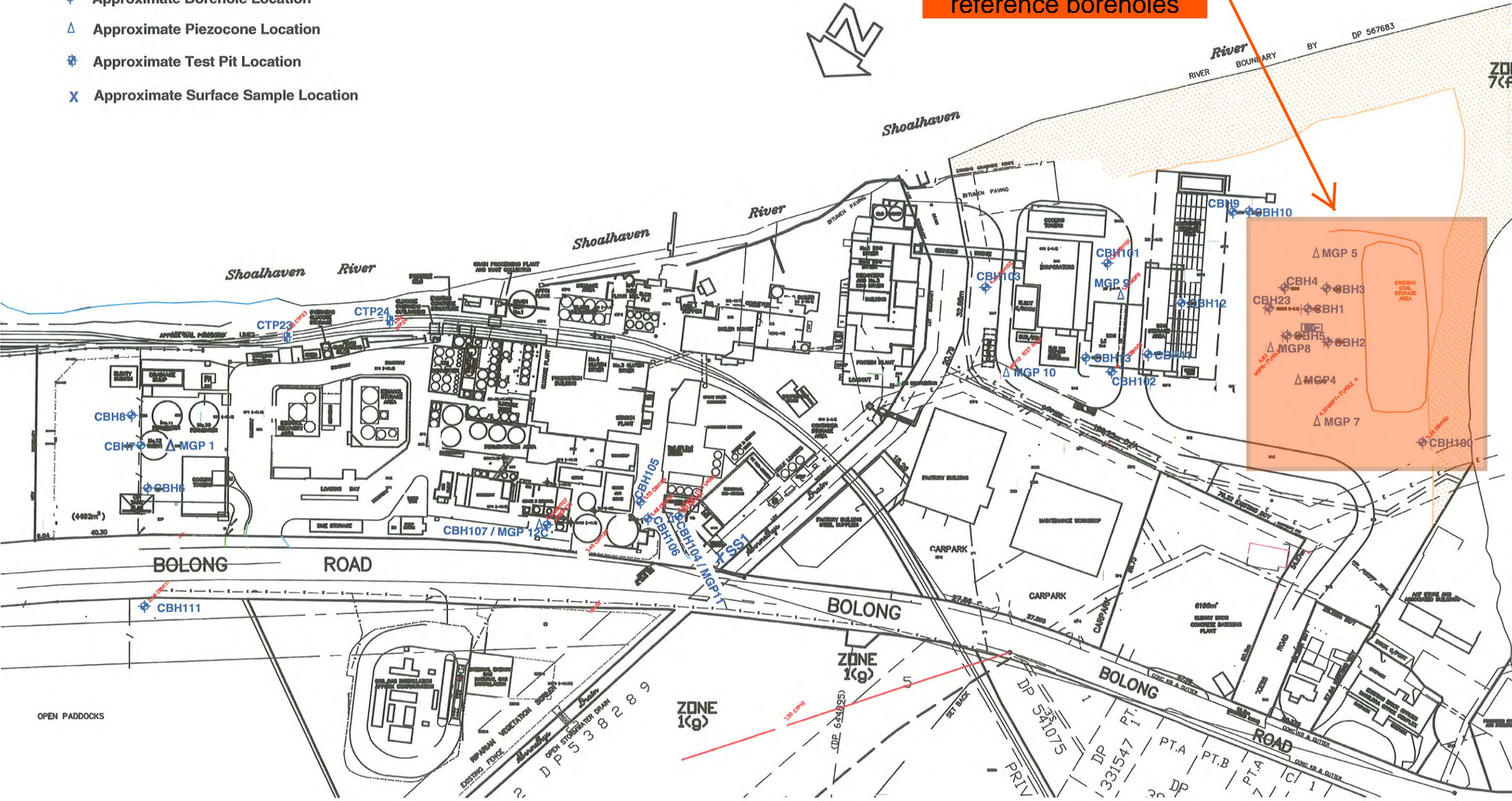


REV	DESCRIPTION	BY	DATE	 allen price & scarratts pty ltd land and development consultants Nowra Office: 75 Plunkett Street, Nowra NSW 2541 Kiama Office: 1/28 Bong Bong Street, Kiama NSW 2533 phone:(02) 4421 6544 consultants@allenprice.com.au www.allenprice.com.au	SKETCH SHOWING CROSS SECTIONS ADJACENT TO BOMADERRY CREEK NEAR WEIGHBRIDGE AT SHOALHAVEN STARCHES ATTN: JOHN STUDDERT		RATIO: 1:300 (AT A3 ORIGINAL)		DATE OF SURVEY: 26.03.2021			
							DRAWING NUMBER N28665-01		SHEET 1 OF 1		REVISION 0	

LEGEND

- Approximate Borehole Location
- Approximate Piezocone Location
- Approximate Test Pit Location
- Approximate Surface Sample Location

Location of relevant reference boreholes



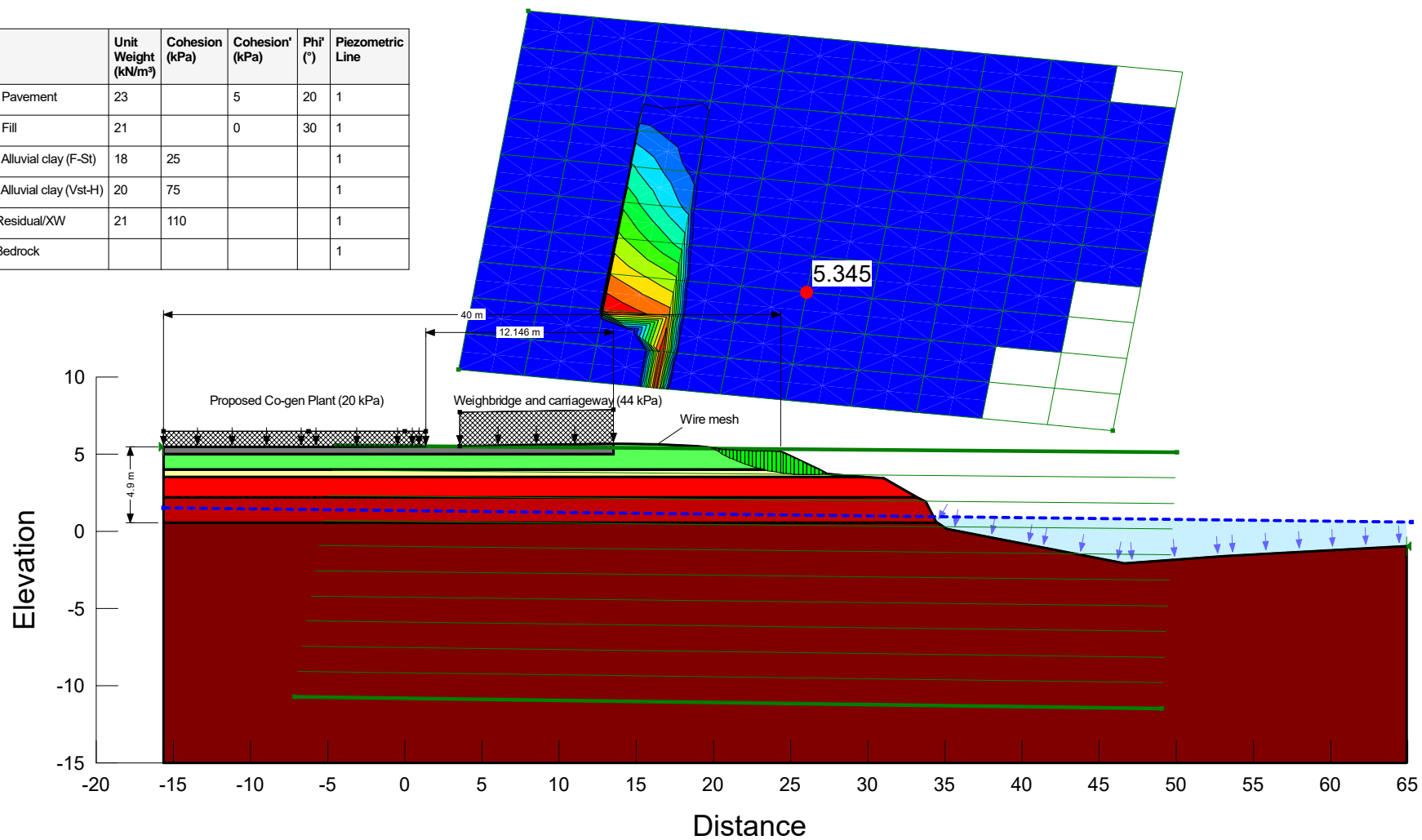
REFERENCE: ALAN PRICE & ASSOCIATES, Drawing No. 23132-10A, Sheet 1 of 2, 16 April 2008

revision	description	drawn	approved	date	<div>050100150</div> <div>Scale (metres)</div>	drawn	MM	<div>coffey</div> <div>environments</div> <div>SPECIALISTS IN LIVING AND WORKING PLACES</div>	client:	MANILDRA GROUP PTY LTD	
						approved	JMF		project:	PRELIMINARY ENVIRONMENTAL SITE ASSESSMENT AND GEOTECHNICAL INVESTIGATION, SHOALHAVEN STARCHES PLANT, BOLONG ROAD, BOMADERRY, NSW	
						date	24/6/08		title:	APPROXIMATE SAMPLING LOCATIONS	
						scale	1: 2500 Approx.		project no:	ENVIUNAN00111AA-R02	figure no:
						original size	A3				FIGURE 12A

Appendix C

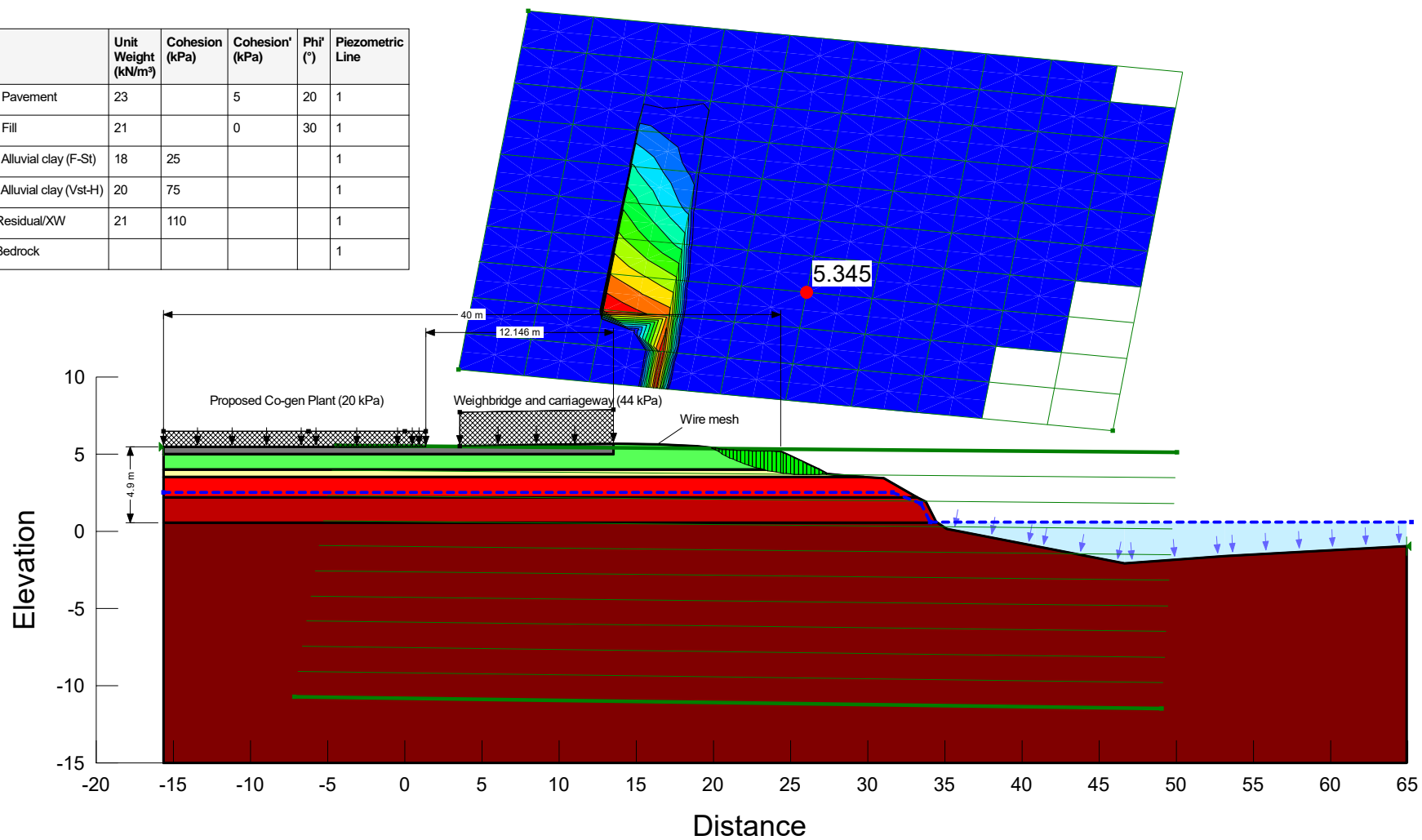
Slope stability analysis results

Color	Name	Unit Weight (kN/m³)	Cohesion (kPa)	Cohesion' (kPa)	Phi' (°)	Piezometric Line
Grey	Unit 1a - Pavement	23		5	20	1
Light Green	Unit 1b - Fill	21		0	30	1
Yellow	Unit 2a - Alluvial clay (F-St)	18	25			1
Red	Unit 2c - Alluvial clay (Vst-H)	20	75			1
Dark Red	Unit 3 - Residual/XW	21	110			1
Dark Red	Unit 4 - Bedrock					1



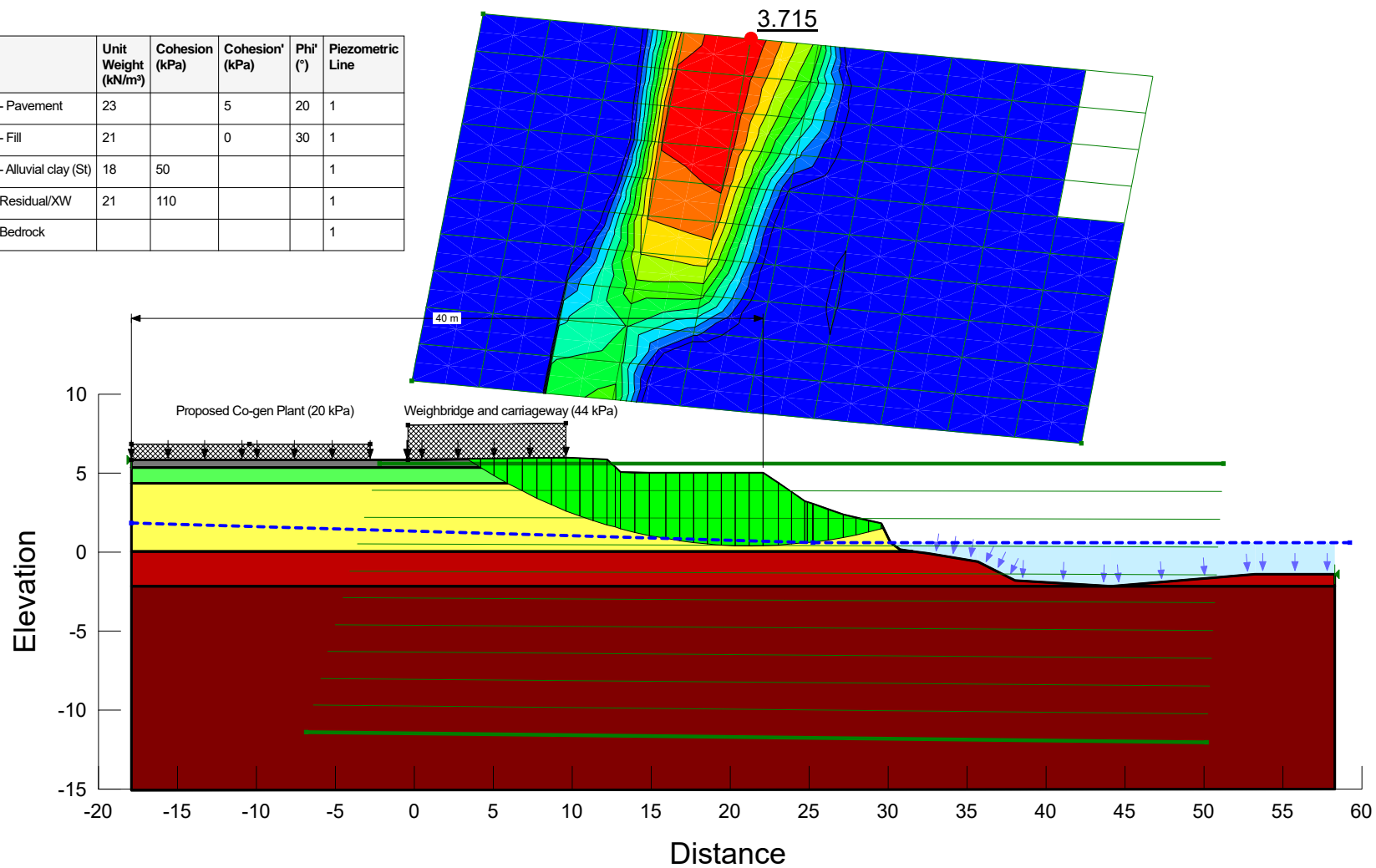
Section A-A' - Normal condition
12548413 MOD 21 Slope Stability Analysis.gsz
09/04/2021
1:400

Color	Name	Unit Weight (kN/m³)	Cohesion (kPa)	Cohesion' (kPa)	Phi' (°)	Piezometric Line
Grey	Unit 1a - Pavement	23		5	20	1
Light Green	Unit 1b - Fill	21		0	30	1
Yellow	Unit 2a - Alluvial clay (F-St)	18	25			1
Red	Unit 2c - Alluvial clay (Vst-H)	20	75			1
Dark Red	Unit 3 - Residual/XW	21	110			1
Dark Red	Unit 4 - Bedrock					1



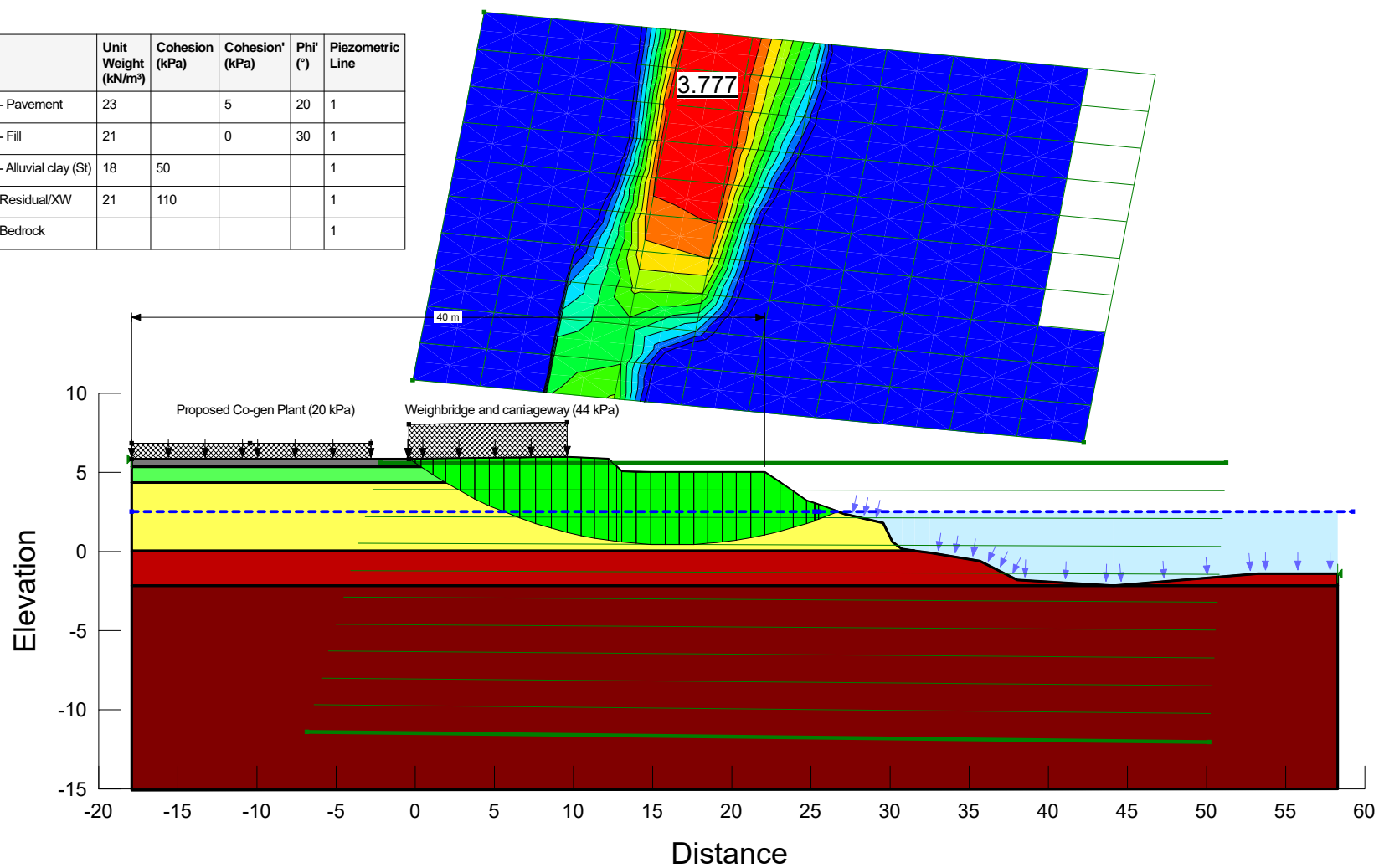
Section A-A' - Rapid drawdown
12548413 MOD 21 Slope Stability Analysis.gsz
09/04/2021
1:400

Color	Name	Unit Weight (kN/m³)	Cohesion (kPa)	Cohesion' (kPa)	Phi' (°)	Piezometric Line
Grey	Unit 1a - Pavement	23		5	20	1
Light Green	Unit 1b - Fill	21		0	30	1
Yellow	Unit 2b - Alluvial clay (St)	18	50			1
Red	Unit 3 - Residual/XW	21	110			1
Dark Red	Unit 4 - Bedrock					1



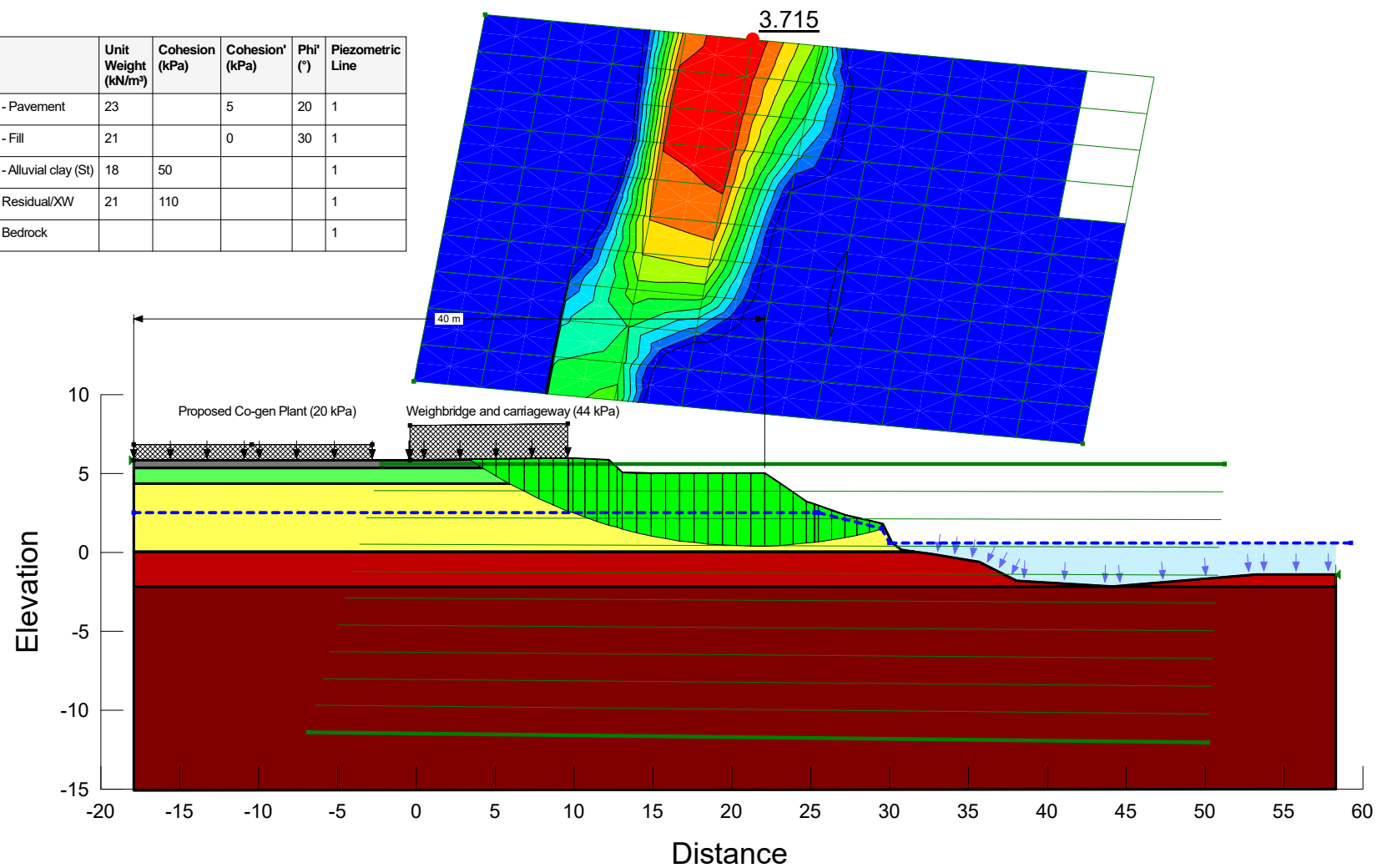
Section B-B' - Normal condition
12548413 MOD 21 Slope Stability Analysis.gsz
09/04/2021
1:400

Color	Name	Unit Weight (kN/m³)	Cohesion (kPa)	Cohesion' (kPa)	Phi' (°)	Piezometric Line
Grey	Unit 1a - Pavement	23		5	20	1
Green	Unit 1b - Fill	21		0	30	1
Yellow	Unit 2b - Alluvial clay (St)	18	50			1
Red	Unit 3 - Residual/XW	21	110			1
Dark Red	Unit 4 - Bedrock					1



Section B-B' - Flood condition
12548413 MOD 21 Slope Stability Analysis.gsz
09/04/2021
1:400

Color	Name	Unit Weight (kN/m³)	Cohesion (kPa)	Cohesion' (kPa)	Phi' (°)	Piezometric Line
Grey	Unit 1a - Pavement	23		5	20	1
Light Green	Unit 1b - Fill	21		0	30	1
Yellow	Unit 2b - Alluvial clay (St)	18	50			1
Red	Unit 3 - Residual/XW	21	110			1
Dark Red	Unit 4 - Bedrock					1



Section B-B' - Rapid drawdown
12548413 MOD 21 Slope Stability Analysis.gsz
09/04/2021
1:400

Appendix D

Site photographs



Photograph 1: View looking southwest along site boundary about 20m from western side of Co-generation plant. Note thick vegetation in riparian corridor above Bomaderry Creek



Photograph 2: View looking northwest across Bomaderry Creek from riparian corridor west of the Co-generation plant.



Photograph 3: Significant tree growth close to shoreline of Bomaderry Creek providing bank support.



Photograph 4: Recent erosion and slumping along shoreline of Bomaderry Creek during minor flood event and raised river and creek levels in March 2021.



Photograph 5: View looking southwest over Bomaderry Creek showing substantial tree growth and undergrowth along banks.



Photograph 6: Lower part of eastern bank of Bomaderry Creek where local slumping and collapse of trees into the creek has occurred.



Photograph 7: Large tree at top of eastern bank of Bomaderry Creek. Tree is at least 40 years old indicating no large-scale failure of the bank has occurred during this time.



Photograph 8: Looking north along the boundary fence, showing upper riparian corridor and concrete block wall with container storage in the background.



Photograph 9: Looking north along boundary with container storage close to top of fill batter. These containers are located to southwest of the proposed co-generation plant.



Photograph 10: Looking north along western boundary with co-gen plant site to right of photo. Note tilting of concrete block wall supporting fill and paved area.



Photograph 11: Looking south towards containers shown in Photo 11, noting that containers are tilted likely due to settlement of fill.



Photograph 12: Typical shipping container in storage yard at site of co-generation plant. Containers typically weigh about 2t when empty and 30t when loaded.



Photograph 13: Looking south over paved access and storage area. Co-generation plant is to be located in area currently occupied by shipping containers. Note local pavement damage along edge of accessway to storage area.



Photograph 14: Looking south along eastern side of proposed co-generation plant, with container storage currently occurring over hardstand pavement.



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