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Davistown and Empire Bay Climate Change Adaptation Study

Final Report

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Cover Photo: King Tide at Davistown 12 June 2005 – photo supplied by Central Coast Council

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Glossary

1% Probability of Exceedance	The level that one can be 99% confident will not be exceeded.
Annual exceedance probability (AEP)	The chance of a flood of a given size (or larger) occurring in any one year, usually expressed as a percentage. For example, if a peak flood discharge of 500 m^3/s has an AEP of 5%, it means that there is a 5% chance (i.e. a 1 in 20 chance) of a peak discharge of 500 m^3/s (or larger) occurring in any one year. (See also average recurrence interval).
Australian Height Datum (AHD)	National survey datum corresponding approximately to mean sea level.
Average recurrence interval (ARI)	The long-term average number of years between the occurrence of a flood as big as (or larger than) the selected event. For example, floods with a discharge as great as (or greater than) the 20 year ARI design flood will occur on average once every 20 years. ARI is another way of expressing the likelihood of occurrence of a flood event. (See also annual exceedance probability).
Catchment	The catchment, at a particular point, is the area of land that drains to that point.
Coastal Inundation	Coastal inundation occurs when a combination of marine and atmospheric processes raises the water level at the coast above normal elevations, causing land that is usually 'dry' to become inundated by sea water. Alternatively, the elevated water level may result in wave run-up and overtopping of natural or built shoreline structures (e.g. dunes, seawalls).
Design flood	A hypothetical flood representing a specific likelihood of occurrence (for example the 100 year ARI or 1% AEP flood).
Development	Is defined in Part 4 of the AP&A Act as: - Infill Development: development of vacant blocks of land that are generally surrounded by developed properties. - New Development: development of a completely different nature to that associated with the former land use. - Redevelopment: Rebuilding in an area with similar development.
Discharge	The rate of flow of water measured in terms of volume per unit time, for example, cubic metres per second (m^3/s). Discharge is different from the speed or velocity of flow, which is a measure of how fast the water is moving for example, metres per second (m/s).
Flood	Relatively high river or creek flows, which overtop the natural or artificial banks, and inundate floodplains and/or coastal inundation resulting from super elevated sea levels and/or waves overtopping coastline defences.
Flood Awareness	Awareness is an appreciation of the likely effects of flooding and knowledge of the relevant flood warning, response ad evacuation procedures.

Flood Education	Education that seeks to provide information to raise awareness of the flood problem to enable individuals to understand how to manage themselves and their property in a flood event.
Flood level	The height or elevation of floodwaters relative to a datum (typically the Australian Height Datum). Also referred to as “stage”.
Floodplain	Area of land which is subject to floods up to and including the probable maximum flood.
Floodplain risk management plan	A document outlining a range of actions aimed at improving floodplain management. The plan is the principal means of managing the risks associated with the use of the floodplain. A floodplain risk management plan needs to be developed in accordance with the principles and guidelines contained in the NSW Floodplain Development Manual. The plan usually contains both written and diagrammatic information describing how particular areas of the floodplain are to be used and managed to achieve defined objectives.
Flood planning levels (FPLs)	Flood planning levels selected for planning purposes are derived from a combination of the adopted flood level plus freeboard, as determined in floodplain management studies and incorporated in floodplain risk management plans. Flood planning levels for the low lying areas of Davistown and Empire Bay are derived from the Brisbane Water Floodplain Risk Management Study and Plan. The FPL is based on the flood levels associated with elevated water levels in Brisbane Water as a result of ocean storms, an allowance for climate change and a freeboard.
Flood prone land	Land susceptible to inundation by the probable maximum flood (PMF) event. Under the merit policy, the flood prone definition should not be seen as necessarily precluding development. Floodplain Risk Management Plans should encompass all flood prone land (i.e. the entire floodplain).
High High Water Spring Solstices	Rarer high tides occurring approximately twice a year, during the June and December solstices (“king tides”)
Hydraulic	The term given to the study of water flow in rivers, estuaries and coastal systems, in particular the evaluation of flow parameters such as water level and velocity.
Hydrograph	A graph showing how a river or creek’s discharge changes with time.
Hydrologic	Pertaining to rainfall-runoff processes in catchments.
Hydrology	The term given to the study of the rainfall-runoff process in catchments, in particular, the evaluation of peak flows and flow volumes. .
Maladaptation	Incomplete, inadequate, or faulty adaptation.
Mean High Water Springs	“Every day” tidal inundation caused by high tides. The MHWS tide is the average of all high water observations at the time of spring tide over a period time (generally 19 years)
Peak flood level, flow or velocity	The maximum flood level, flow or velocity that occurs during a flood event.

Probable maximum flood (PMF)	An extreme flood deemed to be the maximum flood that could conceivably occur.
Probability	A statistical measure of the likely frequency or occurrence of flooding.
Runoff	The amount of rainfall from a catchment that actually ends up as flowing water in the river or creek.
Storm Surge	A rise and onshore surge of seawater as the result primarily of the winds of a storm, and secondarily of the surface pressure drop near the storm centre.
Topography	The shape of the surface features of land.
Velocity	The speed at which the floodwaters are moving. A flood velocity predicted by a 2D computer flood model is quoted as the depth averaged velocity, i.e. the average velocity throughout the depth of the water column. A flood velocity predicted by a 1D or quasi-2D computer flood model is quoted as the depth and width averaged velocity, i.e. the average velocity across the whole river or creek section.

Acronyms

1D	One Dimensional
2D	Two Dimensional
AEP	Annual Exceedance Propability
AHD	Australian Height Datum
ARI	Average Recurrence Interval
ARF	Areal Reduction Factor
AR&R	Australian Rainfall and Runoff
BoM	Bureau of Meteorology
BVSC	Bega Valley Shire Council
DCP	Development Control Plan
DEM	Digital Elevation Model
DPE	Department of Planning and Environment
ECL	East Coast Low
IFD	Intensity Frequency Duration
FPL	Flood Planning Level
FRMP	Floodplain Risk Management Plan
FRMS	Floodplain Risk Management Study
FPRMSP	Floodplain Risk Management Study & Plan
ha	hectare
HAT	Highest Astronomical Tide
HCCREMS	Hunter and Central Coast Regional Environmental Management Strategy
HHWS	High High Water Spring
km	kilometres
km^2	Square kilometres
LEP	Local Environment Plan
LGA	Local Government Area
LiDAR	Light Detection and Ranging
m	metre
m^2	Square metres
m^3	Cubic metres
mAHD	metres to Australian Height Datum
mm	millimetres

m/s	metres per second
MHWS	Mean High Water Spring
MLWS	Mean Low Water Spring
MHWN	Mean High Water Neap
MLWN	Mean Low Water Neap
MSL	Mean Sea Level
NSW	New South Wales
OEH	Office of Environment and Heritage (NSW)
PMF	Probable Maximum Flood
PoE	Probability of Exceedance
SES	State Emergency Service (NSW)

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1 Introduction

1.1 Background

Davistown and Empire Bay are located within the Brisbane Water catchment, within the Central Coast Local Government Area (LGA). Previous studies of Brisbane Water (*Brisbane Water Foreshore Flood Study and the Floodplain Risk Management Study and Plan (BWFRMP)* (Cardno, 2015a,b)) have shown that the low lying portions of Davistown and Empire Bay will face difficulty to maintain normal urban residential area functions under climate change projections for sea level rise.

The flood planning level (FPL) for development within the low-lying areas of Davistown and Empire Bay has an allowance for sea level rise to ensure the building is protected against flood from ocean storms for the life of the structure. However, this does not consider the impacts on the property grounds, streets and public spaces as a result of elevated tidal levels under sea level rise conditions.

Raising existing ground levels and associated infrastructure was identified in Cardno (2015b) as a potential solution provided there are no long-term detrimental effects as a result of maladaptation. Raising land on a large-scale regional basis is not practical given the multiple landholders and existing development. However, by developing regional adaptation masterplan, incremental filling could be achieved, albeit over the longer term on individual or multiple sites through development and urban renewal.

Local studies of catchment flooding for both Davistown and Empire Bay (Cardno Lawson Treloar, 2010) show that they are at risk of flooding by overland flows. These issues were also raised by residents at recent community engagement in the area. This study will consider the feasibility of a landform design that jointly addresses risk of sea level rise and the current local drainage issues.

The suburbs of Davistown & Empire Bay are representative of a number of suburbs that are low lying and susceptible to the effects of climate change and the existing threat from flooding in and around Brisbane Water Estuary. This adaptation study is an important step in addressing climate change risk for all low-lying areas of the Central Coast LGA. **Figure 1-1** shows how this adaptation study fits within Council's approach to climate change adaptation across the LGA. Further details of the Brisbane Water Floodplain Risk Management Plan and the Climate Change Policy can be found in **Sections 3.2.2** and **3.2.4**.

By undertaking a regional adaptation masterplan for Davistown and Empire Bay, adaption pathways can be developed such as development controls, levees and other mitigation measures which could be implemented over time in consultation with the community. The purpose of this climate change adaptation study is to inform the development of a regional adaptation masterplan and these associated processes.

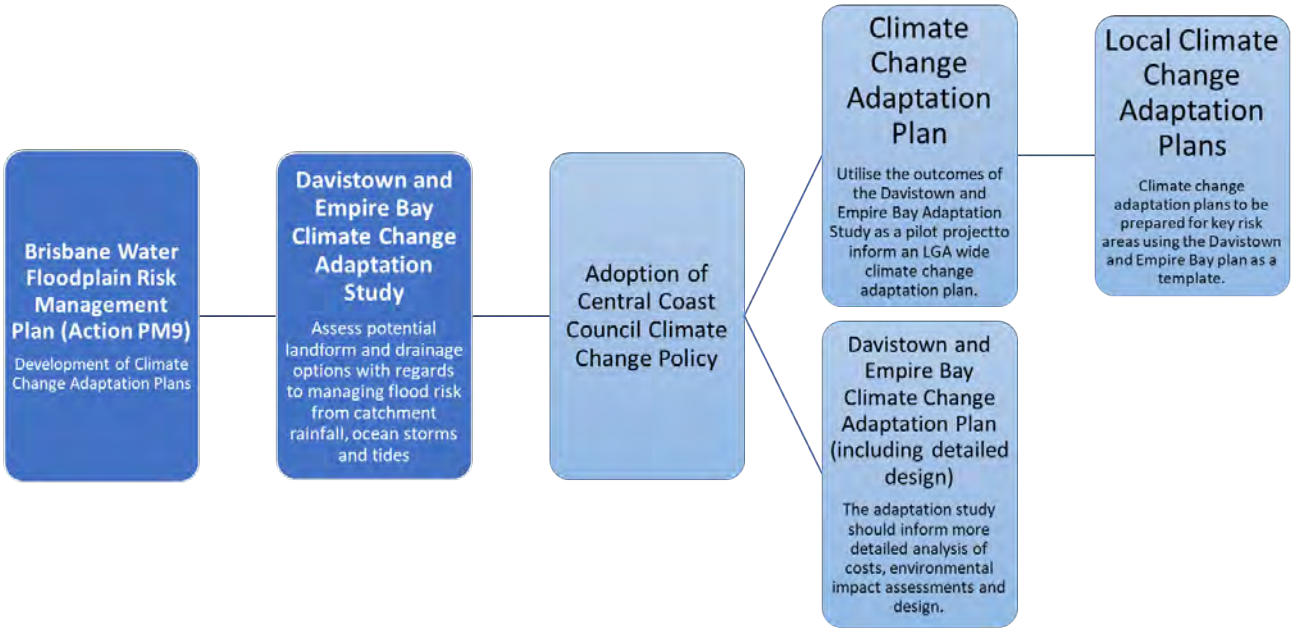


Figure 1-1 Climate Change Adaptation Process

1.2 Study Objectives

The primary aim of this climate change adaptation study is to undertake a case study that will assist planning for future development in low lying suburbs in and around the Brisbane Water Foreshore to adapt to future changes such as climate risks.

This climate change adaptation study focuses on the technical analysis of potential landforms and associated measures to provide flood protection against existing and future flood risk associated with both catchment and ocean flooding (both tidal and storm induced).

The key objectives are to:

- provide the technical analysis to inform a future concept landform and drainage masterplan for the suburbs of Davistown & Empire Bay.
- provide the technical analysis to inform the strategic phasing plan that would assist the implementation of the concept landform and drainage masterplan.
- inform Management Action PM9 of the BWFRMP.

1.3 Document Structure

This document comprises the following:

- **Section 2 – Study Area:** The study area is defined as the low lying portions of Davistown and Empire Bay.
- **Section 3 – Existing Data:** A range of data was reviewed in the preparation this adaptation plan.
- **Section 4 – Existing and Future Risk:** An analysis was undertaken of the existing and future flood risk associated with catchment flows, ocean storms and tidal inundation.
- **Section 5 – Options Analysis:** Several landform and drainage plans have been refined through the consideration of various planning and design inputs to ensure feasibility of the proposed climate change adaptation strategy.

- **Section 6 – Concept Landform and Drainage Plan:** Based on the outcomes of the options analysis and consultation with stakeholders, a concept landform and drainage plan has been prepared that addresses existing and future drainage issues, and foreshore flooding (from tides and ocean storms).
- **Section 7 – Flood Modelling:** Local catchment flood modelling has been undertaken to understand the local catchment flood behaviour associated with the final landform and impacts associated with a likely interim stage of the implementation.
- **Section 8 – Economic Analysis:** An economic assessment has been undertaken on the proposed landform and drainage plan for Empire Bay and Davistown to understand the overall economic viability of implementing it.
- **Section 9 – Implementation:** The strategic aspects of the future climate change adaptation masterplan, including staging of works, trigger levels, land use planning and other considerations.
- **Section 10 – Recommendations:** The outcomes of this study provide a series of potential actions and recommendations for Council planning and specifically for the Davistown and Empire Bay Floodplain Risk Management Study and Plan (currently being undertaken).

2 Study Area

Davistown and Empire Bay are suburbs that will face difficulty with maintaining normal urban residential area functions under climate change projections for sea level rise. These two locations offer the opportunity to conduct a case study for climate change adaptation in the form of a concept landform and drainage plan. The outcomes of this case study will hopefully provide an example for many other locations (not only on the Central Coast, but across Australia) that face the same or similar challenges under climate change, where community stakeholders have identified that actions such as planned retreat are not desirable outcomes.

The Davistown Catchment and Empire Bay Catchment Flood Studies were completed in 2010. The Sobek models and associated DEMs developed for the purpose of these studies provided an opportunity to be utilised as part of a climate change adaptation plan. The study area for this current study focuses on the low-lying portions of the study areas from the 2010 Flood Studies (Cardno Lawson Treloar).

The study areas are show in **Figures 2-1 and 2-2**.

Figure 2-1 Davistown Study Area

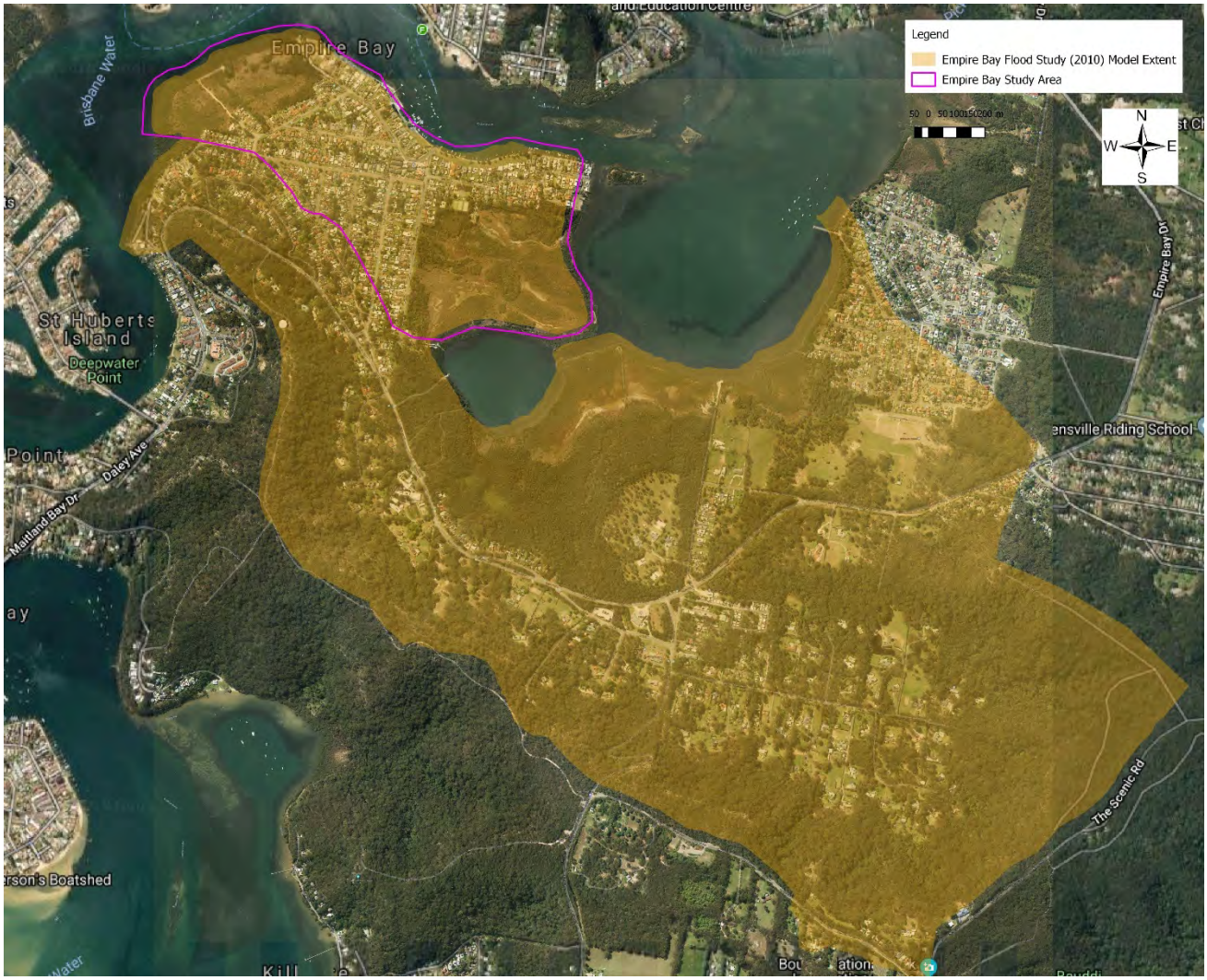


Figure 2-2 Empire Bay Study Area

3 Existing Data

3.1 Site Inspection

Site inspections of the study areas were undertaken on 17 May 2018 and 6 November 2018 by Rhelm and Council staff. The inspections were undertaken to review the results of the 2010 flood studies and to appraise existing development, foreshore usage, topography and property access. The second site inspection was also undertaken as part of the site appraisal for the Floodplain Risk Management Study and Plan to identify opportunities to manage existing flood risk (this is discussed further in **Section 3.2.6**)

Photos were taken at the locations shown in **Appendix A**.

A foreshore resident provided some details on elevated water levels she had witnessed along the foreshore. The photos she provided are included in **Appendix A**.

3.2 Existing Reports and Data

A range of existing reports and data were reviewed as part of this study. All reports and data included in the review are summarised in **Table 3-1**.

Table 3-1 Data Collation

Data Type	Description	Date	Author	Key Reference for Current Study
Design Plans	Proposed drainage between Rosella Rd and Myrtle Rd and Gordon Rd, Empire Bay - Plan	1989	Gosford City Council	No
Flood Modelling Results	Brisbane Water FS Catchment Flood Modelling Results at Reporting Locations	2014	Cardno	Yes
Flood Modelling Results	Davistown depth and water level contours: 1m	2010	Cardno	Yes
Flood Modelling Results	Davistown extents	2010	Cardno	Yes
Flood Modelling Results	Empire Bay depth and water level contours: 1m	2010	Cardno	Yes
Flood Modelling Results	Empire Bay flood extents	2010	Cardno	Yes
Flood Modelling Results	Davistown depth and water level contours: 2m Filtered	2010	Cardno	Yes
Flood Modelling Results	Empire Bay depth and water level contours: 2m Filtered	2010	Cardno	Yes
Flood Models	Davistown and Empire Bay Sobek Models	2012	Cardno	Yes
Flood Report	Data compilation report for the Brisbane Water Flood Study	1991	PWD	No
Flood Report	Report outlining the data collected for the February 1992 flood event.	1992	MHL	No
Flood Report	Planning for Future Flood Risks: Marks Point and Belmont South Local Adaptation Plan (DRAFT)	2015	Lake Macquarie City Council	Yes

Data Type	Description	Date	Author	Key Reference for Current Study
Flood Report	Brisbane Water FRMS and FRMP	2015	Cardno	Yes
GIS	Council GIS: Veg, Cadastre, Council Reserves, Creeks, Crown Land, Drainage channels, Headwalls, Pipes, Pits, Culverts, Catchments, NPWS, Rain Gauges, Sewer, Water Supply Structures, WL Recorders, Waterways / Ocean.	Various	Central Coast Council	Yes
GIS	WMS for Aerials	2012	Central Coast Council	Yes
Historical Photos	Most are photos provided for the FS, but no dates provided. One set of photos from 2015 event (Robert Baker).	Various	Community	No
Historical Photos	Photos of 1989 Flood	1989	Unknown	No
Historical Photos	Photos of 1988 flooding at Myrtle Rd, Empire Bay	1988	Unknown	No
Survey	Pits, Cross Sections, Structures and Historical Flood Marks	2008	Johnson Partners	Yes
Survey	Historical and survey marks shown on plans (pdf only)	2007	Johnson Partners	No
Survey	Survey points	2007	Johnson Partners	No
Survey	Foreshore survey coordinates in excel	2007	Johnson Partners	No
Survey	Historical flood mark coordinates and levels in excel (with comments)	2007	Johnson Partners	No
Survey	Historical flood marks by address and level (no coordinate provided)	2007	Johnson Partners	No
Survey	Cross sections in Excel	2007	Johnson Partners	No
Survey	Brisbane Water Floor Level Survey	2015	Cardno	Yes
Survey	Council Lidar	2013	Central Coast Council	Yes

3.2.1 Brisbane Water Flood Study (2010)

The Brisbane Water Foreshore Flood Study (Cardno Lawson Treloar) was completed in 2010. Prior to this study being undertaken, numerous floodplain management studies for the tributaries of Brisbane Water had been undertaken utilising a 1% AEP flood level in Brisbane Water of 1.95mAHD. This level was based on a review of compiled observed levels in Brisbane Water during the 1974 ocean storm event (Department of Public Works, 1976).

The 2010 Flood Study provided more reliable estimates of the 1% AEP flood level throughout Brisbane Water. The study investigated a range of natural mechanisms that impact water level, as well as the effects of man-made structures. The flood study also assessed the locally generated waves across the waterway.

The key results of the Flood Study (2010) in the vicinity of the Davistown and Empire Bay study area are summarised in **Table 3-2**.

Table 3-2 Water Levels at Model Reporting Location 059 and Tidal Site 11 (Cardno Lawson Treloar, 2010)

HHWS[1]	MHWS[2]	1% PoE[3]	1% AEP	5% AEP	20% AEP
0.56 m AHD	0.33 m AHD	0.64 m AHD	1.49 m AHD	1.36 m AHD	1.24 m AHD

[1] High High Water Spring tide (see glossary)

[2] Mean High Water Spring tide (see glossary)

[3] Probability of Exceedance: the level that one can be 99% confident will not be exceeded.

3.2.2 Brisbane Water Floodplain Risk Management Study and Plan (2015)

This Floodplain Risk Management Study and Plan (FRMSP) looked at options to manage the flood risks that results from coastal processes, such as significant coastal wave events and storm surge associated with low pressure systems off the east coast of Australia. In addition to considering the flood risks presented in the Flood Study (2010), the FRMSP also undertook additional assessments of flooding risk under projected sea level rise scenarios. These assessments looked at the impacts of sea level rise on flooding from ocean storm events and also the impact on more regular (but less severe) tidal inundation. The study looked at sea level rise of 0.4m and 0.9m.

The detailed assessment of the impacts associated with increased tidal inundation as a result of sea level rise was beyond the scope of the FRMSP. However, management Action PM9 of the FRMSP recommended the development of Climate Change Adaptation Plans.

Given that new developments may have an asset life of 50+ years any present-day planning approvals could have longer term implications to occupiers of land subject to flooding. Action PM9 highlights the importance of beginning the process of planning for the potential impacts of sea level rise.

In addition to PM9, there were several options within Davistown and Empire Bay, that were identified to be considered within a climate change adaptation plan, namely:

- FM1a Raise all flood affected roads;
- FM1b Raise major and critical flood affected roads;
- FM5 Seawall maintenance and raising;
- FM6a Construct a levee around Davistown and Empire Bay to the PMF level;
- FM6b Construct a levee around Davistown and Empire Bay to the 5 Year ARI level;
- FM9 Raise land affected by coastal flooding; and
- PM11b Undertake a review/updated investigation of the impacts of structural floodplain risk management options on overland flows.

3.2.3 Independent Report on Sea Level Rise (2015)

An independent report on projected sea level rise in Brisbane Water was prepared by Doug Lord of Coastal Environment Pty Ltd and by Dr David Wainwright from Whitehead and Associates in 2015.

The independent report recommended RCP8.5 as a suitable and defensible basis for sea level rise projection in 2015. The report also identified that research on recent global emissions indicates that we are tracking at

the top of the RCP8.5 projection. Within the high emissions scenario (RCP 8.5), there are three possible trajectories (low, medium, high) which encapsulate the range of the modelling. In March 2015 Gosford City Council resolved to adopt sea level rise planning levels based on projections for the Representative Concentration Pathway Scenario RCP8.5, utilising the medium sea level rise projection. This projection has been provided from 2015 mean sea level. The adopted sea level rise predictions are summarised in **Table 3-3**.

Table 3-3 Projected Sea Level Rise RCP8.5

Year	Sea Level Rise (m)
2015	0
2030	0.1
2050	0.2
2070	0.4
2100	0.7

3.2.4 Central Coast Council Climate Change Policy (2019)

The Central Coast Council Climate Change Policy (The Policy) sets out Council's position relating to climate change with a view to maximising the economic, social and environmental wellbeing of Council and guides the planning and development of the Central Coast Region's resilience to climate change.

Of specific relevance to this climate change adaptation study are the following strategic principals and commitments made in The Policy:

- Principle 2: Council implement a holistic approach to anticipate and adapt to climate change actions that comprise the time scales such as now and the future as well as the impacts of the complex interactions and interdependencies between the human and the environment systems.
- Principle 3: Council implement an evidence based decision making to respond, to adapt and build resilience to Climate Change.
- Principle 5: Council implement a proactive approach and ensure continuity to better anticipate and adapt to complex challenges posed by the changing climate.
- Principle 6: Council implement a Place-based approach to enhance Council and community capacity for climate resilience that is context specific, knowledge based and collaborative.
- Commitment D4: Council develop place based Climate Change Action Plans in partnership with the community that establishes regional targets for mitigation and prioritises local adaptation planning (e.g. sea level rise, coastal hazards, disaster management).
- Commitment D7: Incorporate climate change risks in strategic and infrastructure planning for the region to maximise local liveability through informed land use planning, development of planning controls and guidelines that facilitates regional urban growth, transport connectivity and utility services.

3.2.5 Davistown and Empire Bay Flood Studies (2010)

Flood studies were undertaken for Davistown and Empire Bay catchments to assess the risk associated with catchment flooding.

Hydrologic and hydraulic modelling was completed to assess flood behaviour within the catchments. The SOBEK modelling system was used to model the catchment and to hydraulically route overland flood flows and street flow. The SOBEK modelling utilises the rainfall-on-grid methodology for developing the hydrology.

In the model, rainfall is applied directly to the 2D terrain, and the hydraulic model automatically routes the flow.

Flood behaviour was modelled for a series of Annual Exceedance Probabilities (AEP); 0.5% AEP, 1%, 2%, 5%, 10%, 20%, 50%, and 100% AEP and Probable Maximum Flood (PMF).

The flood models developed for these flood studies have been used as the basis of the models developed to assess the local flood behaviour as part of this climate change adaptation plan and also for the Davistown and Empire Bay FRMSP (**Section 3.2.6**).

3.2.6 Davistown and Empire Bay Floodplain Risk Management Study and Plan (Currently Underway)

This FRMSP is currently being prepared by Council to address existing and future flood risk associated with catchment and coastal storm events. While there will be a large focus on addressing existing flood risk, one of the key inputs to this study will be the recommendations of this climate change adaptation plan with regards to addressing future flood risk. Where possible, management actions will be recommended that are able to address existing risk and be adapted or staged to also address future risk.

3.3 Existing Case DEM

A Digital Elevation Model (DEM) was prepared to form the basis of the 2010 Flood Study for input into the hydraulic models. Since the development of the 2010 models, that there has been more recent LiDAR data collected by Council (2013).

A comparison of the Flood Study (Cardno Lawson Treloar, 2010) model DEMs to the LiDAR received from NSW Spatial Services (dated 2013) was undertaken. Throughout the study area, the 2013 LiDAR data is generally at the same elevation with isolated areas where the LiDAR elevation data is greater than 0.3 m different than the DEM.

Due to the minor differences in the revised LiDAR when compared to the Flood Study (2010) DEM, the existing (flood study) DEMs have been used for the 'base' modelling for this study. However, landform and drainage design has also considered the 2013 LiDAR.

4 Current and Future Risk

Davistown and Empire Bay can be impacted by three mechanisms of flood risk:

- Brisbane Water flooding as a result of ocean storms,
- local catchment flooding as a result of local rainfall, and
- tidal inundation during high tides.

All of these flood risks will increase as a result of sea level rise.

The flood risks in Davistown and Empire Bay have been discussed briefly below with regards to existing risks (based on existing studies) and the likely increase in those risks as a result of sea level rise, based on the RCP8.5 projections (**Section 3.2.3**).

4.1 Brisbane Water Flooding

Major historical coastal flood events for the Brisbane Water foreshore floodplain include the severe ocean storm of 1974 and the more recent, but less severe, event in 2007.

There are significant low-lying areas within Davistown and Empire Bay susceptible to flooding from Brisbane Water even in more frequent events. Existing high tides in this area can cause foreshore inundation, especially with joint occurrence with local rainfall. In Davistown inland penetration by flood waters and number of properties affected by flooding is more significant than Empire Bay due to the very flat terrain.

The Brisbane Water Flood Study (2010) considered the flooding that results from coastal processes, such as significant coastal wave events and storm surge associated with low pressure systems off the East Coast of Australia. Analysis undertaken in the Brisbane Water Flood Study (2010) identified that sea level rise would result in an almost equivalent increase in water levels at Davistown and Empire Bay.

In 2015 an independent report on projected sea level rise in Brisbane Water was prepared for Council (see **Section 3.2.3**). The sea level rise values from this report have been used to define the increase in flood levels over time, as shown in **Table 4-1**. The mapping of these 1% AEP levels for 2015, 2050 and 2100 are shown in **Appendix B – Figure B1**. The 2015 condition has been used as the 'base case' or 'existing scenario' against which to assess the impacts of future flooding.

Table 4-1 Brisbane Water Flood Levels (Flood Study Reporting Location 059)

Year	Sea Level Rise (m)	1%PoE (m AHD)	1% AEP (m AHD)	5% AEP (m AHD)	20% AEP (m AHD)
2015	0	0.64	1.5	1.4	1.2
2030	0.1	0.74	1.6	1.5	1.3
2050	0.2	0.84	1.7	1.6	1.4
2070	0.4	1.04	1.9	1.8	1.6
2100	0.7	1.34	2.2	2.1	1.9

4.2 Local Catchment Flooding

The Davistown Catchment Flood Study (2010) analysis demonstrated that runoff and higher flood depths due to the 1% AEP event occur in the open space and vegetated-marsh areas of Davistown. However, some properties and sections of road experience flood depths up to 0.5m in this event. In the 1% AEP event, the

modelling showed that no houses in Davistown are flooded above the floor level when the storm runoff is combined with a 1% probability of exceedance level in the estuary.

The Empire Bay Catchment Flood Study (2010) analysis showed that in a 1% AEP event some properties and roads may be inundated up to 0.5m. This occurs notably around Gordon Road, Boongala Avenue, Rickard Road and Greenfield Road. In the 1% AEP event, the modelling showed that 22 houses are flooded above the floor level when the storm runoff is combined with a 1% probability of exceedance level in the estuary.

Potential impacts to flood behaviour in the catchments due to climate change were analysed for estuary level rises of 0.2m and 0.91m. Flood inundation in the low elevation areas of the catchment were particularly affected by increases in sea level which influences the levels in Brisbane Water estuary.

Climate change also has the potential to impact rainfall. The ARR data hub suggests that rainfall could increase as a result of climate change by up to 20% by 2090 (RCP8.5). The flood studies (2010) undertook sensitivity testing of the flood behaviour to a 20% increase of the 1% AEP 2 hour storm event rainfall. The analysis resulted in increases in flood levels up to 0.04m. In general, the increased flow 'spread out' rather than increased in depth.

The 1% AEP local catchment flooding extent under existing conditions from the 2010 flood studies is shown in **Appendix B**.

4.3 Tidal Inundation

The *Sea Level Rise and the Estuarine Intertidal Zone discussion paper* (Cardno, 2010b) was included as an Appendix to the Brisbane Water Estuary Management Study undertaken by Cardno (2010a). The paper focused on the environmental implications of sea level rise (such as the impacts on intertidal vegetation).

A discussion paper was also included in the *Brisbane Water Foreshore Floodplain Risk Management Study* to identify the impacts of projected sea level rise on tidal inundation. The Delft3D hydrodynamic model was used to investigate the tidal response to climate change and entrance morphology. The model setup used for the Brisbane Water Foreshore Flood Study (Cardno, 2013) was employed for these tasks. The potential change in tidal attenuation was investigated for the 0.4m projected sea level rise scenario, and this was achieved by raising the water level downstream boundary condition by 0.4m to account for the rise in sea level.

The tidal events selected for mapping represent:

- High High Water Spring Solstices (HHWSS) – Rare high tides occurring approximately twice a year, during the June and December solstices ("king tides"); and
- Mean High Water Springs (MHWS) – "Every day" tidal inundation caused by high tides. The MHWS tide is the average of all high water observations at the time of spring tide over a period of time (generally 19 years).

The modelled tidal levels relative to the current study areas are summarised in **Table 4-2**. The modelling indicates that a 0.4m rise in sea levels relates to close to 0.4m rise in estuarine levels at Davistown and Empire Bay.

Table 4-2 Tidal Planes at Site 11 (BW FRMS 2015)

	MHWSS (m AHD)	MLWS (m AHD)	HHWS (m AHD)
Existing	0.33	-0.16	0.56
0.4m SLR	0.73	0.13	0.97

The sea level rise projections outlined in **Section 3.2.3** were applied to the results of the discussion paper and are summarised in **Table 4-3**. The risk areas associated with the HHWS levels is provided in **Appendix B – Figure B3**. If we interpolate between the values shown below it can be seen that a large proportion of the study area will be affected by "king tides" tides by 2100. And it can be inferred that the impacts of "every day (MHWS)" tides will cause significant road and property flooding by approximately 2070.

Table 4-3 Sea Level Rise Impacts on Tidal levels

Year	Sea Level Rise (m)	MHWS (m AHD)	HHWSS (m AHD)
2015	0	0.33	0.56
2030	0.07	0.40	0.63
2050	0.20	0.53	0.76
2070	0.39	0.72	0.95
2100	0.74	1.07	1.30

5 Climate Change Adaptation - Concept Designs

5.1 Approach

Adapting to climate change and rising sea levels is a complex problem, with no single technical solution, and involving multiple interests and stakeholders. The *Decision Support for Coastal Adaptation: The Handbook* (The Handbook) was developed in 2012 to assist the HCCREMS coastal councils more effectively approach and determine adaptation responses and pathways for vulnerable coastal areas. The Handbook discusses ten key stages in the decision-making process. Although the process is presented as a series of numbered stages, it is recognised that in reality decision-making will often jump backwards and forwards between stages. The stages are summarised in **Figure 5-1**.

The stages focused on in this adaptation plan are:

- **Stage 4 Assess hazards and risks:** this has been done in previous studies and forms the basis on the adaptation plan. The hazards and risks are summarised in **Section 4**.
- **Stage 5 Identify options and pathways:** various options are presented in this document (**Section 5.2**). Through collaboration with stakeholder a preferred approach was identified (**Section 5.3**). Flood behaviour and civil design aspects of the preferred approach were assessed (**Section 7**).
- **Stage 6 Establish Triggers:** As part of the strategic planning, a series of triggers have been identified to assist future decision making and implementation (**Section 8.3.2**).

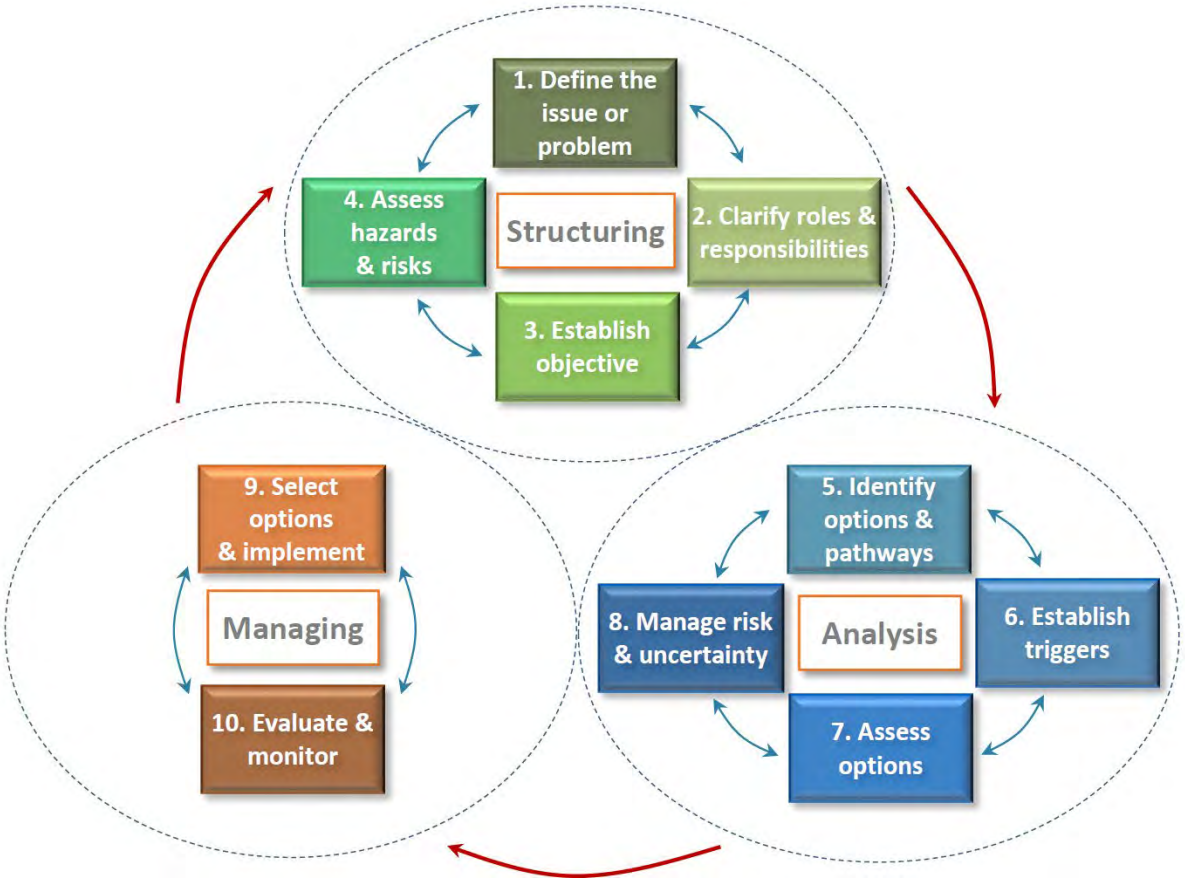


Figure 5-1 Stages in the adaptation decision making process (HCCREMS, 2012)

5.2 Preliminary Options Assessment

A range of approaches to climate change adaptation were assessed for the study area including filling of properties, raising assets and foreshore barriers. A workshop with internal Council stakeholders was undertaken to identify a preferred approach for more detailed assessment. An overview of the preliminary options is provided in **Section 5.2.1 to 5.2.3** and **Appendix C,** and the concept design of the preferred climate change adaptation approaches in described in **Section 5.3**.

5.2.1 Business as Usual

If no steps towards climate change adaptation are adopted in the coming decades then current sea level rise predictions would suggest that Davistown and Empire Bay will become increasing impacted by tides, with large areas inundated by 'every day' high tides (MHWS) by 2100. Under these conditions the study areas would not be habitable.

Planned retreat is a coastal hazards management approach that aims to allow the natural coastal processes (e.g. inundation and erosion) to carry on without resisting against them with counteracting engineering structures. As the inundation areas and / or erosion escarpment moves landward the existing development, infrastructure and property boundaries will be required to retreat along with it.

Planned retreat is not an option considered by this study; it has been used as the base case against which to compare climate change adaptation options.

5.2.2 Filling

The Gosford DCP 2013 requires all floor levels of residential buildings to be above the Flood Planning Level (FPL). To assist in achieving this level, filling of individual properties is permitted by the FRMP (2015) where it does not impact on active flow areas in the stream networks feeding Brisbane Water. Filling operations must include adequate provision for drainage of surface water erosion and siltation control and be so placed and graded as to prevent the shedding of surface water directly to adjoining properties.

The flood planning level for Davistown and Empire Bay varies slightly depending on location but is approximately 2.2 m AHD. There is currently very little direction in Council's DCP with regards to filling properties in the floodplain, the fill level, and how filling of properties can be undertaken to minimise the long-term impacts on local drainage.

The FRMS (2015) assessed options to address flood risk that included broadscale filling of Davistown and Empire Bay (Option FM9). However, it was found that master planning, consultation and effective staging, were required to establish whether filling would be feasible on a regional scale. Further the FRMS suggested that planning controls could consider longer term management strategies such as incremental filling. The FRMS noted that the potential change in flood hazard (i.e. from low to high hazard) as a result of climate change would need to be considered in any filling strategy (i.e. partial filling of the areas could result in flood island surrounded by high hazard flooding in the future).

Several options for filling of low lying areas of Davistown and Empire Bay were discussed with a range of internal Council stakeholders. These included allowing a standard fill depth on all properties and variable fill depths to optimise the landform for drainage outcomes. All filling strategies proposed full landform design as to include filling of roads and open space as well as private properties. This addresses the issue of unfilled land becoming high hazard due to sea level rise, creating high hazard flood islands of the filled land. Further details on the preliminary filling options are provided in **Appendix C**.

The initial step in investigating fill options was to identify an appropriate level of protection. Based on the information presented in **Section 4**, it was determined that a minimum level of 1.5m AHD provides reasonable protection for existing and future risks, namely because;

- The existing 1% AEP flood level is approximately 1.5m AHD;
- This provides protection from king tides (HHWS) past 2100; and
- This provides protection from 1% PoE past 2100.

It should be noted that floor levels would generally be set higher than the ground level affording a greater level of protection than the fill levels proposed, e.g. the Flood Planning Level of flood affected properties under current conditions would be around 2.2 m AHD.

5.2.3 Davistown Foreshore Barrier

To achieve the ultimate landform design presented by any of the filling options above, the majority of roads cannot be filled until all adjoining properties have also been filled to allow for access and avoid drainage issues (i.e. if the street is higher than the property, the property will not be able to drain to the street. Depending on Council's approach to policy and planning around property filling, it is likely that in the short term, at least, properties will be filled as Development Applications are lodged for property redevelopment and therefore the staging will be subject to progressive urban renewal.

Although there will likely be trigger points with regards to sea level rise that may expediate property owners need or desire to fill, the reality is that impacts associated with king tides and ocean storm events are likely to increase to a level that causes access issues and property damage before the final landform is achieved.

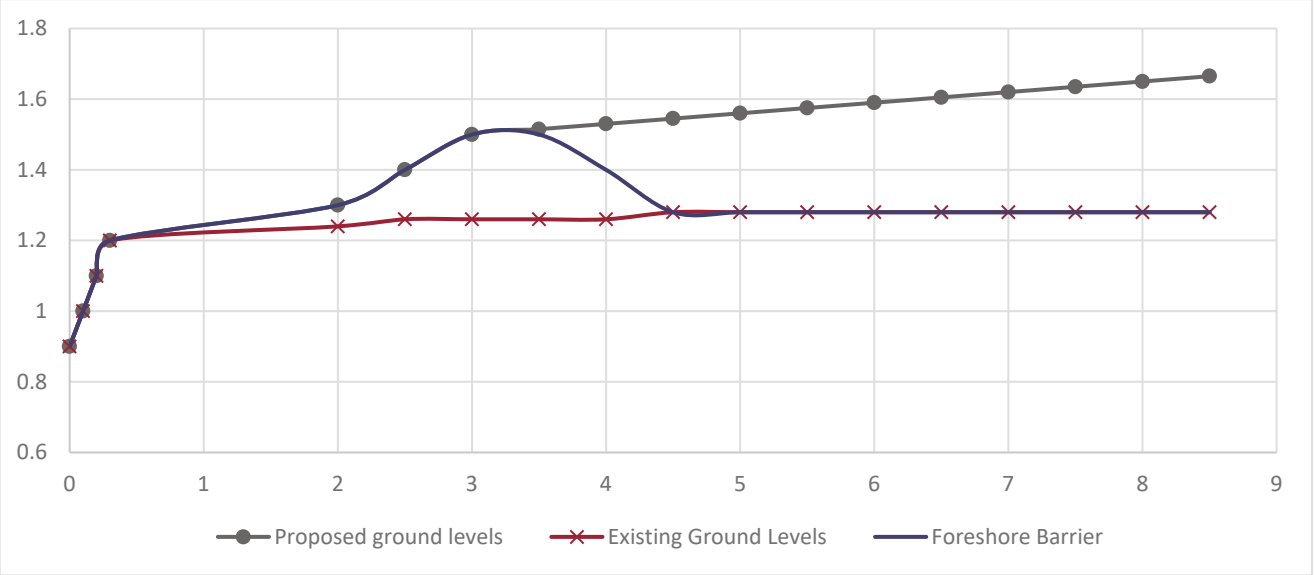
In Empire Bay, this is likely to be less of an issue due to the smaller number of properties and the fact that 'key locations' could be targeted by Council for voluntary or compulsory acquisition to allow for landform completion.

In Davistown an interim measure may be required if property filling does not progress sufficiently in time to provide adequate protection from sea level rise. A foreshore barrier has been identified as a potential option for this purpose.

Two preliminary concept designs of the foreshore barrier are shown in **Appendix C (Options 5 and 6**). The concept includes:

- Achieving a barrier for the majority of Davistown at 1.5m AHD;
- Retrofitting existing drainage pipes which discharge from behind the barrier to Brisbane Water with non-return valves or flap gates;
- Integrating a foreshore cycle / pathway along the existing foreshore reserve;
- Integrating with ground levels already at or above 1.5m AHD to reduce the length of constructed barrier;
- Incorporating 'walls' in locations that do not allow for a battered slope; and
- Utilising the barrier to protect wetlands from the impacts of sea level rise (i.e. restricting flows through the barrier to replicate existing tidal flows into the future).

Once the final landform is complete, the foreshore barrier would no longer be higher than the adjoining ground levels. A concept sketch showing these features is shown below.



5.2.4 Outcomes of Options Assessment

The preliminary concept design options were presented to a group of internal Council stakeholders across a range of divisions, including waterways, planning, assets and ecology. The following key issues were noted for inclusion in the preferred landform and drainage plan:

- General:
  - A minimum landform level of 1.5mAHD was considered appropriate.
  - Although a road grade of 0.5% is desirable, a road grade of 0.3% could be tolerated by Council. This would reduce fill depths in locations where the proposed topography is being driven by road drainage.
  - Design optimisation may reduce fill depths in key locations.
- Davistown:
  - The proposed landform was received positively by the stakeholders.
  - The use of vegetated swales could provide ecological corridors between wetlands and habitat for some species such as frogs.
  - The use of a foreshore barrier was considered a good interim option, and the concept of the barrier being 'integrated' into the final landform was positively received.
  - The dual use of the foreshore barrier as a cycle / pathway could result in opportunities for funding with other Council projects.
  - It was suggested that those areas resulting in the greatest depth of fill (and associated costs) could be reviewed for possible rezoning.
- Empire Bay:
  - The proposed landform results in low points on Rickard Road that rely on underground drainage. In the event of drainage blockage, these locations would become trapped low points, increasing the flood risk to adjacent properties.
  - The cost of the proposed large culverts would be significant.
  - The flows from the upper catchment are causing drainage issues within the proposed landform that need to be addressed. Options to be considered as part of the preferred design are:

- Collecting flows from Rosella Road and diverting them directly to Brisbane Water – this was not considered achievable due to inlet pit losses, and the cost of drainage upgrades to do so.
- Incorporating a drainage easement and / or channel running east from Myrtle Road across Echuca Road, Greenfield Road and Kendell Road and into the receiving waters.
- Rickard Road may need to have a very low grade to reduce fill depths and allow for drainage considerations.

The outcomes of the concept design options assessment were used to prepare the concept landform and drainage plan design described in **Section 5.3**.

5.3 Concept Landform and Drainage Plan

5.3.1 Davistown

5.3.1.1 Proposed Landform

Following the evaluation of the preferred options from the conceptual design (Option 3), the Davistown landform was further optimised to both reduce the maximum fill depths and provide improved drainage outcomes.

The following general changes were made to the preferred concept option landform:

- Reduce the minimum road grade, and subsequently the minimum stormwater pipe grade, from 0.5% to 0.3%. This allows for the reduction of fill depths, minimally, across the study area but more significantly at the high points in the landform design along Illawong Close, Jenkins Street and Malinya Road. The maximum elevation of the proposed landform in these areas was reduced by approximately 200 mm with the resulting levels at 2.2 to 2.6 m AHD.
- Davistown Memorial Park's proposed gradient was changed from a flat surface at 1.5 m AHD to incorporate a minimal grade (0.3%) towards the proposed swale. This will assist in reducing minor ponding and the park remaining usable for longer as sea levels rise. There is no significant effect on flood storage during local catchment flooding events.
- A conceptual pit and pipe system was included to provide drainage in low points along the roadways to achieve the desired drainage outcomes. The proposed pits are located within the roadside swales and are assumed to be grated inlet pits with a 1.2 x 1.2 m opening. During detailed design the inlet sizes may vary depending on approaching flows in the swales, or potentially be changed to a letterbox style inlet pit as is currently used in Empire Bay.
- Design of typical roadside swale sections for longitudinal drainage. This includes various sizes of swales and some piped drainage to eliminate significant flooding of the roadways during minor local catchment rainfall events.

Refer to the following maps in **Appendix D** for further information on the Davistown landform design:

- Map GD701 – Final Landform
- Map GD702 – Roadside Swale Treatment
- Map GD703 – Fill Depths

The civil design drawings and details of swale treatment types are provided in **Appendix F**.

5.3.1.2 Interim Landform Assessment

Between the completion of the final landform and the landform as it currently exists, an interim landform was developed to gain an appreciation to how this scenario might be realised. It involves the construction of the foreshore barrier, raising of select roadways, and filling of selected properties. The proposed implementation of the landform and potential pathway for its development is further discussed in **Section 8**. As such, this interim landform should be taken for information purposes only as the actual landform construction may proceed differently.

To create an interim landform a selection of properties was assumed to be redeveloped under the condition that ground levels within the lot boundary were required to be raised to the levels identified in the final landform (refer **Map GD701 in Appendix D**). Using a combination of photographs gathered from the site inspection, aerial imagery and Google Street View, a number of properties were identified as likely to be redeveloped within the next 30 years. These properties were selected as those properties that were smaller than the average house size and did not appear to have been recently renovated or built. A 30 year timeframe was selected to correspond with the estimated 2050 sea level rise scenario in **Table 3-3**. A total of 255 properties were identified and these are illustrated in Map GD706. It should be noted that as an outcome of increased tidal inundation, additional properties may also be filled in response to this. These properties have not been included in this interim scenario, but are discussed further as part of the economic analysis undertaken in **Appendix G**.

Selection of the roadways to be raised involved assessing whether adjacent properties were higher or lower than the roadway and if construction of the raised roadway would prevent existing properties from draining to the road. Roadways were also selected which comprise the proposed flood barrier. The following roadways were selected for reconstruction in the interim scenario based on this assessment:

- Morton Crescent and Pyang Avenue, west of Lenora Avenue;
- Murna Road;
- Davistown Road, north of Murnra Road;
- Dilgara Avenue, north of Lilli Pilli Street;
- Magnolia Avenue, north of Kincumber Crescent;
- Kincumber Crescent, east of Magnolia Avenue;
- Ilumba Avenue;
- Alkoomie Close and Arrunga Close; and
- Romford Close.

The extent of roadways raised as part of the interim scenario are shown in **Appendix D - Map GD706**.

The proposed foreshore barrier is alignment is also shown in **Map GD706** and indicates which parts of the barrier could consist of berms, shared pathways, retaining walls and reconstructed roadway.

5.3.2 Empire Bay

5.3.2.1 Proposed Landform

Following the evaluation of the preferred options from the conceptual design, the Empire Bay landform was further optimised to both reduce the maximum fill depths and provide improved drainage outcomes.

The following general changes were made to the preferred concept option landform:

- Reduce the minimum road grade, and subsequently the minimum stormwater pipe grade, from 0.5% to 0.3%. This allowed for the reduction of fill depths relative to the previous iteration. The most significant areas of fill depths are near the existing low point along Gordon Road and the proposed high point along Rickard Road. Each of these areas requires filling up to a maximum depth of 1.5 m.
- Introduction of a channel between and aligned perpendicular to Myrtle Road and Kendall Road to allow for drainage improvements both immediately and into the future.
- Raising of Rickard Road to create a ridge in the landform where runoff is split between flowing south to the proposed channel and north to the existing drainage points to Brisbane Water. The maximum fill depth associated with the raising of Rickard Road itself is approximately 1.3 m.
- A conceptual pit and pipe system was included to provide drainage in low points along the roadways to achieve the desired drainage outcomes. The proposed pits are located within the roadside swales and are assumed to be grated inlet pits with a 1.2 x 1.2 m opening. During detailed design the inlet sizes may vary depending on approaching flows in the swales, or potentially be changed to a letterbox style inlet pit as is currently used in this area.
- Design of typical roadside swale sections for longitudinal drainage. This includes various sizes of swales and some piped drainage to eliminate significant flooding of the roadways during minor local catchment rainfall events.

These elements furthered the concept design to a point where detailed design can be completed and construction commence when sea level rise triggers are observed.

Refer to the following maps in **Appendix D** for further information on the Empire Bay concept landform design:

- Map GE601 – Final Landform
- Map GE602 – Roadside Swale Treatment
- Map GE603 – Fill Depths

The most significant change to the landform of Empire Bay is the introduction of a channel crossing all of Echuca Road, Greenfield Road and Kendall Road. The total length is approximately 360 m and a set of three 3.7m wide x 0.6m high reinforced concrete box culverts are proposed beneath the aforementioned roadways. The proposed channel is essentially a rectangular section with an invert at 0.9 m AHD for the purposes of modelling; however, the final form is flexible and may range from a swale set in public open space, a buried culvert, or a full width channel. This is largely dependent on Council's and the community's preference and what can hydraulically convey the flows east to Brisbane Water. Whichever form the channel eventually takes, a degree of property acquisition will be necessary to create the drainage easement.

This feature was introduced to 'cut off' the high energy flows approaching from the steep slopes to the south. In previous landform design iterations, these high flows resulted in runoff not being able to be contained to the roadways in the 1% AEP without the introduction of large lengths of cost prohibitive culverts which may also be susceptible to blockage.

In addition to the ability to convey runoff to the receiving waters, the channel is also able to lower the surrounding road and property fill depths because it relies on hydraulic head and not gradient to discharge water to the east.

It should be noted from a staging point of view; it would be essential to construct the proposed channel / drainage easement prior to raising of the adjacent properties and roadways.

5.3.2.2 Interim Landform Assessment

Between the completion of the final landform and the landform as it currently exists, an interim landform was developed to gain an appreciation to how this scenario might be realised. It involves the construction of the drainage easement / channel, raising of select roadways where possible, and filling of selected properties. The proposed implementation of the landform and potential pathway for its development is further discussed in **Section 8**. As such, this interim landform should be taken for information purposes only as the actual landform construction may proceed differently.

To create an interim landform a selection of properties was assumed to be redeveloped under the condition that ground levels within the lot boundary were required to be raised to the levels identified in the final landform (refer **Map GE601 in Appendix D**). Using a combination of photographs gathered from the site inspection, aerial imagery and Google Street View, a number of properties were identified as likely to be redeveloped within the next 30 years. These properties were selected as those properties that were smaller than the average house size and did not appear to have been recently renovated or built. The 30 year timeframe was selected to correspond with the estimated 2050 sea level rise scenario in **Table 3-3**. A total of 74 properties were identified, and these are illustrated in **Map GE607**. It should be noted that as an outcome of increased tidal inundation, additional properties may also be filled in response to this. These properties have not been included in this interim scenario, but are discussed further as part of the economic analysis undertaken in **Appendix G**.

Unlike, Davistown, there are very few roadways that can be raised prior to adjacent property filling being completed. Shelly Beach Road and Sher Close were the only roads raised in the interim scenario.

The extent of roadways raised as part of the interim scenario are shown in **Appendix D - Map GD607**.

6 Flood Modelling

6.1 Flood Behaviour

For both Davistown and Empire Bay, the proposed landforms were modelled for local catchment rainfall with the 1% and 20% AEP events. Previous modelling undertaken in the Davistown and Empire Bay Flood Studies (Cardno Lawson Treloar, 2010) and the ongoing modelling taking place for the Davistown and Empire Bay FRMSP by Rhelm indicate that the 2-hour duration represents the critical duration for a majority of both study areas. For the purposes of the evaluation of the proposed landforms, the 2-hour event was modelled.

The downstream water level selected is 1.5 m AHD and is modelled as a static water level. This level is slightly higher than the 1%PoE in 2100 (1.34m AHD), but has been selected an appropriate downstream boundary condition considering the uncertainty in sea level rise the unknown impacts of climate change on extreme storm events creating elevated ocean levels.

No changes were made to local design rainfall associated with climate change. This could be investigated further as part of the detailed design process.

The landform modelling only included major pits and pipes, the street drainage was simply modelled as an open swale.

Results from local catchment flooding are shown in the following maps in **Appendix E**:

- Map GD704 – Davistown Final Landform – 1% AEP Flood Depth
- Map GD705 – Davistown Final Landform – 20% AEP Flood Depth
- Map GE604 – Empire Bay Final Landform – 1% AEP Flood Depth
- Map GE605 – Empire Bay Final Landform – 20% AEP Flood Depth

In the Davistown proposed landform private properties are flood free in both the 20% and 1% AEP events. A majority of the roadways remain passable in the 1% AEP with areas along Lintern Street, Emora Avenue, and Mirreen Avenue becoming inundated. Any isolated properties resulting from this flooding will not be isolated for a long duration. Access into Davistown is maintained by the proposed raising of Davistown Road from the north. In the 20% AEP event, all roadways within Davistown remain passable, with the exception of Malinya Road at the waterway crossing.

Davistown Memorial Park becomes flooded in both the 1% and 20% AEP events. As the park's surface is above 1.5 m AHD, the flooding is considered to be from the local catchment rainfall event and not Brisbane Water. Although, it is acknowledged that the Brisbane Water level (1.5m AHD) contributes to the "backing up" of the local catchment flows and flooding of this area. Maximum flood depths in the park range from 150 mm to 300 mm.

In Empire Bay, private properties are also flood free in both the 20% and 1% AEP events. Most of the roadways remain passable in the 1% AEP event. Roads which are inundated in the 1% AEP event include parts of Boongala Avenue, Rickard Road, Myrtle Road, Echuca Road, and Greenfield Road. Any isolated properties resulting from this flooding will not be isolated for a long duration. In the 20% AEP event, all roadways remain passable.

Comparison between the existing flood depths and the proposed landform flood depths are shown in the following maps in **Appendix E**:

- Map GD709 – Davistown Final Landform – 1% AEP Flood Depth vs. Existing
- Map GE606 – Empire Bay Final Landform – 1% AEP Flood Depth vs. Existing

The changes in flood depths across the properties in the study area range from minimal increases (i.e. less than 100 mm increase) to a significant decrease (up to 300 mm decrease). In generally, roadways displayed an increase in maximum flood depth due to the introduction of trapped low points and the raising of property levels above the roadways, focusing flows into the roadways.

The proposed landform will provide an overall decrease in flood risk for the community from local catchment rainfall.

The interim scenario for Davistown and Empire Bay was modelled to gain an appreciation for the potential flood issue which could arise from a situation where some properties have been progressively raised before others and following the construction of the flood barrier in Davistown and the drainage channel in Empire Bay. For the interim scenario flood results, refer to the following maps:

- Map GD707 – Davistown Interim Scenario 1% AEP Depth
- Map GD708 – Davistown Interim Scenario 20% AEP Depth
- Map GE710 – Davistown Interim Scenario 1% AEP Flood Impacts
- Map GE608 – Empire Bay Interim Scenario 1% AEP Depth
- Map GE609 – Empire Bay Interim Scenario 20% AEP Depth
- Map GE610 – Empire Bay Interim Scenario 1% AEP Flood Impacts

Potential flooding issues exist from the increasing of flood depths on properties adjacent to those which have raised ground levels. This will need to be investigated further as part of detailed design, and as part of individual DA submissions.

Further investigation will also be required to determine the optimal outlet arrangement for existing drainage which crosses the flood barrier. Although the model assumed flap gates on the pipe outlets, additional capacity would be required to ensure flood depths behind the barrier do not increase to unacceptable levels. This is particularly important along the southern end of Magnolia Avenue and Malinya Road.

6.2 Drainage

For Davistown and Empire Bay, the proposed landform improves the existing drainage conditions within the study areas. Refer to the attached set of drawings for a contoured plan of the Davistown and Empire Bay landforms and sections showing typical street drainage (**Appendix F**).

In Davistown, trapped low points are removed and roads are raised to provide positive drainage gradients along roadways. The regrading of lots above the roadways will also eliminate the potential for isolated ponding areas within private properties.

The drainage outcomes for both study areas achieve:

- Flood free private properties in all events equal to or less than the 1% AEP,
- A minor drainage system to convey runoff in roadside swales and drains in all event equal to or less than the 20% AEP, and
- Swales have been designed to keep the velocity-depth product below 0.3m/s.

7 Economic Analysis

An economic assessment has been undertaken on the proposed landform and drainage plan for Empire Bay and Davistown to understand the overall economic viability of implementing it. The full details of this assessment are provided in **Appendix G**.

An economic assessment is undertaken by comparing one alternative against another. It is important that these scenarios or alternatives are clearly defined to ensure a robust analysis. Three scenarios have been adopted for this assessment:

1. **Base Case** – this represents the 'Do-Minimum' scenario, and represents the base case against which the masterplan options are considered;
2. **Masterplan Scenario** – this scenario incorporates the masterplan (landform and drainage plan), without the proposed levee around Davistown;
3. **Masterplan with the Levee Scenario** – this scenario incorporates the masterplan plus the levee. It is noted that the levee only benefits Davistown, and therefore there is no change to Empire Bay in this scenario, when compared to Scenario 2.

A summary of the undiscounted costs is provided in **Table 7-1**. These are provided to give an indication of overall costs associated with the masterplan. They indicate that while the Davistown masterplan is more than double the cost of Empire Bay, this is reflective of the total area and the number of properties at risk. The overall average cost per property is roughly the same. The levee increases the capital works by an additional $10.4M for Davistown.

While it is useful to review the overall costs involved, these costs will be spread over the period 2025 to 2100. The present value of these cost estimates is provided in **Table 7-2**. Given the relatively long time span of the proposed masterplan, the present value costs are significantly less than the undiscounted costs. A key point to note, however, is that the levee, which is implemented early on within the overall timeframe, has a more significant impact on the costs for Davistown.

Table 7-1. Undiscounted Costs (in millions)

Stages of Masterplan	Roads	Levee	Property Filling	Parks	Total	No of Properties	Avg Cost per property
Davistown – no levee	$59.4	$10.4	$15.8	$4.7	$75.2	899	$84,000
Davistown	$59.4	$10.4	$15.8	$4.7	$90.3	899	$100,000
Empire Bay	$28.2	-	$7.9M	$0.7	$36.9	439	$84,000

Table 7-2. Present Value Costs of Masterplan Scenarios

Stages of Masterplan	Costs	No of Properties	Avg Cost per property
Davistown – no levee	$10.4M	899	$12,000
Davistown	$19.3M	899	$21,000
Empire Bay	$6.8M	439	$10,000

A summary of the benefits described above are summarised in **Table 7-3**.

Table 7-3. Summary of Benefits (in $ millions present values)

Stages of Masterplan	Property Retreat	Property Damages[1]	Road Loss	Park Loss	Total	No of Properties	Avg Benefit per property (in dollars)
Davistown	$12.9	-$0.5	$1.2	$1.7	$15.4	899	$17,000
Davistown – no levee	$12.9	$15.9	$1.2	$1.7	$31.8	899	$35,000
Empire Bay	$3.1	$0.2	$0.4	$0.3	$3.9	439	$9,000

The economic assessment was undertaken by comparing the masterplan scenarios against the base case, for both Davistown and Empire Bay. These results are summarised in **Table 7-4**. In addition to the base assumption of a discount rate of 7%, 4% and 10% have also been tested.

For Davistown, the masterplan with no levee has a BCR of 1.5, with the present value of benefits exceeding the costs. This suggests that the masterplan is economically viable.

The incorporation of the levee provides a significant improvement for Davistown, with the BCR increasing to 1.7. This is a result of the significant reduction in flood damages both now and moving forward throughout the assessment period, which compensates for the increase cost of the levee relative to the masterplan scenario with no levee. It is also noted that the scenario with the levee provides additional benefits, such as flexibility in timing of filling and development of the masterplan levels, which is not incorporated in this analysis.

Empire Bay has a BCR of 0.9, suggesting that it is marginally unviable based on the assumptions in this report. However, the incorporation of some of the unquantified benefits may change this outcome.

It is also important to note, the ground levels of the properties as a whole in Empire Bay are higher than those in Davistown. However, there are still a number of low-lying areas. The economic outcome may improve if the masterplan were focused to more of the low-lying properties. However, further testing would be required to confirm this.

Table 7-4. Summary of Economic Results[2]

Discount Rate	Davistown				Empire Bay	
	Masterplan - no levee		Masterplan - with levee		Masterplan	
	NPV	BCR	NPV	BCR	NPV	BCR
7%	$4.95M	1.5	$13.27M	1.7	$-0.41M	0.9
4%	$41.34M	3.1	$63.24M	3.1	$8.35M	2.0
10%	$-1.55M	0.8	$1.29M	1.1	$-1.35M	0.5

The results suggest that the masterplan is economically viable for Davistown, with a BCR of 1.5 without the levee, and 1.7 with the levee. Empire Bay has a lower BCR of 0.9, which suggests that it is marginal unviable. However, there are a number of unquantified benefits that may change this outcome.

[1] A negative benefit in property damages is observed for Davistown due to the properties that have retreated, and therefore in the base case there are less properties impacted over time than in the masterplan scenario

[2] BCR – Benefit Cost Ratio, NPV – Net Present Value

8 Implementation

8.1 Approach

The implementation of the proposed landform and drainage plan within this document needs to consider:

- How to fill private land.
- When roads and public land can be filled. I.e. filling of these areas may not be possible until adjoining private land has been filled to avoid drainage issues on remaining low-lying private land.
- Staging of implementation.
- Sea level rise triggers for the consideration of 'enforced' filling or compulsory acquisition where the lack of filling of isolated lots could be hindering filling of roads.

It is proposed that the landform and drainage plan be implemented through the following approach:

- Preparation of a detailed Masterplan that develops a detailed design of the proposed landform and also provides property filling design guidelines and other specifications.
- Update of *Gosford Council DCP 2013* (or the Draft Central Coast DCP) to require filling of properties in accordance with this climate change adaptation plan. This would be enforced as part of any significant development application within the study area. This would incrementally raise private property to the final landform levels, allowing Council to then raise roads and other infrastructure.
- Council to look for opportunities to raise the roads identified in **Section 5.3.1.2**. This would likely be done as part of road maintenance programs. However, there may also be opportunities to raise key access roads through the state government floodplain risk management process to improve existing emergency response access during Brisbane Water flood events.
- Council to implement the foreshore barrier / access path as soon as practical. This would likely be as funds become available. Funds could be secured through the NSW Government Floodplain Management Grants if the foreshore barrier can be shown to have sufficient protection from existing flood risk. This should be assessed in the *Davistown and Empire Bay Floodplain Risk Management Study* (currently underway).
- Implementation of selected aspects of the landform and drainage plan (including the foreshore barrier described above) to be assessed for their ability to manage existing flood risk in the Davistown and Empire Bay FRMSP (currently being prepared by Council).
- Raising of infrastructure, including roads as completion of adjoining property filling allows.

8.2 Policy and Planning Framework

On 12 May 2016, a proclamation to merge the former Gosford City and Wyong Shire Councils and form the Central Coast Council was announced by the Department of Premier and Cabinet. At the same time, the State Government issued Guidance for Merged Councils on Planning Functions. These guidelines recommended Council analyse the differences in the current planning controls, including existing and deemed Environmental Planning Instruments (EPIs) and Development Control Plans (DCPs).

Council has been preparing a draft Central Coast Local Environmental Plan (CCLEP) and draft Central Coast Development Control Plan (CCDCP) in response to these guidelines. However, at the time this study was undertaken the Gosford DCP (2013) and Gosford LEP (2014) was still in force for Davistown and Empire Bay.

8.2.1 Gosford Council Development Control Plan 2013

Filling of properties (with Council approval) within the Brisbane Water floodplain (i.e. inclusive of the entire current study area) is permitted by the DCP, in so far as it is allowable as part of the Brisbane Water FRMP (2015). However, the FRMP does not permit filling within local catchment floodways or flood storage areas.

The proposed landform would require filling within local catchment floodways and flood storage areas. The DCP would need to be updated to reflect this.

The DCP states that filling of individual sites in isolation, without consideration of the cumulative effects is not permitted. The consideration of the cumulative effects is considered to the modelling and analysis undertaken within this document.

8.2.2 Gosford Local Environmental Plan 2014

The land within the study area is primarily zoned 'R2 – Low Density Residential'. In the locations where significant fill depths are required to achieve the proposed landform, Council may consider rezoning these lots to 'R1 – General Residential' to allow for higher density development (such as multi dwelling housing) to provide better financial returns on development (i.e. the cost of filling and associated works per m^2 will be higher than for those properties with less fill depth).

Any rezoning would need to consider a range of planning aspects outside of the scope of this study.

8.2.3 Central Coast Council Climate Change Policy (2019)

The Central Coast Council Climate Change Policy (2019) supports the adaptation plan proposed in this document for Davistown and Empire Bay.

The Climate Change Adaptation Strategy aims to specifically address Principals 3 and 5 and Commitment D4 of the Central Coast Council Climate Change Policy (2019) (**Section 3.2.4**).

This Climate Change Adaptation Study has involved hydraulic modelling of local catchment flows of the existing and proposed landform under existing and sea level rise conditions to assist in evidence based decision making to respond, to adapt and build resilience to climate change (Principal 3 of the Climate Change Policy). Evidence based decision making is also achieved through the undertaking of a cost benefit analysis. This analysis looked at the staging of costs associated with implementing the proposed landform design (e.g. filling, drainage and roads) and compared this against the economic cost of 'doing nothing' (e.g. flood damages and loss of land value).

The next step in implementing the outcomes of this study is the preparation of a Masterplan that will be used to develop specific development controls that consider constructability, adaptive pathways and staging of development. It is critical that these controls are developed before critical sea level rise triggers are reached to ensure that the controls are implemented as development occurs to achieve a proactive approach and to ensure continuity to better anticipate and adapt to complex challenges posed by the changing climate (Principal 5 of the Climate Change Policy).

8.2.4 Floodplain Management Program

The floodplain management program is implemented by State Government in collaboration with local councils to assist in the implementation of measures to reduce the impacts of flooding and flood liability on communities.

There may be opportunities to implement aspects of the landform and drainage plan under this program to manage existing flood risk, while also contributing to planning for the management of future risk. This may include:

- Davistown foreshore barrier;
- Raising of selected roads; and
- Construction of drainage between Myrtle Roads and Kendall Road, Empire Bay (including acquisition of full or partial private properties).

The benefits of these works in managing existing flood risk will be assessed further in the Davistown and Empire Bay FRMSP (currently being undertaken by Council).

It is also noted that the outcomes of this climate change adaptation study seek to address the following recommendations of the Brisbane Water FRMP (2015):

- PM9 – Develop Climate Change Adaptation Plan: this is the key purpose of this study.
- PM11 – Overland Flows Studies: The analysis undertaken as part of this landform design assessed the impacts of filling in the floodplain on local flood behaviour.

8.3 Triggers and Staging

8.3.1 Staging

As discussed in **Section 8.1 and 5.3**, the landform implementation will occur progressively overtime. It is important that incremental filling does not have negative impacts on the unfilled portion of the floodplain. It is therefore proposed that the filling and infrastructure raising be undertaken in a staged manner.

8.3.1.1 Private Property Filling

Due to the large number of properties within the study area, and the relatively slow rate of development, it is not proposed to stage the private property filling. Once the outcomes of this study are progressed to a detailed Masterplan that is adopted by Council, it is proposed that the DCP be amended to require all development applications within the study area to include fill to the required landform level. As roads and adjacent properties will not yet be filled, the design of the filling will need to consider:

- The use of retaining walls along property boundaries;
- A transition zone (i.e. appropriate slope) between the finished fill level of the property and the access road;
- Inter-allotment drainage to manage potential drainage impacts on adjacent properties; and
- Geotechnical guidelines for property filling and drainage design.

8.3.1.2 Davistown Foreshore Barrier

As funding becomes available the foreshore barrier should be implemented. It is proposed that the foreshore barrier be incorporated with a foreshore access and cycleway.

The foreshore barrier would eventually be incorporated into the landform design such that it is ‘flush’ with the surrounding levels. Until such time, the barrier would provide flood protection from elevated water levels within Brisbane Water (associated with ocean storms and extreme tide events).

The design of the foreshore barrier would need to incorporate non-return value outlets on drainage from the catchment.

The foreshore barrier could be undertaken as a collaboratively funded project utilising funding associated with flood protection and open space / recreation.

8.3.1.3 Empire Bay Drainage Easement

The proposed landform in Empire Bay incorporates a drainage easement between Myrtle Road and Kendall Road (**Section 5.3.2**). This easement is critical to drainage behaviour of the overall landform design; however, it is also likely that the drainage easement will have benefits with regards to managing the existing local catchment flooding risk. This will be assessed in more detail as part of the Davistown and Empire Bay FRMS.

Further, this easement could be incorporated into public open space; providing connectivity of the residential areas to the foreshore area and open space adjoining Kendall Road. The design and width of the easement would be dependent on the desired use, e.g. public open space may require more space than a drainage channel.

Pending detailed design and community support, the construction of the easement could occur as soon as funding is available as it is unlikely to have negative flood impacts on surrounding properties and assets.

8.3.1.4 Stage 1 Road Raising

There are several roads that can be raised prior to the completion of filling of adjoining properties. This is due to the fact that the drainage from the adjoining properties is not directed to the subject roads. The locations of these roads, or sections of roads are shown on **Map GD706 and Map GE607 – Appendix D**.

Opportunities to raise these roads and associated infrastructure and services could be as a result of funding associated with:

- flood emergency response improvements (to be considered as part of the Davistown and Empire Bay FRMS); and
- existing maintenance works.

Recent community engagement undertaken with the Davistown and Empire Bay communities (October 2019) identified that road improvements, particularly formalised drainage were a high priority for the community. These works could be undertaken concurrently with any road raising.

8.3.1.5 Stage 2 Road Raising

Most roads cannot be raised until the adjoining properties are filled. Therefore, the staging of most road raising will be dependent on the completion of collections of properties filling to the landform design levels.

Raising of these roads will also need to include the filling of the 'transition zones' at property frontages (see **Section 8.3.1.1**) and road drainage as shown in the civil drawings (**Appendix F**).

As discussed above in the Stage 1 Road raising improved roadside drainage works could be undertaken concurrently with any road raising.

8.3.1.6 Public Land Raising

Filling of public land should be undertaken as funding permits. However, prior to filling of any public land, the associated drainage impacts and access should be considered. It may be necessary to hold off filling of some land until all surrounding private land (and possibly roads) are also filled.

8.3.2 Triggers

The key triggers for implementation of the landform will be sea level rise. As discussed in **Section 4.3**, tidal inundation associated with only 0.2m of sea level rise will impact large areas of Davistown and some isolated areas of Empire Bay. This inundation increases dramatically with sea level rise beyond 0.2m, with 0.74m of sea

level rise resulting in the entire of the study area being inundated by everyday tides. Current predictions of sea level rise expect this to occur by 2100.

The implementation of the foreshore barrier prior to sea level rise of 0.2m occurring would afford Davistown protection against tidal inundation for a period of time and protection against existing 1% AEP Brisbane Water flooding. However, as sea levels rise further the flood protection will reduce and the risk of tidal inundation (particularly from 'king tides') will also become more likely. The foreshore barrier should only be considered an interim protection method to allow for incremental filling of the landform behind the barrier.

Sea level rise, and the associated inundation of the study area will need to be monitored. Other impacts associated with sea level rise such as groundwater response, may result in increased impacts not considered as part of this climate change adaptation study.

If private property filling is occurring at a slow rate, such that roads cannot be raised and 'intolerable' inundation occurs along roadways, Council may need to consider enforcing compulsory filling or compulsory acquisition of those lots that remain unfilled. Council may then have the opportunity to redevelop those lots (including required fill) and sell or retain the lots to improve public open space and / or drainage easements.

9 Recommendations

The outcomes of this adaptation plan will be used to inform a series of planning decision by Council. The key recommendations to assist in this process are to undertake the following:

- Distribution of the information contained in this study to all relevant Council staff and Councillors.
- Review the outcomes of this study and prepare a Drainage Masterplan-Public Domain Plan that will inform a future local precinct development control. Plan and develop adaptive pathways that considers constructability with respect to incremental phasing and implementation of a future landform.
- Detailed Drainage Masterplan-Public Domain Plan that will inform a future precinct development control plan and development adaptive pathways that consider constructability with respect to incremental phasing and implementation of a future landform. Drainage masterplan would need to consider:
    - Sensitivity of the drainage system and the flood protection to downstream boundary conditions and changes in rainfall
    - More detailed investigations into interim scenarios, impacts and triggers
    - Prepare standardised schematic drawings for individual lots (e.g. fill containment, drainage)
    - Constructability methodology report.
- Investigate options for internal and external funding for the Detailed Drainage Masterplan-Public Domain Plan.
- Include specific works in FRMSP to assess the existing flood risk management benefits:
    - Davistown levee / foreshore barrier
    - Empire Bay drainage channel / easement.
- Include the recommended landform in the *Davistown and Empire Bay FRMSP* (currently being prepared) to assess its ability to address existing and future flood risk. This may assist in application for funding from the NSW Floodplain Management Program for components of the landform (such as raising of public assets, easements.
- Review rezoning opportunities with Council planners to consider planning aspects not considered in this study.
- Community engagement for the proposed landform and individual flood management works (e.g. levee and drainage channel) to be undertaken as part of the Masterplan preparation.
- Community engagement for the proposed landform and associated works to showcase Council's innovative and proactive approach to climate change adaptation.

The outcomes of this study should also be used to develop climate change adaptation studies for other at-risk locations.

10 Conclusion

This climate change adaptation study identified that incremental filling to reduce existing and future flood risk may be feasible within Davistown and Empire Bay. Filling of private and public land in this way achieves a flood compatible landform where the cost is shared by those who gain the most benefit (the landowners) and public funding. This provides some equity across the LGA with regards to community costs associated with climate change adaptation.

The uncertainty and unreliability associated with determining future climate change scenarios means planning and management options need to be adaptive and adjustable. However, the available data and sea level rise projections would indicate that adaptation needs to start as soon as possible to ensure communities achieve adaptation goals before sea level rise trigger levels are reached. Within the context of this adaptation study and the study area, this mean providing the community with private property filling criteria so that all future development can incorporate this. This is likely to be most effectively achieved by incorporating these criteria within Council's DCP. This is a high priority outcome of this study.

11 References

Cardno (2015a) Brisbane Water Foreshore Floodplain Risk Management Study

Cardno (2015b) Brisbane Water Foreshore Floodplain Risk Management Plan

Cardno Lawson Treloar (2010) Brisbane Water Foreshore Flood Study

Cardno Lawson Treloar (2010b) Davistown Catchment Flood Study

Cardno Lawson Treloar (2010c) Empire Bay Catchment Flood Study

Department of Public Works (1976) "Brisbane Water Flood Levels – May 1974" Department of Public Works Harbours and Rivers Branch. Report No. 204 July 1976.

HCCREMS (2012) Decision Support for Coastal Adaptation: The Handbook. Hunter Councils NSW

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APPENDIX A

Site Inspection 17 May 2018

Photographs Provided by Resident During Site Inspection

April 2015, Foreshore at 29 Elinya Lane, Davistown

April 2015, Looking south towards Empire Bay across Cockle Channel, 29 Elinya Lane Davistown

December High Tide at 29 Elinya Lane, Davistown

Davistown Progress Hall following heavy rain in March 2018

APPENDIX B

Existing Flood Risk Maps

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Figure B1
Brisbane Water
Flooding

Legend

1% AEP

- 1.5 mAHD (2015)
- 1.7 mAHD (2050)
- 2.2 mAHD (2100)

100 0 100 200 300 m

Date : 18 July 2018
Revision : A
Created by : ERM
Coordinate System : Map Grid of Australia 94

Rhelm

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Figure B2
Local Catchment 1% AEP Extent

Legend

1% AEP Flood Extent

100 0 100 200 300 m

Date : 23 July 2018
Revision : A
Created by : ERM
Coordinate System : Map Grid of Australia 94

Rhelm

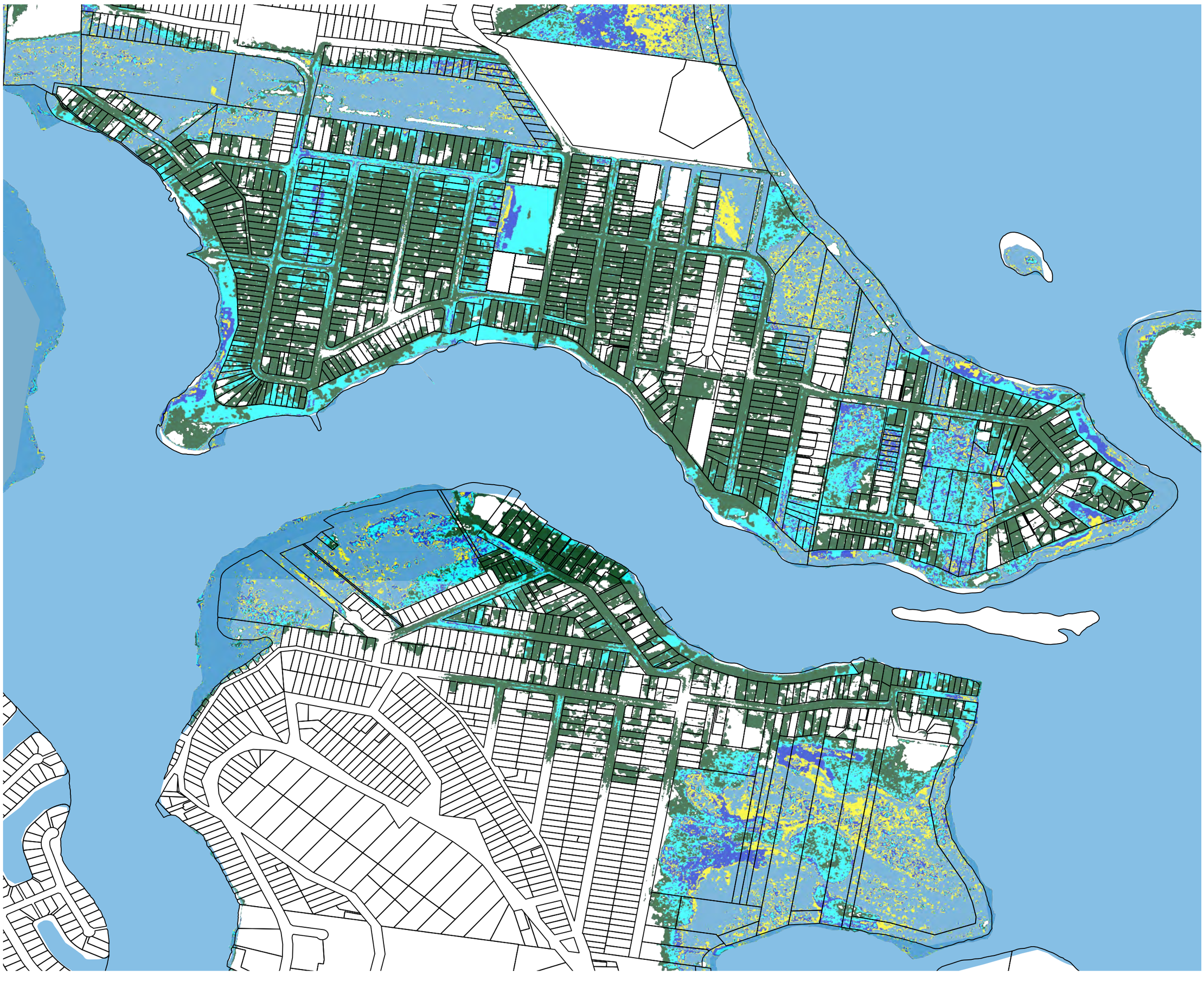

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Figure B3
Tidal Inundation

Legend

- Cadastre

HHWS Inundation

- 0.56 mAHD Existing
- 0.63 mAHD 2030
- 0.76 mAHD 2050
- 0.95 mAHD 2070
- 1.30 mAHD 2100

50 0 50 100 150 200 m

Scale : 1:5000@A3
Date : 15 August 2019
Revision : B
Created by : ERM
Coordinate System : Map Grid of Australia 94

Rhelm

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Figure B4
Low Lying Areas

Legend

Cadastre

Areas below 1m AHD

50 0 50 100 150 200 m

Scale : 1:5000@A3
Date : 24 July 2018
Revision : A
Created by : ERM
Coordinate System : Map Grid of Australia 94

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APPENDIX C

Climate Change Adaptation Preliminary Options

C1 Preliminary Options

A range of approaches to climate change adaptation were assessed for the study area including filling of properties, raising assets and foreshore barriers. A workshop with internal Council stakeholders was undertaken to identify a preferred approach for more detailed assessment. An overview of the preliminary options is provided in **Section 5.2.1 to 5.2.3** and the concept design of the preferred climate change adaptation approaches in described in **Section 5.3**. This appendix provides additional details of the filling options assessed, and the preliminary concept option maps for filling and foreshore barrier options.

The following preliminary option maps are provided in this Appendix:

- Map GD101 Option 1 Davistown Filling – Topography Map
- Map GD102 Option 1 Davistown Filling – Cut and Fill Map
- Map GD201 Option 2 Davistown Filling – Topography Map
- Map GD202 Option 2 Davistown Filling – Cut and Fill Map
- Map GD301 Option 3 Davistown Filling – Topography Map
- Map GD302 Option 3 Davistown Filling – Cut and Fill Map
- Map GE101 Option 4 Empire Bay Filling – Topography Map
- Map GE102 Option 4 Empire Bay Filling – Cut and Fill Map
- Map GD401 Option 5 Davistown Foreshore Barrier
- Map GD501 Option 6 Davistown Foreshore Barrier

C1.1 Preliminary Filling Options

Several options for filling of low lying areas of Davistown and Empire Bay were discussed with a range of internal Council stakeholders. These included allowing a standard fill depth on all properties and variable fill depths to optimise the landform for drainage outcomes. All filling strategies proposed full landform design as to include filling of roads and open space as well as private properties. This addresses the issue of unfilled land becoming high hazard due to sea level rise, creating high hazard flood islands of the filled land.

C1.1.1 Standard Fill Depth

One approach to property filling is to apply the same amount of fill on all properties. This would ensure no properties are required to fill more than others and filling only impacts adjoining properties by equal height above existing ground levels. However, this would also in its ultimate fill condition (i.e. all properties, public space and roads filled) maintain the existing topography and therefore existing drainage issues and low points.

There are residential and road areas of Davistown and Empire Bay currently at or just below 1 m AHD. These areas are shown **Appendix B**. Based on a minimum level of protection of 1.5mAHD, it is proposed by this option to apply 0.6m of fill to all locations.

As the topography is simply raised, not modified, the local catchment 1% AEP extent would remain almost unchanged from that shown in **Appendix B – Figure B2**. However, minor drainage improvements could be incorporated into road and public space filling, that could improve the flood behaviour from local catchment flooding. This has not been assessed as part of this option. Once sea level rise of 0.6m has occurred (approximately by 2090), the inundation from Brisbane Water during tidal and storm events would be almost identical to the current inundation maps shown in **Appendix B**.

C1.1.2 Davistown Optimised Landform Options

Three landform designs were investigated and presented to stakeholders. All three designs aimed to achieve a minimum inundation protection of 1.5m AHD and to optimise local drainage conditions at the same time.

The landform and fill depths for all three options are shown in **Maps GD101, GD102, GD201, GD202, GD301,** and **GD302**. The three options include:

- **Option 1** sets the foreshore boundary of all roads at 1.5m AHD and then applies a 0.5% grade increasing the height of the roads away from the foreshore. This allows for road drainage (most likely swales) to achieve a reasonable grade to the foreshore, and therefore should reduce the existing local drainage and flooding issues. The resulting landform has high points through the centre of Davistown at approximately 2.6 to 2.8 m AHD. This option results in fill depths of approximately 1.5 to 2 m across a significant portion of Davistown.
- **Option 2** also sets the foreshore boundary of all roads at 1.5m AHD and 0.5% grade on roads but incorporates the following features to reduce fill heights across the study area:
    - A low drainage swale along Lintern Street and adopts a flatter road grade along the swale's length.
    - A drainage easement through private property between Restella Avenue and Davistown Memorial Park (to be implemented through the purchasing of an easement through one or two properties).
    - A swale around the complete boundary of Davistown Memorial Park (while aiming to retain a centralised active recreational area) set at 1.5m AHD.
    - A drainage easement through private property on the southern foreshore at the end of Jenkins Street.

  This option does not result in fill depths over 1.5m, however, there are still significant areas with fill depths greater than 1m.
- **Option 3** further refines the landform design presented in Option 2 by:
    - Incorporating low lying swale drainage along the foreshore ends of Mireen Avenue, Restella Avenue, Davistown Road, Davis Avenue, Pine Avenue, Magnolia Avenue and Pyang Avenue. These swales are anticipated to have an invert lower than 1.5m AHD, similar to the Lintern Street swale in Option 2, and would allow for the road to be kept at an elevation of around 1.5m AHD adjacent to the swale. Given the low invert, these swales would be influenced by tidal conditions. These swales generally extend around 50 - 100 metres inland, approximately one or two property lengths.
    - Reducing the height of Davistown Memorial Park (to 1.5m AHD) and lowering the boundary swale to an invert of around 1m AHD, which would result in this becoming a tidal wetland or similar, connected by culvert or channel to the main wetland to the north. All boundaries of this swale are assumed to be at 1.5m AHD.

  This option significantly reduces the areas with fill depths greater than 1m, and with refinement as part of the design process in Stage 2 this may be able to be reduced further.

Rising road access along Davistown Road is proposed in all three options to allow for evacuation and access during flood events.

C1.1.3 Empire Bay Optimised Landform

The process for development of the Empire Bay landform was similar to that of the Davistown landform. As such only one option was developed as part of the preliminary options assessment (**Option 4** shown in **Map GE101 and GE102**).

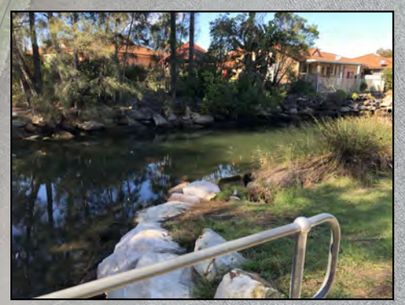
Following a review of the road network, it was identified that there were much longer lengths of road leading away from the foreshore areas. When incorporating a rising 0.5% grade, this results in some significant fill depths that would not be realistic.

A key difference in the drainage system in Empire Bay is that there is a significant existing drainage network. To keep the fill depths down as much as possible, it was assumed that the existing alignment of the drainage system would remain, allowing for low points to be established or flatter grades on roads to be achieved. For example, a relatively flat grade (with a minimum elevation of around 1.8m AHD, compared with the existing which is less than 1m AHD) was achieved by connecting into a drainage system that was assumed to be aligned with the existing drainage system.

It is noted that this drainage system may require floodgates and other controls on the outlets and could continue to result in some local drainage capacity issues as it is difficult to achieve desired flow capacities. However, with improvements to the drainage system, the capacity should be improved over the existing system. Further, there are a number of low lying properties (e.g. Gordon Road) which would currently experience ponding and flooding. The proposed landform directs water away from properties and on to roads.

There are also a number of locations where a connection, or easement, is proposed from road areas to the foreshore. Similar to Davistown, these are intended to reduce the amount of fill by providing a direct connection to Brisbane Water.

The proposed landform results in less than 1m filling for the majority of Empire Bay. Some sections of road and approximately 12 properties may have fill greater than 1m.



Existing drainage channel

Wetland at rear of properties

Existing Canals
to be utlised for drainage connections

Existing Reserve
to be used for drainage

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Map GD101
Landform
Davistown
Option 1

Legend

- Contours (0.2m)
- Cadastre

Design Terrain

- 1.5
- 1.8
- 2
- 2.2
- 2.4
- 2.6
- 2.8
- 3

50 0 50 100 150 200 m

Scale : 1:7000@A3
Date : 24 July 2018
Revision : B
Created by : RST
Coordinate System : Map Grid of Australia 94

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Map GD102
Cut and Fill
Davistown
Option 1

Legend

Cadastre

Cut/ Fill (m)

- <= -0.5
- -0.5 - -0.001
- -0.001 - 0.001
- 0.001 - 0.5
- 0.5 - 1
- 1 - 1.5
- 1.5 - 2

50 0 50 100 150 200 m

Scale : 1:7000@A3
Date : 9 July 2018
Revision : A
Created by : RST
Coordinate System : Map Grid of Australia 94

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Vegetated Swale / Bioretention around reserve boundary

Rising Road Access

Roadside Drainage Swale

Drainage Easement (through private property)

Map GD201 Landform Davistown Option 2

Legend

- Contours (0.2m)
- Cadastre

Design Terrain

- 1.5
- 1.8
- 2
- 2.2
- 2.4
- 2.6
- 2.8
- 3

50 0 50 100 150 200 m

Scale : 1:7000@A3
Date : 24 July 2018
Revision : B
Created by : RST
Coordinate System : Map Grid of Australia 94

Rhelm

N
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Map GD202
Cut and Fill
Davistown
Option 2

Legend

Cadastre

Cut/ Fill (m)

- <= -0.5
- -0.5 - -0.001
- -0.001 - 0.001
- 0.001 - 0.5
- 0.5 - 1
- 1 - 1.5
- 1.5 - 2

50 0 50 100 150 200 m

Scale : 1:7000@A3
Date : 9 July 2018
Revision : A
Created by : RST
Coordinate System : Map Grid of Australia 94

Rhelm

Indicative concept only.
Cut (negative values) represent areas that are currently higher, and therefore would require no filling

Vegetated Swale / Bioretention around reserve boundary. Will become tidal over time.

Rising Road Access

Roadside Drainage Swale will become tidal over time

Drainage Easement (through private property)

Roadside Drainage Swales will become tidal over time

N

W E

S

Map GD301
Landform
Davistown
Option 3

Legend

- Contours (0.2m)
- Cadastre

Design Terrain

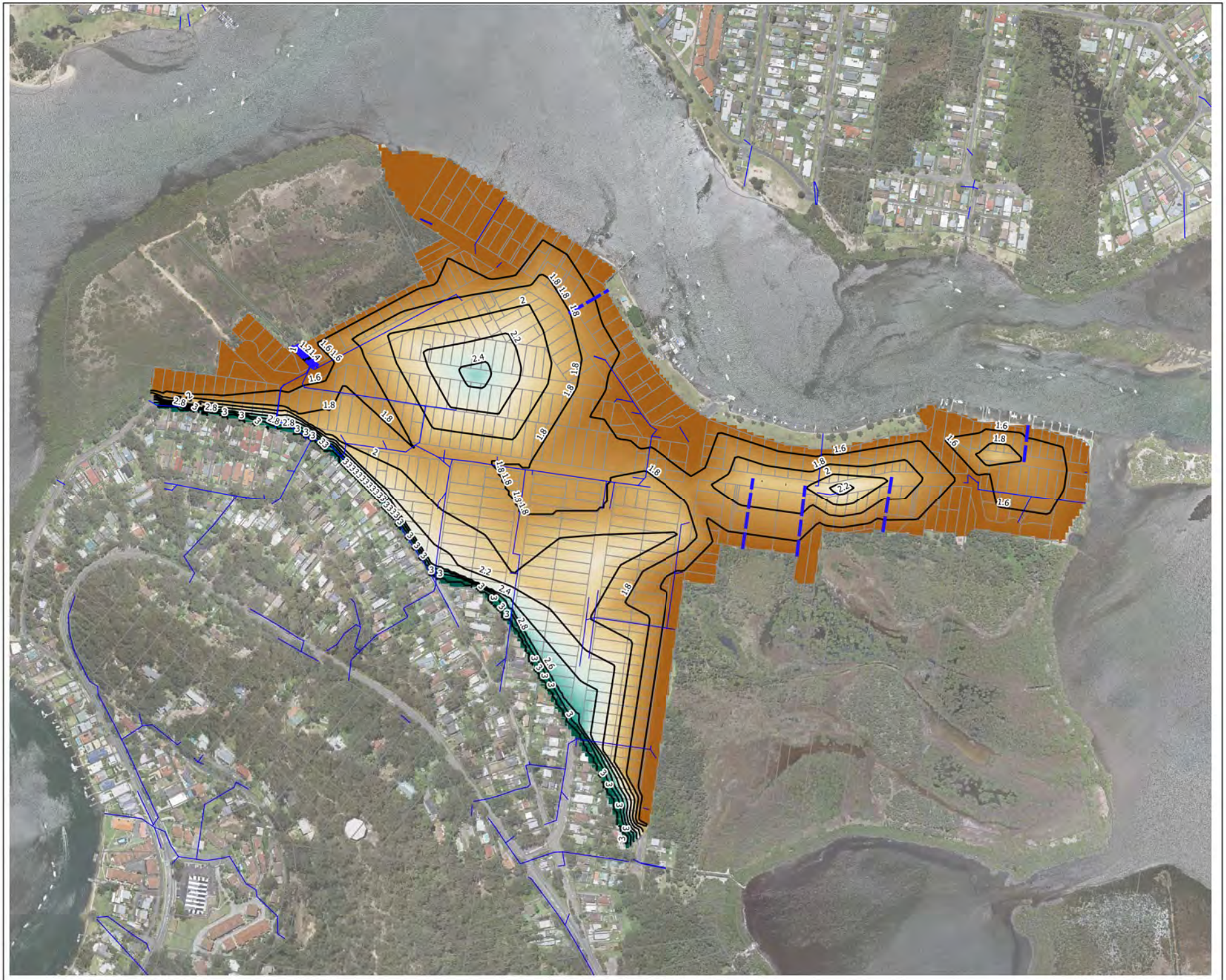
- 1.5
- 1.8
- 2
- 2.2
- 2.4
- 2.6
- 2.8
- 3

50 0 50 100 150 200 m

Scale : 1:7000@A3
Date : 24 July 2018
Revision : B
Created by : RST
Coordinate System : Map Grid of Australia 94

Rhelm


N
W
E
S
Map GD302
Cut and Fill
Davistown
Option 3
Legend
Cadastre
Cut/ Fill (m)
<= -0.5
-0.5 - -0.001
-0.001 - 0.001
0.001 - 0.5
0.5 - 1
1 - 1.5
1.5 - 2
50 0 50 100 150 200 m
Scale : 1:7000@A3
Date : 9 July 2018
Revision : A
Created by : RST
Coordinate System : Map Grid of Australia 94
Rhelm
Indicative concept only.
Cut (negative values) represent areas that are currently higher, and therefore would require no filling



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Map GE101
Landform
Empire Bay
Option 4

Legend

Contours (0.2m)

Cadastre

Existing Drainage Pipes

Design Connection

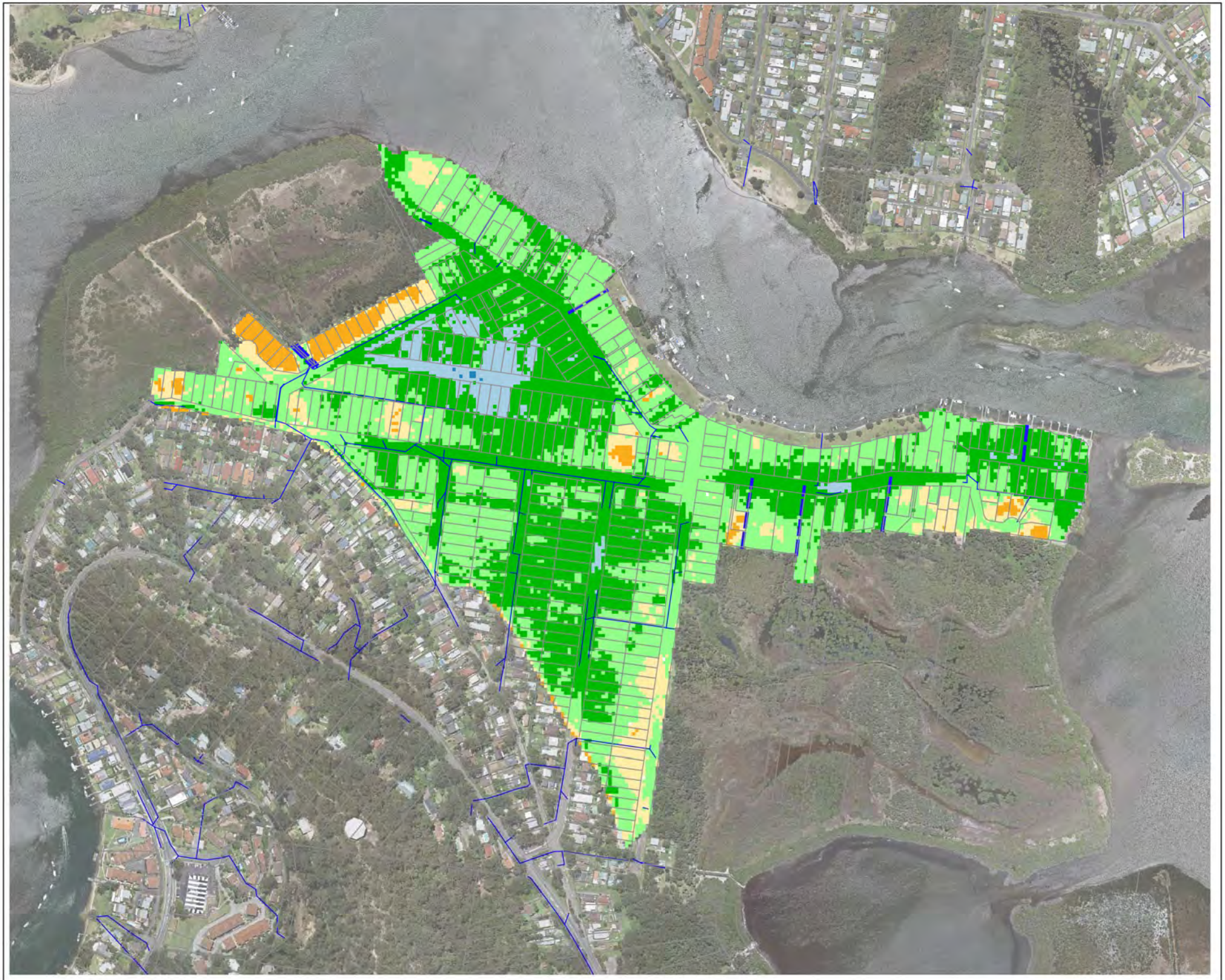
Terrain (m AHD)

- 1.5
- 1.8
- 2
- 2.2
- 2.4
- 2.6
- 2.8
- 3

50 0 50 100 150 m

Scale : 1:5000@A3
Date : 10 July 2018
Revision : A
Created by : RST
Coordinate System : Map Grid of Australia 94

Rhelm



N
W E
S

Map GE102
Cut Fill
Empire Bay
Option 4

Legend

Contours (0.2m)

Cadastre

Existing Drainage Pipes

Design Connection

Cut/ Filll (m)

- <= -0.5
- -0.5 - -0.001
- -0.001 - 0.001
- 0.001 - 0.5
- 0.5 - 1
- 1 - 1.5
- 1.5 - 2

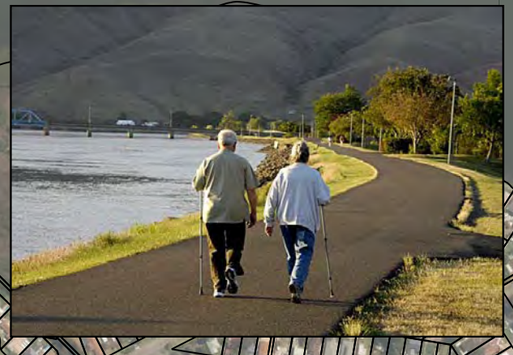
50 0 50 100 150 m

Scale : 1:5000@A3
Date : 10 July 2018
Revision : A
Created by : RST
Coordinate System : Map Grid of Australia 94

Rhelm

Flood barrier 'walls' along properties can be constructed in many different ways. Ultimately the walls should allow for the property to be filled behind it to raise property ground levels.

Shared pathway integrated with foreshore barrier. Embankment approximately 0.5m above existing ground levels.



N

W E

S

Map GD401
Foreshore Barrier
Davistown
Option 5

Legend

- Cadastre

Foreshore Barrier

- Location of Barrier
- Raise Existing Road
- Barrier Wall
- Shared pathway

Where no specific foreshore barrier features are shows, the barrier would integrate with existing ground levels already above 1.5m AHD.

50 0 50 100 150 200 m

Scale : 1:7000@A3
Date : 24 July 2018
Revision : A
Created by : ERM
Coordinate System : Map Grid of Australia 94

Rhelm

Extending the shared pathway as a foreshore barrier provides foreshore access connectivity, an opportunity to protect the wetlands from sea level rise and removes the need for barrier walls along some private properties.

Road raising provides flood protection and also allows for rising road access for evacuation during a flood event.

Flood gates or flow restriction could be used to protect properties inside the barrier during ocean storms and could also be used to 'mimic' existing tidal flows to protect wetland areas from impacts of sea level rise.

N
W E
S

Map GD501
Foreshore Barrier
Davistown
Option 6

Legend

- Cadastre

Foreshore Barrier

- Location of Barrier
- Raise Existing Road
- Barrier Wall
- Shared Pathway

Where no specific foreshore barrier features are shows, the barrier would integrate with existing ground levels already above 1.5m AHD.

50 0 50 100 150 200 250 m

Scale : 1:10000@A3
Date : 24 July 2018
Revision : A
Created by : ERM
Coordinate System : Map Grid of Australia 94

Rhelm

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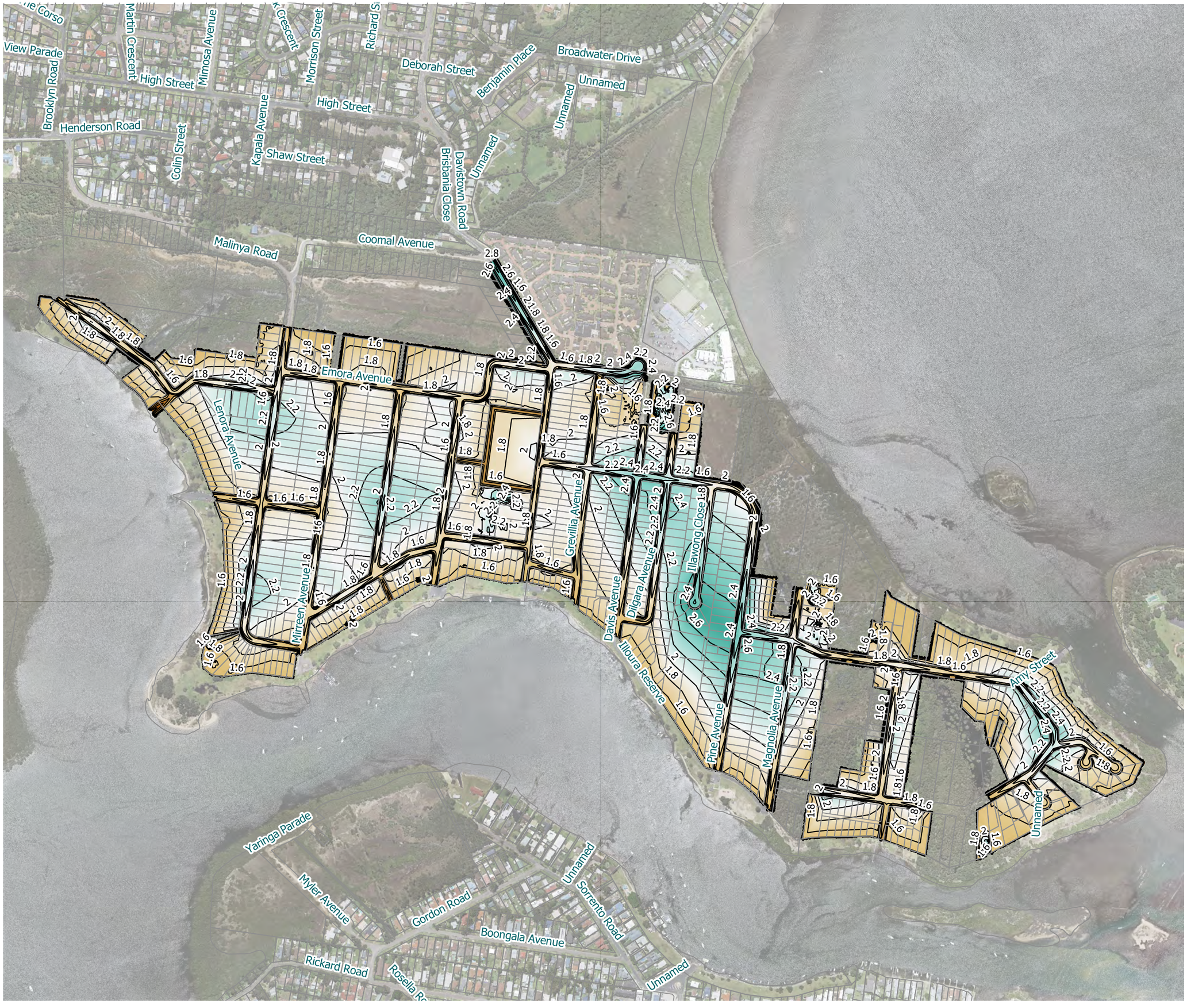
APPENDIX D

Climate Change Adaptation Landform Designs



N

W E

S

Map GD701
Final Landform
Davistown

Legend

Contours (0.2m)

Cadastre

Terrain (m AHD)

1
1.25
1.5
1.75
2
2.25
2.5
2.75
3

100 0 100 200 m

Scale : 1:7000@A3
Date : 15 May 2019
Revision : A
Created by : JRF
Coordinate System : Map Grid of Australia 94

Rhelm

N

W E

S

Map GD702
Final Landform
Swale Treatment
Davistown

Legend

Cadastre

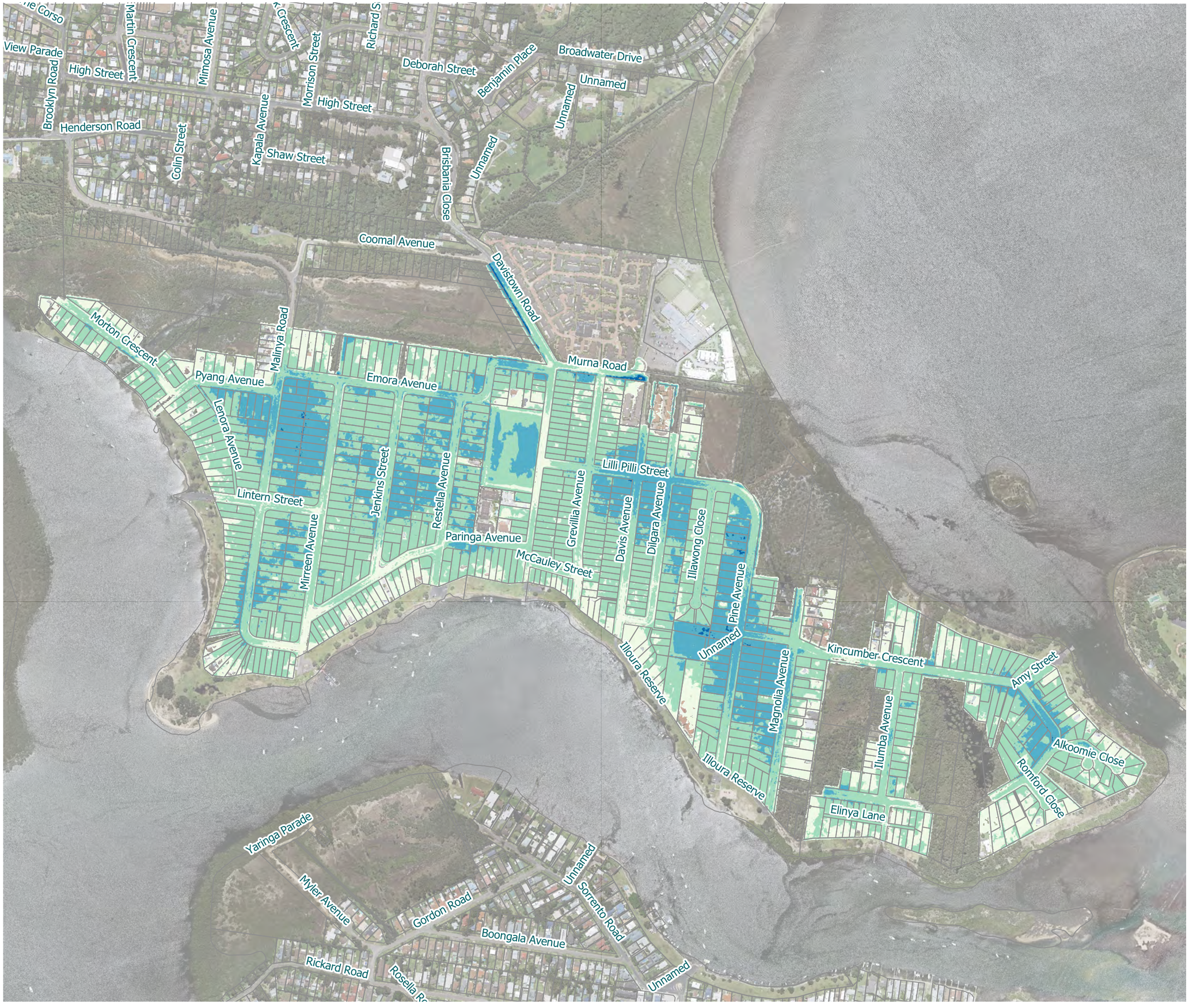
Road Swale Type

- Type 1
- Type 2
- Type 3

100 0 100 200 m

Scale : 1:7000@A3
Date : 15 May 2019
Revision : A
Created by : JRF
Coordinate System : Map Grid of Australia 94

Rhelm



N

W E

S

Map GD703
Final Landform
Fill Depths
Davistown

Legend

- Cadastre

Fill Depth (m)

- 0.1 - 0.5
- 0.5 - 1
- 1 - 1.5
- 1.5 - 2

100 0 100 200 m

Scale : 1:7000@A3
Date : 15 May 2019
Revision : A
Created by : JRF
Coordinate System : Map Grid of Australia 94

Rhelm

N

W E

S

Map GD706
Interim Landform Scenario
Davistown

Legend

- Cadastre

Proposed Levee at 1.5 m AHD

- Berm
- Retaining Wall
- Shared Pathway

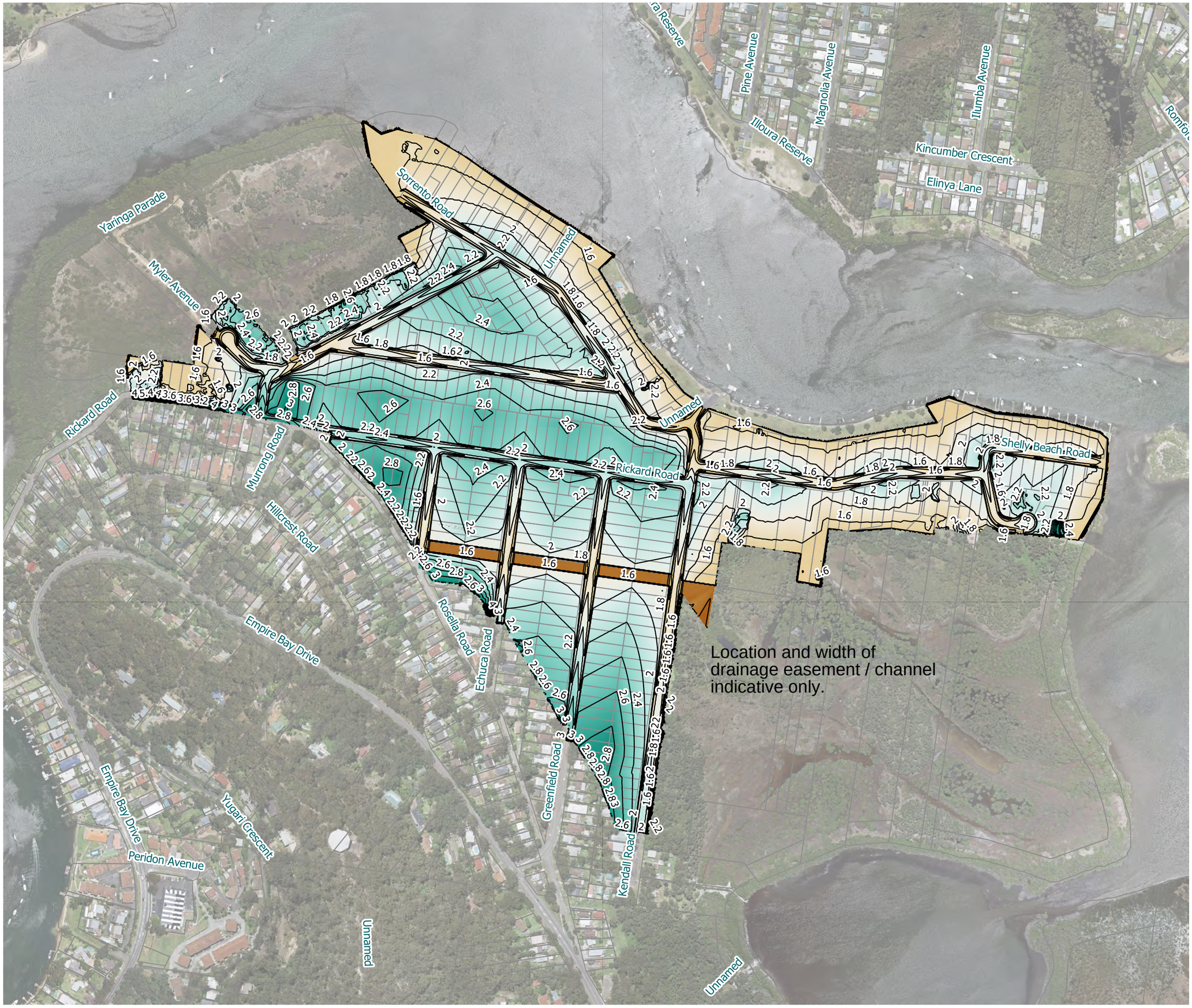
Landform Raised

- Roadways
- Preperties

100 0 100 200 m

Scale : 1:7000@A3
Date : 15 May 2019
Revision : A
Created by : JRF
Coordinate System : Map Grid of Australia 94

Rhelm



N

W E

S

Map GE601
Final Landform
Empire Bay

Legend

Contours (0.2m)

Cadastre

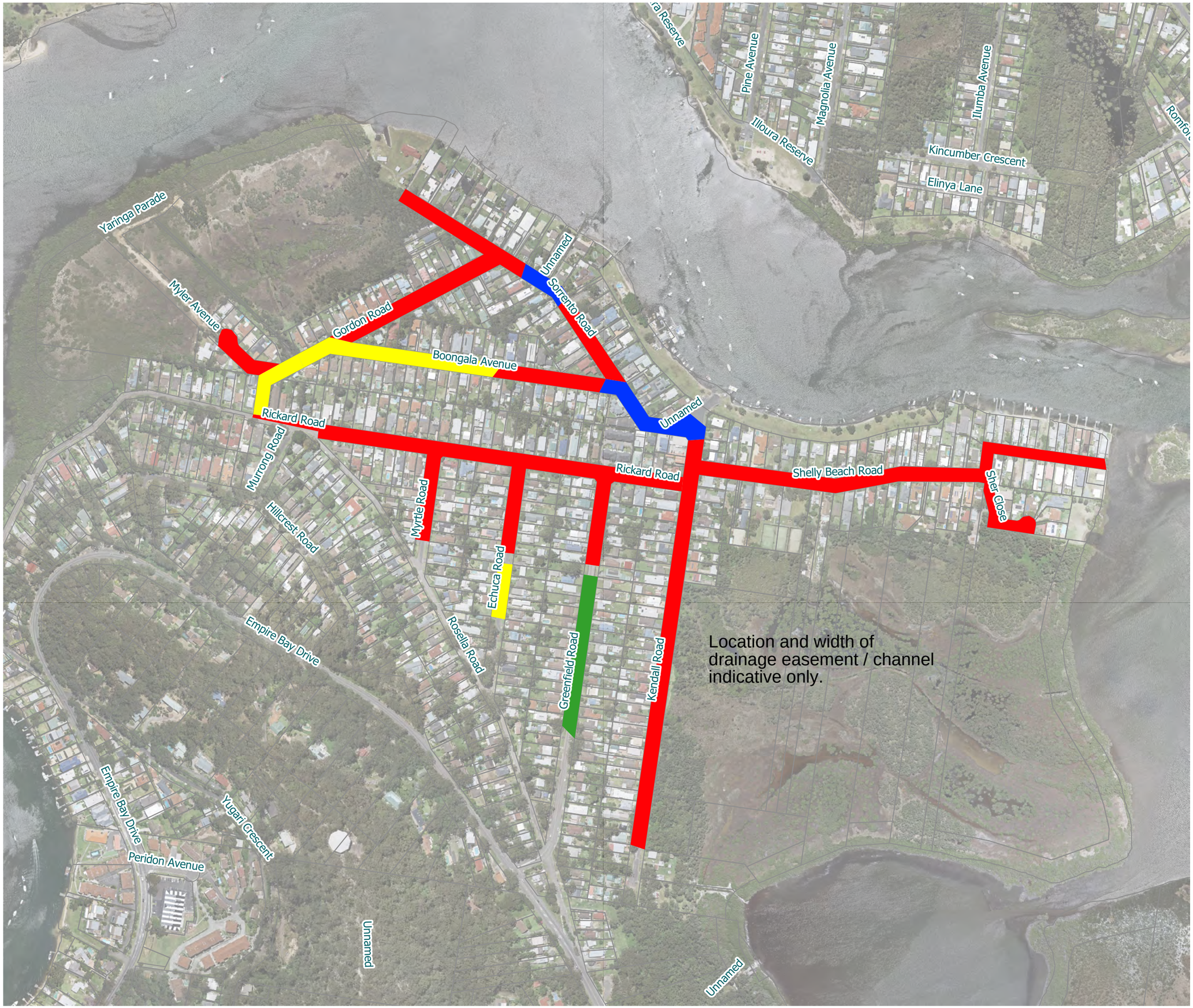
Terrain (m AHD)

0.8
1
1.2
1.4
1.6
1.8
2
2.2
2.4
2.6
2.8
3

50 0 50 100 150 200 m

Scale : 1:5000@A3
Date : 15 May 2019
Revision : A
Created by : JRF
Coordinate System : Map of Grid Australia 94

Rhelm



N
W E
S

Map GE602
Final Landform
Swale Treatment
Empire Bay

Legend

Cadastre

Road Swale Type

- Type 1
- Type 2
- Type 3
- Type 4

50 0 50 100 150 200 m

Scale : 1:5000@A3
Date : 15 May 2019
Revision : A
Created by : JRF
Coordinate System : Map of Grid Australia 94

Rhelm

N
W E
S

Map GE603
Final Landform
Fill Depths
Empire Bay

Legend

- Cadastre

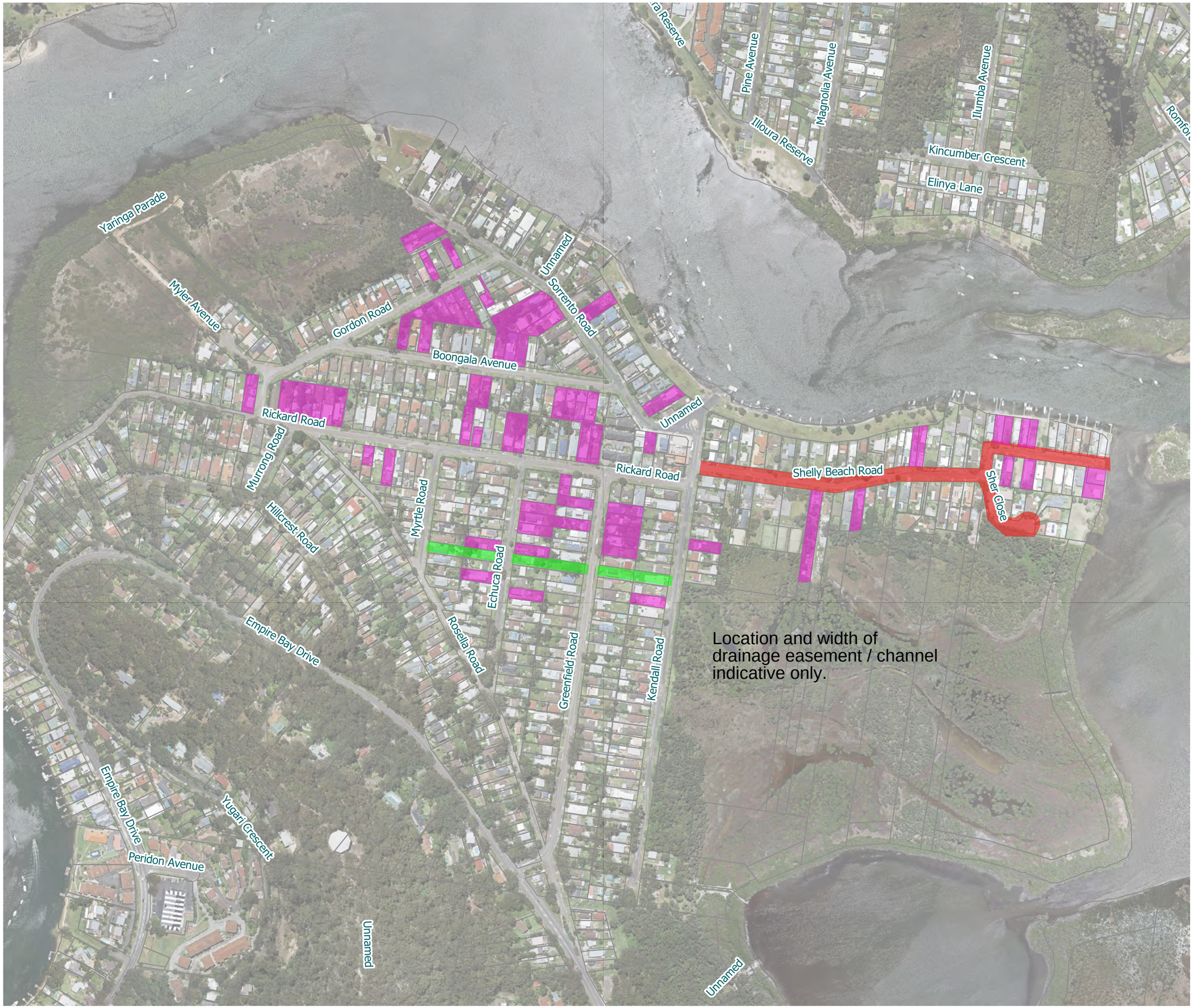
Fill Depth (m)

- 0.1 - 0.5
- 0.5 - 1
- 1 - 1.5
- 1.5 - 2

50 0 50 100 150 200 m

Scale : 1:5000@A3
Date : 15 May 2019
Revision : A
Created by : JRF
Coordinate System : Map of Grid Australia 94

Rhelm



N

W E

S

Map GE607
Interim Landform Scenario
Empire Bay

Legend

- Cadastre

Landform Constructed

- Roadway
- Canal
- Filled Properties

Filled properties are an estimate only of the properties that may be redeveloped by 2050. Actual property filling may occur differently to what is shown on this map.

50 0 50 100 150 200 m

Scale : 1:5000@A3
Date : 21 August 2019
Revision : A
Created by : JRF
Coordinate System : Map of Grid Australia 94

Rhelm

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APPENDIX E

Flood Modelling Results

N

W E

S

Map GD704
Final Landform
Flood Depth
1% AEP, 2 Hour Event
Davistown

Legend

- Cadastre

Flood Depth (m)

- 0.15 - 0.2
- 0.2 - 0.3
- 0.3 - 0.4
- 0.4 - 0.5
- 0.5 - 0.75
- 0.75 - 1
- 1 - 1.2
- > 1.2

100 0 100 200 m

Scale : 1:7000@A3
Date : 15 May 2019
Revision : A
Created by : JRF
Coordinate System : Map Grid of Australia 94

Rhelm

N

W E

S

Map GD705
Final Landform
Flood Depth
20% AEP, 2 Hour Event
Davistown

Legend

- Cadastre

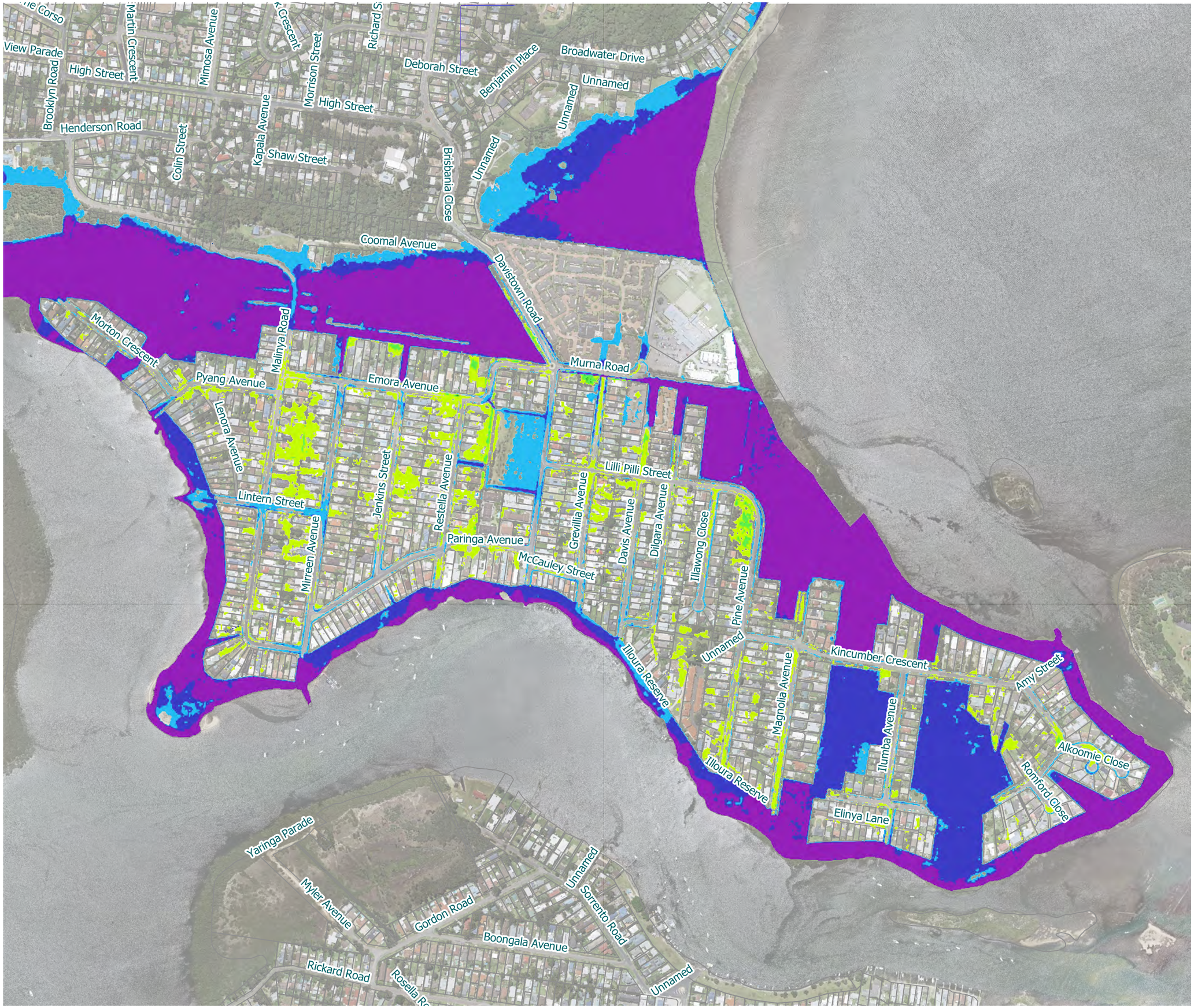
Flood Depth (m)

- 0.15 - 0.2
- 0.2 - 0.3
- 0.3 - 0.4
- 0.4 - 0.5
- 0.5 - 0.75
- 0.75 - 1
- 1 - 1.2
- > 1.2

100 0 100 200 m

Scale : 1:7000@A3
Date : 15 May 2019
Revision : A
Created by : JRF
Coordinate System : Map Grid of Australia 94

Rhelm



N
W E
S

Map GD709
Final Landform
Flood Depth vs Existing
1% AEP, 2 Hour Event
Davistown

Legend

- Cadastre

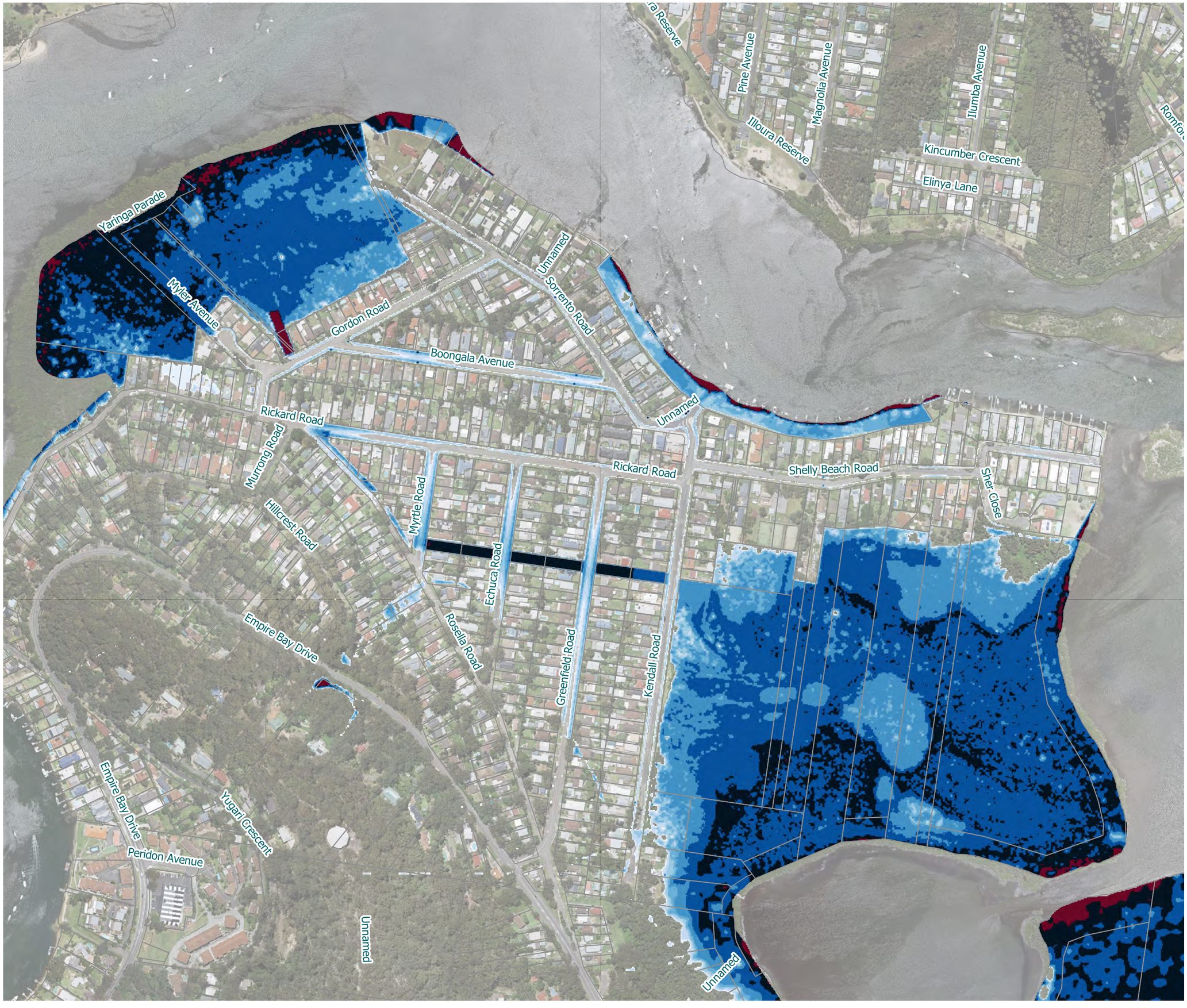
Depth Difference (m)

- <= -0.5
- -0.5 - -0.3
- -0.3 - -0.1
- 0.1 - 0.3
- 0.3 - 0.5
- > 0.5

100 0 100 200 m

Scale : 1:7000@A3
Date : 15 May 2019
Revision : A
Created by : JRF
Coordinate System : Map Grid of Australia 94

Rhelm



N
W E
S

Map GE604
Final Landform
Flood Depth
1% AEP, 2 Hour Event
Empire Bay

Legend

- Cadastre

Flood Depth (m)

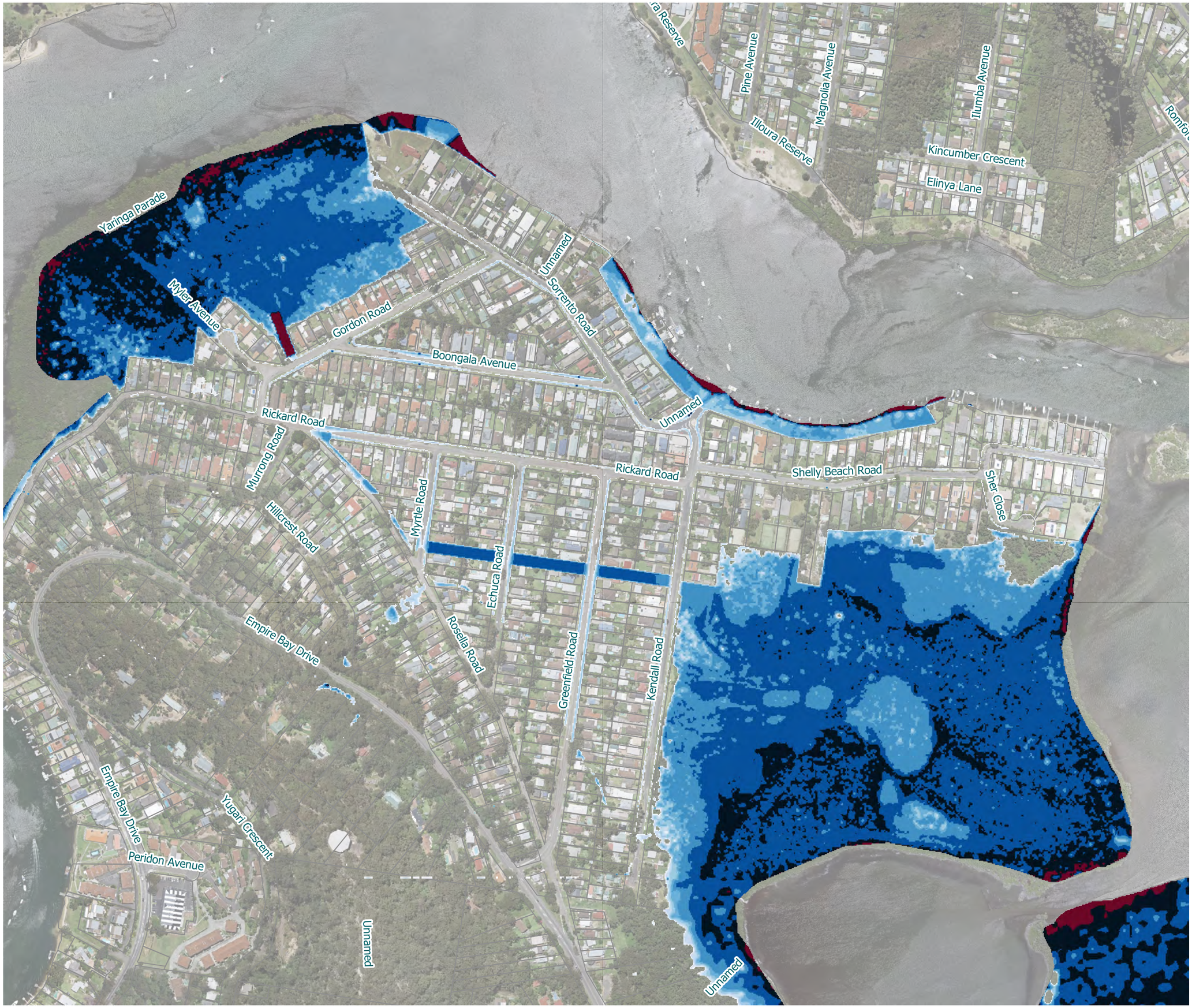
- 0.15 - 0.2
- 0.2 - 0.3
- 0.3 - 0.4
- 0.4 - 0.5
- 0.5 - 0.75
- 0.75 - 1
- 1 - 1.2
- > 1.2

Location and width of drainage easement / channel indicative only.

50 0 50 100 150 200 m

Scale : 1:5000@A3
Date : 15 May 2019
Revision : A
Created by : JRF
Coordinate System : Map of Grid Australia 94

Rhelm



Map GE605
Final Landform
Flood Depth
20% AEP, 2 Hour Event
Empire Bay

N
W E
S

Legend

- Cadastre

Flood Depth (m)

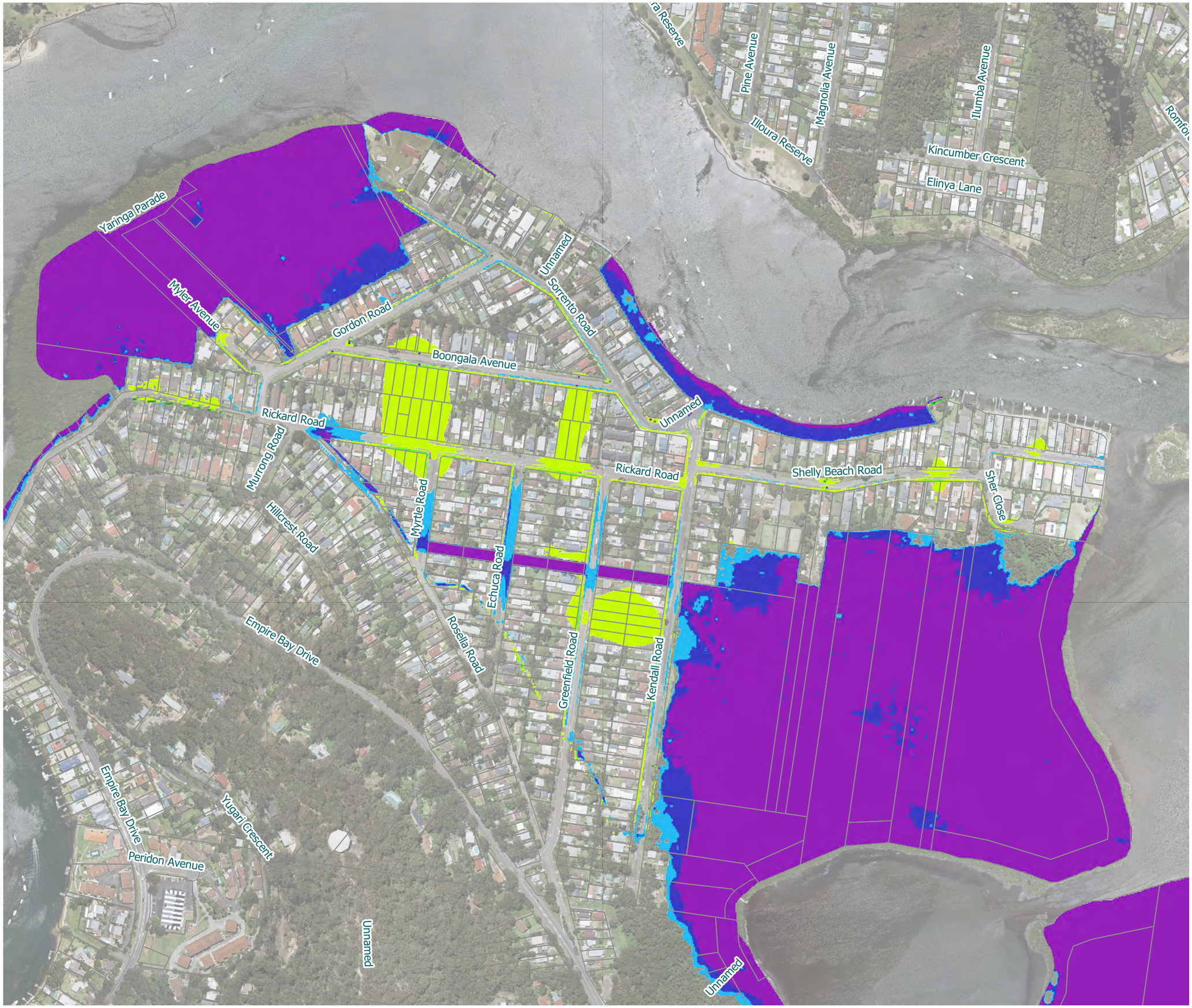
- 0.15 - 0.2
- 0.2 - 0.3
- 0.3 - 0.4
- 0.4 - 0.5
- 0.5 - 0.75
- 0.75 - 1
- 1 - 1.2
- > 1.2

Location and width of drainage easement / channel indicative only.

50 0 50 100 150 200 m

Scale : 1:5000@A3
Date : 15 May 2019
Revision : A
Created by : JRF
Coordinate System : Map of Grid Australia 94

Rhelm



N

W E

S

Map GE606
Final Landform
Flood Depth vs Existing
1% AEP, 2 Hour Event
Empire Bay

Legend

- Cadastre

Depth Difference (m)

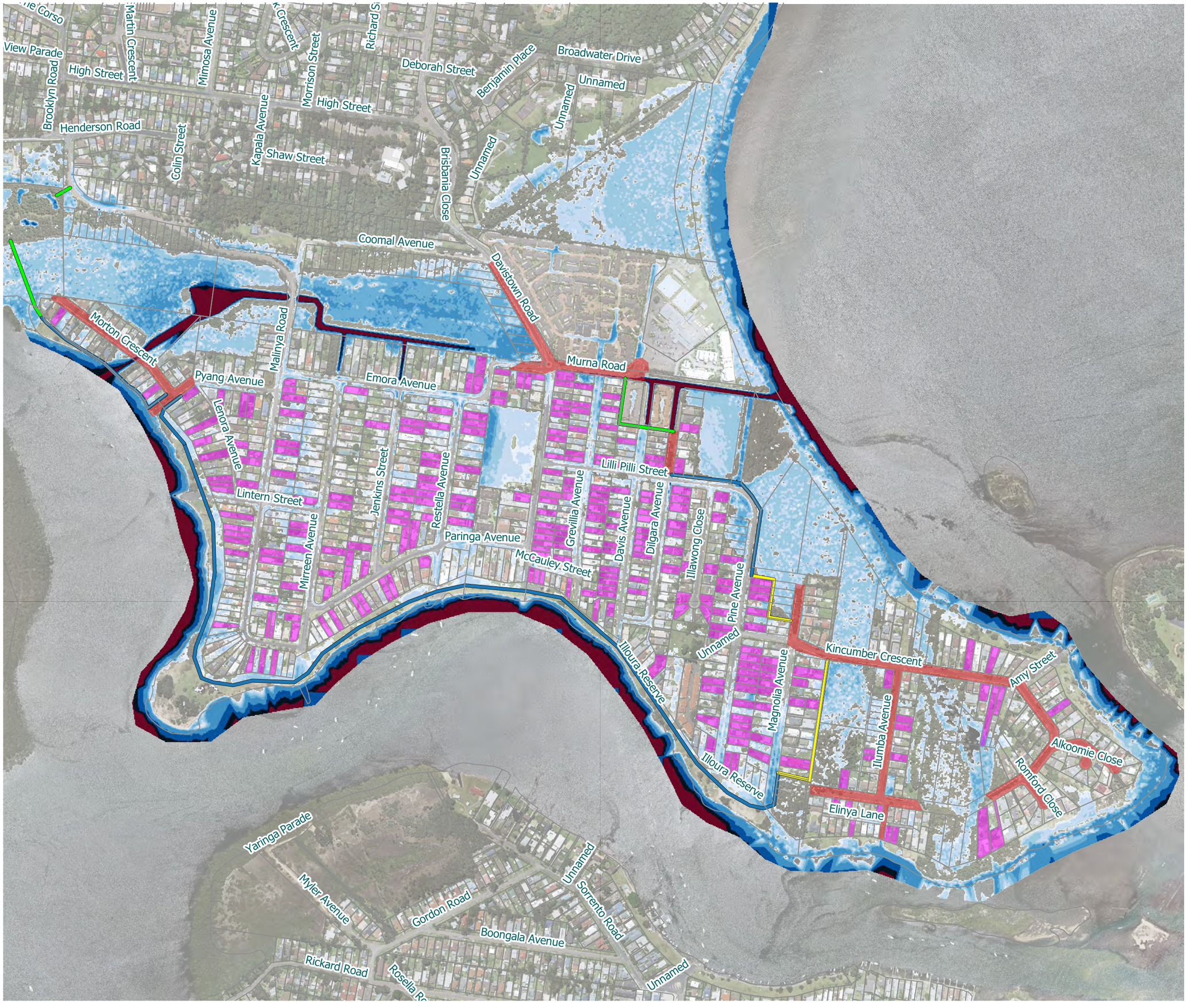
- <= -0.5
- -0.5 - -0.3
- -0.3 - -0.1
- 0.1 - 0.3
- 0.3 - 0.5
- > 0.5

Location and width of drainage easement / channel indicative only.

50 0 50 100 150 200 m

Scale : 1:5000@A3
Date : 15 May 2019
Revision : A
Created by : JRF
Coordinate System : Map of Grid Australia 94

Rhelm



N

W E

S

Map GD707
Interim Landform
Flood Depth
1% AEP, 2 Hour Event
Davistown

Legend

- Cadastre

Proposed Levee at 1.5 m AHD

- Berm
- Retaining Wall
- Shared Pathway

Landform

- Raised Roadways
- Filled Properties

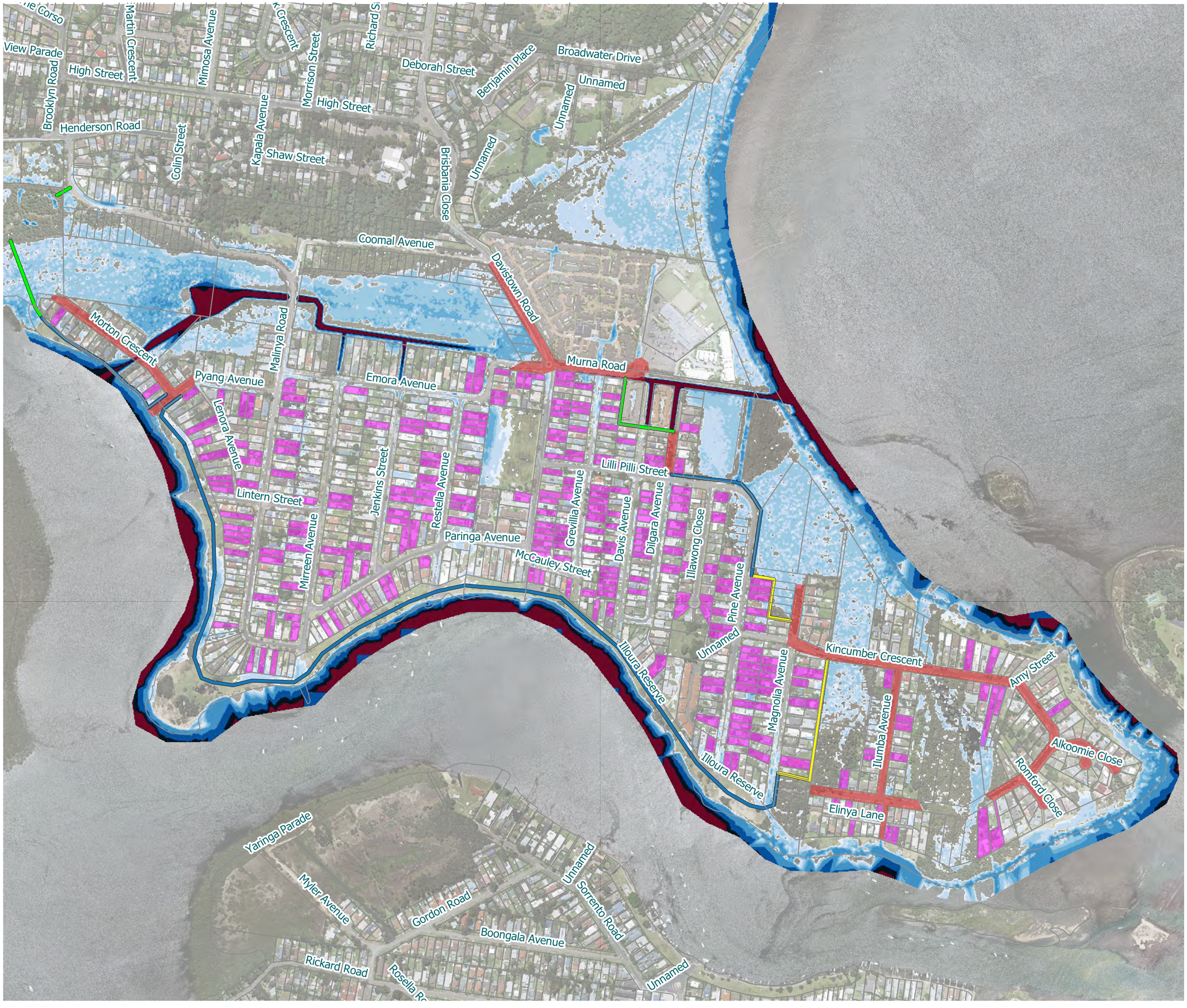
Flood Depth (m)

- 0.15 - 0.2
- 0.2 - 0.3
- 0.3 - 0.4
- 0.4 - 0.5
- 0.5 - 0.75
- 0.75 - 1
- 1 - 1.2
- > 1.2

100 0 100 200 m

Scale : 1:7000@A3
Date : 15 May 2019
Revision : A
Created by : JRF
Coordinate System : Map Grid of Australia 94

Rhelm



N

W E

S

Map GD708
Interim Landform
Flood Depth
20% AEP, 2 Hour Event
Davistown

Legend

- Cadastre

Proposed Levee at 1.5 m AHD

- Berm
- Retaining Wall
- Shared Pathway

Landform

- Raised Roadways
- Filled Properties

Flood Depth (m)

- 0.15 - 0.2
- 0.2 - 0.3
- 0.3 - 0.4
- 0.4 - 0.5
- 0.5 - 0.75
- 0.75 - 1
- 1 - 1.2
- > 1.2

100 0 100 200 m

Scale : 1:7000@A3
Date : 15 May 2019
Revision : A
Created by : JRF
Coordinate System : Map Grid of Australia 94

Rhelm

N

W E

S

Map GD710
Interim Landform
Flood Depth vs Existing
1% AEP, 2 Hour Event
Davistown

Legend

- Cadastre

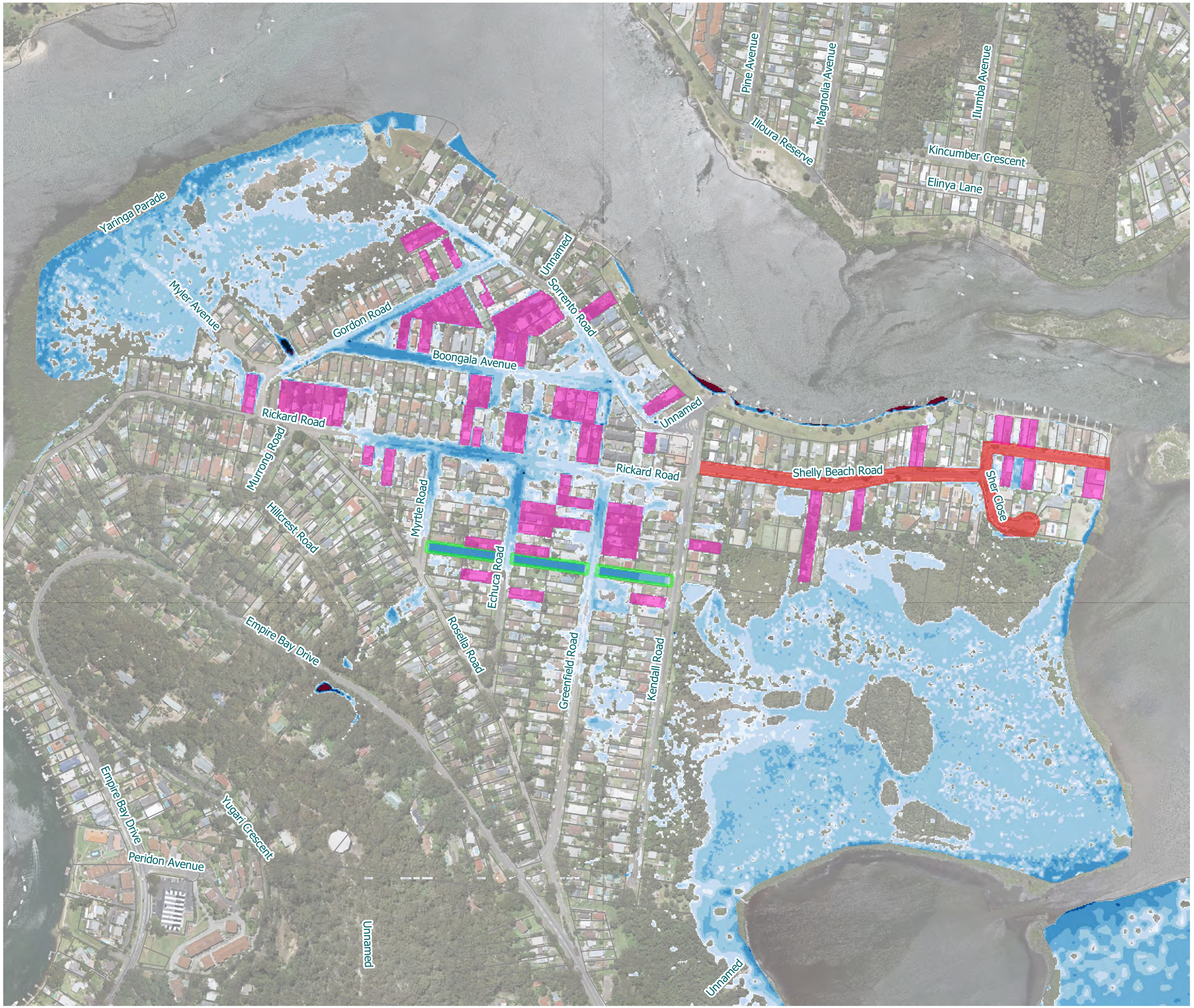
Depth Difference (m)

- <= -0.5
- -0.5 - -0.3
- -0.3 - -0.1
- 0.1 - 0.3
- 0.3 - 0.5
- > 0.5

100 0 100 200 m

Scale : 1:7000@A3
Date : 21 August 2019
Revision : A
Created by : JRF
Coordinate System : Map Grid of Australia 94

Rhelm



N

W E

S

Map GE608
Interim Landform
Flood Depth
1% AEP, 2 Hour Event
Empire Bay

Legend

- Cadastre

Landform Constructed

- Roadway
- Canal
- Properties

Flood Depth (m)

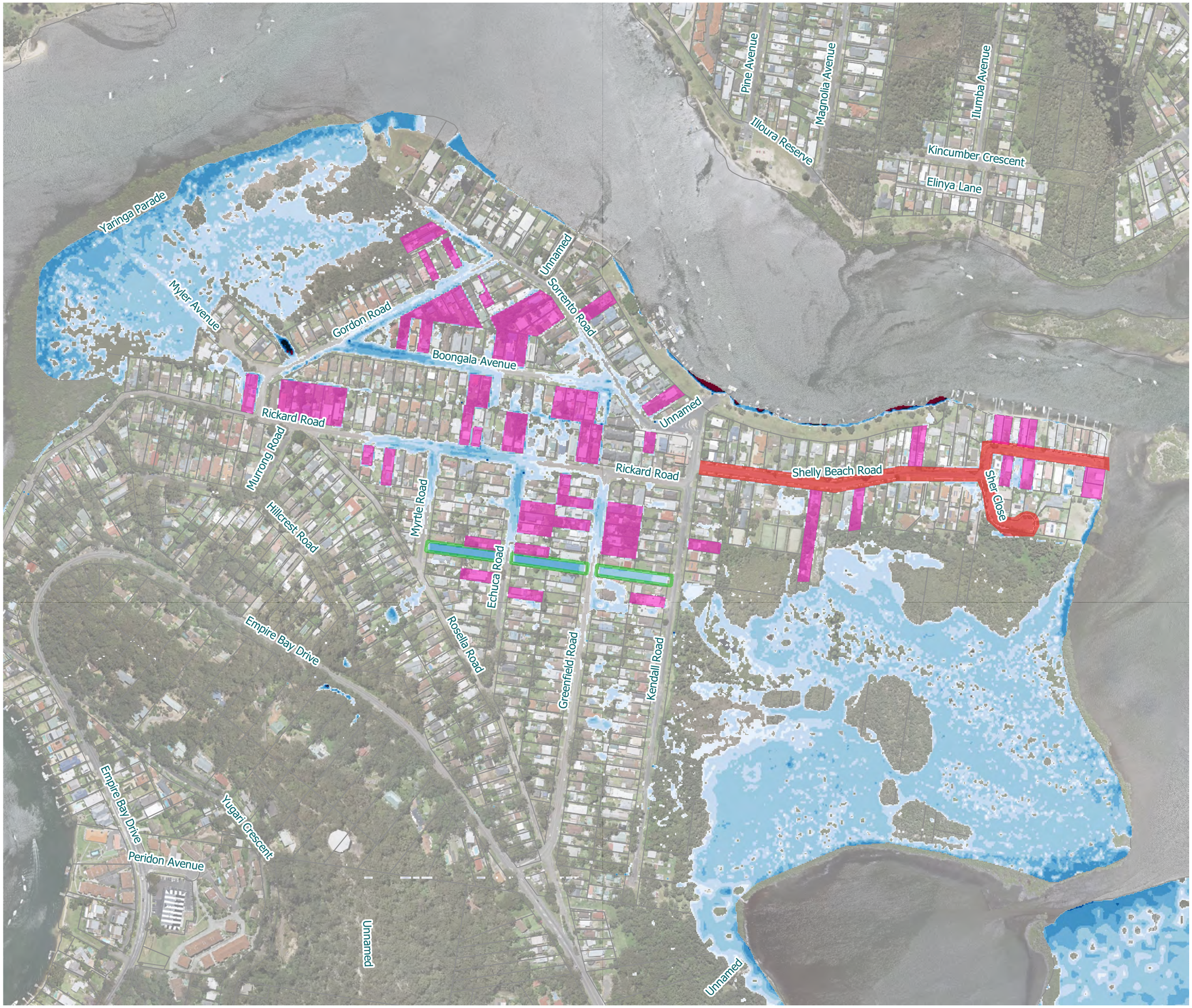
- 0.15 - 0.2
- 0.2 - 0.3
- 0.3 - 0.4
- 0.4 - 0.5
- 0.5 - 0.75
- 0.75 - 1
- 1 - 1.2
- > 1.2

Location and width of drainage easement / channel indicative only.

50 0 50 100 150 200 m

Scale : 1:5000@A3
Date : 27 August 2019
Revision : B
Created by : JS
Coordinate System : Map of Grid Australia 94

Rhelm



N

W E

S

Map GE609
Interim Landform
Flood Depth
20% AEP, 2 Hour Event
Empire Bay

Legend

- Cadastre

Landform Construcuted

- Roadway
- Canal
- Properties

Flood Depth (m)

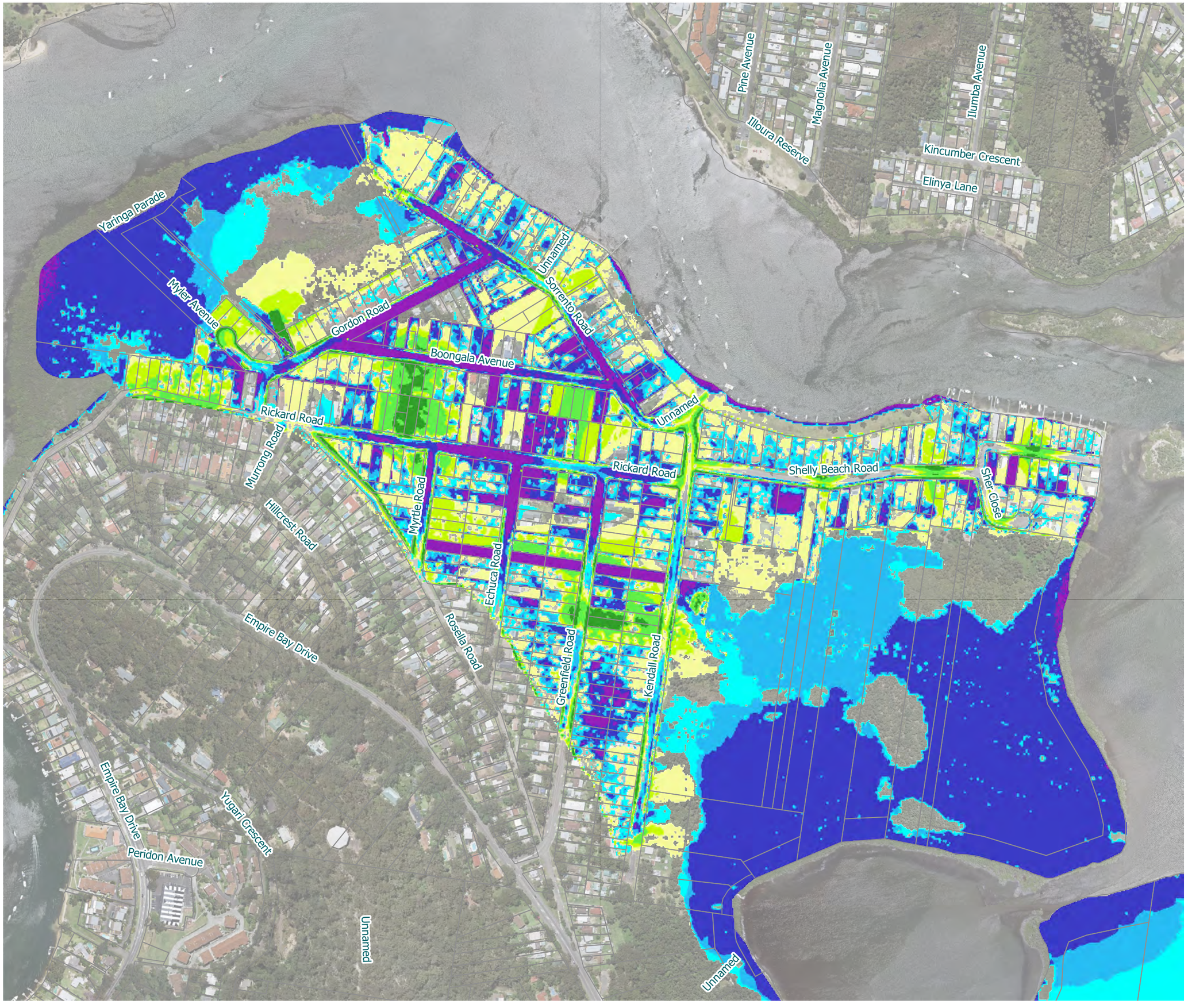
- 0.15 - 0.2
- 0.2 - 0.3
- 0.3 - 0.4
- 0.4 - 0.5
- 0.5 - 0.75
- 0.75 - 1
- 1 - 1.2
- > 1.2

Location and width of drainage easement / channel indicative only.

50 0 50 100 150 200 m

Scale : 1:5000@A3
Date : 27 August 2019
Revision : B
Created by : JS
Coordinate System : Map of Grid Australia 94

Rhelm



N

W E

S

Map GE610
Interim Landform
Flood Depth vs Existing
1% AEP, 2 Hour Event
Empire Bay

Legend

- Cadastre

Depth Difference (m)

- <= -0.2
- -0.2 - -0.1
- -0.1 - -0.05
- -0.05 - -0.01
- 0.01 - 0.05
- 0.05 - 0.1
- 0.1 - 0.2
- > 0.2

Location and width of drainage easement / channel indicative only.

50 0 50 100 150 200 m

Scale : 1:5000@A3
Date : 26 August 2019
Revision : B
Created by : JS
Coordinate System : Map of Grid Australia 94

Rhelm

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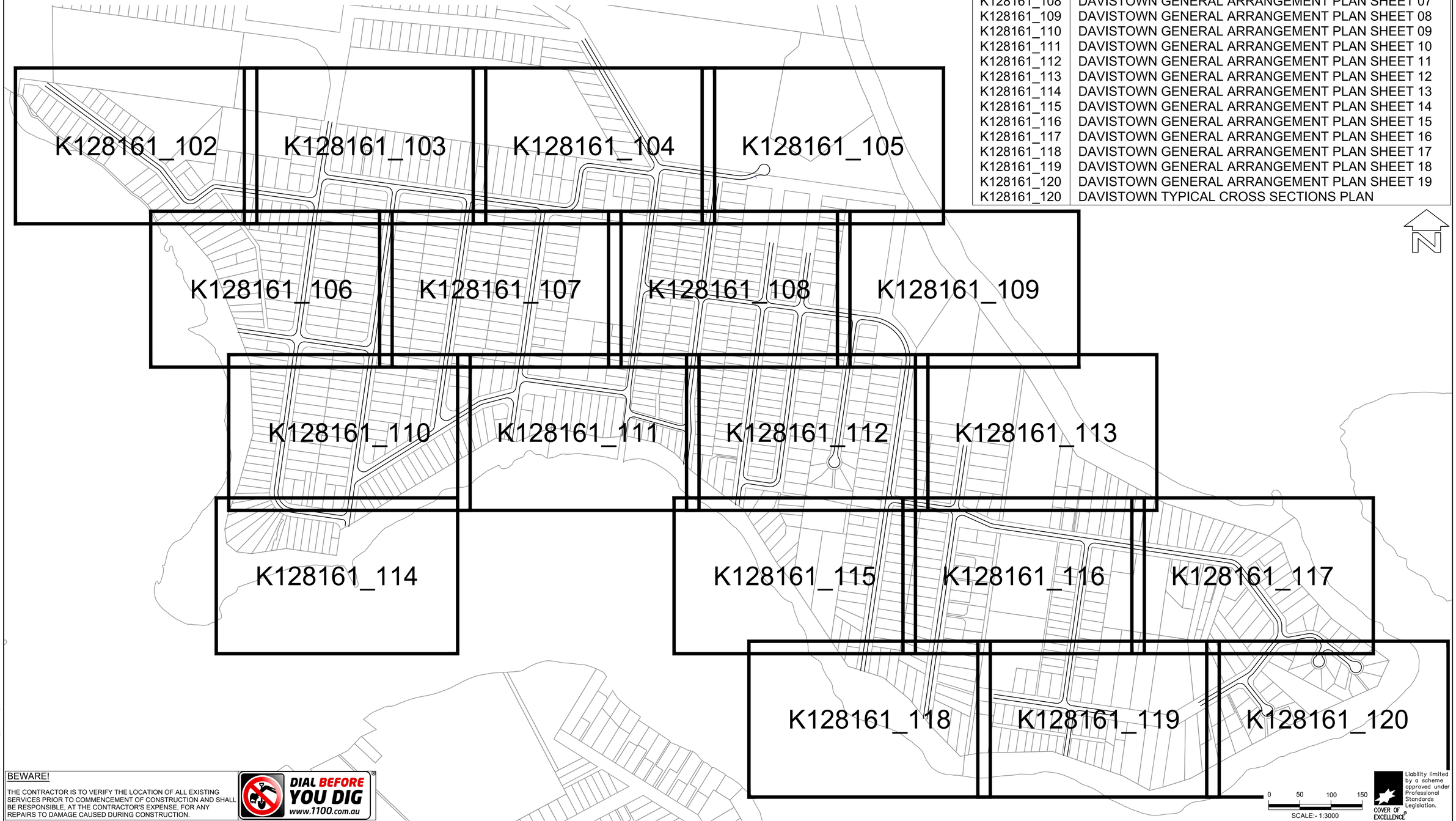
APPENDIX F

Civil and Drainage Designs

DAVISTOWN CLIMATE CHANGE ADAPTATION LANDFORM DESIGN

DRAWING SCHEDULE

K128161_101	DAVISTOWN COVER SHEET & DRAWING SCHEDULE PLAN
K128161_102	DAVISTOWN GENERAL ARRANGEMENT PLAN SHEET 01
K128161_103	DAVISTOWN GENERAL ARRANGEMENT PLAN SHEET 02
K128161_104	DAVISTOWN GENERAL ARRANGEMENT PLAN SHEET 03
K128161_105	DAVISTOWN GENERAL ARRANGEMENT PLAN SHEET 04
K128161_106	DAVISTOWN GENERAL ARRANGEMENT PLAN SHEET 05
K128161_107	DAVISTOWN GENERAL ARRANGEMENT PLAN SHEET 06
K128161_108	DAVISTOWN GENERAL ARRANGEMENT PLAN SHEET 07
K128161_109	DAVISTOWN GENERAL ARRANGEMENT PLAN SHEET 08
K128161_110	DAVISTOWN GENERAL ARRANGEMENT PLAN SHEET 09
K128161_111	DAVISTOWN GENERAL ARRANGEMENT PLAN SHEET 10
K128161_112	DAVISTOWN GENERAL ARRANGEMENT PLAN SHEET 11
K128161_113	DAVISTOWN GENERAL ARRANGEMENT PLAN SHEET 12
K128161_114	DAVISTOWN GENERAL ARRANGEMENT PLAN SHEET 13
K128161_115	DAVISTOWN GENERAL ARRANGEMENT PLAN SHEET 14
K128161_116	DAVISTOWN GENERAL ARRANGEMENT PLAN SHEET 15
K128161_117	DAVISTOWN GENERAL ARRANGEMENT PLAN SHEET 16
K128161_118	DAVISTOWN GENERAL ARRANGEMENT PLAN SHEET 17
K128161_119	DAVISTOWN GENERAL ARRANGEMENT PLAN SHEET 18
K128161_120	DAVISTOWN GENERAL ARRANGEMENT PLAN SHEET 19
K128161_120	DAVISTOWN TYPICAL CROSS SECTIONS PLAN



BEWARE!

THE CONTRACTOR IS TO VERIFY THE LOCATION OF ALL EXISTING SERVICES PRIOR TO COMMENCEMENT OF CONSTRUCTION AND SHALL BE RESPONSIBLE, AT THE CONTRACTOR'S EXPENSE, FOR ANY REPAIRS TO DAMAGE CAUSED DURING CONSTRUCTION.

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COVER OF EXCELLENCE

RATIO: 1:3000 (AT A1 ORIGINAL)

DATUM: AUSTRALIAN HEIGHT DATUM

ORIGIN: SSM RL

DATE OF PLAN: MAY 2019

SURVEY	RHELM	REV	DESCRIPTION	BY	DATE
DESIGN	CJG	=			
DRAWN	CJG				
CHECK'D	RHM				

allen price & scarratts pty ltd
land and development consultants
Nowra Branch: 75 Plunkett Street, Nowra NSW 2541
Kiama Branch: 1/28 Bong Bong Street, Kiama NSW 2533
phone:(02) 4421 6544
consultants@allenprice.com.au www.allenprice.com.au

DAVISTOWN COVER SHEET & DRAWING SCHEDULE PLAN
DAVISTOWN CLIMATE CHANGE ADAPTATION
LANDFORM DESIGN IN SUPPORT OF CLIMATE CHANGE ADAPTATION OPTIONS AT DAVISTOWN, NSW
FOR RHELM PTY LTD

DRAWING STATUS: PRELIMINARY
NOT TO BE USED FOR CONSTRUCTION PURPOSES

DRAWING NUMBER: K128161_101

SHEET 1 OF 21

REVISION: P0

K:\Projects-Kiama\128000\K128161\Drawings\K128161_101.dwg

LAYOUT PLAN
SCALE 1:500

LEGEND:
- 1.5 DESIGN SURFACE CONTOURS
- 1.5 EXISTING SURFACE CONTOURS
- D STORMWATER DRAINAGE LINES

0 5 10 15 20 25
SCALE:- 1:500

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COVER OF EXCELLENCE®

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RATIO: 1:500 (AT A1 ORIGINAL)

DATUM: AUSTRALIAN HEIGHT DATUM
ORIGIN: SSM RL
DATE OF PLAN: MAY 2019

		REV	DESCRIPTION	BY	DATE
SURVEY	RHELM	=			
DESIGN	CJG				
DRAWN	CJG				
CHECK'D	RHM				

allen price & scarratts pty ltd
land and development consultants
Nowra Branch: 75 Plunkett Street, Nowra NSW 2541
Kiama Branch: 1/28 Bong Bong Street, Kiama NSW 2533
phone:(02) 4421 6544
consultants@allenprice.com.au www.allenprice.com.au

DAVISTOWN GENERAL ARRANGEMENT PLAN SHEET 01
DAVISTOWN CLIMATE CHANGE ADAPTATION
LANDFORM DESIGN IN SUPPORT OF CLIMATE CHANGE ADAPTATION OPTIONS AT DAVISTOWN, NSW
FOR RHELM PTY LTD

DRAWING STATUS: PRELIMINARY
NOT TO BE USED FOR CONSTRUCTION PURPOSES

DRAWING NUMBER: K128161_102
SHEET: 2 OF 21
REVISION: P0

K:\Projects-Kiama\128000\K128161\Drawings\K128161_102.dwg

MALINYA ROAD

PYANG AVENUE

EMORA AVENUE

Ø480

Ø600

Ø750

LAYOUT PLAN
SCALE 1:500

BEWARE!

THE CONTRACTOR IS TO VERIFY THE LOCATION OF ALL EXISTING SERVICES PRIOR TO COMMENCEMENT OF CONSTRUCTION AND SHALL BE RESPONSIBLE, AT THE CONTRACTOR'S EXPENSE, FOR ANY REPAIRS TO DAMAGE CAUSED DURING CONSTRUCTION.

DIAL BEFORE YOU DIG www.1100.com.au

LEGEND:

- DESIGN SURFACE CONTOURS
- EXISTING SURFACE CONTOURS
- STORMWATER DRAINAGE LINES

SCALE:- 1:500

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COVER OF EXCELLENCE®

RATIO: 1:500 (AT A1 ORIGINAL)

DATUM: AUSTRALIAN HEIGHT DATUM

ORIGIN: SSM RL

DATE OF PLAN: MAY 2019

	SURVEY	RHELM
	DESIGN	CJG
	DRAWN	CJG
	CHECK'D	RHM

REV	DESCRIPTION	BY	DATE
=			

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DAVISTOWN GENERAL ARRANGEMENT PLAN SHEET 02
DAVISTOWN CLIMATE CHANGE ADAPTATION
LANDFORM DESIGN IN SUPPORT OF CLIMATE CHANGE ADAPTATION OPTIONS AT DAVISTOWN, NSW
FOR RHELM PTY LTD

DRAWING STATUS: PRELIMINARY
NOT TO BE USED FOR CONSTRUCTION PURPOSES

DRAWING NUMBER: K128161_103

SHEET 3 OF 21

REVISION: P0

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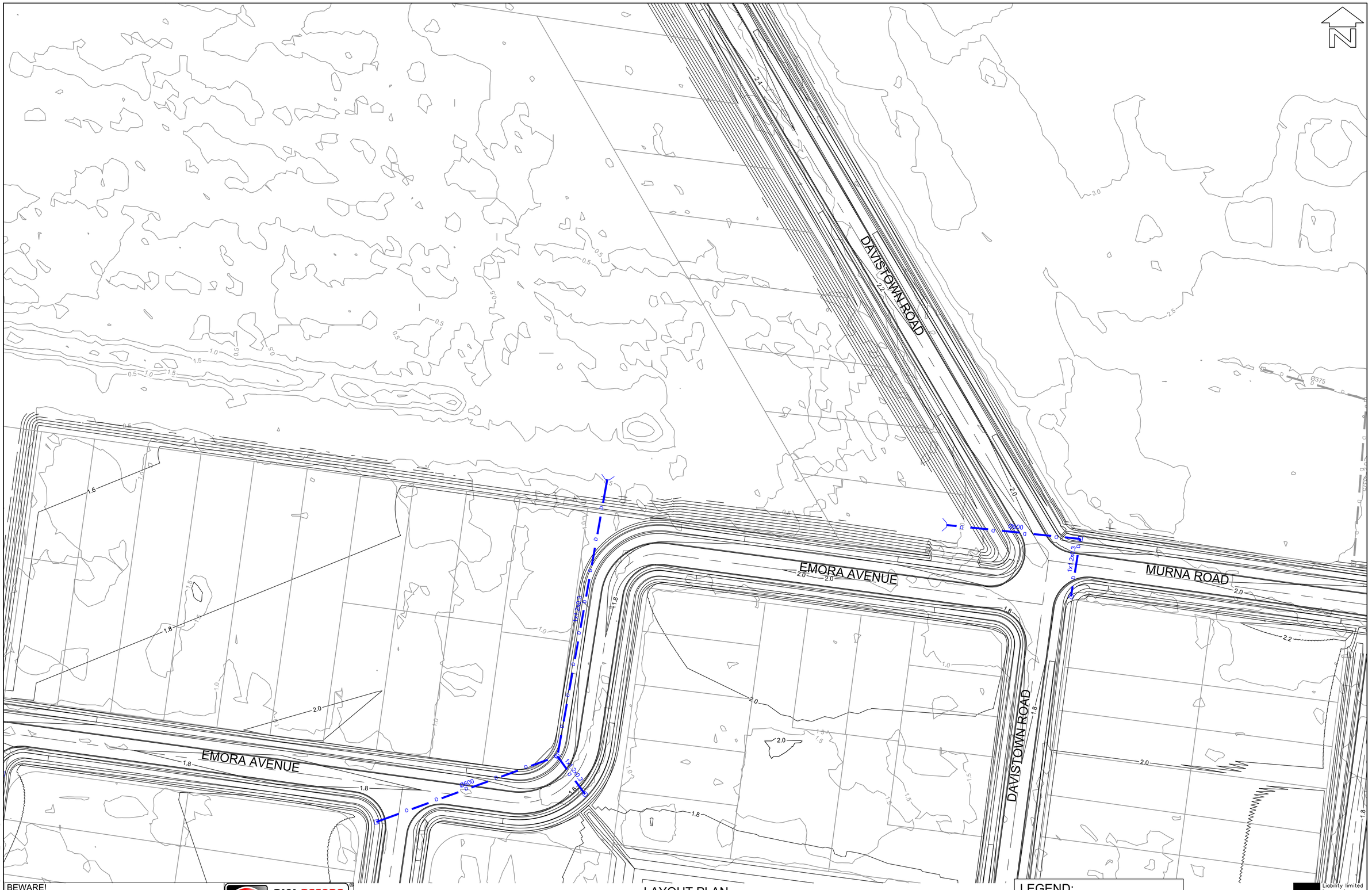

BEWARE!

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LAYOUT PLAN
SCALE 1:500

LEGEND:

——1.5——	DESIGN SURFACE CONTOURS
——1.5——	EXISTING SURFACE CONTOURS
━━ D ━━	STORMWATER DRAINAGE LINES

0 5 10 15 20 25
SCALE:- 1:500

COVER OF EXCELLENCE®
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RATIO: 1:500 (AT A1 ORIGINAL)	DATUM: AUSTRALIAN HEIGHT DATUM ORIGIN: SSM RL	SURVEY	RHELM	REV	DESCRIPTION	BY	DATE
		DESIGN	CJG	=			
		DRAWN	CJG				
		CHECK'D	RHM				
	DATE OF PLAN: MAY 2019						

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DAVISTOWN GENERAL ARRANGEMENT PLAN SHEET 03
DAVISTOWN CLIMATE CHANGE ADAPTATION
LANDFORM DESIGN IN SUPPORT OF CLIMATE CHANGE
ADAPTATION OPTIONS AT DAVISTOWN, NSW
FOR RHELM PTY LTD

DRAWING STATUS
PRELIMINARY
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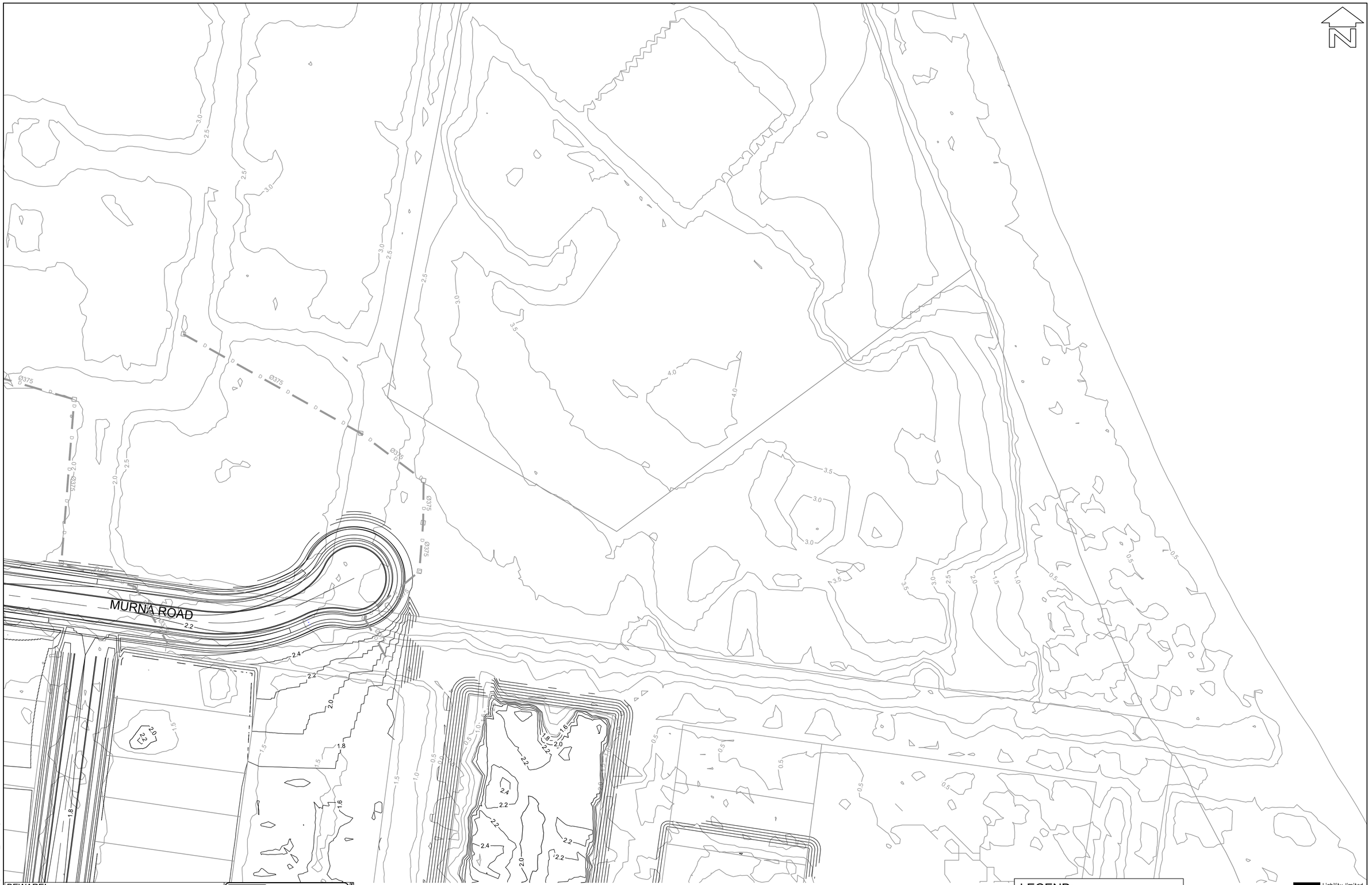
DRAWING NUMBER K128161_104
SHEET 4 OF 21
REVISION P0



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LAYOUT PLAN
SCALE 1:500

LEGEND:

- 1.5 DESIGN SURFACE CONTOURS
- 1.5 EXISTING SURFACE CONTOURS
- D STORMWATER DRAINAGE LINES

0 5 10 15 20 25
SCALE:- 1:500

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RATIO:	DATUM:						
1:500 (AT A1 ORIGINAL)	AUSTRALIAN HEIGHT DATUM	SURVEY	RHELM	REV	DESCRIPTION	BY	DATE
	ORIGIN: SSM RL	DESIGN	CJG	=			
		DRAWN	CJG				
		CHECK'D	RHM				
	DATE OF PLAN: MAY 2019						

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DAVISTOWN GENERAL ARRANGEMENT PLAN SHEET 04
DAVISTOWN CLIMATE CHANGE ADAPTATION
LANDFORM DESIGN IN SUPPORT OF CLIMATE CHANGE ADAPTATION OPTIONS AT DAVISTOWN, NSW
FOR RHELM PTY LTD

DRAWING STATUS
PRELIMINARY
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DRAWING NUMBER	SHEET	REVISION
K128161_105	5 OF 21	P0

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LAYOUT PLAN
SCALE 1:500

LEGEND:
- DESIGN SURFACE CONTOURS
- EXISTING SURFACE CONTOURS
- STORMWATER DRAINAGE LINES

SCALE:- 1:500

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RATIO: 1:500 (AT A1 ORIGINAL)

DATUM: AUSTRALIAN HEIGHT DATUM
ORIGIN: SSM RL
DATE OF PLAN: MAY 2019

SURVEY	RHELM	
DESIGN	CJG	
DRAWN	CJG	
CHECK'D	RHM	

REV	DESCRIPTION	BY	DATE
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DAVISTOWN GENERAL ARRANGEMENT PLAN SHEET 05
DAVISTOWN CLIMATE CHANGE ADAPTATION
LANDFORM DESIGN IN SUPPORT OF CLIMATE CHANGE ADAPTATION OPTIONS AT DAVISTOWN, NSW
FOR RHELM PTY LTD

DRAWING STATUS: PRELIMINARY
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DRAWING NUMBER: K128161_106
SHEET 6 OF 21
REVISION: P0

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MIRREEN AVENUE

JENKINS STREET

RESTELLA AVENUE

21

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LAYOUT PLAN
SCALE 1:500

LEGEND:

- 1.5 — DESIGN SURFACE CONTOURS
- 1.5 — EXISTING SURFACE CONTOURS
- D — STORMWATER DRAINAGE LINES

0 5 10 15 20 25
SCALE:- 1:500

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RATIO:	DATUM:						
1:500 (AT A1 ORIGINAL)	AUSTRALIAN HEIGHT DATUM	SURVEY	RHELM	REV	DESCRIPTION	BY	DATE
	ORIGIN: SSM RL	DESIGN	CJG	=			
		DRAWN	CJG				
		CHECK'D	RHM				
	DATE OF PLAN: MAY 2019						

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DAVISTOWN GENERAL ARRANGEMENT PLAN SHEET 06
DAVISTOWN CLIMATE CHANGE ADAPTATION
LANDFORM DESIGN IN SUPPORT OF CLIMATE CHANGE ADAPTATION OPTIONS AT DAVISTOWN, NSW
FOR RHELM PTY LTD

DRAWING STATUS
PRELIMINARY
NOT TO BE USED FOR CONSTRUCTION PURPOSES

DRAWING NUMBER K128161_107 | SHEET 7 OF 21 | REVISION P0

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LAYOUT PLAN
SCALE 1:500

LEGEND:
- 1.5 — DESIGN SURFACE CONTOURS
- 1.5 — EXISTING SURFACE CONTOURS
- D — STORMWATER DRAINAGE LINES

SCALE:- 1:500

BEWARE!

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RATIO: 1:500 (AT A1 ORIGINAL)

DATUM: AUSTRALIAN HEIGHT DATUM
ORIGIN: SSM RL
DATE OF PLAN: MAY 2019

	SURVEY	RHELM
DESIGN		CJG
DRAWN		CJG
CHECK'D		RHM

REV	DESCRIPTION	BY	DATE
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DAVISTOWN GENERAL ARRANGEMENT PLAN SHEET 07
DAVISTOWN CLIMATE CHANGE ADAPTATION
LANDFORM DESIGN IN SUPPORT OF CLIMATE CHANGE ADAPTATION OPTIONS AT DAVISTOWN, NSW
FOR RHELM PTY LTD

DRAWING STATUS: PRELIMINARY
NOT TO BE USED FOR CONSTRUCTION PURPOSES

DRAWING NUMBER: K128161_108
SHEET 8 OF 21
REVISION: P0

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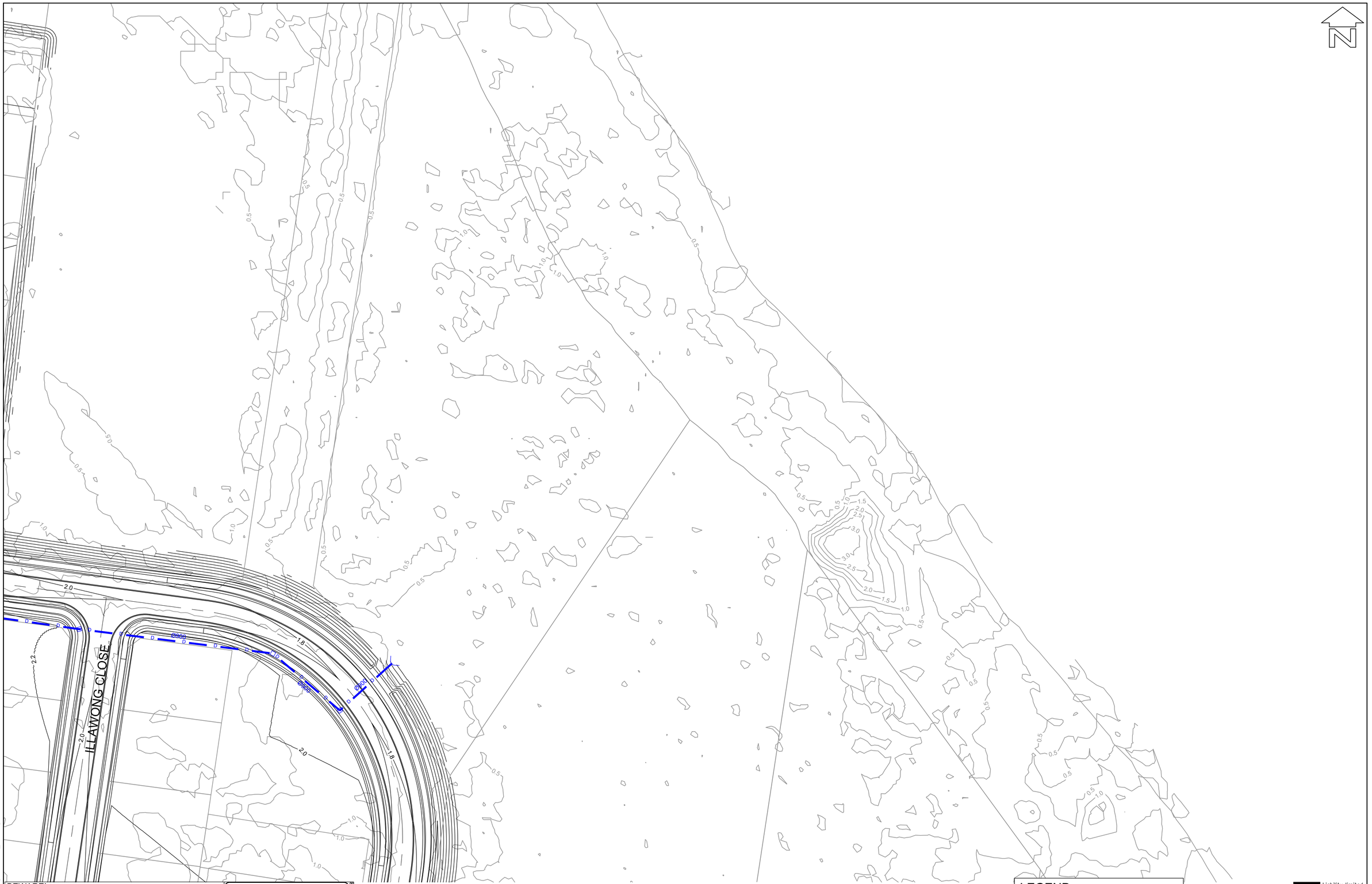

LAYOUT PLAN
SCALE 1:500

BEWARE!

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LEGEND:

- 1.5 — DESIGN SURFACE CONTOURS
- 1.5 — EXISTING SURFACE CONTOURS
- D — STORMWATER DRAINAGE LINES

0 5 10 15 20 25
SCALE:- 1:500

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RATIO: 1:500 (AT A1 ORIGINAL)

DATUM: AUSTRALIAN HEIGHT DATUM
ORIGIN: SSM RL
DATE OF PLAN: MAY 2019

SURVEY	RHELM	
DESIGN	CJG	
DRAWN	CJG	
CHECK'D	RHM	

REV	DESCRIPTION	BY	DATE
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DAVISTOWN GENERAL ARRANGEMENT PLAN SHEET 08
DAVISTOWN CLIMATE CHANGE ADAPTATION
LANDFORM DESIGN IN SUPPORT OF CLIMATE CHANGE ADAPTATION OPTIONS AT DAVISTOWN, NSW
FOR RHELM PTY LTD

DRAWING STATUS: PRELIMINARY
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DRAWING NUMBER: K128161_109
SHEET 9 OF 21
REVISION: P0

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LAYOUT PLAN
SCALE 1:500

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LEGEND:

- 1.5 DESIGN SURFACE CONTOURS
- 1.5 EXISTING SURFACE CONTOURS
- D STORMWATER DRAINAGE LINES

0 5 10 15 20 25
SCALE:- 1:500

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COVER OF EXCELLENCE

RATIO: 1:500 (AT A1 ORIGINAL)

DATUM: AUSTRALIAN HEIGHT DATUM
ORIGIN: SSM RL
DATE OF PLAN: MAY 2019

		REV	DESCRIPTION	BY	DATE
SURVEY	RHELM	=			
DESIGN	CJG				
DRAWN	CJG				
CHECK'D	RHM				

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DAVISTOWN GENERAL ARRANGEMENT PLAN SHEET 09
DAVISTOWN CLIMATE CHANGE ADAPTATION
LANDFORM DESIGN IN SUPPORT OF CLIMATE CHANGE ADAPTATION OPTIONS AT DAVISTOWN, NSW
FOR RHELM PTY LTD

DRAWING STATUS: PRELIMINARY
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DRAWING NUMBER: K128161_110
SHEET 10 OF 21
REVISION: P0

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LAYOUT PLAN
SCALE 1:500

LEGEND:

- 1.5 — DESIGN SURFACE CONTOURS
- 1.5 — EXISTING SURFACE CONTOURS
- D — STORMWATER DRAINAGE LINES

0 5 10 15 20 25
SCALE:- 1:500

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COVER OF EXCELLENCE

RATIO: 1:500 (AT A1 ORIGINAL)

DATUM: AUSTRALIAN HEIGHT DATUM
ORIGIN: SSM RL
DATE OF PLAN: MAY 2019

	SURVEY	RHELM
	DESIGN	CJG
	DRAWN	CJG
	CHECK'D	RHM

REV	DESCRIPTION	BY	DATE
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DAVISTOWN GENERAL ARRANGEMENT PLAN SHEET 10
DAVISTOWN CLIMATE CHANGE ADAPTATION
LANDFORM DESIGN IN SUPPORT OF CLIMATE CHANGE ADAPTATION OPTIONS AT DAVISTOWN, NSW
FOR RHELM PTY LTD

DRAWING STATUS: PRELIMINARY
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DRAWING NUMBER: K128161_111
SHEET 11 OF 21
REVISION: P0

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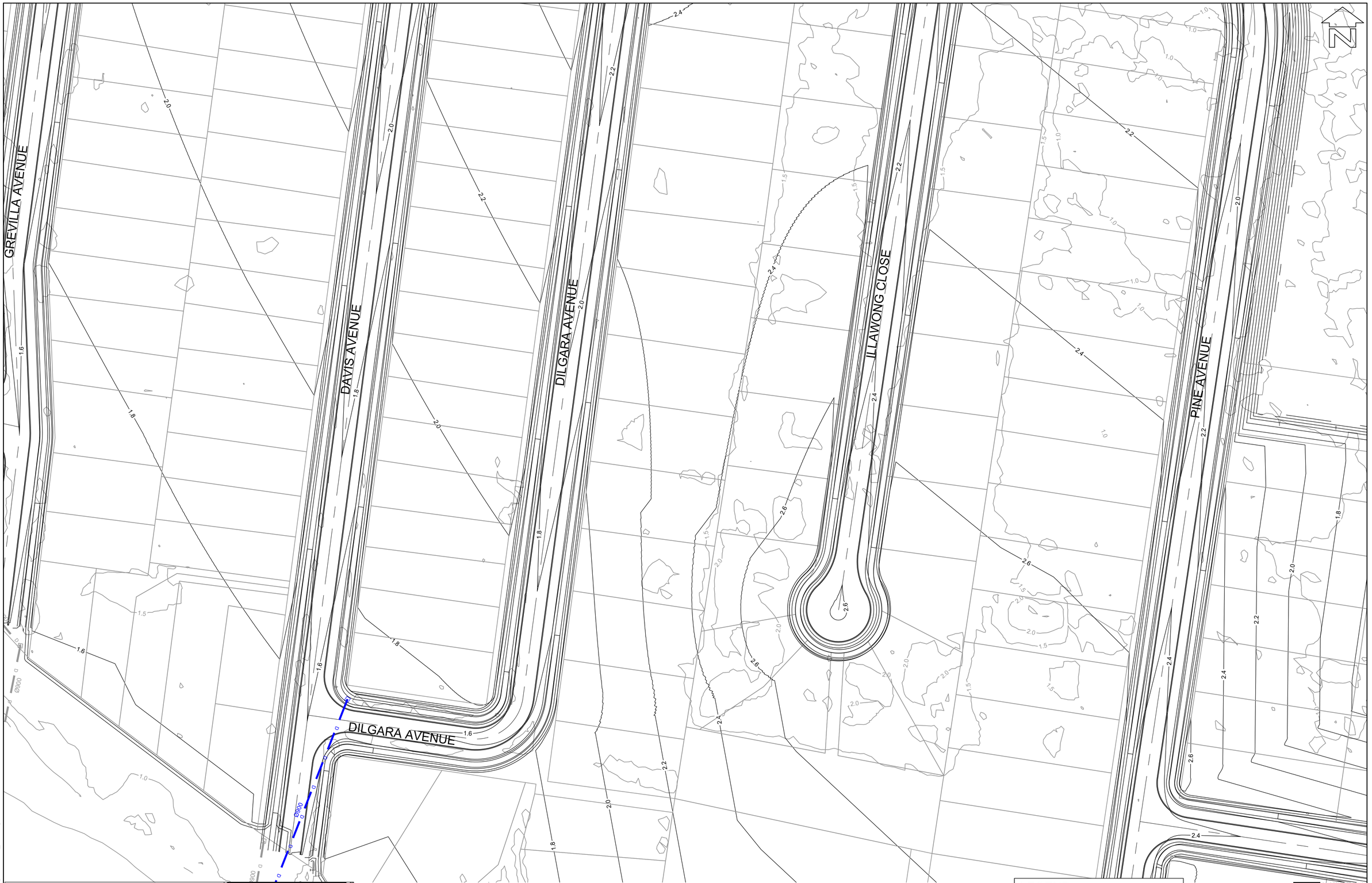

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LAYOUT PLAN
SCALE 1:500

LEGEND:

- 1.5 — DESIGN SURFACE CONTOURS
- 1.5 — EXISTING SURFACE CONTOURS
- D — STORMWATER DRAINAGE LINES

0 5 10 15 20 25
SCALE:- 1:500

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COVER OF EXCELLENCE

RATIO:	DATUM:						
1:500	AUSTRALIAN HEIGHT DATUM	SURVEY	RHELM	REV	DESCRIPTION	BY	DATE
(AT A1 ORIGINAL)	ORIGIN: SSM RL	DESIGN	CJG	=			
		DRAWN	CJG				
		CHECK'D	RHM				
	DATE OF PLAN: MAY 2019						

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DAVISTOWN GENERAL ARRANGEMENT PLAN SHEET 11
DAVISTOWN CLIMATE CHANGE ADAPTATION
LANDFORM DESIGN IN SUPPORT OF CLIMATE CHANGE ADAPTATION OPTIONS AT DAVISTOWN, NSW
FOR RHELM PTY LTD

DRAWING STATUS
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DRAWING NUMBER	SHEET	REVISION
K128161_112	12 OF 21	P0

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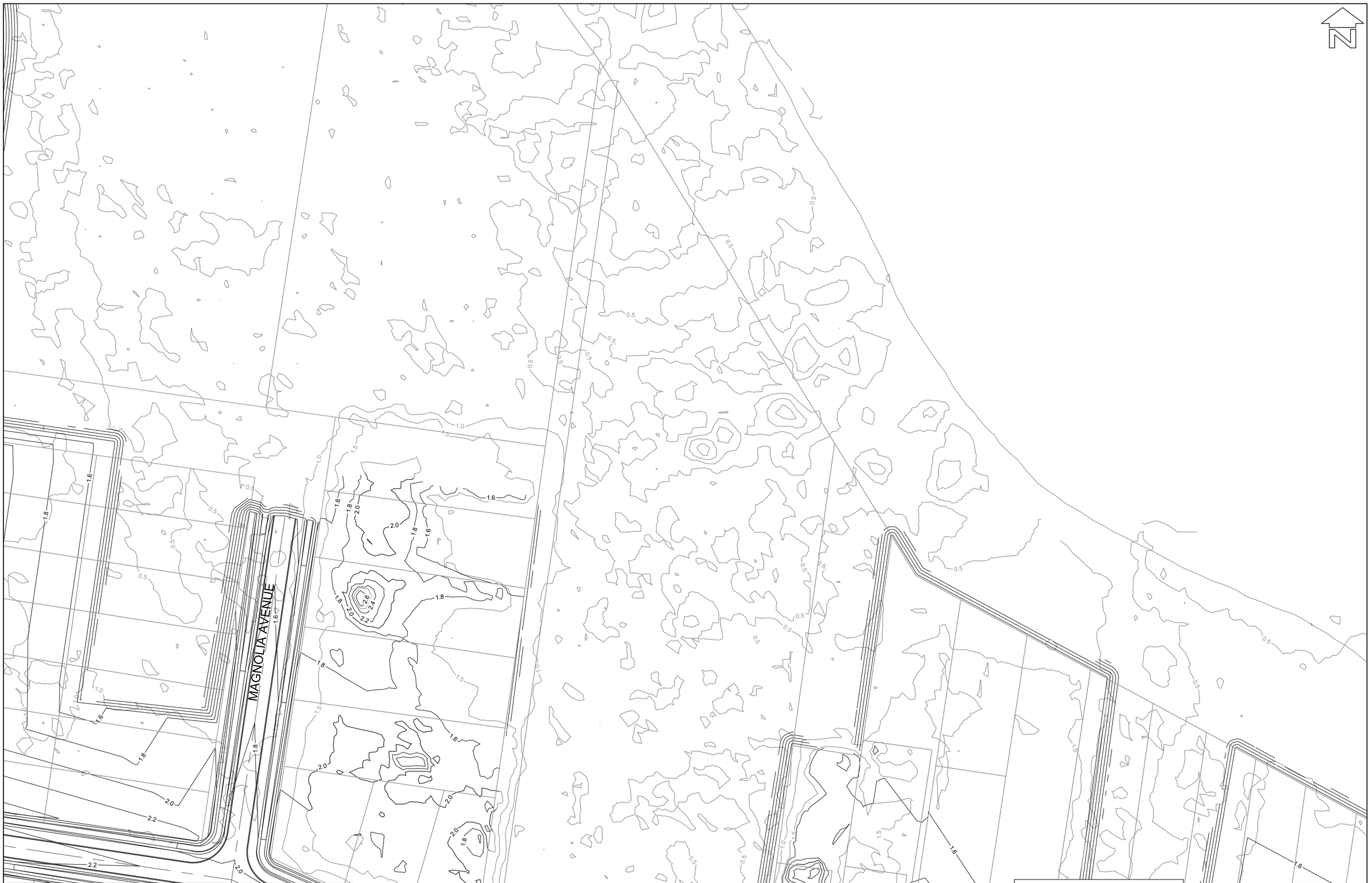

LAYOUT PLAN
SCALE 1:500

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LEGEND:

- 1.5 — DESIGN SURFACE CONTOURS
- 1.5 — EXISTING SURFACE CONTOURS
- D — STORMWATER DRAINAGE LINES

0 5 10 15 20 25
SCALE:- 1:500

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RATIO: 1:500 (AT A1 ORIGINAL)

DATUM: AUSTRALIAN HEIGHT DATUM
ORIGIN: SSM RL
DATE OF PLAN: MAY 2019

	SURVEY	RHELM
DESIGN	CJG	
DRAWN	CJG	
CHECK'D	RHM	

REV	DESCRIPTION	BY	DATE
=			

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DAVISTOWN GENERAL ARRANGEMENT PLAN SHEET 12
DAVISTOWN CLIMATE CHANGE ADAPTATION
LANDFORM DESIGN IN SUPPORT OF CLIMATE CHANGE ADAPTATION OPTIONS AT DAVISTOWN, NSW
FOR RHELM PTY LTD

DRAWING STATUS: PRELIMINARY
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DRAWING NUMBER: K128161_113
SHEET 13 OF 21
REVISION: P0

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LAYOUT PLAN
SCALE 1:500

LEGEND:

- 1.5 — DESIGN SURFACE CONTOURS
- 1.5 — EXISTING SURFACE CONTOURS
- D — STORMWATER DRAINAGE LINES

0 5 10 15 20 25
SCALE:- 1:500

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RATIO: 1:500 (AT A1 ORIGINAL)

DATUM: AUSTRALIAN HEIGHT DATUM
ORIGIN: SSM RL
DATE OF PLAN: MAY 2019

	SURVEY	RHELM
DESIGN	CJG	
DRAWN	CJG	
CHECK'D	RHM	

REV	DESCRIPTION	BY	DATE
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DAVISTOWN GENERAL ARRANGEMENT PLAN SHEET 13
DAVISTOWN CLIMATE CHANGE ADAPTATION
LANDFORM DESIGN IN SUPPORT OF CLIMATE CHANGE ADAPTATION OPTIONS AT DAVISTOWN, NSW
FOR RHELM PTY LTD

DRAWING STATUS: PRELIMINARY
NOT TO BE USED FOR CONSTRUCTION PURPOSES

DRAWING NUMBER: K128161_114
SHEET 14 OF 21
REVISION: P0

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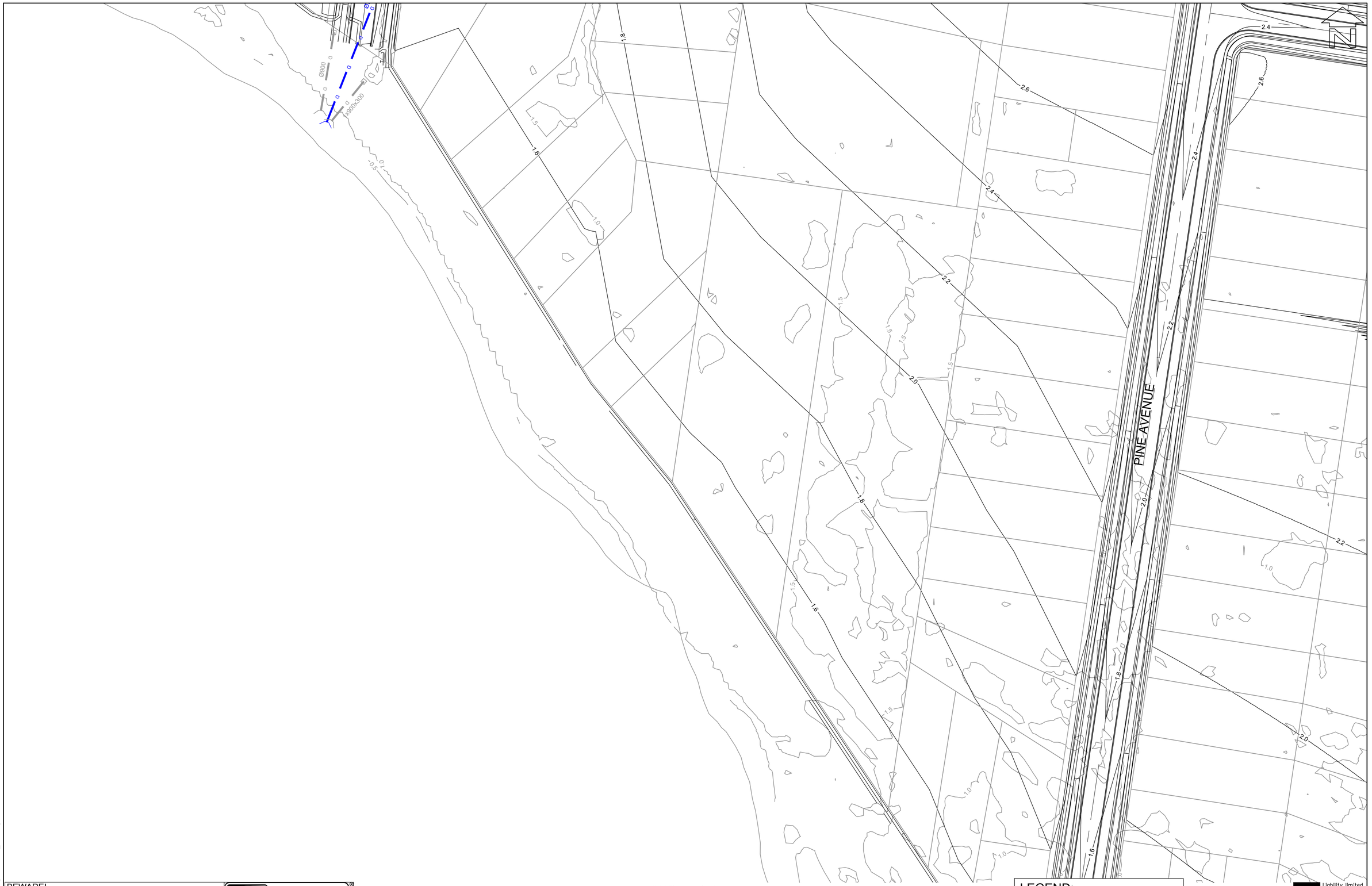

LAYOUT PLAN
SCALE 1:500

LEGEND:
- 1.5 — DESIGN SURFACE CONTOURS
- 1.5 — EXISTING SURFACE CONTOURS
- D — STORMWATER DRAINAGE LINES

0 5 10 15 20 25
SCALE:- 1:500

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RATIO: 1:500 (AT A1 ORIGINAL)

DATUM: AUSTRALIAN HEIGHT DATUM
ORIGIN: SSM RL
DATE OF PLAN: MAY 2019

	SURVEY	RHELM
DESIGN	CJG	
DRAWN	CJG	
CHECK'D	RHM	

REV	DESCRIPTION	BY	DATE
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DAVISTOWN GENERAL ARRANGEMENT PLAN SHEET 14
DAVISTOWN CLIMATE CHANGE ADAPTATION
LANDFORM DESIGN IN SUPPORT OF CLIMATE CHANGE ADAPTATION OPTIONS AT DAVISTOWN, NSW
FOR RHELM PTY LTD

DRAWING STATUS: PRELIMINARY
NOT TO BE USED FOR CONSTRUCTION PURPOSES

DRAWING NUMBER: K128161_115
SHEET 15 OF 21
REVISION: P0

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KINCUMBER CRESCENT

MAGNOLIA AVENUE

ILUMBA AVENUE

Ø600

Ø450

Ø450

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LAYOUT PLAN
SCALE 1:500

LEGEND:

- 1.5 — DESIGN SURFACE CONTOURS
- 1.5 — EXISTING SURFACE CONTOURS
- D — STORMWATER DRAINAGE LINES

0 5 10 15 20 25
SCALE:- 1:500

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RATIO:	DATUM:						
1:500 (AT A1 ORIGINAL)	AUSTRALIAN HEIGHT DATUM	SURVEY	RHELM	REV	DESCRIPTION	BY	DATE
	ORIGIN: SSM RL	DESIGN	CJG	=			
		DRAWN	CJG				
		CHECK'D	RHM				
	DATE OF PLAN: MAY 2019						

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DAVISTOWN GENERAL ARRANGEMENT PLAN SHEET 15
DAVISTOWN CLIMATE CHANGE ADAPTATION
LANDFORM DESIGN IN SUPPORT OF CLIMATE CHANGE ADAPTATION OPTIONS AT DAVISTOWN, NSW
FOR RHELM PTY LTD

DRAWING STATUS: PRELIMINARY
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DRAWING NUMBER: K128161_116
SHEET 16 OF 21
REVISION: P0

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LAYOUT PLAN
SCALE 1:500

LEGEND:
- 1.5 — DESIGN SURFACE CONTOURS
- 1.5 — EXISTING SURFACE CONTOURS
- D — STORMWATER DRAINAGE LINES

SCALE:- 1:500

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COVER OF EXCELLENCE®

BEWARE!

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RATIO: 1:500 (AT A1 ORIGINAL)

DATUM: AUSTRALIAN HEIGHT DATUM
ORIGIN: SSM RL
DATE OF PLAN: MAY 2019

	SURVEY	RHELM
DESIGN	CJG	
DRAWN	CJG	
CHECK'D	RHM	

REV	DESCRIPTION	BY	DATE
=			

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Kiama Branch: 1/28 Bong Bong Street, Kiama NSW 2533
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DAVISTOWN GENERAL ARRANGEMENT PLAN SHEET 16
DAVISTOWN CLIMATE CHANGE ADAPTATION
LANDFORM DESIGN IN SUPPORT OF CLIMATE CHANGE ADAPTATION OPTIONS AT DAVISTOWN, NSW
FOR RHELM PTY LTD

DRAWING STATUS: PRELIMINARY
NOT TO BE USED FOR CONSTRUCTION PURPOSES

DRAWING NUMBER: K128161_117
SHEET 17 OF 21
REVISION: P0

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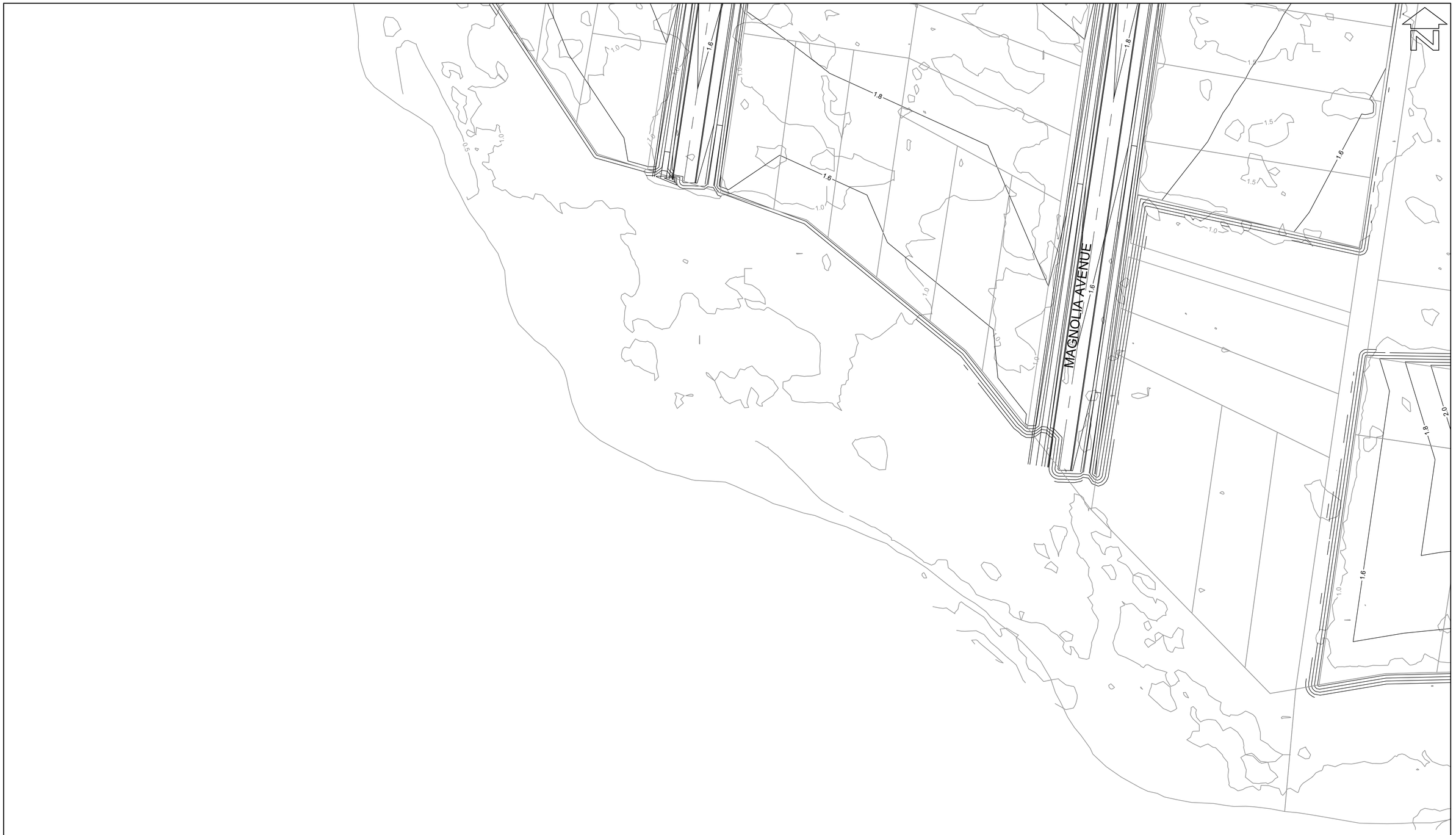

BEWARE!

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LAYOUT PLAN
SCALE 1:500

LEGEND:

- 1.5 — DESIGN SURFACE CONTOURS
- 1.5 — EXISTING SURFACE CONTOURS
- D — STORMWATER DRAINAGE LINES

0 5 10 15 20 25
SCALE:- 1:500

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RATIO: 1:500 (AT A1 ORIGINAL)

DATUM: AUSTRALIAN HEIGHT DATUM
ORIGIN: SSM RL
DATE OF PLAN: MAY 2019

	SURVEY	RHELM
DESIGN	CJG	
DRAWN	CJG	
CHECK'D	RHM	

REV	DESCRIPTION	BY	DATE
=			

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DAVISTOWN GENERAL ARRANGEMENT PLAN SHEET 17
DAVISTOWN CLIMATE CHANGE ADAPTATION
LANDFORM DESIGN IN SUPPORT OF CLIMATE CHANGE
ADAPTATION OPTIONS AT DAVISTOWN, NSW
FOR RHELM PTY LTD

DRAWING STATUS: PRELIMINARY
NOT TO BE USED FOR CONSTRUCTION PURPOSES

DRAWING NUMBER: K128161_118
SHEET 18 OF 21
REVISION: P0

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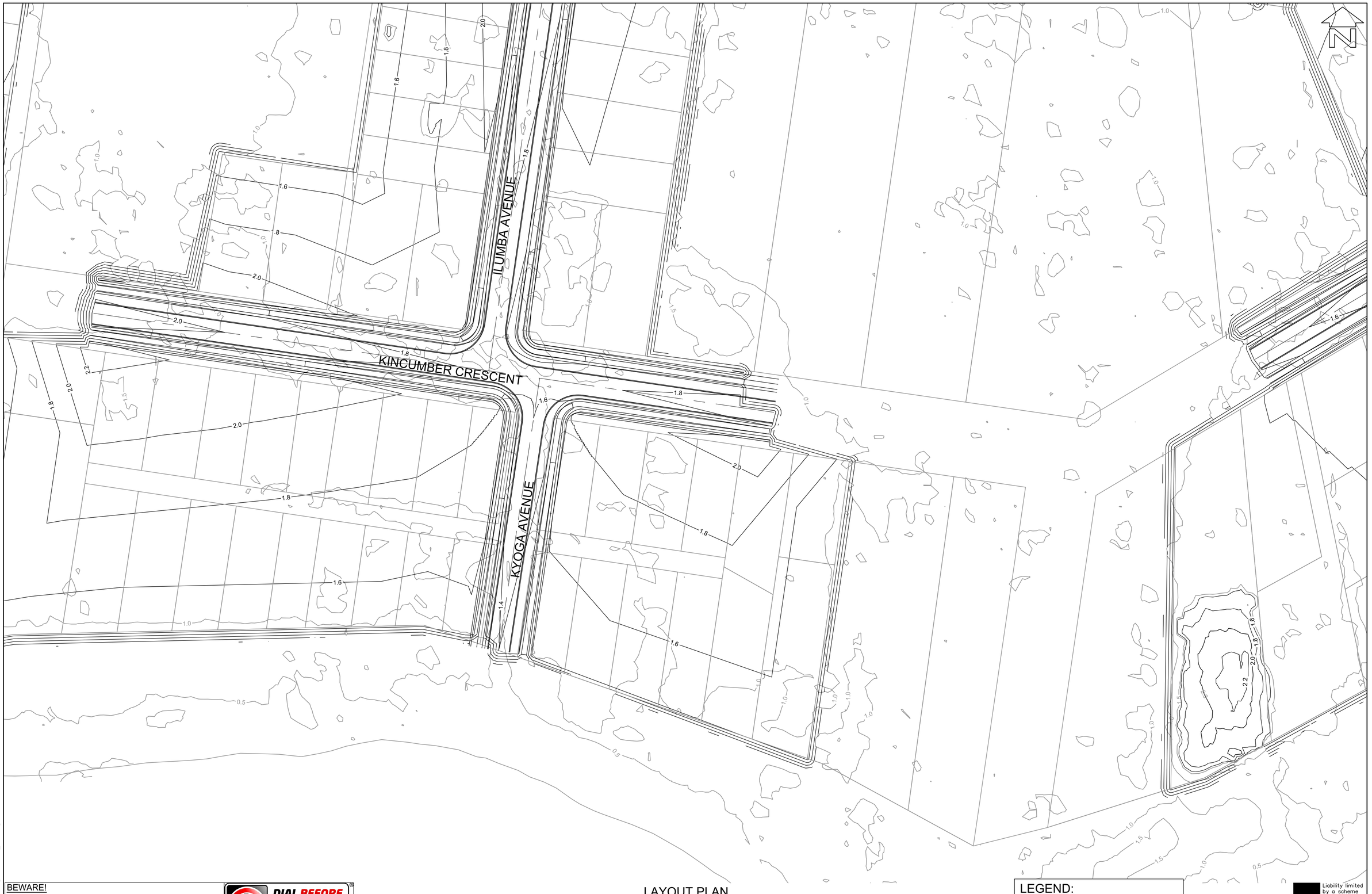

LAYOUT PLAN
SCALE 1:500

BEWARE!

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LEGEND:

- 1.5 DESIGN SURFACE CONTOURS
- 1.5 EXISTING SURFACE CONTOURS
- D STORMWATER DRAINAGE LINES

0 5 10 15 20 25
SCALE:- 1:500

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COVER OF EXCELLENCE®

RATIO:	DATUM:						
1:500 (AT A1 ORIGINAL)	AUSTRALIAN HEIGHT DATUM	SURVEY	RHELM	REV	DESCRIPTION	BY	DATE
	ORIGIN: SSM RL	DESIGN	CJG	=			
		DRAWN	CJG				
		CHECK'D	RHM				
	DATE OF PLAN: MAY 2019						

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DAVISTOWN GENERAL ARRANGEMENT PLAN SHEET 18
DAVISTOWN CLIMATE CHANGE ADAPTATION
LANDFORM DESIGN IN SUPPORT OF CLIMATE CHANGE ADAPTATION OPTIONS AT DAVISTOWN, NSW
FOR RHELM PTY LTD

DRAWING STATUS: PRELIMINARY
NOT TO BE USED FOR CONSTRUCTION PURPOSES

DRAWING NUMBER: K128161_119
SHEET 19 OF 21
REVISION: P0

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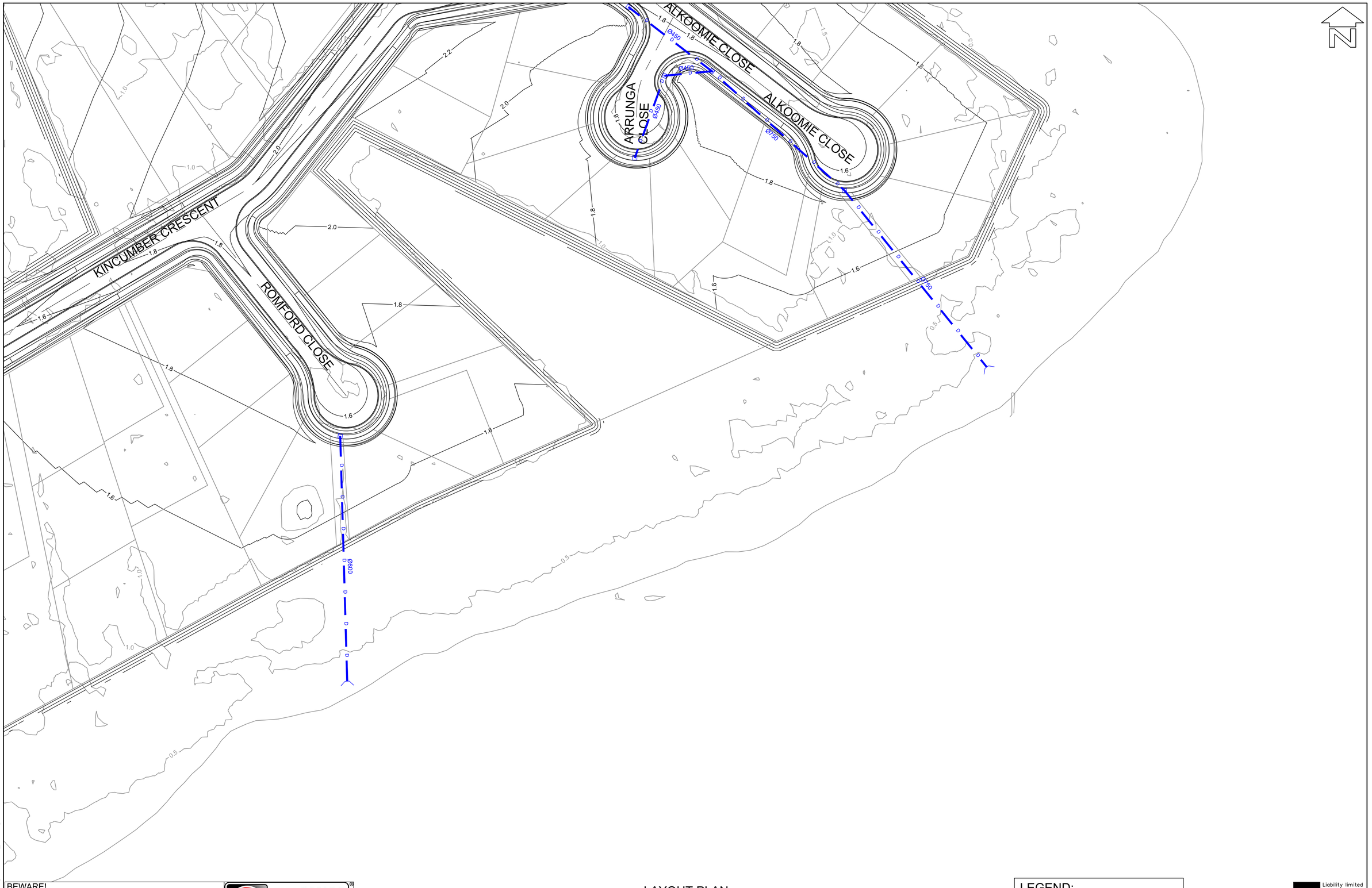

BEWARE!

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LAYOUT PLAN
SCALE 1:500

LEGEND:

1.5 DESIGN SURFACE CONTOURS
1.5 EXISTING SURFACE CONTOURS
D STORMWATER DRAINAGE LINES

0 5 10 15 20 25
SCALE:- 1:500

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COVER OF EXCELLENCE®

RATIO:	DATUM:						
1:500 (AT A1 ORIGINAL)	AUSTRALIAN HEIGHT DATUM	SURVEY	RHELM	REV	DESCRIPTION	BY	DATE
	ORIGIN: SSM RL	DESIGN	CJG	=			
		DRAWN	CJG				
		CHECK'D	RHM				
	DATE OF PLAN: MAY 2019						

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DAVISTOWN GENERAL ARRANGEMENT PLAN SHEET 19
DAVISTOWN CLIMATE CHANGE ADAPTATION
LANDFORM DESIGN IN SUPPORT OF CLIMATE CHANGE ADAPTATION OPTIONS AT DAVISTOWN, NSW
FOR RHELM PTY LTD

DRAWING STATUS: PRELIMINARY
NOT TO BE USED FOR CONSTRUCTION PURPOSES

DRAWING NUMBER: K128161_120
SHEET 20 OF 21
REVISION: P0

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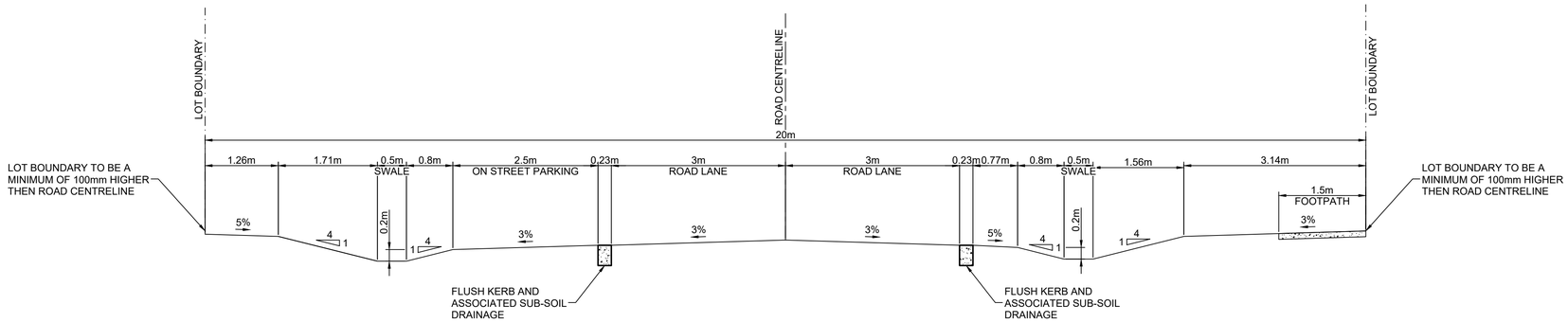
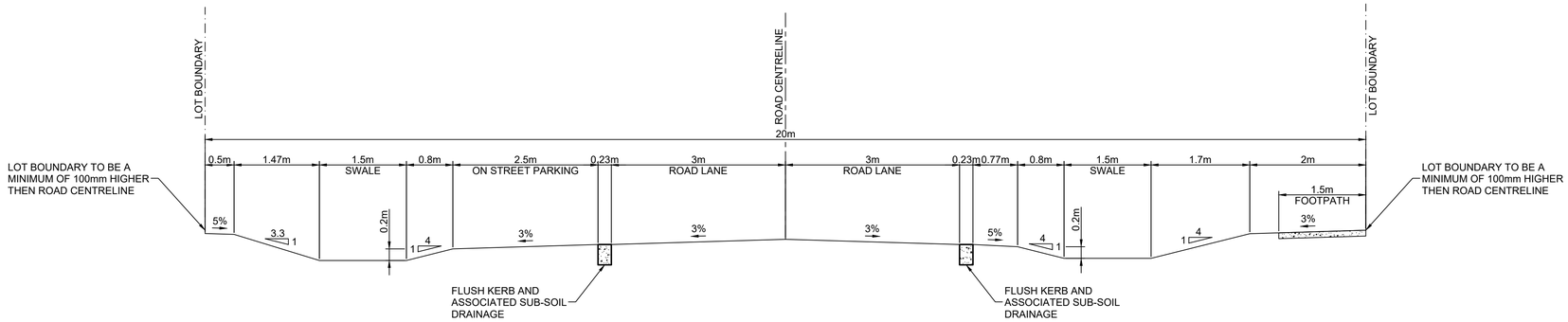


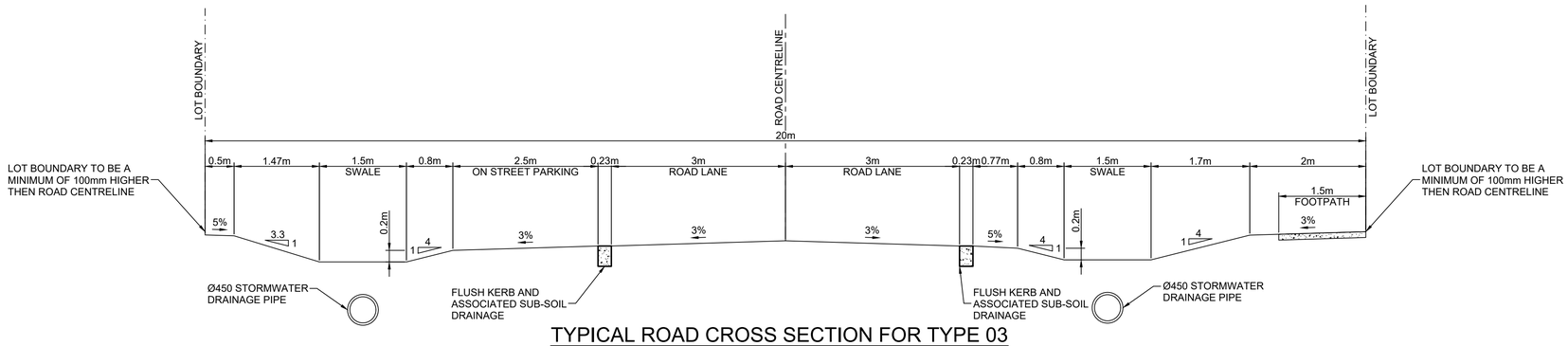
TYPICAL ROAD CROSS SECTION FOR TYPE 01

SCALE 1:50



TYPICAL ROAD CROSS SECTION FOR TYPE 02

SCALE 1:50



TYPICAL ROAD CROSS SECTION FOR TYPE 03

SCALE 1:50

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0 0.5 1.0 1.5 2.0 2.5
SCALE:- 1:50

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COVER OF EXCELLENCE

RATIO: 1:50 (AT A1 ORIGINAL)

DATUM: AUSTRALIAN HEIGHT DATUM
ORIGIN: SSM RL
DATE OF PLAN: MAY 2019

		REV	DESCRIPTION	BY	DATE
SURVEY	RHELM	=			
DESIGN	CJG				
DRAWN	CJG				
CHECK'D	RHM				

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DAVISTOWN TUPICAL CROSS SECTIONS PLAN
DAVISTOWN CLIMATE CHANGE ADAPTATION
LANDFORM DESIGN IN SUPPORT OF CLIMATE CHANGE ADAPTATION OPTIONS AT DAVISTOWN, NSW
FOR RHELM PTY LTD

DRAWING STATUS: PRELIMINARY
NOT TO BE USED FOR CONSTRUCTION PURPOSES

DRAWING NUMBER: K128161_121
SHEET 21 OF 21
REVISION P0

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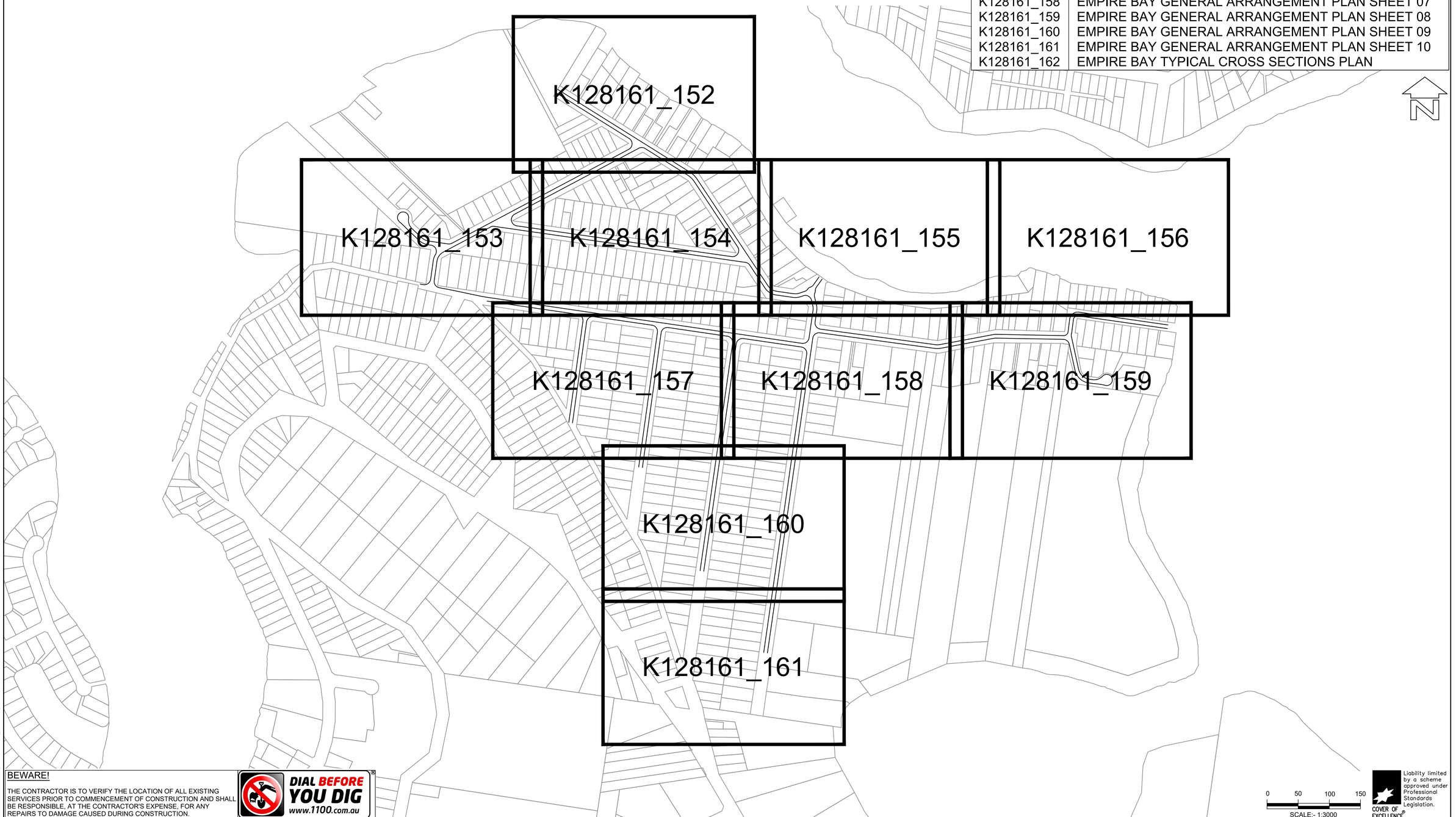
EMPIRE BAY CLIMATE CHANGE ADAPTATION LANDFORM DESIGN

DRAWING SCHEDULE

K128161_151	EMPIRE BAY COVER SHEET & DRAWING SCHEDULE PLAN
K128161_152	EMPIRE BAY GENERAL ARRANGEMENT PLAN SHEET 01
K128161_153	EMPIRE BAY GENERAL ARRANGEMENT PLAN SHEET 02
K128161_154	EMPIRE BAY GENERAL ARRANGEMENT PLAN SHEET 03
K128161_155	EMPIRE BAY GENERAL ARRANGEMENT PLAN SHEET 04
K128161_156	EMPIRE BAY GENERAL ARRANGEMENT PLAN SHEET 05
K128161_157	EMPIRE BAY GENERAL ARRANGEMENT PLAN SHEET 06
K128161_158	EMPIRE BAY GENERAL ARRANGEMENT PLAN SHEET 07
K128161_159	EMPIRE BAY GENERAL ARRANGEMENT PLAN SHEET 08
K128161_160	EMPIRE BAY GENERAL ARRANGEMENT PLAN SHEET 09
K128161_161	EMPIRE BAY GENERAL ARRANGEMENT PLAN SHEET 10
K128161_162	EMPIRE BAY TYPICAL CROSS SECTIONS PLAN



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0 50 100 150
SCALE:- 1:3000

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COVER OF EXCELLENCE®

RATIO: 1:3000 (AT A1 ORIGINAL)

DATUM: AUSTRALIAN HEIGHT DATUM
ORIGIN: SSM RL
DATE OF PLAN: MAY 2019

	SURVEY	RHELM
	DESIGN	CJG
	DRAWN	CJG
	CHECK'D	RHM

REV	DESCRIPTION	BY	DATE
=			

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EMPIRE BAY COVER SHEET & DRAWING SCHEDULE PLAN
EMPIRE BAY CLIMATE CHANGE ADAPTATION
LANDFORM DESIGN IN SUPPORT OF CLIMATE CHANGE
ADAPTATION OPTIONS AT DAVISTOWN, NSW
FOR RHELM PTY LTD

DRAWING STATUS: PRELIMINARY
NOT TO BE USED FOR CONSTRUCTION PURPOSES

DRAWING NUMBER: K128161_151
SHEET 1 OF 12
REVISION: P0

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LAYOUT PLAN
SCALE 1:500

LEGEND:
- 1.5 DESIGN SURFACE CONTOURS
- 1.5 EXISTING SURFACE CONTOURS
- D STORMWATER DRAINAGE LINES

0 5 10 15 20 25
SCALE:- 1:500

Liability limited by a scheme approved under Professional Standards Legislation.
COVER OF EXCELLENCE

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RATIO: 1:500 (AT A1 ORIGINAL)

DATUM: AUSTRALIAN HEIGHT DATUM
ORIGIN: SSM
RL
DATE OF PLAN: MAY 2019

SURVEY	RHELM	
DESIGN	CJG	
DRAWN	CJG	
CHECK'D	RHM	

REV	DESCRIPTION	BY	DATE
=			

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EMPIRE BAY GENERAL ARRANGEMENT PLAN SHEET 01
EMPIRE BAY CLIMATE CHANGE ADAPTATION
LANDFORM DESIGN IN SUPPORT OF CLIMATE CHANGE ADAPTATION OPTIONS AT DAVISTOWN, NSW
FOR RHELM PTY LTD

DRAWING STATUS: PRELIMINARY
NOT TO BE USED FOR CONSTRUCTION PURPOSES

DRAWING NUMBER: K128161_152
SHEET 2 OF 12
REVISION: P0

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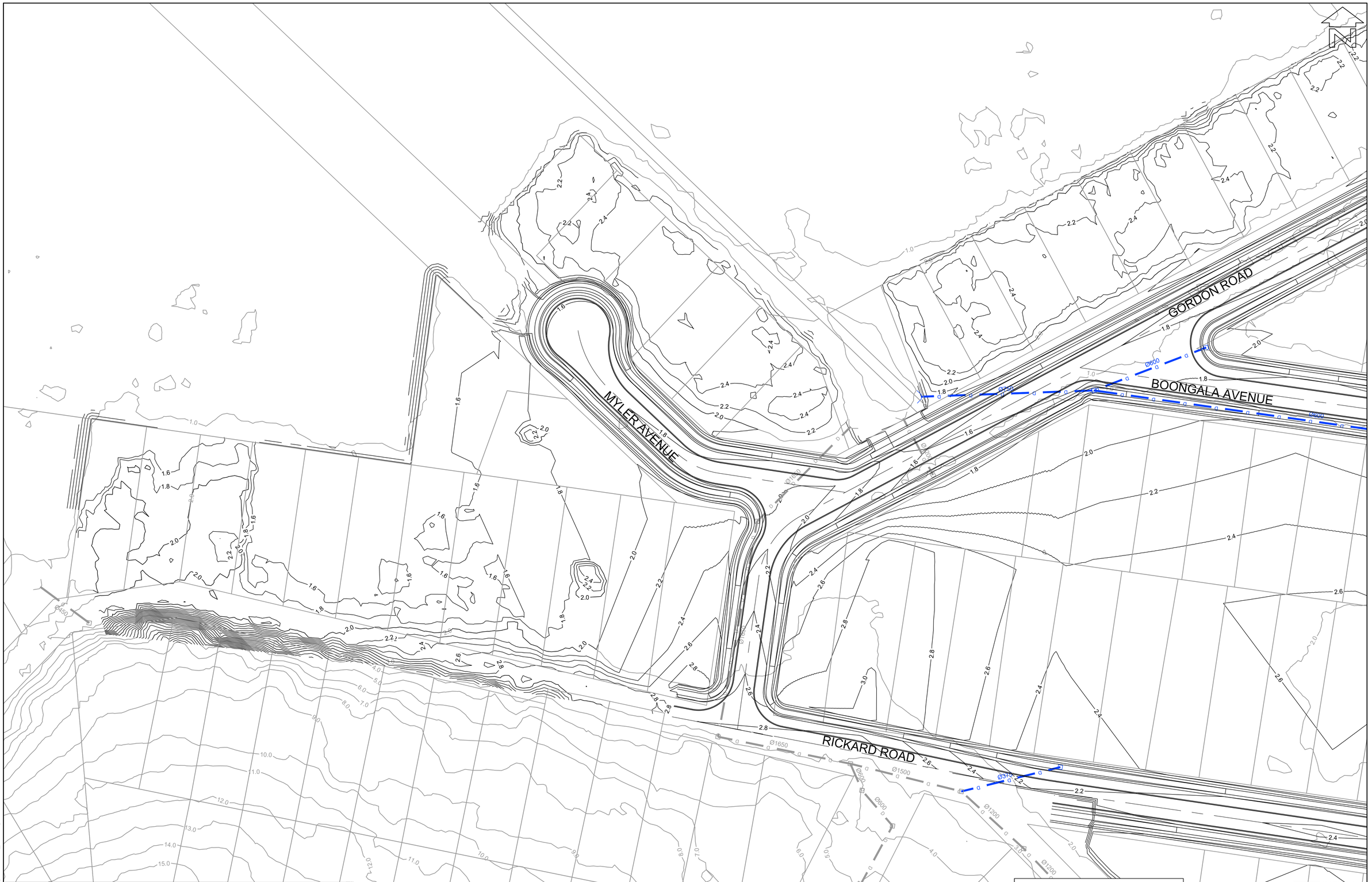

LAYOUT PLAN
SCALE 1:500

BEWARE!

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LEGEND:

- 1.5 DESIGN SURFACE CONTOURS
- 1.5 EXISTING SURFACE CONTOURS
- D STORMWATER DRAINAGE LINES

0 5 10 15 20 25
SCALE:- 1:500

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COVER OF EXCELLENCE

RATIO:	DATUM:						
1:500 (AT A1 ORIGINAL)	AUSTRALIAN HEIGHT DATUM ORIGIN: SSM RL	SURVEY	RHELM	REV	DESCRIPTION	BY	DATE
		DESIGN	CJG	=			
		DRAWN	CJG				
		CHECK'D	RHM				
	DATE OF PLAN: MAY 2019						

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EMPIRE BAY GENERAL ARRANGEMENT PLAN SHEET 02
EMPIRE BAY CLIMATE CHANGE ADAPTATION
LANDFORM DESIGN IN SUPPORT OF CLIMATE CHANGE ADAPTATION OPTIONS AT DAVISTOWN, NSW
FOR RHELM PTY LTD

DRAWING STATUS
PRELIMINARY
NOT TO BE USED FOR CONSTRUCTION PURPOSES

DRAWING NUMBER K128161_153 | SHEET 3 OF 12 | REVISION P0

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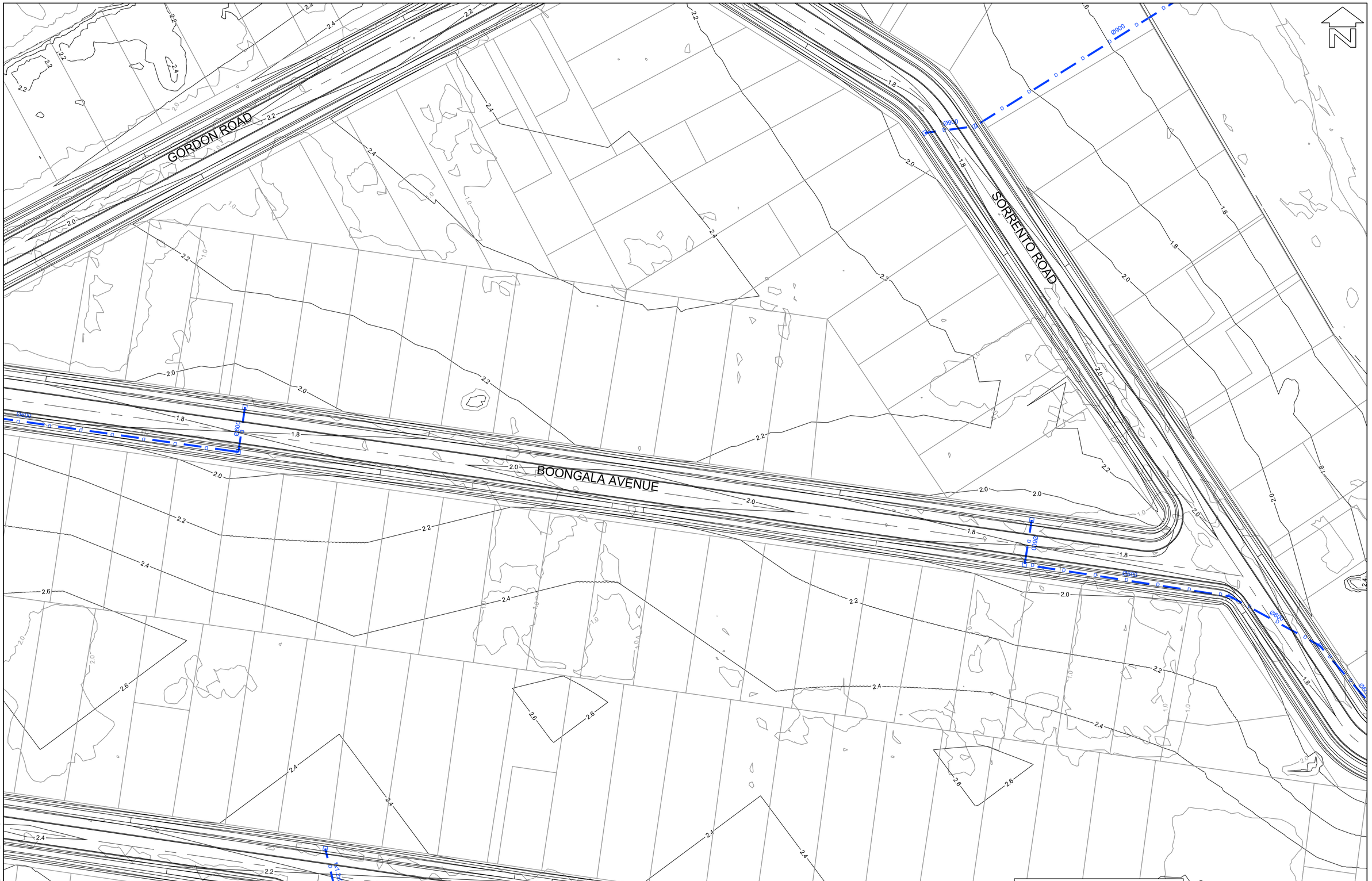

LAYOUT PLAN
SCALE 1:500

BEWARE!

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LEGEND:

- 1.5 — DESIGN SURFACE CONTOURS
- 1.5 — EXISTING SURFACE CONTOURS
- D — STORMWATER DRAINAGE LINES

0 5 10 15 20 25
SCALE:- 1:500

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RATIO:	DATUM:						
1:500 (AT A1 ORIGINAL)	AUSTRALIAN HEIGHT DATUM	SURVEY	RHELM	REV	DESCRIPTION	BY	DATE
	ORIGIN: SSM RL	DESIGN	CJG	=			
		DRAWN	CJG				
		CHECK'D	RHM				
	DATE OF PLAN: MAY 2019						

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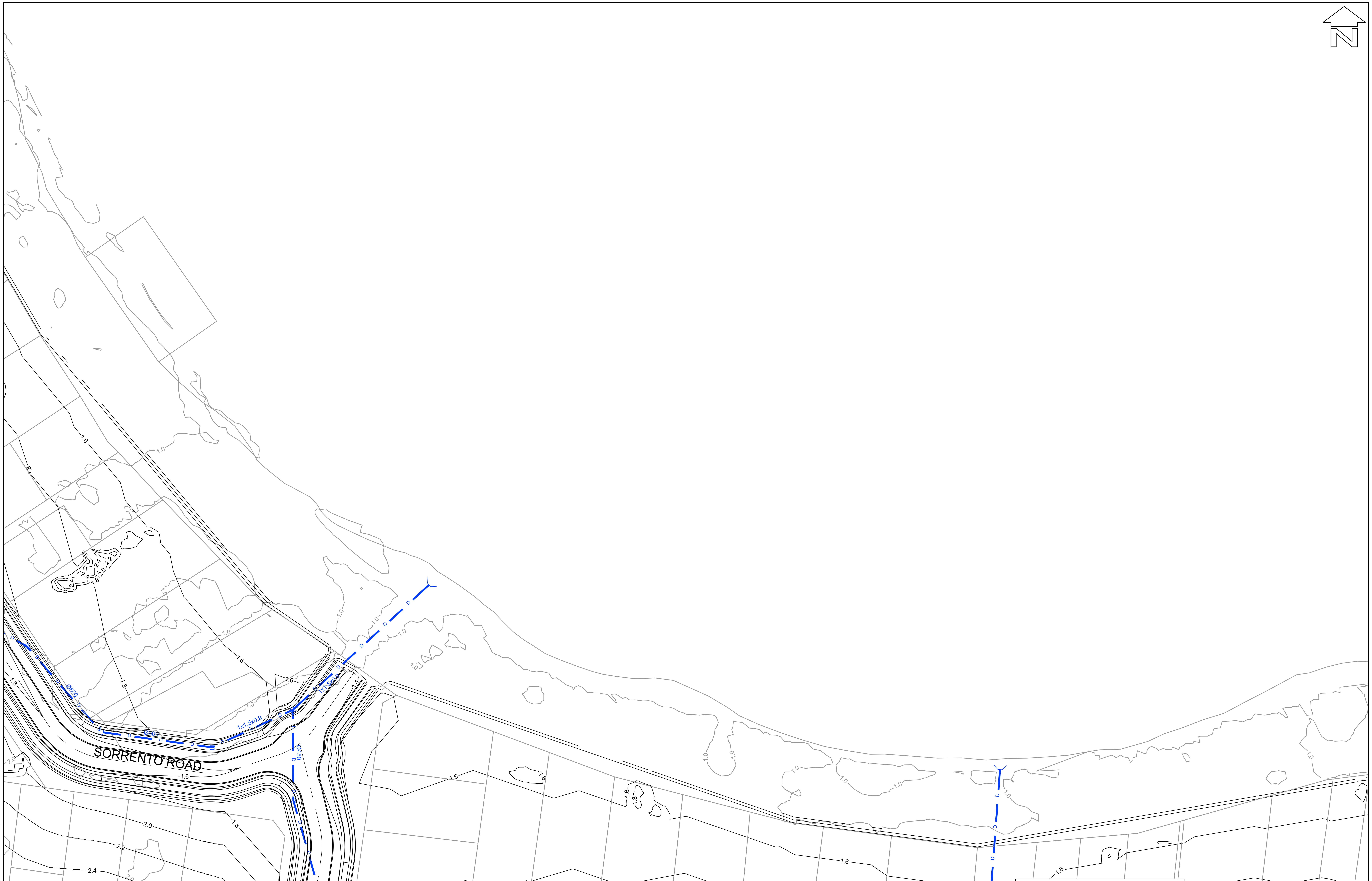
EMPIRE BAY GENERAL ARRANGEMENT PLAN SHEET 03
EMPIRE BAY CLIMATE CHANGE ADAPTATION
LANDFORM DESIGN IN SUPPORT OF CLIMATE CHANGE ADAPTATION OPTIONS AT DAVISTOWN, NSW
FOR RHELM PTY LTD

DRAWING STATUS
PRELIMINARY
NOT TO BE USED FOR CONSTRUCTION PURPOSES

DRAWING NUMBER	SHEET	REVISION
K128161_154	4 OF 12	P0



LAYOUT PLAN
SCALE 1:500

LEGEND:
1.5 DESIGN SURFACE CONTOURS
1.5 EXISTING SURFACE CONTOURS
D STORMWATER DRAINAGE LINES

0 5 10 15 20 25
SCALE:- 1:500

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RATIO:	DATUM: AUSTRALIAN HEIGHT DATUM	SURVEY	RHELM	REV	DESCRIPTION	BY	DATE
1:500	ORIGIN: SSM RL	DESIGN	CJG	=			
(AT A1 ORIGINAL)		DRAWN	CJG				
	DATE OF PLAN: MAY 2019	CHECK'D	RHM				

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EMPIRE BAY GENERAL ARRANGEMENT PLAN SHEET 04
EMPIRE BAY CLIMATE CHANGE ADAPTATION
LANDFORM DESIGN IN SUPPORT OF CLIMATE CHANGE
ADAPTATION OPTIONS AT DAVISTOWN, NSW
FOR RHELM PTY LTD

DRAWING STATUS: PRELIMINARY
NOT TO BE USED FOR CONSTRUCTION PURPOSES

DRAWING NUMBER: K128161_155
SHEET 5 OF 12
REVISION P0

LAYOUT PLAN
SCALE 1:500

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LEGEND:

1.5 DESIGN SURFACE CONTOURS
1.5 EXISTING SURFACE CONTOURS
D STORMWATER DRAINAGE LINES

0 5 10 15 20 25
SCALE:- 1:500

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COVER OF EXCELLENCE

RATIO: 1:500 (AT A1 ORIGINAL)

DATUM: AUSTRALIAN HEIGHT DATUM
ORIGIN: SSM RL
DATE OF PLAN: MAY 2019

SURVEY	RHELM	
DESIGN	CJG	
DRAWN	CJG	
CHECK'D	RHM	

REV	DESCRIPTION	BY	DATE
=			

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EMPIRE BAY GENERAL ARRANGEMENT PLAN SHEET 05
EMPIRE BAY CLIMATE CHANGE ADAPTATION
LANDFORM DESIGN IN SUPPORT OF CLIMATE CHANGE ADAPTATION OPTIONS AT DAVISTOWN, NSW
FOR RHELM PTY LTD

DRAWING STATUS: PRELIMINARY
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DRAWING NUMBER: K128161_156
SHEET 6 OF 12
REVISION: P0

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LAYOUT PLAN
SCALE 1:500

LEGEND:
- DESIGN SURFACE CONTOURS
- EXISTING SURFACE CONTOURS
- STORMWATER DRAINAGE LINES

SCALE:- 1:500

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RATIO: 1:500 (AT A1 ORIGINAL)

DATUM: AUSTRALIAN HEIGHT DATUM
ORIGIN: SSM RL
DATE OF PLAN: MAY 2019

SURVEY	RHELM	
DESIGN	CJG	
DRAWN	CJG	
CHECK'D	RHM	

REV	DESCRIPTION	BY	DATE
=			

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EMPIRE BAY GENERAL ARRANGEMENT PLAN SHEET 06
EMPIRE BAY CLIMATE CHANGE ADAPTATION
LANDFORM DESIGN IN SUPPORT OF CLIMATE CHANGE ADAPTATION OPTIONS AT DAVISTOWN, NSW
FOR RHELM PTY LTD

DRAWING STATUS: PRELIMINARY
NOT TO BE USED FOR CONSTRUCTION PURPOSES

DRAWING NUMBER: K128161_157
SHEET 7 OF 12
REVISION: P0

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RICKARD ROAD

SHELLY BEACH ROAD

GREENFIELD ROAD

KENDALL ROAD

1x0.525x0.32

1x0.525x0.32

1x1.0x0.3

3x2.7x0.6

3x2.7x0.6

BEWARE!

THE CONTRACTOR IS TO VERIFY THE LOCATION OF ALL EXISTING SERVICES PRIOR TO COMMENCEMENT OF CONSTRUCTION AND SHALL BE RESPONSIBLE, AT THE CONTRACTOR'S EXPENSE, FOR ANY REPAIRS TO DAMAGE CAUSED DURING CONSTRUCTION.

DIAL BEFORE YOU DIG www.1100.com.au

LAYOUT PLAN
SCALE 1:500

LEGEND:

- 1.5 DESIGN SURFACE CONTOURS
- 1.5 EXISTING SURFACE CONTOURS
- D STORMWATER DRAINAGE LINES

0 5 10 15 20 25

SCALE:- 1:500

Liability limited by a scheme approved under Professional Standards Legislation.

COVER OF EXCELLENCE

RATIO:	DATUM:							
1:500 (AT A1 ORIGINAL)	AUSTRALIAN HEIGHT DATUM	SURVEY	RHELM	REV	DESCRIPTION	BY	DATE
	ORIGIN: SSM RL	DESIGN	CJG	=			
		DRAWN	CJG				
		CHECK'D	RHM				
	DATE OF PLAN: MAY 2019						

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EMPIRE BAY GENERAL ARRANGEMENT PLAN SHEET 07
EMPIRE BAY CLIMATE CHANGE ADAPTATION
LANDFORM DESIGN IN SUPPORT OF CLIMATE CHANGE ADAPTATION OPTIONS AT DAVISTOWN, NSW
FOR RHELM PTY LTD

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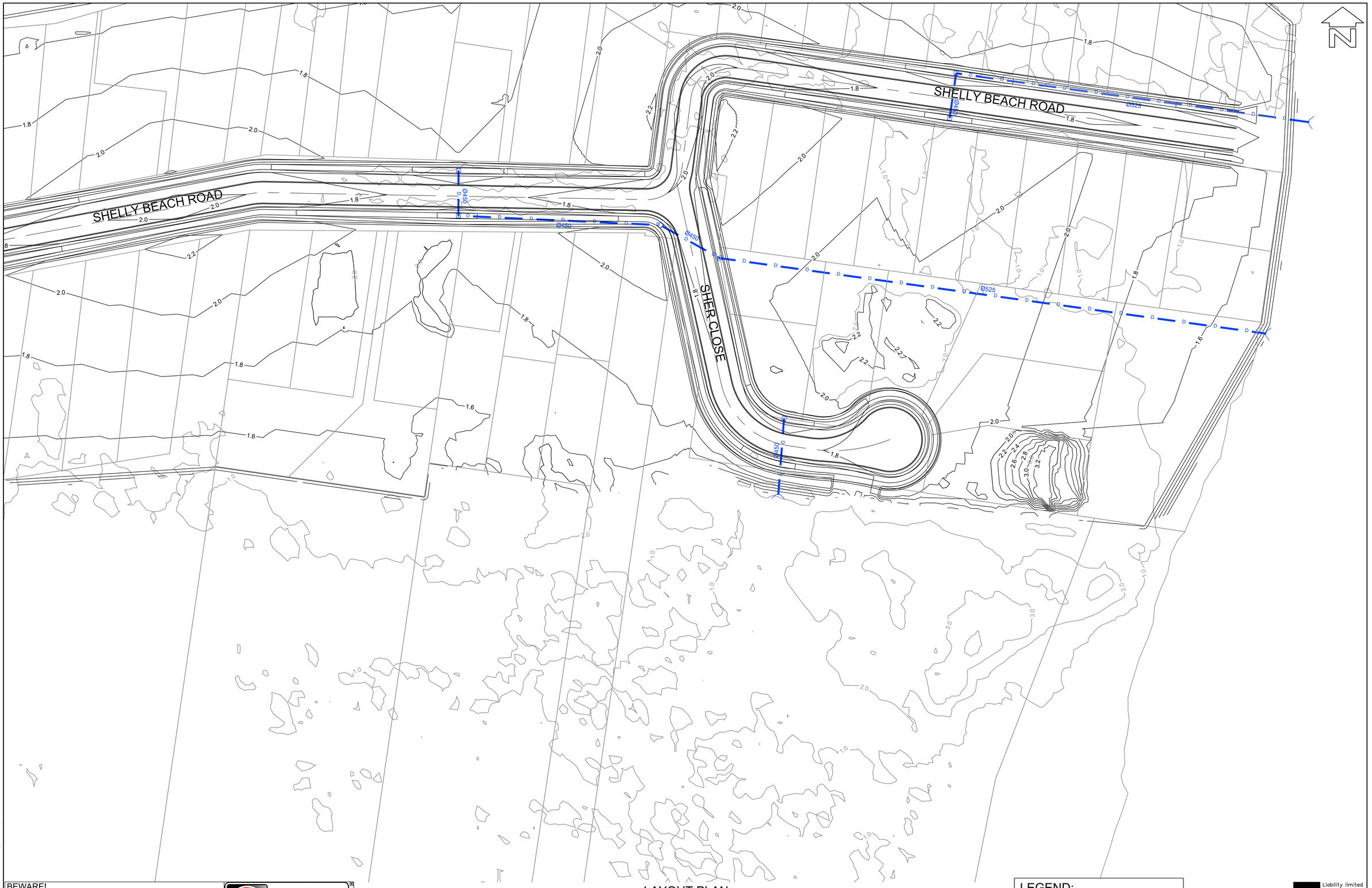

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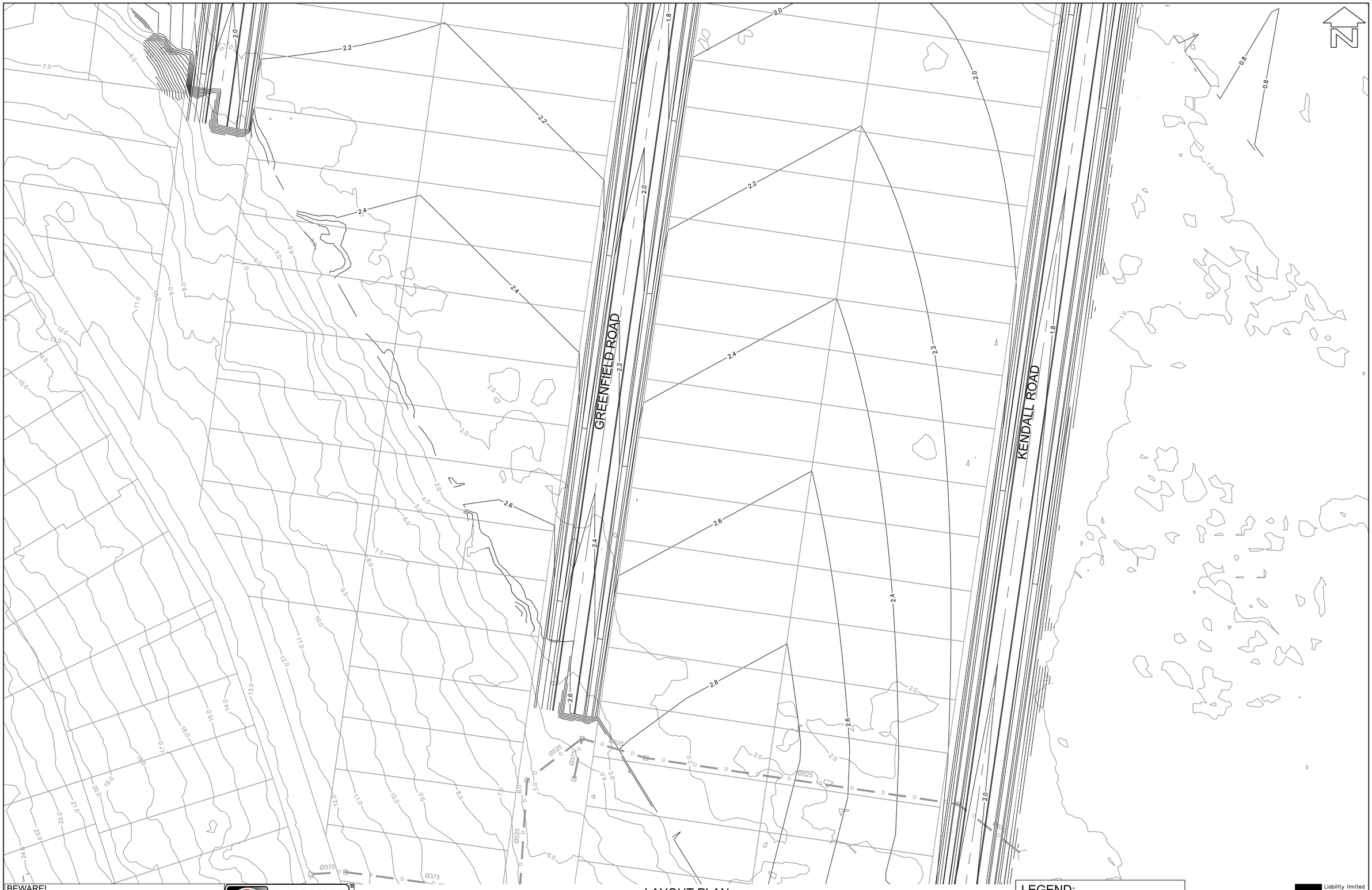

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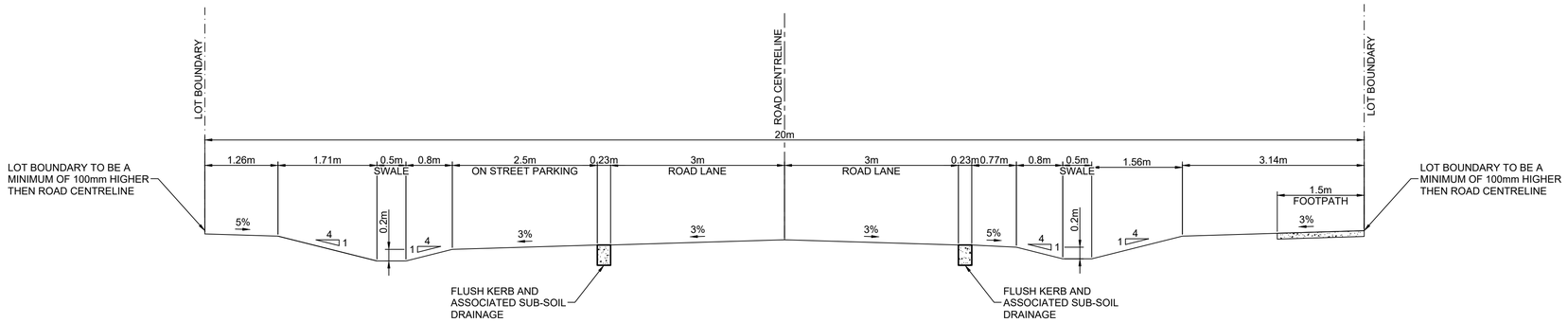

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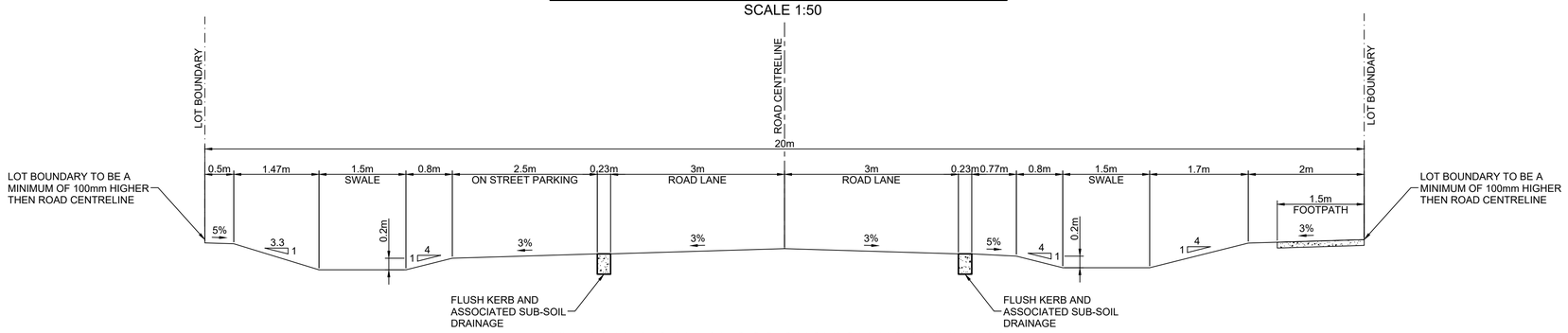

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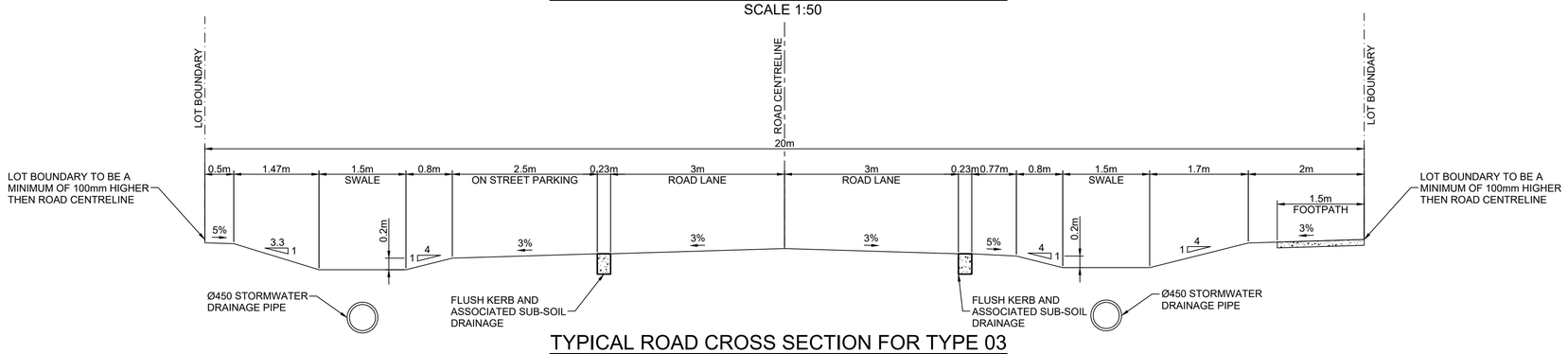

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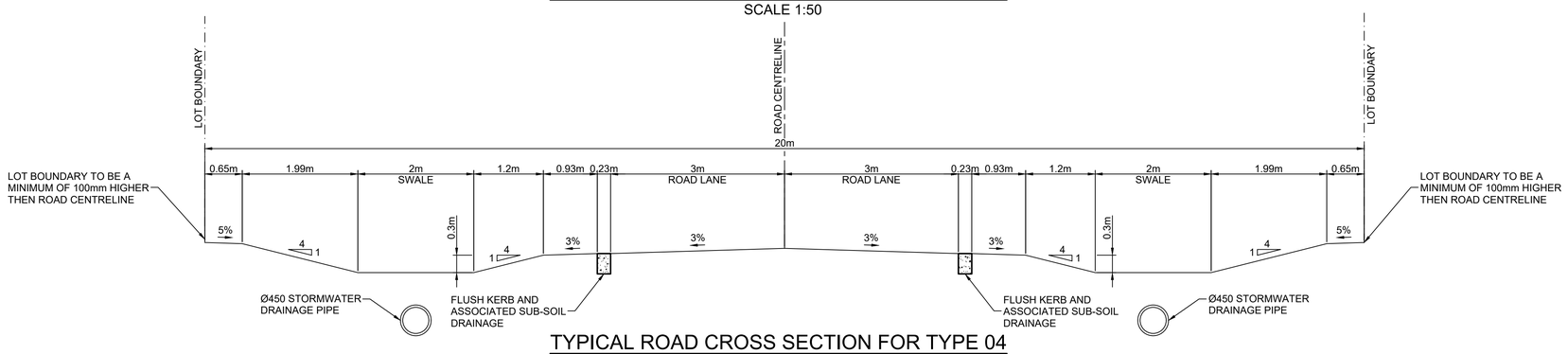

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EMPIRE BAY TYPICAL CROSS SECTIONS PLAN
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APPENDIX G

Economic Analysis

DAVISTOWN & EMPIRE BAY CLIMATE CHANGE ADAPTATION STUDY

Economic Assessment Technical Note

Reference: J1126 **Date : 12 November 2019 Rev: 2**

1 Introduction

Davistown and Empire Bay are both low lying suburbs within the Central Coast Local Government Area (LGA). A climate change adaptation study has been undertaken for Davistown and Empire Bay, as described in the draft *Davistown and Empire Bay Climate Change Adaptation Study* (Rhelm, 2019). This adaptation study describes the development of a draft landform and drainage masterplan for the suburbs of Empire Bay and Davistown, to manage the impacts of sea level rise and local drainage.

This Technical Note describes the economic assessment that has been undertaken on the proposed masterplan for Empire Bay and Davistown to understand the overall economic viability of implementing the proposed masterplan. This Technical Note forms an appendix of the climate change adaptation study (2019).

2 Key Assumptions

2.1 Economic Parameters

The following are the key parameters adopted for the economic assessment:

- Discount Rate of 7%;
- Economic Assessment Period from 2020 to 2100, aligning with the overall timeframe for implementation of the masterplan;
- All values are expressed in 2019 dollars unless otherwise noted; and
- Given the relatively long assessment period, no residual value has been assumed.

2.2 Brisbane Water Flooding

Only impacts from inundation as a result of Brisbane Water flooding have currently been considered in the economic analysis.

Local catchment flooding will be improved by the overall masterplan, following the implementation of all roads and associated drainage. This will occur towards the latter part of the overall economic assessment period, and the benefits are unlikely to be as significant (in dollar terms) as those considered in this assessment. Therefore, these have conservatively not been considered.

2.3 Sea Level Rise

The rate of sea level rise was assumed as per previous work and reporting, as discussed in Rhelm (2019). The key relevant levels are provided in **Table 2-1** (showing Brisbane Water flood levels). The 2015 levels are sourced from the Brisbane Water Flood Study (Cardno, 2010). The rate of sea level rise has been adopted from an independent report on projected sea level rise in Brisbane Water prepared by Doug Lord of Coastal Environment Pty Ltd and by Dr David Wainwright from Whitehead and Associates in 2015.

For simplicity, it has been assumed that there has been no sea level rise between 2015 and 2020, which represents the start of the economic assessment.

Table 2-1. Sea Level Rise Assumed

Year	Sea Level Rise (m)	1% POE	MHWS (m AHD)	PMF (m AHD)	0.5% AEP (m AHD)	1% AEP (m AHD)	2% AEP (m AHD)	5% AEP (m AHD)	10% AEP (m AHD)	20% AEP (m AHD)
2015	0	0.64	0.33	1.74	1.55	1.49	1.43	1.36	1.3	1.24
2020	0	0.64	0.33	1.74	1.55	1.49	1.43	1.36	1.3	1.24
2030	0.07	0.71	0.4	1.81	1.62	1.56	1.5	1.43	1.37	1.31
2050	0.2	0.84	0.53	1.94	1.75	1.69	1.63	1.56	1.5	1.44
2070	0.39	1.03	0.72	2.13	1.94	1.88	1.82	1.75	1.69	1.63
2100	0.74	1.38	1.07	2.48	2.29	2.23	2.17	2.1	2.04	1.98

3 Scenarios

An economic assessment is undertaken by comparing one alternative against another. It is important that these scenarios or alternatives are clearly defined to ensure a robust analysis. Three scenarios have been adopted for this assessment:

1. Base Case – this represents the 'Do-Minimum' scenario, and represents the base case against which the masterplan options are considered;
2. Masterplan Scenario – this scenario incorporates the masterplan as defined in Rhelm (2019), without the proposed levee around Davistown;
3. Masterplan with the Levee Scenario – this scenario incorporates the masterplan plus the levee as defined in Rhelm (2019). It is noted that the levee only benefits Davistown, and therefore there is no change to Empire Bay in this scenario, when compared to Scenario 2.

3.1 Base Case

The base case represents the 'Do-Minimum' scenario moving forward for both Empire Bay and Davistown. The basic premise under this scenario is that while redevelopment will occur (through renewal and redevelopment of properties), little will be done to specifically address climate change. Over time, with increasing sea level rise, it will be necessary to retreat from the area. It is noted that this is not necessarily reflective of Council policies, but rather as a baseline for the economic assessment.

3.1.1 Retreat

Under the base case, it is assumed that there would be minimal action to minimize the impacts of sea level rise, and that eventually properties would be forced to retreat (or abandoned) due to increased tidal inundation and more frequent storm surge inundation.

The point at which this occurs is difficult to estimate and will be dependent on what the community is willing to accept in terms of roads being inundation and properties inundated. In the absence of detailed studies on this issue for Davistown and Empire Bay, a trigger level based on the 1% Probability of Exceedance (1% PoE) has been adopted.

While roads may become inundated in some situations more frequently than properties, the 1% PoE inundation of individual properties was adopted as the trigger at which point a retreat would be undertaken. The 1% PoE represents the tidal level that would be experienced for a total duration of around 3.6 days on average per year.

Given that this would only occur during the high tide periods, this has the potential to occur over numerous tides and periods over a year and therefore was considered as a reasonable trigger for the economic analysis.

The 1% PoE over time was compared against the average ground level over a cadastral lot, based on the available LIDAR information for the area. The LiDAR data was extracted through GIS to determine the average ground level. It is noted that there would be lower ground levels on a property, and therefore this represents approximately 50% of the property that might be inundated by the 1% PoE.

The rate of properties abandoned, or rate of retreat is shown in **Figure 3-1**, as a percentage of the overall properties within the Masterplan study areas (approximately 899 in Davistown and 439 in Empire Bay).

The analysis suggests that the potential retreat would be more pronounced in the latter half of the century, with much larger proportions of properties in Davistown given that it is lower lying than Empire Bay on average. By 2100, roughly 84% of properties would have retreated in Davistown and 53% in Empire Bay.

It is possible that the proportions would be larger than this, particularly for Davistown, as the surrounding roads and services would become increasingly difficult to maintain. Further, as surrounding properties are abandoned, the remaining properties may become less viable. However, for the economic assessment this provided a reasonable basis for the evaluation.

Figure 3-2 and **Figure 3-3** show the histogram of average ground levels for the properties in both Empire Bay and Davistown. This shows the generally higher ground levels in Empire Bay on average, resulting in less retreat across the entire masterplan area compared with Davistown.

A further consideration would be the influence of coastal events. For example, a 20% AEP event that occurs at a higher level would have more significant impacts on the community and may result in a greater acceleration of retreat. However, this has been conservatively ignored for this assessment.

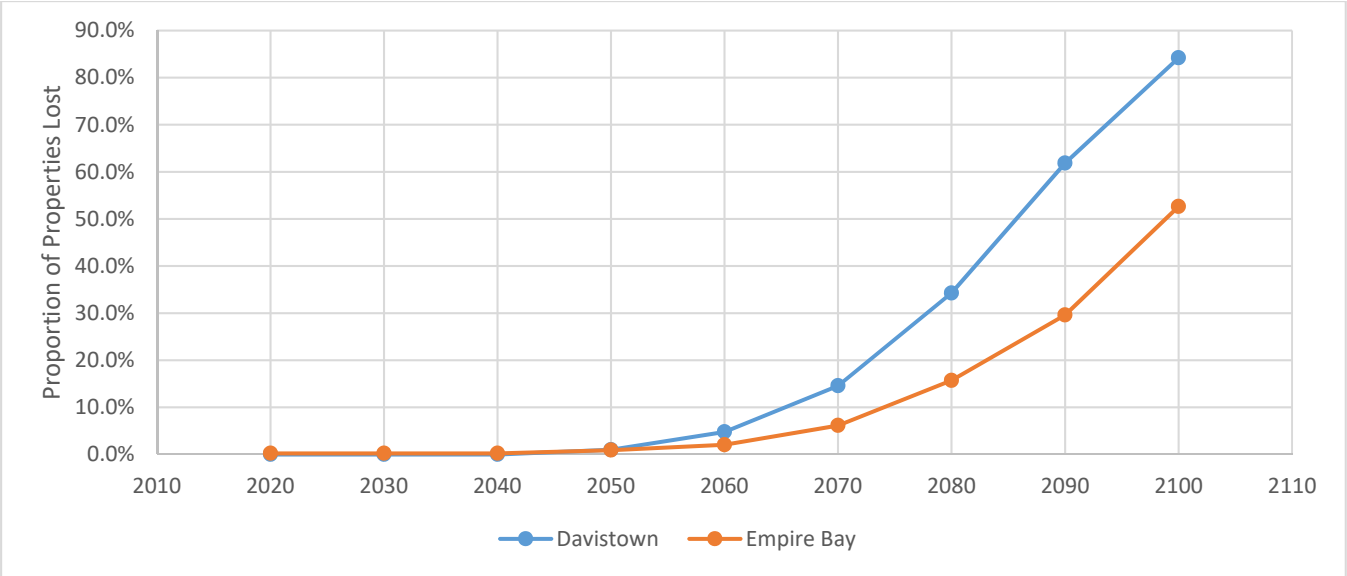

Figure 3-1. Rate of Retreat - Davistown and Empire Bay

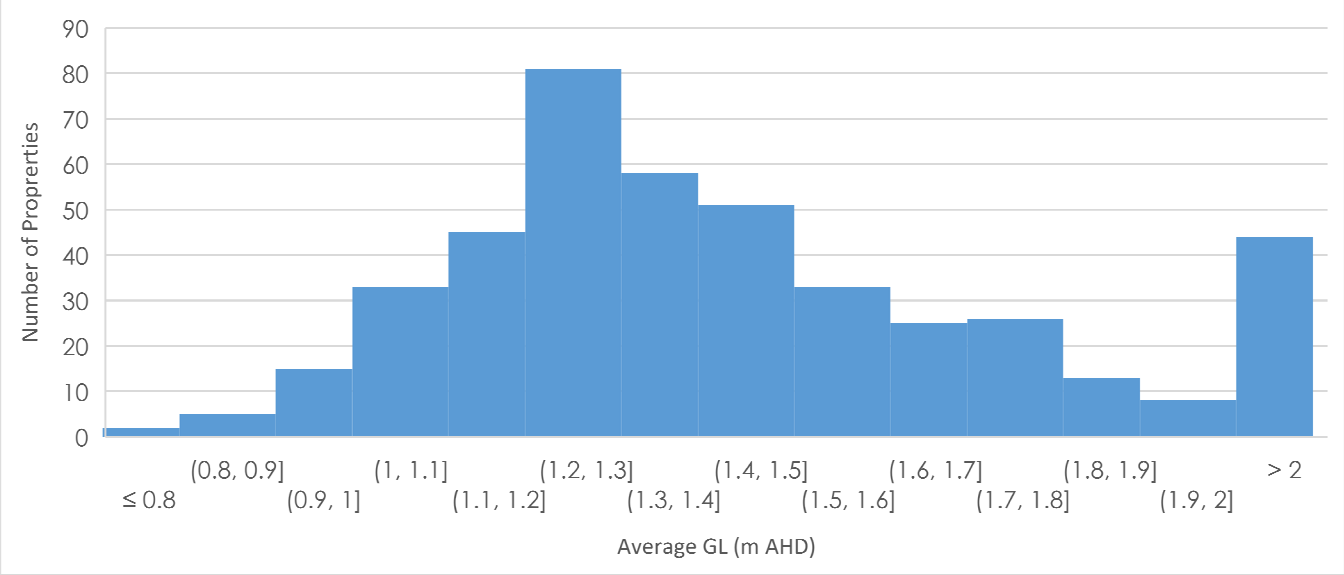

Figure 3-2. Histogram of Ground Levels - Empire Bay

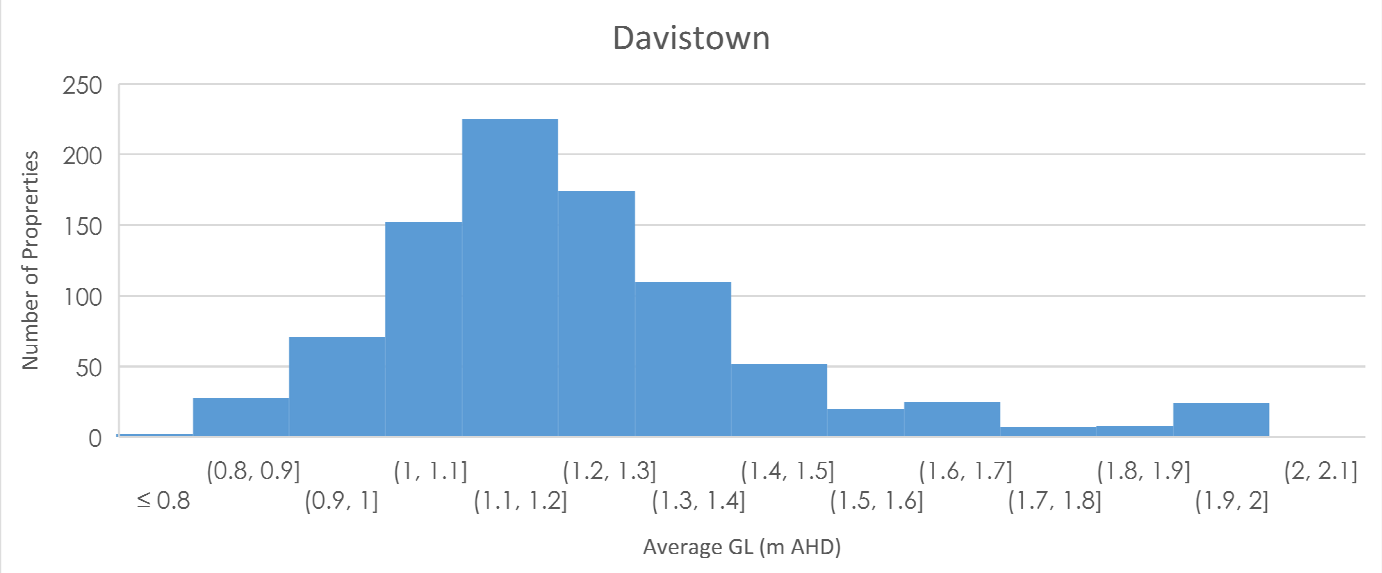

Figure 3-3. Histogram of Ground Level - Davistown

3.1.2 Redevelopment

The rate of retreat identified above occurs more significantly after 2070 to 2080. Given that this is relatively far in the future, it is likely that redevelopment would still occur in the interim time under the base case. Therefore, redevelopment has been included in the base case to reflect the natural renewal and redevelopment.

Based on Council's current policies regarding filling to achieve flood planning levels, it is assumed that Council would permit filling on properties, not for the entire property boundary but only primarily for the building footprint. The following was assumed:

- A typical floor area of a house is roughly 220m^2, NSW state-wide average floor areas[1] for new residential dwelling.
- It was assumed that most new housing stock would be two-storey, resulting in a building footprint of 110m^2.

[1] ABS - 8752.0 - Building Activity, Australia, Dec 2018

- As a part of a redevelopment of a property, a total of 220m^2 of filling was assumed, allowing for batter slopes, garages and other features etc.
- A fill level of 1.49m AHD was assumed, which represents the 1% AEP level at existing condition. It is assumed that the remainder for the flood planning level is achieved through raising of the property floor level.
- A floor level of 1% AEP plus a 0.5 metre freeboard plus a 0.3 metre climate change increase was assumed. This is generally in accordance with Council's existing policies, although it is noted that the climate change allowance varies depending on when the structure is approved. For simplicity, a constant 0.3 metres was adopted.

The rate of development is dependent on a number of factors, including the wider economy, age of the structure and residential market conditions. The interim masterplan from Rhelm (2019), as shown in Maps GE601 and GD707 identified a number of properties that were most likely to redevelop due to their age by 2050. These have been assumed to redevelop by 2050.

In addition, properties that are likely to be impacted by the 1% PoE by 2050 have assumed to be redeveloped in the 2025 – 2050 period. This assumes that they would redevelop in an attempt to mitigate the impacts of sea level rise prior to any abandonment.

A summary of the time periods and the redevelopment are provided in **Table 3-1**.

3.2 Masterplan Scenario

Under the masterplan scenario, properties and roads are progressively raised to the proposed masterplan ground levels as identified in Rhelm (2019) and summarised in GD701 and GE601. Further details on the masterplan are provided in Rhelm (2019).

Associated with the filling and redevelopment of properties, the new properties would have floor levels to comply with Council's development controls. The maximum floor level based on the following was adopted for the analysis:

- Flood planning level of 1%AEP plus 0.5 metre freeboard plus 0.3 metre climate change increase, as per the base case; or
- A level 0.3 metres above ground level, given that the masterplan ground levels exceed the FPL in some locations to achieve the overall surface.

It is assumed that the refinement of the masterplan, together with associated implementation of policies etc., would occur between 2020 and 2025. Therefore, the development of the masterplan would occur after 2025.

A summary of the proposed redevelopment timeframes is provided in **Table 3-1**.

3.3 Masterplan Scenario with Levee

Under this scenario, the masterplan would progress as per **Section 3.2**. However, a levee (as shown in GD706) would also be developed between 2025 and 2030 to provide interim protection for Davistown. This levee would be set at 1.5m AHD, providing protection up to the 1% AEP flood level under existing climatic conditions.

Table 3-1. Summary of Key assumptions - Redevelopment

Time Period	Base Case	Masterplan	Masterplan with Levee
2025 – 2050	Properties identified in GD706, as well as anywhere the 1% PoE would be inundated by 2050, are assumed to redevelop. Fill only within building footprint.	Properties identified in GD706, as well as anywhere the 1% PoE would be inundated by 2050, are assumed to redevelop. Fill properties to proposed masterplan level. Fill selected roads as identified in GD706.	2025 – 2030 : Stage 1 - Development of proposed levee to protect Davistown. 2025 – 2050 : Stage 2 – property filling and road development as per Masterplan Scenario
2050 – 2100	All remaining properties are assumed to redevelop.	All remaining properties and roads are raised and redeveloped as per GD701 and GE601.	As per masterplan scenario

4 Cost Estimates

High level concept cost estimates were prepared for the masterplan for Davistown and Empire Bay. These cost estimates were prepared by Allan Price and Scarratts based on the available conceptual design. Detailed cost estimate breakdowns are provided in Attachment 1. A summary is provided in **Table 4-1 and Table 4-2**.

4.1 Public Infrastructure

Table 4-1 and Table 4-2 provide an estimate of the capital costs associated with the roads and Davistown levee for the masterplan scenarios.

The rate and progress of the development of the roads is uncertain and will be dependent on when properties are filled and raised, as well as Council's available funding. In the absence of a detailed schedule, it has been assumed that the costs are equally spread over the periods of time shown in **Table 4-1 and Table 4-2**.

Table 4-1. Davistown Masterplan Cost Estimates - Public Infrastructure Components

Stages of Masterplan	Cost Estimate	Start Year	End Year
Stage 1 - Roads	$6,400,472	2025	2030
Stage 1 - Levee[2]	$10,410,400	2025	2030
Stage 2 - Roads	$ 8,948,934	2030	2050
Stage 3 - Roads	$44,065,569	2050	2100
Total	**$69,825,374**		

Table 4-2. Empire Bay Masterplan Cost Estimates - Public Infrastructure Components

Stages of Masterplan	Cost Estimate	Start Year	End Year
Stage 1 - Roads	$6,509,118	2025	2050
Stage 2 - Roads	$21,641,839	2050	2100
Total	**$28,150,957**		

[2] Only developed in the masterplan with levee scenario

4.2 Property Filling

The development of properties under both the base case and the masterplan scenarios results in filling on the properties. Under the base case, only a portion of the property is filled to achieve the flood planning level, while under the Masterplan the full property is assumed to be filled to the proposed masterplan level.

Two key periods were considered as identified in **Table 3-1**. It was assumed that the rate of redevelopment was constant over these periods.

The incremental cost of the masterplan is the cost to fill to the masterplan level, less then cost of any fill that might be undertaken under the base case scenario. The amount of fill estimated for the masterplan was based on the average depth of fill for the cadastral lot and multiplied by the area of the cadastral lot.

The cost of fill is difficult to estimate on a property by property basis. Dependent on the magnitude of the works being undertaken, then there may be some economies of scale if a number of properties are developed. For the purposes of this analysis, a flat rate of $\$40/m^3$ has been assumed.

A summary of the incremental cost of filling under the masterplan is shown in **Figure 4-1**. The total cost of filling for Davistown is $15.5M, and for Empire Bay is $7.9M (with no discounting).

It is noted that no cost has been estimated for the redevelopment of the building itself. It is assumed that this would be redeveloped under both the base case and the masterplan scenario, and therefore there is no change in incremental cost.

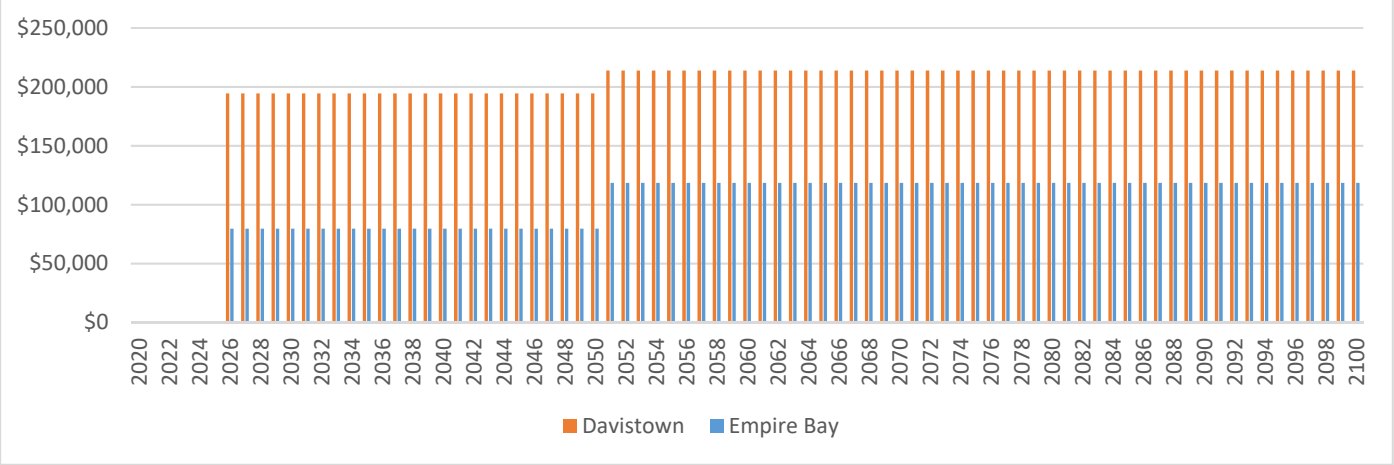

Figure 4-1. Incremental Cost of Filling - Masterplan Scenarios

4.3 Parks

As a part of the masterplan, there are a number of existing parks (both foreshore and recreational areas) that would be raised. An approximate $\$40/m^3$ was assumed, together with an allowance of $\$15/m^2$. This is an approximate value, as it would be highly dependent on the format of the park and the facilities. However, the overall costs for the park are relatively minor compared with the overall masterplan.

Staging of the works in the parks was assumed to occur either between 2025 – 2050 or 2050 – 2100, based on when the park would be inundated by the 1% PoE. Costs for the works were evenly spread across these periods, given the uncertainty of when the work would occur.

4.4 Maintenance

For the purposes of this assessment, the level of maintenance was assumed to be consistent across both the base case and the masterplan scenario. With the exception of the levee, the amount of public infrastructure and private infrastructure is similar, and therefore unlikely to be a significant variance in the overall annual maintenance.

A key issue would be the maintenance of services (such as water, sewer and drainage) with sea level rise. There are likely to become increasingly challenging maintenance requirements on these services moving forward. This has not been quantified for this assessment as it is likely to be a lower order of magnitude compared to other benefits in the assessment but remains a consideration for Council in maintaining their assets.

The levee is considered to be a relatively low maintenance item, particularly given that a large portion of it is an earthen embankment. There would likely be some specific costs associated with any flood gates that might be included with the levee. However, while there would be an overall increase in maintenance associated with this work, it was considered to be relatively minor overall. It is also likely to be balanced by an associated increase in cost in the base case as noted above.

4.5 Summary of Costs

A summary of the undiscounted costs is provided in **Table 4-3**. These are provided to give an indication of overall costs associated with the masterplan. They indicate that while the Davistown masterplan is more than double the cost of Empire Bay, this is reflective of the total area and the number of properties involved. The overall average cost per property is roughly the same. The levee increases the capital works by an additional $10.4M for Davistown.

While it is useful to review the overall costs involved, these costs will be spread over the period 2025 to 2100. The present value of these cost estimates is provided in **Table 4-4**. Given the relatively long timespan of the proposed masterplan, the present value costs are significantly less than the undiscounted costs. A key point to note, however, is that the levee, which is implemented early on within the overall timeframe, has a more significant impact on the costs for Davistown.

Table 4-3. Undiscounted Costs (in millions)

Stages of Masterplan	Roads	Levee	Property Filling	Parks	Total	No of Properties	Avg Cost per property
Davistown – no levee	$59.4	$10.4	$15.8	$4.7	$75.2	899	$84,000
Davistown	$59.4	$10.4	$15.8	$4.7	$90.3	899	$100,000
Empire Bay	$28.2	-	$7.9M	$0.7	$36.9	439	$84,000

Table 4-4. Present Value Costs of Masterplan Scenarios

Stages of Masterplan	Costs	No of Properties	Avg Cost per property
Davistown – no levee	$10.4M	899	$12,000
Davistown	$19.3M	899	$21,000
Empire Bay	$6.8M	439	$10,000

5 Benefits

5.1 Retreat and Loss of Properties

As identified in **Section 3.1.1**, it is assumed in the base case that retreat from individual properties would be triggered by the 1% PoE exceeding the average property ground level. This effectively results in the loss of both the building and land asset.

Typical property prices were estimated for Davistown and Empire Bay as shown in **Table 5-1**. These were estimated based on data from realestate.com.au and cross checked against information from propertyvalue.com.au. Rather than adopting separate values for Empire Bay and Davistown, given the similarities between the two suburbs an overall average was adopted, as identified in **Table 5-1**.

It was assumed that this loss of value would occur in the year when the 1% PoE reaches the average ground level of the property. In reality, it is likely that values of the properties would start to decline earlier than this, as it becomes evident that sea level rise will impact on the suburb. However, from an economic viewpoint it is conservative to assume that the loss in value occurs in the final year (i.e. year of abandonment).

The time series of the loss of property value is shown in **Figure 5-1**.

Table 5-1. Property Values in Davistown and Empire Bay[3]

Davistown	$770,000
Empire Bay	$741,250
Adopted	$755,625

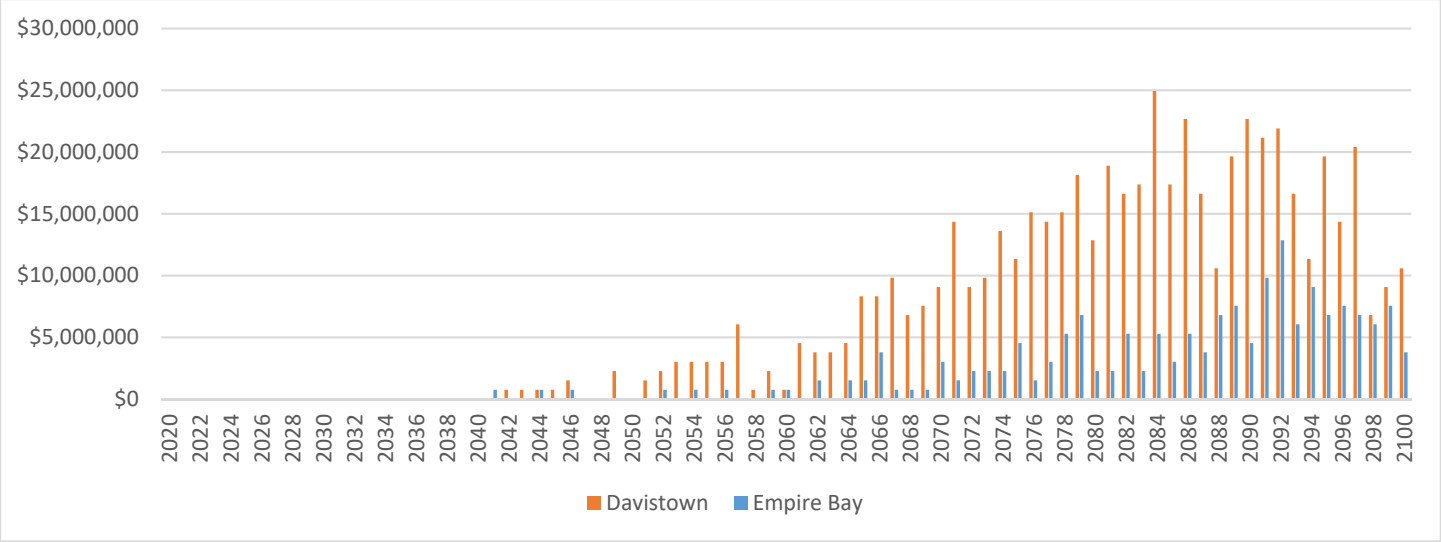

Figure 5-1. Retreat and Loss of Property Value

[3] Based on realestate.com.au suburb profile data (https://www.realestate.com.au/neighbourhoods/davistown-2251-nsw) and (https://www.realestate.com.au/neighbourhoods/empire-bay-2257-nsw) accessed on 10 August 2019. Data cross checked against propertyvalue.com.au (https://www.propertyvalue.com.au/map/empire%20bay-nsw-2257/buy)

5.2 Flood Damages

Flood damage is experienced on a property when flood waters inundate the property, resulting in overground flooding and potential overfloor flooding. This results in an economic impact, with repairs, damages to buildings and loss of building contents.

5.2.1 Flood Damage Curves

Flood damage curves are typically used to estimate the level of damage (in dollar terms) that is likely to be experienced at different depths of inundation. The Department of Planning, Industry and Environment have a guideline prepared that provides a methodology for estimating flood damages for residential structures (DECC, 2007). This guideline was adopted to establish a residential flood damage curve for Davistown and Empire Bay. Key assumptions in the derivation of these curves in accordance with the guideline:

- Changes in average weekly earnings from 2001 to 2019 – 1.89
- Building floor area – 220m^2
- Building Damage Repair Factor – 0.9 (assuming a reasonable duration of inundation)
- Level of flood awareness – Low
- The high set (Queenslander style) development was assumed not to be present in the study area, and therefore only slab on ground and two storey were adopted.

In addition, there are a few commercial properties in Empire Bay. ANUFLOOD estimate of commercial damages (for low value commercial) was adopted. Given the relatively small number of commercial properties these are unlikely to have a significant impact on the results.

A summary of the damage curves is provided in **Figure 5-2**. The damage curves typically have a portion of external damages that trigger when overground flooding of a property occurs. For both Davistown and Empire Bay, there are large numbers of properties with relatively shallow overground flooding. It was conservatively assumed that no external damages occurred when depths of overground flooding were less than 0.2 metres.

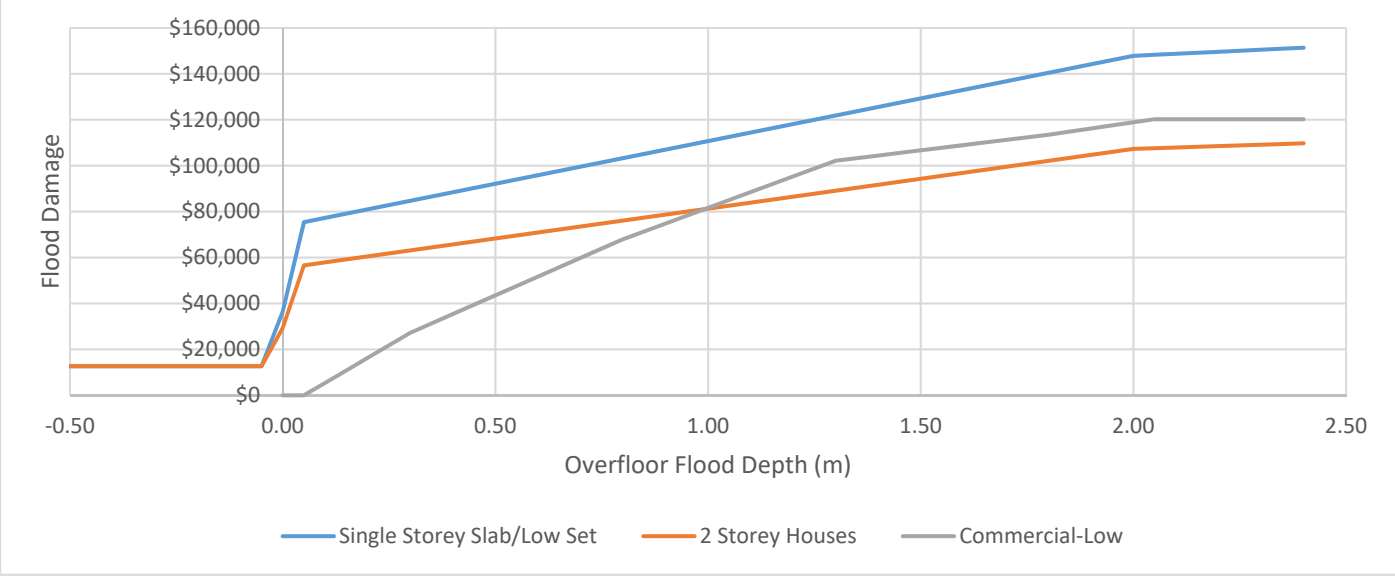

Figure 5-2. Flood Damage Curves

5.2.2 Flood Damages

Using the flood damage curves derived above, flood damages were calculated for Davistown and Empire Bay. Key inputs to this assessment:

- Floor Level Survey – based on information that was collected as a part of the *Brisbane Water Floodplain Risk Management Study* (Cardno, 2015). This data provides information on the floor level, as well as other property characteristics (such as two storey or one storey). It is noted that there are a small number of properties with no floor levels. These have conservatively been excluded from the analysis.
- Flood levels for Brisbane Water, as identified in **Table 2-1**.

Aligning with the information available and the key staging in the masterplan, the damages assessment was undertaken for four snapshots in time (2020, 2030, 2050 and 2100).

Under the base case, as identified in **Section 3.1.1**, retreat has been assumed for properties when the 1% PoE reaches the average property ground level. While this results in an impact on the loss of property value, the removal of that property results in a subsequent reduction in the number of properties exposed to flood damages. To account for this, these properties were removed from the damage analysis based on the period when their retreat would occur.

A summary of the damages and the overfloor flooding is provided in Attachment 2. A summary of the damages is provided in Figure 5-3 for the 2020 base case.

Annual Average Damages (AAD) is the typical method that is adopted in economics to annualise damage costs such as those in flooding based on their probabilities. This allows for the conversion of the different flood event damages into a singular annual average that represents (based on the overall probabilities of events) the most likely damage that is likely to be experienced in any given year. This process is described in detail in the Floodplain Development Manual (2005). It was assumed that there would be no damage in events more frequent than the 20% AEP.

The traditional approach is to calculate this AAD, and then assume that it remains constant for the economic assessment period. However, climate change results in a complication of this assumption, as the damage that is experienced in different flood events is likely to change, and therefore the AAD is no longer stationary.

In recognition of these changes, the AAD was calculated at four snapshots in time as noted above (2020, 2030, 2050 and 2100). It was then assumed that the AAD changed linearly between these snapshots, which effectively assumes a linear change in climate change and other time variant factors (such as the property retreat). These are summarised in **Figure 5-4 and Figure 5-5**.

An interesting outcome of the analysis is the reduction of AAD in Davistown in the Base Case Scenario. This is a result of a relatively large number of properties that have been abandoned through retreat, leading to a reduction in the AAD. A similar effect occurs for Empire Bay, although there are sufficient properties remaining, together with higher flood levels increasing damages, so that the AAD plateaus rather than reduces in 2100.

As the base case assumes that redevelopment will still occur, and that properties will build to the flood planning level, there are minimal differences in flood damages between the two scenarios. The key impact is the flood levee. Set at the 1% AEP level (existing climate), this results in significant benefits to a number of properties within the Davistown Area.

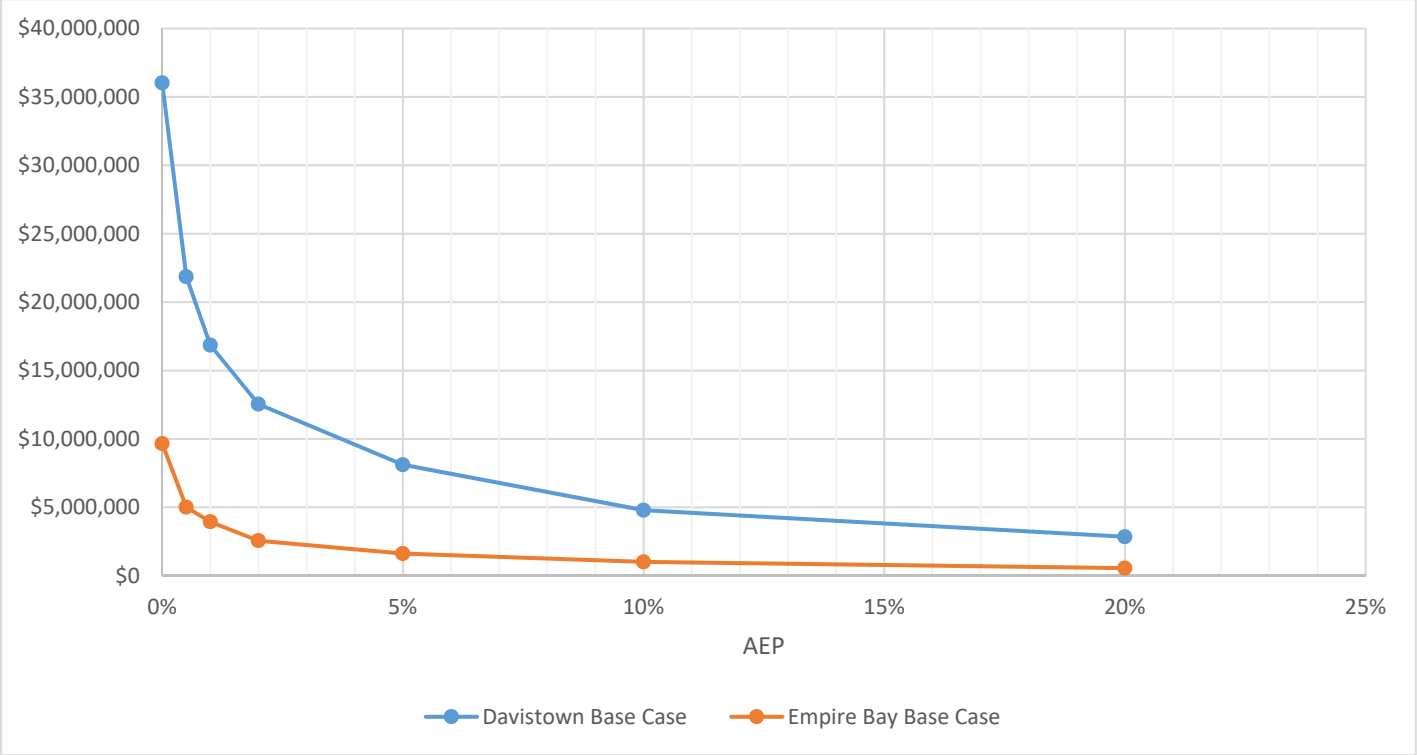

Figure 5-3. Flood Damages - Base Case – 2020

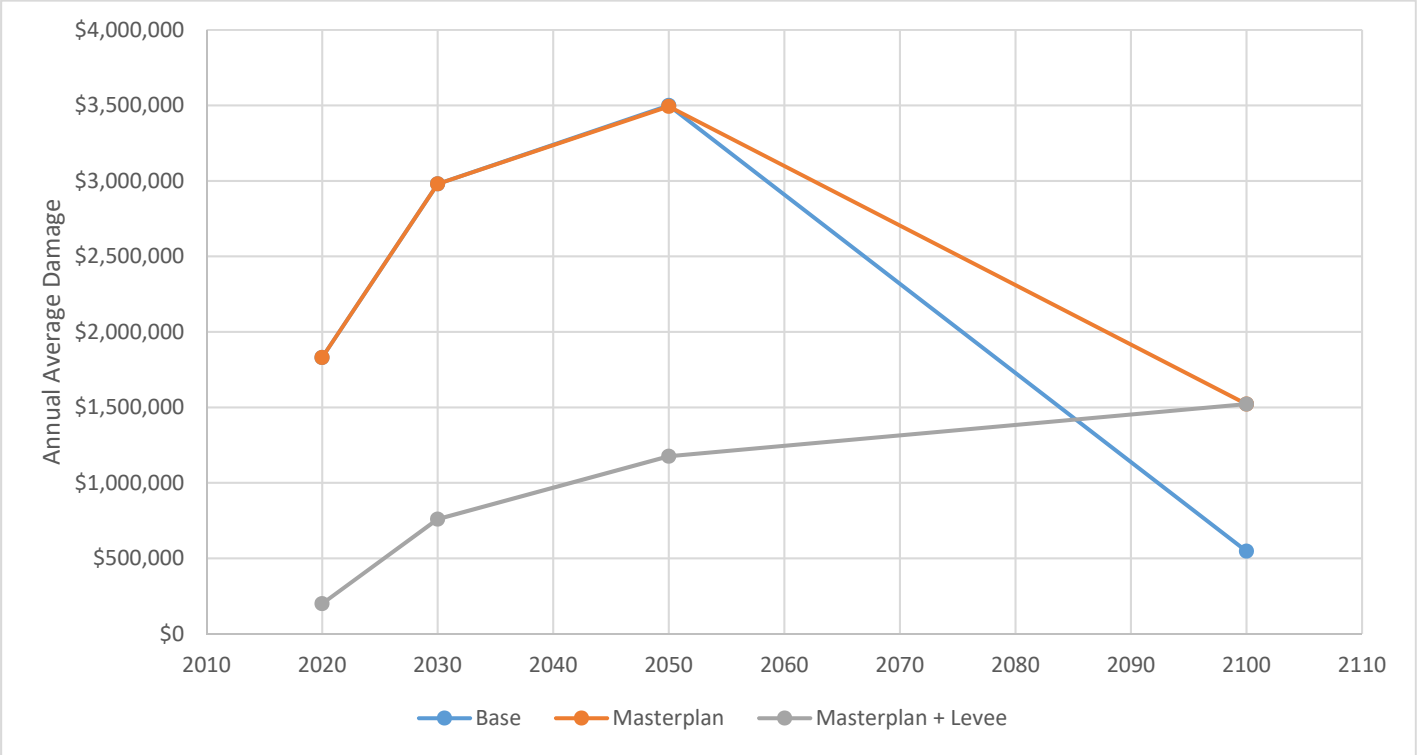

Figure 5-4. Davistown Annual Average Damage

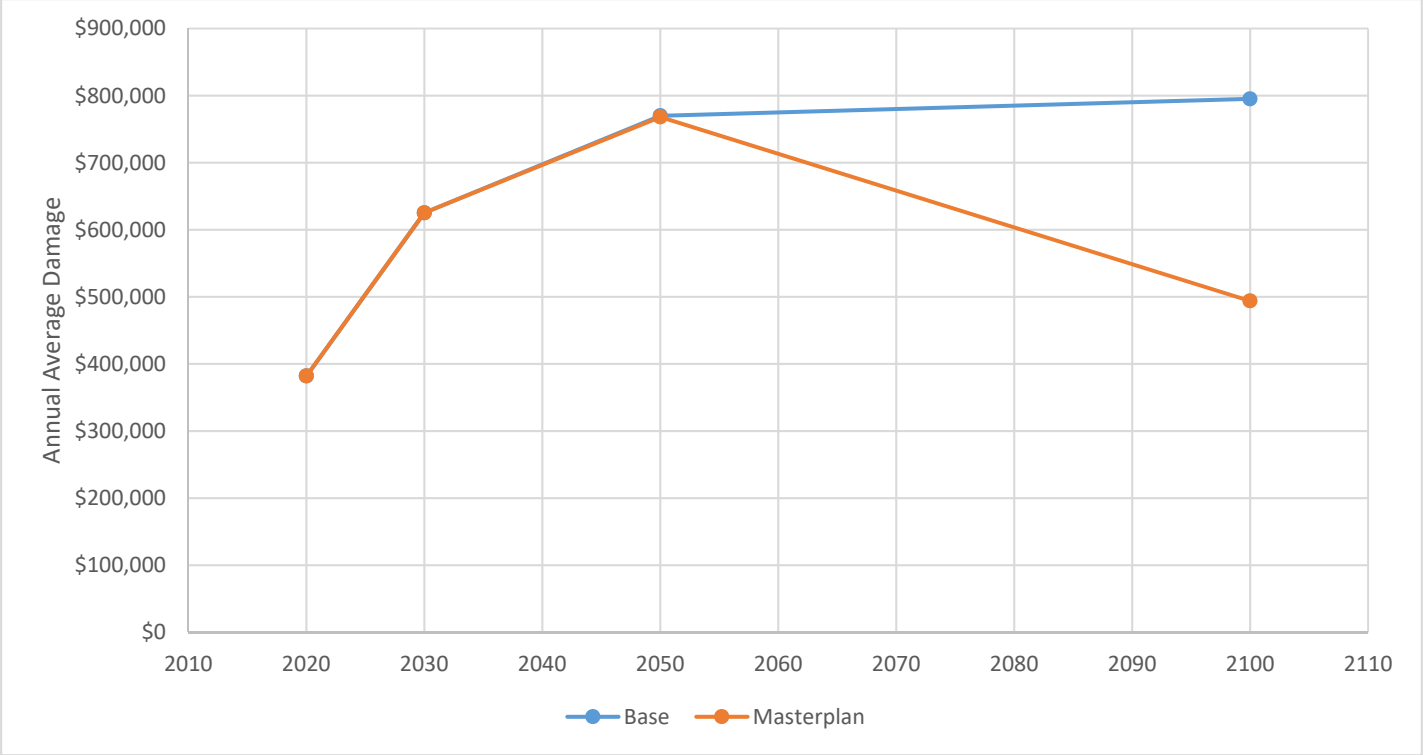

Figure 5-5. Empire Bay Annual Average Damage

5.3 Loss of Public Infrastructure

The retreat under the base case will progressively result in the loss of key public infrastructure, including parks, roads, nature reserves and utilities and services. Of these, the following was included in the economic analysis:

- Roads and associated smaller services – these are the road areas plus services (such as power, telecommunications) provided alongside the road. It does not include major services such as pumping stations and sub-stations;
- Parks, both passive foreshore parks and recreational parks in the study areas.

At this stage, other services, such as pumping stations, sub-stations have conservatively not been included in the analysis.

5.3.1 Roads

With increasing sea levels, the existing roads will progressively become less usable and eventually need to be abandoned unless raising of the roads, along the lines of the masterplan, is undertaken.

Using GIS, representative minimum, maximum and average levels along the various roads in the study area were extracted. Using this information, it was assumed that the road would be progressively abandoned once the 1% PoE reached the minimum ground level on the road[4]. It was assumed that there would be a linear loss of value between that point in time and when the 1% PoE reached the average ground level, when the entire road would be abandoned. The assumption on this basis is that once half of the road has been inundated by the 1% PoE, it is unlikely to be functional. This is particularly because a number of roads are undulating in the study area, and therefore there would be multiple points cut off along the road. Further, the minimum, average and maximum levels include road crest and gutter levels along a road, so may result in partial widths of the road being closed.

[4] The earliest year when this would occur was adopted as 2025

This is likely to be a relatively conservative assumption, given that the road base and services associated with the road would become progressively more difficult to maintain with rising sea levels.

The cost estimates provided in Attachment 1 were used as a basis to estimate the asset value of the roads. Table 5-2 shows the items that were included in order to estimate the asset values. Based on a representative selection of the roads within the study area under the masterplan, a typical value of approximately $1250 per metre was adopted.

A key consideration is understanding the point in its service life when the road would be abandoned. It is difficult to know when this would occur. For simplicity, it was assumed that on average the roads would be roughly 50% through their service life when they are abandoned.

Table 5-2. Cost Items included in Asset Value Estimate

Cost Component	Included (Y/N)	Comment
Establishment & Preliminaries	N	
Site Works	N	This generally includes the fill for the masterplan roads. Have excluded to be conservative.
Road works	Y	
Stormwater Drainage	Y	
Concrete Works	Y	
Signage and Road furniture	N	It was assumed that these would either be partially recoverable, or towards the end of their service life.
Testing and WAE	N	Assumed that this did not contribute to the asset value at the mid point of service life
Soil & Water management	N	Assumed that this did not contribute to the asset value at the mid point of service life
Service Conduit Installation	Y	
Miscellaneous	N	Assumed that this did not contribute to the asset value at the mid point of service life

5.3.2 Parks

Under the base case, the recreational (passive and active) parks in the study area would be progressively abandoned as they are inundated. The parks themselves have an economic value, which is combined by the value they provide to the community through recreational activities, visual amenity and general existence values.

Understanding this value would typically require detailed willingness to pay studies and surveys, or usage surveys on the parks. These types of studies have not been undertaken for the study area. In the absence of detailed studies, relevant literature reviewed.

Pascoe et al (2017) provides non-market values for a number of coastal areas, but does not include estimates for parkland. While there are some similar studies on parkland values, most require some estimate of the usage of the parkland. Given the immediate proximity to the water for a large amount of the parkland, the Pascoe et al (2017) was adopted as a basis to determine the parkland non-market non-use values.

A summary of the average non-use values from Pascoe et al (2017) are provided in Table 5-3. For the purposes of this study, it was conservatively assumed that the non-use value of the parks would be approximately $120/m^2, which is on the lowest end of these values.

A review of the average cadastral lot and property values as identified in Section 5.1, suggests that the average property value is around $950/m^2. Therefore, a value of $120/m^2 would appear to be in the appropriate order of magnitude, and likely a conservative estimate.

Table 5-3. Values for Different Areas (based on Pascoe, 2017)

	Value ($/square metre)
Sandy Beach	$263
Rocky Shoreline	$125
Dunes	$184
Scrubland	$149

For the parks, a minimum and maximum elevation were extracted for the base case. It was assumed that there would be a linear loss in value from the point at which the minimum elevation was inundation in the 1% PoE until the maximum elevation is reached. This assumes that the remaining areas of the park that are not inundated in a particular point of time are still operational and functional.

5.4 Unquantified Benefits

There are a number of unquantified benefits in this analysis. These generally have been excluded to be conservative, or where monetary values are more difficult to estimate. A summary of some of these includes:

- Loss of Public Infrastructure – no allowance was provided for the loss of public infrastructure assets beyond road and parks were included.
- Environmental values – no inclusion of environmental values was provided (other than through some non-use values for the parks). There is some opportunity in the masterplan to provide some protection of existing wetlands, by regulating tidal inflows. This may allow existing wetlands to be retained to some degree.
- Recreational value – under the base case, the existing foreshore parks would be lost as retreat is undertaken. These parks would have a recreational value associated with them and have an overall value. This has not been included in the assessment.

The unquantified benefits are discussed in more detail in the Adaptation Study (Rhelm, 2019).

5.5 Summary of Benefits

A summary of the benefits described above are summarised in **Table 5-4**.

Table 5-4. Summary of Benefits (in $ millions present values)

Stages of Masterplan	Property Retreat	Property Damages[5]	Road Loss	Park Loss	Total	No of Properties	Avg Benefit per property (in dollars)
Davistown	$12.9	-$0.5	$1.2	$1.7	$15.4	899	$17,000
Davistown – no levee	$12.9	$15.9	$1.2	$1.7	$31.8	899	$35,000
Empire Bay	$3.1	$0.2	$0.4	$0.3	$3.9	439	$9,000

[5] A negative benefit in property damages is observed for Davistown due to the properties that have retreated, and therefore in the base case there are less properties impacted over time than in the masterplan scenario

6 Economic Results

The economic assessment was undertaken by comparing the masterplan scenarios against the base case, for both Davistown and Empire Bay. These results are summarised in **Table 6-1**. In addition to the base assumption of a discount rate of 7%, 4% and 10% have also been tested.

For Davistown, the masterplan with no levee has a BCR of 1.5, with the present value of benefits exceeding the costs. This suggests that the masterplan is economically viable.

The incorporation of the levee provides a significant improvement for Davistown, with the BCR increasing to 1.7. This is a result of the significant reduction in flood damages both now and moving forward throughout the assessment period, which compensates for the increase cost of the levee relative to the masterplan scenario with no levee. It is also noted that the scenario with the levee provides additional benefits, such as flexibility in timing of filling and development of the masterplan levels, which is not incorporated in this analysis.

Empire Bay has a BCR of 0.9, suggesting that it is marginally unviable based on the assumptions in this report. However, the incorporation of some of the unquantified benefits may change this outcome.

It is also important to note, that as identified in Figure 3-2, the ground levels of the properties as a whole in Empire Bay are higher than those in Davistown. However, there are still a number of low lying areas. The economic outcome may improve if the masterplan were focused to more of the low lying properties. However, further testing would be required to confirm this.

Table 6-1. Summary of Economic Results[6]

Discount Rate	Davistown				Empire Bay	
	Masterplan - no levee		Masterplan - with levee		Masterplan	
	NPV	BCR	NPV	BCR	NPV	BCR
7%	$4.95M	1.5	$13.27M	1.7	$-0.41M	0.9
4%	$41.34M	3.1	$63.24M	3.1	$8.35M	2.0
10%	$-1.55M	0.8	$1.29M	1.1	$-1.35M	0.5

6.1 Sensitivity Analysis

To understand the sensitivity of the economic results to the key assumptions in the assessment, a sensitivity analysis was undertaken on some of the key parameters. These results are summarised in **Table 6-2**.

The results for Davistown show that the BCR would be unlikely to reduce below 1 for changes in costs and benefits within 20%. The biggest impact would be a slower sea level rise, if the rate of sea level rise were to reduce by 20% over the current assumed rates adopted by Council. Conversely, the BCR improves significantly with a 20% increase in the rate of sea level rise.

The key influence of sea level rise is the rate at which properties are impacted by tidal inundation, as well as the frequency in which overground and overfloor flooding is experienced. Given the influence of this on the results, this may suggest that a trigger-based approach may be warranted, aligning the raising of roads to trigger levels rather than specific periods of time.

[6] BCR – Benefit Cost Ratio, NPV – Net Present Value

However, for properties, the length of time for a redevelopment to occur may suggest that this would need to be opportunistic, rather than based on specific trigger levels.

Table 6-2. Sensitivity Analysis

Sensitivity Scenario	Davistown				Empire Bay	
	Masterplan - no levee		Masterplan - with levee		Masterplan	
	NPV	BCR	NPV	BCR	NPV	BCR
Costs +20%	$3.29M	1.3	$10.31M	1.5	$-1.04M	0.8
Costs -20%	$6.61M	1.8	$16.23M	2.0	$0.22M	1.1
Benefits + 20%	$8.03M	1.8	$19.62M	2.1	$0.37M	1.1
Benefits - 20%	$1.87M	1.2	$6.92M	1.4	$-1.19M	0.7
SLR[7] - 20%	$-0.71M	0.9	$6.51M	1.4	$-1.77M	0.6
SLR + 20%	$12.32M	2.2	$23.22M	2.3	$1.64M	1.4

7 Conclusions

An economic assessment has been undertaken on the draft masterplan prepared for Davistown and Empire Bay as a part of the Rhelm (2019) *Davistown and Empire Bay Climate Change Adaptation Study*. This assessment has compared a Base Case or 'Do-Minimum' scenario against masterplan scenarios for both Davistown and Empire Bay.

The results suggest that the masterplan is economically viable for Davistown, with a BCR of 1.3 without the levee, and 1.7 with the levee. Empire Bay has a lower BCR of 0.9, which suggests that it is marginal unviable. However, there are a number of unquantified benefits that may change this outcome.

8 References

Cardno (2015a) Brisbane Water Foreshore Floodplain Risk Management Study

Cardno Lawson Treloar (2010) Brisbane Water Foreshore Flood Study

Department of Environment and Climate Change (2007) *Floodplain Risk Management Guideline - Residential Flood Damages*, Revision 1, October.

NSW Government (2005). *Floodplain Development Manual.*

Pascoe, S., Doshi, A., Kovac M. & Austin, A. (2017). *What's my beach worth? Economic values of NSW coastal Assets*. NSW Coastal Conference: November 2017. Port Stephens, NSW.

Rhelm (2019). *Davistown and Empire Bay Climate Change Adaptation Study*, draft, Rev2, May.

[7] SLR = Sea Level Rise

ATTACHMENT 1 – COST ESTIMATES

Allen Price & Scarratts
Land & Development Consultants
NOWRA AND KIAMA - NSW

Key Assumptions

Cost estimates have been prepared on the basis on Allen Price & Scarratts drawings K128161_101 to 120, Rev P0.

No investigation, survey or design has been undertaken to assist with the preparation of the quantities and cost estimates.

No investigation in relation into any utility services locations, sizing, or current/future capacity of utility services has been undertaken.

No investigation in relation into any sewerage or water reticulation location, sizing, or current/future capacity of has been undertaken.

No liaison has been undertaken with any service authority or the local Council to ascertain their requirements in relation to design or construction requirements.

No geotechnical investigation has been undertaken.

Cost estimates have been prepared for budget estimate forecasting only and should not be relied upon as a true reflection of the costs associated with land raising of this nature given the lack of investigation, survey and design available at the time of preparing the estimates.

Allen Price & Scarratts
Land & Development Consultants
NOWRA AND KIAMA - NSW

ESTIMATED QUANTITIES

Stg 1-Morton Crescent, Pyang Avenue

Road

ITEM	DESCRIPTION	QTY	UNIT	RATE	AMOUNT excl GST
1	**ESTABLISHMENT AND PRELIMINARIES**				
1.1	Establishment	1	Item	20,000	20,000
1.2	Set out works	1	Item	10,000	10,000
1.3	Services location	1	Item	5,000	5,000
1.4	Traffic & Pedestrian Management Plan	1	Item	30,000	30,000
1.5	Stabilised site access and wash bay	1	Each	15,000	15,000
				Subtotal	**80,000**
2	**SITE WORKS**				
2.1	Demolition (allowance)	0.7	ha	100,000	69,400
2.2	Import, place and compact select fill	3432	m^3	40	137,269
2.3	Trim and compact verge areas and swales	3991	m^2	5	19,953
2.4	Topsoil and turf verge areas and swales	3470	m^2	10	34,700
2.5	Street trees	46	each	500	23,133.33
				Subtotal	**284,454.43**
3	**ROADWORKS**				
3.1	**Road Pavement (8.5m wide)**				
3.2	Trim and Compact Subgrade	3297	m^2	5	16,483
3.3	Subbase DGB20 (280mm thick)	3297	m^2	25	82,413
3.4	Base Course DGB20 (120mm thick)	2950	m^2	15	44,243
3.5	Prime Seal	2950	m^2	8	23,596
3.6	Asphalt AC10 (min 30mm thick)	2950	m^2	25	73,738
				Subtotal	**240,471**
4	**STORMWATER DRAINAGE**				
4.1	DN450 RRJ Class 3	15	m	250	3,750
4.2	Pit (900x900)	1	each	2,500	2,500
4.3	DN450mm Headwall	1	Item	1,500	1,500
4.4	DN100mm subsoil drainage	694	m	35	24,290
				Subtotal	**32,040**
5	**CONCRETE WORKS**				
5.1	Kerb - Edge strip	694	m	50	34,700
5.2	Footpath - 1.5m wide	347	m	150	52,050
				Subtotal	**86,750**
6	**SIGNAGE & ROAD FURNITURE**				
6.1	Signage and linemarking	347	m	15	5,205
				Subtotal	**5,205**
7	**TESTING & WAE**				
7.1	Density testing	347	m	20	6,940
7.2	Road & drainage works as executed	347	Item	15	5,205
				Subtotal	**12,145**

8	**SOIL AND WATER MANAGEMENT**				
8.1	Soil and water management	347	m	20	6,940
				Subtotal	**6,940**
9	**SERVICE CONDUIT INSTALLATION**				
9.1	Install new elec and comms road crossings	347	m	20	6,940
9.2	Install new water conduit crossings	231	m	15	3,470
				Subtotal	**10,410**
10	**MISCELLANEOUS**				
10.1	Road ends transition allowance	2	Each	10,000	20,000
10.2	Clean-up and disestablish	1	Item	10,000	10,000
				Subtotal	**30,000**
				Sub-total (excl GST)	**788,415**
				Contingency (30%)	**236,525**
				Total (excl GST)	**1,024,940**

Reticulated services

11	**Reticulated services**				
11.1	Underground electricity and street lighting	31	Lots	8,000	248,000
11.2	Underground telecommunications	31	Lots	1,000	31,000
11.3	Water reticulation	31	Lots	3,000	93,000
11.3	Re-connections allowance	31	Lots	10,000	310,000
				Subtotal	**682,000**
				Sub-total (excl GST)	**682,000**
				Contingency (30%)	**204,600**
				Total (excl GST)	**886,600**

Consultancy services

12	**Consultancy services**				
12.1	Survey, design and construction management	31	Lots	2,500	77,500
12.2	Geotechnical/pavement design	31	Lots	150	4,650
12.3	Electrical and street lighting design	31	Lots	250	7,750
12.4	Telecommunications design	31	Lots	80	2,480
				Subtotal	**92,380**
				Sub-total (excl GST)	**92,380**
				Contingency (20%)	**18,476**
				Total (excl GST)	**110,856**

Authority design and inspection fees

13	**Authority design and inspection fees**				
13.1	Electricity authority	31	Lots	100	3,100
13.2	Telecommunications authority	31	Lots	600	18,600
13.3	Council	31	Lots	300	9,300
13.4	Water authority	31	Lots	80	2,480
				Subtotal	**33,480**
				Sub-total (excl GST)	**33,480**
				Contingency (20%)	**6,696**
				Total (excl GST)	**40,176**
	Grand Total including contingency (excl GST)				**2,062,572**

Allen Price & Scarratts
Land & Development Consultants
NOWRA AND KIAMA - NSW

ESTIMATED QUANTITIES

Stg 1-Davistown Road, Emora Avenue, Murna Road

Road

ITEM	DESCRIPTION	QTY	UNIT	RATE	AMOUNT excl GST
1	**ESTABLISHMENT AND PRELIMINARIES**				
1.1	Establishment	1	Item	20,000	20,000
1.2	Set out works	1	Item	15,000	15,000
1.3	Services location	1	Item	10,000	10,000
1.4	Traffic & Pedestrian Management Plan	1	Item	60,000	60,000
1.5	Stabilised site access and wash bay	2	Each	15,000	30,000
				Subtotal	**135,000**
2	**SITE WORKS**				
2.1	Demolition (allowance)	1.0	ha	100,000	101,400
2.2	Import, place and compact select fill	6947	m^3	40	277,877
2.3	Trim and compact verge areas and swales	5831	m^2	5	29,153
2.4	Topsoil and turf verge areas and swales	5070	m^2	10	50,700
2.5	Street trees	68	each	500	33,800.00
				Subtotal	**492,929.10**
3	**ROADWORKS**				
3.1	**Road Pavement (8.5m wide)**				
3.2	Trim and Compact Subgrade	4817	m^2	5	24,083
3.3	Subbase DGB20 (280mm thick)	4817	m^2	25	120,413
3.4	Base Course DGB20 (120mm thick)	4310	m^2	15	64,643
3.5	Prime Seal	4310	m^2	8	34,476
3.6	Asphalt AC10 (min 30mm thick)	4310	m^2	25	107,738
3.7	Extra-over for roundabout re-construction	1	Item	150,000	150,000
				Subtotal	**501,351**
4	**STORMWATER DRAINAGE**				
4.1	DN900 RRJ Class 3	37	m	550	20,350
4.2	Pit (1200x1200)	1	each	4,000	4,000
4.3	Pit (1500x1500)	1	each	5,000	5,000
4.4	DN900mm Headwall	1	Item	3,500	3,500
4.5	1.3 x 0.3 RCBC	16	m	900	14,400
4.6	DN100mm subsoil drainage	1014	m	35	35,490
				Subtotal	**82,740**
5	**CONCRETE WORKS**				
5.1	Kerb - Edge strip	1014	m	50	50,700
5.2	Footpath - 1.5m wide	507	m	150	76,050
				Subtotal	**126,750**
6	**SIGNAGE & ROAD FURNITURE**				
6.1	Signage and linemarking	507	m	15	7,605
6.2	Bus shelter	1	Each	10,000	10,000
				Subtotal	**17,605**
7	**TESTING & WAE**				
7.1	Density testing	507	m	20	10,140

7.2	Road & drainage works as executed	507	Item	15	7,605
				Subtotal	**17,745**
8	**SOIL AND WATER MANAGEMENT**				
8.1	Soil and water management	507	m	20	10,140
				Subtotal	**10,140**
9	**SERVICE CONDUIT INSTALLATION**				
9.1	Install new elec and comms road crossings	507	m	20	10,140
9.2	Install new water conduit crossings	338	m	15	5,070
				Subtotal	**15,210**
10	**MISCELLANEOUS**				
10.1	Road ends transition allowance	4	Each	10,000	40,000
10.2	Clean-up and disestablish	1	Item	10,000	10,000
				Subtotal	**50,000**
				Sub-total (excl GST)	**1,449,470**
				Contingency (30%)	**434,841**
				Total (excl GST)	**1,884,311**

Reticulated services

11	**Reticulated services**				
11.1	Underground electricity and street lighting	20	Lots	8,000	160,000
11.2	Underground telecommunications	20	Lots	1,000	20,000
11.3	Water reticulation	20	Lots	3,000	60,000
11.3	Re-connections allowance	20	Lots	10,000	200,000
				Subtotal	**440,000**
				Sub-total (excl GST)	**440,000**
				Contingency (30%)	**132,000**
				Total (excl GST)	**572,000**

Consultancy services

12	**Consultancy services**				
12.1	Survey, design and construction management	20	Lots	2,500	50,000
12.2	Geotechnical/pavement design	20	Lots	150	3,000
12.3	Electrical and street lighting design	20	Lots	250	5,000
12.4	Telecommunications design	20	Lots	80	1,600
				Subtotal	**59,600**
				Sub-total (excl GST)	**59,600**
				Contingency (20%)	**11,920**
				Total (excl GST)	**71,520**

Authority design and inspection fees

13	**Authority design and inspection fees**				
13.1	Electricity authority	20	Lots	100	2,000
13.2	Telecommunications authority	20	Lots	600	12,000
13.3	Council	20	Lots	300	6,000
13.4	Water authority	20	Lots	80	1,600
				Subtotal	**21,600**
				Sub-total (excl GST)	**21,600**
				Contingency (20%)	**4,320**
				Total (excl GST)	**25,920**
	Grand Total including contingency (excl GST)				**2,553,751**

Allen Price & Scarratts
Land & Development Consultants
NOWRA AND KIAMA - NSW

ESTIMATED QUANTITIES

Stg 1-Dilgara Avenue

Road

ITEM	DESCRIPTION	QTY	UNIT	RATE	AMOUNT excl GST
1	**ESTABLISHMENT AND PRELIMINARIES**				
1.1	Establishment	1	Item	20,000	20,000
1.2	Set out works	1	Item	10,000	10,000
1.3	Services location	1	Item	5,000	5,000
1.4	Traffic & Pedestrian Management Plan	1	Item	10,000	10,000
1.5	Stabilised site access and wash bay	1	Each	15,000	15,000
				Subtotal	**60,000**
2	**SITE WORKS**				
2.1	Demolition (allowance)	0.2	ha	100,000	16,200
2.2	Import, place and compact select fill	904	m^3	40	36,158
2.3	Trim and compact verge areas and swales	932	m^2	5	4,658
2.4	Topsoil and turf verge areas and swales	810	m^2	10	8,100
2.5	Street trees	11	each	500	5,400.00
				Subtotal	**70,515.30**
3	**ROADWORKS**				
3.1	**Road Pavement (8.5m wide)**				
3.2	Trim and Compact Subgrade	770	m^2	5	3,848
3.3	Subbase DGB20 (280mm thick)	770	m^2	25	19,238
3.4	Base Course DGB20 (120mm thick)	689	m^2	15	10,328
3.5	Prime Seal	689	m^2	8	5,508
3.6	Asphalt AC10 (min 30mm thick)	689	m^2	25	17,213
				Subtotal	**56,133**
4	**STORMWATER DRAINAGE**				
4.1	DN100mm subsoil drainage	162	m	35	5,670
				Subtotal	**5,670**
5	**CONCRETE WORKS**				
5.1	Kerb - Edge strip	162	m	50	8,100
5.2	Footpath - 1.5m wide	81	m	150	12,150
				Subtotal	**20,250**
6	**SIGNAGE & ROAD FURNITURE**				
6.1	Signage and linemarking	81	m	15	1,215
				Subtotal	**1,215**
7	**TESTING & WAE**				
7.1	Density testing	81	m	20	1,620
7.2	Road & drainage works as executed	81	Item	15	1,215
				Subtotal	**2,835**
8	**SOIL AND WATER MANAGEMENT**				

8.1	Soil and water management	81	m	20	1,620
				Subtotal	**1,620**
9	**SERVICE CONDUIT INSTALLATION**				
9.1	Install new elec and comms road crossings	81	m	20	1,620
9.2	Install new water conduit crossings	54	m	15	810
				Subtotal	**2,430**
10	**MISCELLANEOUS**				
10.1	Road ends transition allowance	2	Each	10,000	20,000
10.2	Clean-up and disestablish	1	Item	10,000	10,000
				Subtotal	**30,000**
				Sub-total (excl GST)	**250,668**
				Contingency (30%)	**75,200**
				Total (excl GST)	**325,869**

Reticulated services

11	**Reticulated services**				
11.1	Underground electricity and street lighting	11	Lots	8,000	88,000
11.2	Underground telecommunications	11	Lots	1,000	11,000
11.3	Water reticulation	11	Lots	3,000	33,000
11.3	Re-connections allowance	11	Lots	10,000	110,000
				Subtotal	**242,000**
				Sub-total (excl GST)	**242,000**
				Contingency (30%)	**72,600**
				Total (excl GST)	**314,600**

Consultancy services

12	**Consultancy services**				
12.1	Survey, design and construction management	11	Lots	2,500	27,500
12.2	Geotechnical/pavement design	11	Lots	150	1,650
12.3	Electrical and street lighting design	11	Lots	250	2,750
12.4	Telecommunications design	11	Lots	80	880
				Subtotal	**32,780**
				Sub-total (excl GST)	**32,780**
				Contingency (20%)	**6,556**
				Total (excl GST)	**39,336**

Authority design and inspection fees

13	**Authority design and inspection fees**				
13.1	Electricity authority	11	Lots	100	1,100
13.2	Telecommunications authority	11	Lots	600	6,600
13.3	Council	11	Lots	300	3,300
13.4	Water authority	11	Lots	80	880
				Subtotal	**11,880**
				Sub-total (excl GST)	**11,880**
				Contingency (20%)	**2,376**
				Total (excl GST)	**14,256**
	Grand Total including contingency (excl GST)				**694,061**

Allen Price & Scarratts
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NOWRA AND KIAMA - NSW

ESTIMATED QUANTITIES

Stg 1-Magnolia Avenue, Kincumber Crescent

Road

ITEM	DESCRIPTION	QTY	UNIT	RATE	AMOUNT excl GST
1	**ESTABLISHMENT AND PRELIMINARIES**				
1.1	Establishment	1	Item	20,000	20,000
1.2	Set out works	1	Item	10,000	10,000
1.3	Services location	1	Item	5,000	5,000
1.4	Traffic & Pedestrian Management Plan	1	Item	30,000	30,000
1.5	Stabilised site access and wash bay	1	Each	15,000	15,000
				Subtotal	**80,000**
2	**SITE WORKS**				
2.1	Demolition (allowance)	0.4	ha	100,000	38,600
2.2	Import, place and compact select fill	2195	m^3	40	87,783
2.3	Trim and compact verge areas and swales	2220	m^2	5	11,098
2.4	Topsoil and turf verge areas and swales	1930	m^2	10	19,300
2.5	Street trees	26	each	500	12,866.67
				Subtotal	**169,647.57**
3	**ROADWORKS**				
3.1	**Road Pavement (8.5m wide)**				
3.2	Trim and Compact Subgrade	1834	m^2	5	9,168
3.3	Subbase DGB20 (280mm thick)	1834	m^2	25	45,838
3.4	Base Course DGB20 (120mm thick)	1641	m^2	15	24,608
3.5	Prime Seal	1641	m^2	8	13,124
3.6	Asphalt AC10 (min 30mm thick)	1641	m^2	25	41,013
				Subtotal	**133,749**
4	**STORMWATER DRAINAGE**				
4.1	DN600 RRJ Class 3	92	m	300	27,600
4.2	Pit (900x900)	2	each	2,500	5,000
4.3	DN600mm Headwall	1	Item	2,500	2,500
4.4	DN100mm subsoil drainage	386	m	35	13,510
				Subtotal	**48,610**
5	**CONCRETE WORKS**				
5.1	Kerb - Edge strip	386	m	50	19,300
5.2	Footpath - 1.5m wide	193	m	150	28,950
				Subtotal	**48,250**
6	**SIGNAGE & ROAD FURNITURE**				
6.1	Signage and linemarking	193	m	15	2,895
				Subtotal	**2,895**
7	**TESTING & WAE**				
7.1	Density testing	193	m	20	3,860
7.2	Road & drainage works as executed	193	Item	15	2,895
				Subtotal	**6,755**

8	**SOIL AND WATER MANAGEMENT**				
8.1	Soil and water management	193	m	20	3,860
				Subtotal	**3,860**
9	**SERVICE CONDUIT INSTALLATION**				
9.1	Install new elec and comms road crossings	193	m	20	3,860
9.2	Install new water conduit crossings	129	m	15	1,930
				Subtotal	**5,790**
10	**MISCELLANEOUS**				
10.1	Road ends transition allowance	2	Each	10,000	20,000
10.2	Clean-up and disestablish	1	Item	10,000	10,000
				Subtotal	**30,000**
				Sub-total (excl GST)	**529,557**
				Contingency (30%)	**158,867**
				Total (excl GST)	**688,424**

Reticulated services

11	**Reticulated services**				
11.1	Underground electricity and street lighting	12	Lots	8,000	96,000
11.2	Underground telecommunications	12	Lots	1,000	12,000
11.3	Water reticulation	12	Lots	3,000	36,000
11.3	Re-connections allowance	12	Lots	10,000	120,000
				Subtotal	**264,000**
				Sub-total (excl GST)	**264,000**
				Contingency (30%)	**79,200**
				Total (excl GST)	**343,200**

Consultancy services

12	**Consultancy services**				
12.1	Survey, design and construction management	12	Lots	2,500	30,000
12.2	Geotechnical/pavement design	12	Lots	150	1,800
12.3	Electrical and street lighting design	12	Lots	250	3,000
12.4	Telecommunications design	12	Lots	80	960
				Subtotal	**35,760**
				Sub-total (excl GST)	**35,760**
				Contingency (20%)	**7,152**
				Total (excl GST)	**42,912**

Authority design and inspection fees

13	**Authority design and inspection fees**				
13.1	Electricity authority	12	Lots	100	1,200
13.2	Telecommunications authority	12	Lots	600	7,200
13.3	Council	12	Lots	300	3,600
13.4	Water authority	12	Lots	80	960
				Subtotal	**12,960**
				Sub-total (excl GST)	**12,960**
				Contingency (20%)	**2,592**
				Total (excl GST)	**15,552**
	Grand Total including contingency (excl GST)				**1,090,088**

Allen Price & Scarratts
Land & Development Consultants
NOWRA AND KIAMA - NSW

ESTIMATED QUANTITIES

Stg 1-Earthern embankment levee

Levee

ITEM	DESCRIPTION	QTY	UNIT	RATE	AMOUNT excl GST
1	**Levee**				
1.1	Levee cost estimate	2900	m	2,500	7,250,000
1.2	Footpath - 1.5m wide	2900	m	150	435,000
				Subtotal	**7,685,000**
				Sub-total (excl GST)	**7,685,000**
				Contingency (30%)	**2,305,500**
				Total (excl GST)	**9,990,500**

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NOWRA AND KIAMA - NSW

ESTIMATED QUANTITIES

Stg 1-Retaining walls

Retaining walls

ITEM	DESCRIPTION	QTY	UNIT	RATE	AMOUNT excl GST
1	**Retaining walls**				
1.1	Pine to Magnolia	100	m2	800	80,000
1.1	Kincumber to Magnolia	160	m2	800	128,000
				Subtotal	**208,000**
				Sub-total (excl GST)	**208,000**
				Contingency (30%)	**62,400**
				Total (excl GST)	**270,400**

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NOWRA AND KIAMA - NSW

ESTIMATED QUANTITIES

Stg 1-Floodgates

Floodgates

ITEM	DESCRIPTION	QTY	UNIT	RATE	AMOUNT excl GST
1	**Floodgates**				
1.1	Morton Crescent	1	Item	100,000	100,000
1.1	(West of) Morton Crescent	1	Item	15,000	15,000
				Subtotal	**115,000**
				Sub-total (excl GST)	**115,000**
				Contingency (30%)	**34,500**
				Total (excl GST)	**149,500**

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NOWRA AND KIAMA - NSW

ESTIMATED QUANTITIES

Stg 2-Kincumber Crescent (North East)

Road

ITEM	DESCRIPTION	QTY	UNIT	RATE	AMOUNT excl GST
1	**ESTABLISHMENT AND PRELIMINARIES**				
1.1	Establishment	1	Item	20,000	20,000
1.2	Set out works	1	Item	15,000	15,000
1.3	Services location	1	Item	10,000	10,000
1.4	Traffic & Pedestrian Management Plan	1	Item	60,000	60,000
1.5	Stabilised site access and wash bay	1	Each	15,000	15,000
				Subtotal	**120,000**
2	**SITE WORKS**				
2.1	Demolition (allowance)	1.4	ha	100,000	138,600
2.2	Import, place and compact select fill	8167	m^3	40	326,683
2.3	Trim and compact verge areas and swales	7970	m^2	5	39,848
2.4	Topsoil and turf verge areas and swales	6930	m^2	10	69,300
2.5	Street trees	92	each	500	46,200.00
				Subtotal	**620,630.90**
3	**ROADWORKS**				
3.1	**Road Pavement (8.5m wide)**				
3.2	Trim and Compact Subgrade	6584	m^2	5	32,918
3.3	Subbase DGB20 (280mm thick)	6584	m^2	25	164,588
3.4	Base Course DGB20 (120mm thick)	5891	m^2	15	88,358
3.5	Prime Seal	5891	m^2	8	47,124
3.6	Asphalt AC10 (min 30mm thick)	5891	m^2	25	147,263
				Subtotal	**480,249**
4	**STORMWATER DRAINAGE**				
4.1	DN450 RRJ Class 3	53	m	250	13,250
4.2	Pit (900x900)	3	each	2,500	7,500
4.3	DN450mm Headwall	1	Item	1,500	1,500
4.4	DN525 RRJ Class 3	20	m	275	5,500
4.5	DN525mm Headwall	1	Item	2,000	2,000
4.6	DN100mm subsoil drainage	1386	m	35	48,510
				Subtotal	**78,260**
5	**CONCRETE WORKS**				
5.1	Kerb - Edge strip	1386	m	50	69,300
5.2	Footpath - 1.5m wide	693	m	150	103,950
				Subtotal	**173,250**
6	**SIGNAGE & ROAD FURNITURE**				
6.1	Signage and linemarking	693	m	15	10,395
				Subtotal	**10,395**
7	**TESTING & WAE**				
7.1	Density testing	693	m	20	13,860

7.2	Road & drainage works as executed	693	Item	15	10,395
				Subtotal	**24,255**
8	**SOIL AND WATER MANAGEMENT**				
8.1	Soil and water management	693	m	20	13,860
				Subtotal	**13,860**
9	**SERVICE CONDUIT INSTALLATION**				
9.1	Install new elec and comms road crossings	693	m	20	13,860
9.2	Install new water conduit crossings	462	m	15	6,930
				Subtotal	**20,790**
10	**MISCELLANEOUS**				
10.1	Road ends transition allowance	2	Each	10,000	20,000
10.2	Clean-up and disestablish	1	Item	10,000	10,000
				Subtotal	**30,000**
				Sub-total (excl GST)	**1,571,690**
				Contingency (30%)	**471,507**
				Total (excl GST)	**2,043,197**

Reticulated services

11	**Reticulated services**				
11.1	Underground electricity and street lighting	48	Lots	8,000	384,000
11.2	Underground telecommunications	48	Lots	1,000	48,000
11.3	Water reticulation	48	Lots	3,000	144,000
11.3	Re-connections allowance	48	Lots	10,000	480,000
				Subtotal	**1,056,000**
				Sub-total (excl GST)	**1,056,000**
				Contingency (30%)	**316,800**
				Total (excl GST)	**1,372,800**

Consultancy services

12	**Consultancy services**				
12.1	Survey, design and construction management	48	Lots	2,500	120,000
12.2	Geotechnical/pavement design	48	Lots	150	7,200
12.3	Electrical and street lighting design	48	Lots	250	12,000
12.4	Telecommunications design	48	Lots	80	3,840
				Subtotal	**143,040**
				Sub-total (excl GST)	**143,040**
				Contingency (20%)	**28,608**
				Total (excl GST)	**171,648**

Authority design and inspection fees

13	**Authority design and inspection fees**				
13.1	Electricity authority	48	Lots	100	4,800
13.2	Telecommunications authority	48	Lots	600	28,800
13.3	Council	48	Lots	300	14,400
13.4	Water authority	48	Lots	80	3,840
				Subtotal	**51,840**
				Sub-total (excl GST)	**51,840**
				Contingency (20%)	**10,368**
				Total (excl GST)	**62,208**
	Grand Total including contingency (excl GST)				**3,649,853**

Allen Price & Scarratts
Land & Development Consultants
NOWRA AND KIAMA - NSW

ESTIMATED QUANTITIES

Stg 2-Kincumber Crescent (South West)

Road

ITEM	DESCRIPTION	QTY	UNIT	RATE	AMOUNT excl GST
1	**ESTABLISHMENT AND PRELIMINARIES**				
1.1	Establishment	1	Item	20,000	20,000
1.2	Set out works	1	Item	10,000	10,000
1.3	Services location	1	Item	5,000	5,000
1.4	Traffic & Pedestrian Management Plan	1	Item	10,000	10,000
1.5	Stabilised site access and wash bay	1	Each	15,000	15,000
				Subtotal	**60,000**
2	**SITE WORKS**				
2.1	Demolition (allowance)	0.4	ha	100,000	39,000
2.2	Import, place and compact select fill	2192	m^3	40	87,691
2.3	Trim and compact verge areas and swales	2243	m^2	5	11,213
2.4	Topsoil and turf verge areas and swales	1950	m^2	10	19,500
2.5	Street trees	26	each	500	13,000.00
				Subtotal	**170,403.50**
3	**ROADWORKS**				
3.1	**Road Pavement (8.5m wide)**				
3.2	Trim and Compact Subgrade	1853	m^2	5	9,263
3.3	Subbase DGB20 (280mm thick)	1853	m^2	25	46,313
3.4	Base Course DGB20 (120mm thick)	1658	m^2	15	24,863
3.5	Prime Seal	1658	m^2	8	13,260
3.6	Asphalt AC10 (min 30mm thick)	1658	m^2	25	41,438
				Subtotal	**135,135**
4	**STORMWATER DRAINAGE**				
4.1	DN100mm subsoil drainage	390	m	35	13,650
				Subtotal	**13,650**
5	**CONCRETE WORKS**				
5.1	Kerb - Edge strip	390	m	50	19,500
5.2	Footpath - 1.5m wide	195	m	150	29,250
				Subtotal	**48,750**
6	**SIGNAGE & ROAD FURNITURE**				
6.1	Signage and linemarking	195	m	15	2,925
				Subtotal	**2,925**
7	**TESTING & WAE**				
7.1	Density testing	195	m	20	3,900
7.2	Road & drainage works as executed	195	Item	15	2,925
				Subtotal	**6,825**
8	**SOIL AND WATER MANAGEMENT**				

8.1	Soil and water management	195	m	20	3,900
				Subtotal	**3,900**
9	**SERVICE CONDUIT INSTALLATION**				
9.1	Install new elec and comms road crossings	195	m	20	3,900
9.2	Install new water conduit crossings	130	m	15	1,950
				Subtotal	**5,850**
10	**MISCELLANEOUS**				
10.1	Road ends transition allowance	2	Each	10,000	20,000
10.2	Clean-up and disestablish	1	Item	10,000	10,000
				Subtotal	**30,000**
				Sub-total (excl GST)	**477,439**
				Contingency (30%)	**143,232**
				Total (excl GST)	**620,670**

Reticulated services

11	**Reticulated services**				
11.1	Underground electricity and street lighting	20	Lots	8,000	160,000
11.2	Underground telecommunications	20	Lots	1,000	20,000
11.3	Water reticulation	20	Lots	3,000	60,000
11.3	Re-connections allowance	20	Lots	10,000	200,000
				Subtotal	**440,000**
				Sub-total (excl GST)	**440,000**
				Contingency (30%)	**132,000**
				Total (excl GST)	**572,000**

Consultancy services

12	**Consultancy services**				
12.1	Survey, design and construction management	20	Lots	2,500	50,000
12.2	Geotechnical/pavement design	20	Lots	150	3,000
12.3	Electrical and street lighting design	20	Lots	250	5,000
12.4	Telecommunications design	20	Lots	80	1,600
				Subtotal	**59,600**
				Sub-total (excl GST)	**59,600**
				Contingency (20%)	**11,920**
				Total (excl GST)	**71,520**

Authority design and inspection fees

13	**Authority design and inspection fees**				
13.1	Electricity authority	20	Lots	100	2,000
13.2	Telecommunications authority	20	Lots	600	12,000
13.3	Council	20	Lots	300	6,000
13.4	Water authority	20	Lots	80	1,600
				Subtotal	**21,600**
				Sub-total (excl GST)	**21,600**
				Contingency (20%)	**4,320**
				Total (excl GST)	**25,920**
	Grand Total including contingency (excl GST)				**1,290,110**

Allen Price & Scarratts
Land & Development Consultants
NOWRA AND KIAMA - NSW

ESTIMATED QUANTITIES

Stg 2-Ilumba Avenue

Road

ITEM	DESCRIPTION	QTY	UNIT	RATE	AMOUNT excl GST
1	**ESTABLISHMENT AND PRELIMINARIES**				
1.1	Establishment	1	Item	20,000	20,000
1.2	Set out works	1	Item	10,000	10,000
1.3	Services location	1	Item	5,000	5,000
1.4	Traffic & Pedestrian Management Plan	1	Item	10,000	10,000
1.5	Stabilised site access and wash bay	1	Each	15,000	15,000
				Subtotal	**60,000**
2	**SITE WORKS**				
2.1	Demolition (allowance)	0.5	ha	100,000	53,800
2.2	Import, place and compact select fill	2867	m^3	40	114,672
2.3	Trim and compact verge areas and swales	3094	m^2	5	15,468
2.4	Topsoil and turf verge areas and swales	2690	m^2	10	26,900
2.5	Street trees	36	each	500	17,933.33
				Subtotal	**228,773.03**
3	**ROADWORKS**				
3.1	**Road Pavement (8.5m wide)**				
3.2	Trim and Compact Subgrade	2556	m^2	5	12,778
3.3	Subbase DGB20 (280mm thick)	2556	m^2	25	63,888
3.4	Base Course DGB20 (120mm thick)	2287	m^2	15	34,298
3.5	Prime Seal	2287	m^2	8	18,292
3.6	Asphalt AC10 (min 30mm thick)	2287	m^2	25	57,163
				Subtotal	**186,417**
4	**STORMWATER DRAINAGE**				
4.1	DN100mm subsoil drainage	538	m	35	18,830
				Subtotal	**18,830**
5	**CONCRETE WORKS**				
5.1	Kerb - Edge strip	538	m	50	26,900
5.2	Footpath - 1.5m wide	269	m	150	40,350
				Subtotal	**67,250**
6	**SIGNAGE & ROAD FURNITURE**				
6.1	Signage and linemarking	269	m	15	4,035
				Subtotal	**4,035**
7	**TESTING & WAE**				
7.1	Density testing	269	m	20	5,380
7.2	Road & drainage works as executed	269	Item	15	4,035
				Subtotal	**9,415**
8	**SOIL AND WATER MANAGEMENT**				

8.1	Soil and water management	269	m	20	5,380
				Subtotal	**5,380**
9	**SERVICE CONDUIT INSTALLATION**				
9.1	Install new elec and comms road crossings	269	m	20	5,380
9.2	Install new water conduit crossings	179	m	15	2,690
				Subtotal	**8,070**
10	**MISCELLANEOUS**				
10.1	Road ends transition allowance	2	Each	10,000	20,000
10.2	Clean-up and disestablish	1	Item	10,000	10,000
				Subtotal	**30,000**
				Sub-total (excl GST)	**618,170**
				Contingency (30%)	**185,451**
				Total (excl GST)	**803,621**

Reticulated services

11	**Reticulated services**				
11.1	Underground electricity and street lighting	25	Lots	8,000	200,000
11.2	Underground telecommunications	25	Lots	1,000	25,000
11.3	Water reticulation	25	Lots	3,000	75,000
11.3	Re-connections allowance	25	Lots	10,000	250,000
				Subtotal	**550,000**
				Sub-total (excl GST)	**550,000**
				Contingency (30%)	**165,000**
				Total (excl GST)	**715,000**

Consultancy services

12	**Consultancy services**				
12.1	Survey, design and construction management	25	Lots	2,500	62,500
12.2	Geotechnical/pavement design	25	Lots	150	3,750
12.3	Electrical and street lighting design	25	Lots	250	6,250
12.4	Telecommunications design	25	Lots	80	2,000
				Subtotal	**74,500**
				Sub-total (excl GST)	**74,500**
				Contingency (20%)	**14,900**
				Total (excl GST)	**89,400**

Authority design and inspection fees

13	**Authority design and inspection fees**				
13.1	Electricity authority	25	Lots	100	2,500
13.2	Telecommunications authority	25	Lots	600	15,000
13.3	Council	25	Lots	300	7,500
13.4	Water authority	25	Lots	80	2,000
				Subtotal	**27,000**
				Sub-total (excl GST)	**27,000**
				Contingency (20%)	**5,400**
				Total (excl GST)	**32,400**
	Grand Total including contingency (excl GST)				**1,640,421**

Allen Price & Scarratts
Land & Development Consultants
NOWRA AND KIAMA - NSW

ESTIMATED QUANTITIES

Stg 2-Kyoga Avenue

Road

ITEM	DESCRIPTION	QTY	UNIT	RATE	AMOUNT excl GST
1	**ESTABLISHMENT AND PRELIMINARIES**				
1.1	Establishment	1	Item	20,000	20,000
1.2	Set out works	1	Item	10,000	10,000
1.3	Services location	1	Item	5,000	5,000
1.4	Traffic & Pedestrian Management Plan	1	Item	10,000	10,000
1.5	Stabilised site access and wash bay	1	Each	15,000	15,000
				Subtotal	**60,000**
2	**SITE WORKS**				
2.1	Demolition (allowance)	0.2	ha	100,000	15,600
2.2	Import, place and compact select fill	255	m^3	40	10,196
2.3	Trim and compact verge areas and swales	897	m^2	5	4,485
2.4	Topsoil and turf verge areas and swales	780	m^2	10	7,800
2.5	Street trees	10	each	500	5,200.00
				Subtotal	**43,281.40**
3	**ROADWORKS**				
3.1	**Road Pavement (8.5m wide)**				
3.2	Trim and Compact Subgrade	741	m^2	5	3,705
3.3	Subbase DGB20 (280mm thick)	741	m^2	25	18,525
3.4	Base Course DGB20 (120mm thick)	663	m^2	15	9,945
3.5	Prime Seal	663	m^2	8	5,304
3.6	Asphalt AC10 (min 30mm thick)	663	m^2	25	16,575
				Subtotal	**54,054**
4	**STORMWATER DRAINAGE**				
4.1	DN100mm subsoil drainage	156	m	35	5,460
				Subtotal	**5,460**
5	**CONCRETE WORKS**				
5.1	Kerb - Edge strip	156	m	50	7,800
5.2	Footpath - 1.5m wide	78	m	150	11,700
				Subtotal	**19,500**
6	**SIGNAGE & ROAD FURNITURE**				
6.1	Signage and linemarking	78	m	15	1,170
				Subtotal	**1,170**
7	**TESTING & WAE**				
7.1	Density testing	78	m	20	1,560
7.2	Road & drainage works as executed	78	Item	15	1,170
				Subtotal	**2,730**
8	**SOIL AND WATER MANAGEMENT**				

8.1	Soil and water management	78	m	20	1,560
				Subtotal	**1,560**
9	**SERVICE CONDUIT INSTALLATION**				
9.1	Install new elec and comms road crossings	78	m	20	1,560
9.2	Install new water conduit crossings	52	m	15	780
				Subtotal	**2,340**
10	**MISCELLANEOUS**				
10.1	Road ends transition allowance	1	Each	10,000	10,000
10.2	Clean-up and disestablish	1	Item	10,000	10,000
				Subtotal	**20,000**
				Sub-total (excl GST)	**210,095**
				Contingency (30%)	**63,029**
				Total (excl GST)	**273,124**

Reticulated services

11	**Reticulated services**				
11.1	Underground electricity and street lighting	4	Lots	8,000	32,000
11.2	Underground telecommunications	4	Lots	1,000	4,000
11.3	Water reticulation	4	Lots	3,000	12,000
11.3	Re-connections allowance	4	Lots	10,000	40,000
				Subtotal	**88,000**
				Sub-total (excl GST)	**88,000**
				Contingency (30%)	**26,400**
				Total (excl GST)	**114,400**

Consultancy services

12	**Consultancy services**				
12.1	Survey, design and construction management	4	Lots	2,500	10,000
12.2	Geotechnical/pavement design	4	Lots	150	600
12.3	Electrical and street lighting design	4	Lots	250	1,000
12.4	Telecommunications design	4	Lots	80	320
				Subtotal	**11,920**
				Sub-total (excl GST)	**11,920**
				Contingency (20%)	**2,384**
				Total (excl GST)	**14,304**

Authority design and inspection fees

13	**Authority design and inspection fees**				
13.1	Electricity authority	4	Lots	100	400
13.2	Telecommunications authority	4	Lots	600	2,400
13.3	Council	4	Lots	300	1,200
13.4	Water authority	4	Lots	80	320
				Subtotal	**4,320**
				Sub-total (excl GST)	**4,320**
				Contingency (20%)	**864**
				Total (excl GST)	**5,184**
	Grand Total including contingency (excl GST)				**407,012**

Allen Price & Scarratts
Land & Development Consultants
NOWRA AND KIAMA - NSW

ESTIMATED QUANTITIES

Stg 2-Romford Close

Road

ITEM	DESCRIPTION	QTY	UNIT	RATE	AMOUNT excl GST
1	**ESTABLISHMENT AND PRELIMINARIES**				
1.1	Establishment	1	Item	20,000	20,000
1.2	Set out works	1	Item	10,000	10,000
1.3	Services location	1	Item	5,000	5,000
1.4	Traffic & Pedestrian Management Plan	1	Item	10,000	10,000
1.5	Stabilised site access and wash bay	1	Each	15,000	15,000
				Subtotal	**60,000**
2	**SITE WORKS**				
2.1	Demolition (allowance)	0.2	ha	100,000	15,600
2.2	Import, place and compact select fill	499	m^3	40	19,956
2.3	Trim and compact verge areas and swales	897	m^2	5	4,485
2.4	Topsoil and turf verge areas and swales	780	m^2	10	7,800
2.5	Street trees	10	each	500	5,200.00
				Subtotal	**53,041.40**
3	**ROADWORKS**				
3.1	**Road Pavement (8.5m wide)**				
3.2	Trim and Compact Subgrade	741	m^2	5	3,705
3.3	Subbase DGB20 (280mm thick)	741	m^2	25	18,525
3.4	Base Course DGB20 (120mm thick)	663	m^2	15	9,945
3.5	Prime Seal	663	m^2	8	5,304
3.6	Asphalt AC10 (min 30mm thick)	663	m^2	25	16,575
				Subtotal	**54,054**
4	**STORMWATER DRAINAGE**				
4.1	DN600 RRJ Class 3	68	m	300	20,400
4.2	Pit (900x900)	1	each	2,500	2,500
4.3	DN600mm Headwall	1	Item	2,500	2,500
4.4	DN100mm subsoil drainage	156	m	35	5,460
				Subtotal	**30,860**
5	**CONCRETE WORKS**				
5.1	Kerb - Edge strip	156	m	50	7,800
5.2	Footpath - 1.5m wide	78	m	150	11,700
				Subtotal	**19,500**
6	**SIGNAGE & ROAD FURNITURE**				
6.1	Signage and linemarking	78	m	15	1,170
				Subtotal	**1,170**
7	**TESTING & WAE**				
7.1	Density testing	78	m	20	1,560
7.2	Road & drainage works as executed	78	Item	15	1,170
				Subtotal	**2,730**

8	**SOIL AND WATER MANAGEMENT**				
8.1	Soil and water management	78	m	20	1,560
				Subtotal	**1,560**
9	**SERVICE CONDUIT INSTALLATION**				
9.1	Install new elec and comms road crossings	78	m	20	1,560
9.2	Install new water conduit crossings	52	m	15	780
				Subtotal	**2,340**
10	**MISCELLANEOUS**				
10.1	Road ends transition allowance	1	Each	10,000	10,000
10.2	Clean-up and disestablish	1	Item	10,000	10,000
				Subtotal	**20,000**
				Sub-total (excl GST)	**245,255**
				Contingency (30%)	**73,577**
				Total (excl GST)	**318,832**

Reticulated services

11	**Reticulated services**				
11.1	Underground electricity and street lighting	10	Lots	8,000	80,000
11.2	Underground telecommunications	10	Lots	1,000	10,000
11.3	Water reticulation	10	Lots	3,000	30,000
11.3	Re-connections allowance	10	Lots	10,000	100,000
				Subtotal	**220,000**
				Sub-total (excl GST)	**220,000**
				Contingency (30%)	**66,000**
				Total (excl GST)	**286,000**

Consultancy services

12	**Consultancy services**				
12.1	Survey, design and construction management	10	Lots	2,500	25,000
12.2	Geotechnical/pavement design	10	Lots	150	1,500
12.3	Electrical and street lighting design	10	Lots	250	2,500
12.4	Telecommunications design	10	Lots	80	800
				Subtotal	**29,800**
				Sub-total (excl GST)	**29,800**
				Contingency (20%)	**5,960**
				Total (excl GST)	**35,760**

Authority design and inspection fees

13	**Authority design and inspection fees**				
13.1	Electricity authority	10	Lots	100	1,000
13.2	Telecommunications authority	10	Lots	600	6,000
13.3	Council	10	Lots	300	3,000
13.4	Water authority	10	Lots	80	800
				Subtotal	**10,800**
				Sub-total (excl GST)	**10,800**
				Contingency (20%)	**2,160**
				Total (excl GST)	**12,960**
	Grand Total including contingency (excl GST)				**653,552**

Allen Price & Scarratts
Land & Development Consultants
NOWRA AND KIAMA - NSW

ESTIMATED QUANTITIES

Stg 2-Alkoomie Close, Arrunga Close

Road

ITEM	DESCRIPTION	QTY	UNIT	RATE	AMOUNT excl GST
1	**ESTABLISHMENT AND PRELIMINARIES**				
1.1	Establishment	1	Item	20,000	20,000
1.2	Set out works	1	Item	10,000	10,000
1.3	Services location	1	Item	5,000	5,000
1.4	Traffic & Pedestrian Management Plan	1	Item	10,000	10,000
1.5	Stabilised site access and wash bay	1	Each	15,000	15,000
				Subtotal	**60,000**
2	**SITE WORKS**				
2.1	Demolition (allowance)	0.4	ha	100,000	40,200
2.2	Import, place and compact select fill	1915	m^3	40	76,614
2.3	Trim and compact verge areas and swales	2312	m^2	5	11,558
2.4	Topsoil and turf verge areas and swales	2010	m^2	10	20,100
2.5	Street trees	27	each	500	13,400.00
				Subtotal	**161,871.30**
3	**ROADWORKS**				
3.1	**Road Pavement (8.5m wide)**				
3.2	Trim and Compact Subgrade	1910	m^2	5	9,548
3.3	Subbase DGB20 (280mm thick)	1910	m^2	25	47,738
3.4	Base Course DGB20 (120mm thick)	1709	m^2	15	25,628
3.5	Prime Seal	1709	m^2	8	13,668
3.6	Asphalt AC10 (min 30mm thick)	1709	m^2	25	42,713
				Subtotal	**139,293**
4	**STORMWATER DRAINAGE**				
4.1	DN450 RRJ Class 3	66	m	250	16,500
4.2	DN750 RRJ Class 3	112	m	375	42,000
4.3	Pit (900x900)	3	each	2,500	7,500
4.4	Pit (1200x1200)	2	each	4,000	8,000
4.5	DN750mm Headwall	1	Item	3,100	3,100
4.6	DN100mm subsoil drainage	402	m	35	14,070
				Subtotal	**91,170**
5	**CONCRETE WORKS**				
5.1	Kerb - Edge strip	402	m	50	20,100
5.2	Footpath - 1.5m wide	201	m	150	30,150
				Subtotal	**50,250**
6	**SIGNAGE & ROAD FURNITURE**				
6.1	Signage and linemarking	201	m	15	3,015
				Subtotal	**3,015**
7	**TESTING & WAE**				
7.1	Density testing	201	m	20	4,020

7.2	Road & drainage works as executed	201	Item	15	3,015
				Subtotal	**7,035**
8	**SOIL AND WATER MANAGEMENT**				
8.1	Soil and water management	201	m	20	4,020
				Subtotal	**4,020**
9	**SERVICE CONDUIT INSTALLATION**				
9.1	Install new elec and comms road crossings	201	m	20	4,020
9.2	Install new water conduit crossings	134	m	15	2,010
				Subtotal	**6,030**
10	**MISCELLANEOUS**				
10.1	Road ends transition allowance	1	Each	10,000	10,000
10.2	Clean-up and disestablish	1	Item	10,000	10,000
				Subtotal	**20,000**
				Sub-total (excl GST)	**542,684**
				Contingency (30%)	**162,805**
				Total (excl GST)	**705,490**

Reticulated services

11	**Reticulated services**				
11.1	Underground electricity and street lighting	18	Lots	8,000	144,000
11.2	Underground telecommunications	18	Lots	1,000	18,000
11.3	Water reticulation	18	Lots	3,000	54,000
11.3	Re-connections allowance	18	Lots	10,000	180,000
				Subtotal	**396,000**
				Sub-total (excl GST)	**396,000**
				Contingency (30%)	**118,800**
				Total (excl GST)	**514,800**

Consultancy services

12	**Consultancy services**				
12.1	Survey, design and construction management	18	Lots	2,500	45,000
12.2	Geotechnical/pavement design	18	Lots	150	2,700
12.3	Electrical and street lighting design	18	Lots	250	4,500
12.4	Telecommunications design	18	Lots	80	1,440
				Subtotal	**53,640**
				Sub-total (excl GST)	**53,640**
				Contingency (20%)	**10,728**
				Total (excl GST)	**64,368**

Authority design and inspection fees

13	**Authority design and inspection fees**				
13.1	Electricity authority	18	Lots	100	1,800
13.2	Telecommunications authority	18	Lots	600	10,800
13.3	Council	18	Lots	300	5,400
13.4	Water authority	18	Lots	80	1,440
				Subtotal	**19,440**
				Sub-total (excl GST)	**19,440**
				Contingency (20%)	**3,888**
				Total (excl GST)	**23,328**
	Grand Total including contingency (excl GST)				**1,307,986**

Allen Price & Scarratts
Land & Development Consultants
NOWRA AND KIAMA - NSW

ESTIMATED QUANTITIES

Stg 3-Malinya Road

Road

ITEM	DESCRIPTION	QTY	UNIT	RATE	AMOUNT excl GST
1	**ESTABLISHMENT AND PRELIMINARIES**				
1.1	Establishment	1	Item	20,000	20,000
1.2	Set out works	1	Item	20,000	20,000
1.3	Services location	1	Item	15,000	15,000
1.4	Traffic & Pedestrian Management Plan	1	Item	60,000	60,000
1.5	Stabilised site access and wash bay	2	Each	15,000	30,000
				Subtotal	**145,000**
2	**SITE WORKS**				
2.1	Demolition (allowance)	1.5	ha	100,000	146,600
2.2	Import, place and compact select fill	7832	m^3	40	313,275
2.3	Trim and compact verge areas and swales	8430	m^2	5	42,148
2.4	Topsoil and turf verge areas and swales	7330	m^2	10	73,300
2.5	Street trees	98	each	500	48,866.67
				Subtotal	**624,189.57**
3	**ROADWORKS**				
3.1	**Road Pavement (8.5m wide)**				
3.2	Trim and Compact Subgrade	6964	m^2	5	34,818
3.3	Subbase DGB20 (280mm thick)	6964	m^2	25	174,088
3.4	Base Course DGB20 (120mm thick)	6231	m^2	15	93,458
3.5	Prime Seal	6231	m^2	8	49,844
3.6	Asphalt AC10 (min 30mm thick)	6231	m^2	25	155,763
				Subtotal	**507,969**
4	**STORMWATER DRAINAGE**				
4.1	DN450 RRJ Class 3	56	m	250	14,000
4.2	DN600 RRJ Class 3	24	m	300	7,200
4.3	DN900 RRJ Class 3	20	m	550	11,000
4.4	Pit (900x900)	4	each	2,500	10,000
4.5	Pit (1200x1200)	2	each	4,000	8,000
4.6	DN450mm Headwall	1	Item	1,500	1,500
4.7	DN100mm subsoil drainage	1466	m	35	51,310
				Subtotal	**103,010**
5	**CONCRETE WORKS**				
5.1	Kerb - Edge strip	1466	m	50	73,300
5.2	Footpath - 1.5m wide	733	m	150	109,950
				Subtotal	**183,250**
6	**SIGNAGE & ROAD FURNITURE**				
6.1	Signage and linemarking	733	m	15	10,995
				Subtotal	**10,995**
7	**TESTING & WAE**				
7.1	Density testing	733	m	20	14,660
7.2	Road & drainage works as executed	733	Item	15	10,995

				Subtotal	**25,655**
8	**SOIL AND WATER MANAGEMENT**				
8.1	Soil and water management	733	m	20	14,660
				Subtotal	**14,660**
9	**SERVICE CONDUIT INSTALLATION**				
9.1	Install new elec and comms road crossings	733	m	20	14,660
9.2	Install new water conduit crossings	489	m	15	7,330
				Subtotal	**21,990**
10	**MISCELLANEOUS**				
10.1	Road ends transition allowance	6	Each	10,000	60,000
10.2	Clean-up and disestablish	1	Item	10,000	10,000
				Subtotal	**70,000**
				Sub-total (excl GST)	**1,706,719**
				Contingency (30%)	**512,016**
				Total (excl GST)	**2,218,734**

Reticulated services

11	**Reticulated services**				
11.1	Underground electricity and street lighting	85	Lots	8,000	680,000
11.2	Underground telecommunications	85	Lots	1,000	85,000
11.3	Water reticulation	85	Lots	3,000	255,000
11.3	Re-connections allowance	85	Lots	10,000	850,000
				Subtotal	**1,870,000**
				Sub-total (excl GST)	**1,870,000**
				Contingency (30%)	**561,000**
				Total (excl GST)	**2,431,000**

Consultancy services

12	**Consultancy services**				
12.1	Survey, design and construction management	85	Lots	2,500	212,500
12.2	Geotechnical/pavement design	85	Lots	150	12,750
12.3	Electrical and street lighting design	85	Lots	250	21,250
12.4	Telecommunications design	85	Lots	80	6,800
				Subtotal	**253,300**
				Sub-total (excl GST)	**253,300**
				Contingency (20%)	**50,660**
				Total (excl GST)	**303,960**

Authority design and inspection fees

13	**Authority design and inspection fees**				
13.1	Electricity authority	85	Lots	100	8,500
13.2	Telecommunications authority	85	Lots	600	51,000
13.3	Council	85	Lots	300	25,500
13.4	Water authority	85	Lots	80	6,800
				Subtotal	**91,800**
				Sub-total (excl GST)	**91,800**
				Contingency (20%)	**18,360**
				Total (excl GST)	**110,160**
	Grand Total including contingency (excl GST)				**5,063,854**

Allen Price & Scarratts
Land & Development Consultants
NOWRA AND KIAMA - NSW

ESTIMATED QUANTITIES

Stg 3-Pyang Avenue

Road

ITEM	DESCRIPTION	QTY	UNIT	RATE	AMOUNT excl GST
1	**ESTABLISHMENT AND PRELIMINARIES**				
1.1	Establishment	1	Item	20,000	20,000
1.2	Set out works	1	Item	10,000	10,000
1.3	Services location	1	Item	5,000	5,000
1.4	Traffic & Pedestrian Management Plan	1	Item	10,000	10,000
1.5	Stabilised site access and wash bay	1	Each	15,000	15,000
				Subtotal	**60,000**
2	**SITE WORKS**				
2.1	Demolition (allowance)	0.4	ha	100,000	42,600
2.2	Import, place and compact select fill	2216	m^3	40	88,659
2.3	Trim and compact verge areas and swales	2450	m^2	5	12,248
2.4	Topsoil and turf verge areas and swales	2130	m^2	10	21,300
2.5	Street trees	28	each	500	14,200.00
				Subtotal	**179,006.90**
3	**ROADWORKS**				
3.1	**Road Pavement (8.5m wide)**				
3.2	Trim and Compact Subgrade	2024	m^2	5	10,118
3.3	Subbase DGB20 (280mm thick)	2024	m^2	25	50,588
3.4	Base Course DGB20 (120mm thick)	1811	m^2	15	27,158
3.5	Prime Seal	1811	m^2	8	14,484
3.6	Asphalt AC10 (min 30mm thick)	1811	m^2	25	45,263
				Subtotal	**147,609**
4	**STORMWATER DRAINAGE**				
4.1	DN450 RRJ Class 3	13	m	250	3,250
4.2	Pit (900x900)	1	each	2,500	2,500
4.3	DN100mm subsoil drainage	426	m	35	14,910
				Subtotal	**20,660**
5	**CONCRETE WORKS**				
5.1	Kerb - Edge strip	426	m	50	21,300
5.2	Footpath - 1.5m wide	213	m	150	31,950
				Subtotal	**53,250**
6	**SIGNAGE & ROAD FURNITURE**				
6.1	Signage and linemarking	213	m	15	3,195
				Subtotal	**3,195**
7	**TESTING & WAE**				
7.1	Density testing	213	m	20	4,260
7.2	Road & drainage works as executed	213	Item	15	3,195
				Subtotal	**7,455**

8	**SOIL AND WATER MANAGEMENT**				
8.1	Soil and water management	213	m	20	4,260
				Subtotal	**4,260**
9	**SERVICE CONDUIT INSTALLATION**				
9.1	Install new elec and comms road crossings	213	m	20	4,260
9.2	Install new water conduit crossings	142	m	15	2,130
				Subtotal	**6,390**
10	**MISCELLANEOUS**				
10.1	Road ends transition allowance	2	Each	10,000	20,000
10.2	Clean-up and disestablish	1	Item	10,000	10,000
				Subtotal	**30,000**
				Sub-total (excl GST)	**511,826**
				Contingency (30%)	**153,548**
				Total (excl GST)	**665,374**

Reticulated services

11	**Reticulated services**				
11.1	Underground electricity and street lighting	15	Lots	8,000	120,000
11.2	Underground telecommunications	15	Lots	1,000	15,000
11.3	Water reticulation	15	Lots	3,000	45,000
11.3	Re-connections allowance	15	Lots	10,000	150,000
				Subtotal	**330,000**
				Sub-total (excl GST)	**330,000**
				Contingency (30%)	**99,000**
				Total (excl GST)	**429,000**

Consultancy services

12	**Consultancy services**				
12.1	Survey, design and construction management	15	Lots	2,500	37,500
12.2	Geotechnical/pavement design	15	Lots	150	2,250
12.3	Electrical and street lighting design	15	Lots	250	3,750
12.4	Telecommunications design	15	Lots	80	1,200
				Subtotal	**44,700**
				Sub-total (excl GST)	**44,700**
				Contingency (20%)	**8,940**
				Total (excl GST)	**53,640**

Authority design and inspection fees

13	**Authority design and inspection fees**				
13.1	Electricity authority	15	Lots	100	1,500
13.2	Telecommunications authority	15	Lots	600	9,000
13.3	Council	15	Lots	300	4,500
13.4	Water authority	15	Lots	80	1,200
				Subtotal	**16,200**
				Sub-total (excl GST)	**16,200**
				Contingency (20%)	**3,240**
				Total (excl GST)	**19,440**
	Grand Total including contingency (excl GST)				**1,167,454**

Allen Price & Scarratts
Land & Development Consultants
NOWRA AND KIAMA - NSW

ESTIMATED QUANTITIES

Stg 3-Lenora Avenue

Road

ITEM	DESCRIPTION	QTY	UNIT	RATE	AMOUNT excl GST
1	**ESTABLISHMENT AND PRELIMINARIES**				
1.1	Establishment	1	Item	20,000	20,000
1.2	Set out works	1	Item	10,000	10,000
1.3	Services location	1	Item	5,000	5,000
1.4	Traffic & Pedestrian Management Plan	1	Item	10,000	10,000
1.5	Stabilised site access and wash bay	1	Each	15,000	15,000
				Subtotal	**60,000**
2	**SITE WORKS**				
2.1	Demolition (allowance)	0.2	ha	100,000	15,600
2.2	Import, place and compact select fill	757	m^3	40	30,272
2.3	Trim and compact verge areas and swales	520	m^2	5	2,600
2.4	Topsoil and turf verge areas and swales	520	m^2	10	5,200
2.5	Street trees	0	each	500	-
				Subtotal	**53,672.00**
3	**ROADWORKS**				
3.1	**Road Pavement (4.0m wide)**				
3.2	Trim and Compact Subgrade	1300	m^2	5	6,500
3.3	Subbase DGB20 (280mm thick)	1300	m^2	25	32,500
3.4	Base Course DGB20 (120mm thick)	1040	m^2	15	15,600
3.5	Prime Seal	1040	m^2	8	8,320
3.6	Asphalt AC10 (min 30mm thick)	1040	m^2	25	26,000
				Subtotal	**88,920**
4	**STORMWATER DRAINAGE**				
4.1	DN100mm subsoil drainage	520	m	35	18,200
				Subtotal	**18,200**
5	**CONCRETE WORKS**				
5.1	Kerb - Edge strip	520	m	50	26,000
5.2	Footpath - 1.5m wide	0	m	150	-
				Subtotal	**26,000**
6	**SIGNAGE & ROAD FURNITURE**				
6.1	Signage and linemarking	260	m	15	3,900
				Subtotal	**3,900**
7	**TESTING & WAE**				
7.1	Density testing	260	m	20	5,200
7.2	Road & drainage works as executed	260	Item	15	3,900
				Subtotal	**9,100**
8	**SOIL AND WATER MANAGEMENT**				

8.1	Soil and water management	260	m	20	5,200
				Subtotal	**5,200**
9	**SERVICE CONDUIT INSTALLATION**				
9.1	Install new elec and comms road crossings	260	m	20	5,200
9.2	Install new water conduit crossings	173	m	15	2,600
				Subtotal	**7,800**
10	**MISCELLANEOUS**				
10.1	Road ends transition allowance	2	Each	10,000	20,000
10.2	Clean-up and disestablish	1	Item	10,000	10,000
				Subtotal	**30,000**
				Sub-total (excl GST)	**302,792**
				Contingency (30%)	**90,838**
				Total (excl GST)	**393,630**

Reticulated services

11	**Reticulated services**				
11.1	Underground electricity and street lighting	18	Lots	8,000	144,000
11.2	Underground telecommunications	18	Lots	1,000	18,000
11.3	Water reticulation	18	Lots	3,000	54,000
11.3	Re-connections allowance	18	Lots	10,000	180,000
				Subtotal	**396,000**
				Sub-total (excl GST)	**396,000**
				Contingency (30%)	**118,800**
				Total (excl GST)	**514,800**

Consultancy services

12	**Consultancy services**				
12.1	Survey, design and construction management	18	Lots	2,500	45,000
12.2	Geotechnical/pavement design	18	Lots	150	2,700
12.3	Electrical and street lighting design	18	Lots	250	4,500
12.4	Telecommunications design	18	Lots	80	1,440
				Subtotal	**53,640**
				Sub-total (excl GST)	**53,640**
				Contingency (20%)	**10,728**
				Total (excl GST)	**64,368**

Authority design and inspection fees

13	**Authority design and inspection fees**				
13.1	Electricity authority	18	Lots	100	1,800
13.2	Telecommunications authority	18	Lots	600	10,800
13.3	Council	18	Lots	300	5,400
13.4	Water authority	18	Lots	80	1,440
				Subtotal	**19,440**
				Sub-total (excl GST)	**19,440**
				Contingency (20%)	**3,888**
				Total (excl GST)	**23,328**
	Grand Total including contingency (excl GST)				**996,126**

Allen Price & Scarratts
Land & Development Consultants
NOWRA AND KIAMA - NSW

ESTIMATED QUANTITIES

Stg 3-Elinya Lane

Road

ITEM	DESCRIPTION	QTY	UNIT	RATE	AMOUNT excl GST
1	**ESTABLISHMENT AND PRELIMINARIES**				
1.1	Establishment	1	Item	20,000	20,000
1.2	Set out works	1	Item	10,000	10,000
1.3	Services location	1	Item	5,000	5,000
1.4	Traffic & Pedestrian Management Plan	1	Item	10,000	10,000
1.5	Stabilised site access and wash bay	1	Each	15,000	15,000
				Subtotal	**60,000**
2	**SITE WORKS**				
2.1	Demolition (allowance)	0.1	ha	100,000	10,980
2.2	Import, place and compact select fill	412	m^3	40	16,490
2.3	Trim and compact verge areas and swales	366	m^2	5	1,830
2.4	Topsoil and turf verge areas and swales	366	m^2	10	3,660
2.5	Street trees	0	each	500	-
				Subtotal	**32,959.60**
3	**ROADWORKS**				
3.1	**Road Pavement (4.0m wide)**				
3.2	Trim and Compact Subgrade	915	m^2	5	4,575
3.3	Subbase DGB20 (280mm thick)	915	m^2	25	22,875
3.4	Base Course DGB20 (120mm thick)	732	m^2	15	10,980
3.5	Prime Seal	732	m^2	8	5,856
3.6	Asphalt AC10 (min 30mm thick)	732	m^2	25	18,300
				Subtotal	**62,586**
4	**STORMWATER DRAINAGE**				
4.1	DN100mm subsoil drainage	366	m	35	12,810
				Subtotal	**12,810**
5	**CONCRETE WORKS**				
5.1	Kerb - Edge strip	366	m	50	18,300
5.2	Footpath - 1.5m wide	0	m	150	-
				Subtotal	**18,300**
6	**SIGNAGE & ROAD FURNITURE**				
6.1	Signage and linemarking	183	m	15	2,745
				Subtotal	**2,745**
7	**TESTING & WAE**				
7.1	Density testing	183	m	20	3,660
7.2	Road & drainage works as executed	183	Item	15	2,745
				Subtotal	**6,405**
8	**SOIL AND WATER MANAGEMENT**				

8.1	Soil and water management	183	m	20	3,660
				Subtotal	**3,660**
9	**SERVICE CONDUIT INSTALLATION**				
9.1	Install new elec and comms road crossings	183	m	20	3,660
9.2	Install new water conduit crossings	122	m	15	1,830
				Subtotal	**5,490**
10	**MISCELLANEOUS**				
10.1	Road ends transition allowance	2	Each	10,000	20,000
10.2	Clean-up and disestablish	1	Item	10,000	10,000
				Subtotal	**30,000**
				Sub-total (excl GST)	**234,956**
				Contingency (30%)	**70,487**
				Total (excl GST)	**305,442**

Reticulated services

11	**Reticulated services**				
11.1	Underground electricity and street lighting	16	Lots	8,000	128,000
11.2	Underground telecommunications	16	Lots	1,000	16,000
11.3	Water reticulation	16	Lots	3,000	48,000
11.3	Re-connections allowance	16	Lots	10,000	160,000
				Subtotal	**352,000**
				Sub-total (excl GST)	**352,000**
				Contingency (30%)	**105,600**
				Total (excl GST)	**457,600**

Consultancy services

12	**Consultancy services**				
12.1	Survey, design and construction management	16	Lots	2,500	40,000
12.2	Geotechnical/pavement design	16	Lots	150	2,400
12.3	Electrical and street lighting design	16	Lots	250	4,000
12.4	Telecommunications design	16	Lots	80	1,280
				Subtotal	**47,680**
				Sub-total (excl GST)	**47,680**
				Contingency (20%)	**9,536**
				Total (excl GST)	**57,216**

Authority design and inspection fees

13	**Authority design and inspection fees**				
13.1	Electricity authority	16	Lots	100	1,600
13.2	Telecommunications authority	16	Lots	600	9,600
13.3	Council	16	Lots	300	4,800
13.4	Water authority	16	Lots	80	1,280
				Subtotal	**17,280**
				Sub-total (excl GST)	**17,280**
				Contingency (20%)	**3,456**
				Total (excl GST)	**20,736**
	Grand Total including contingency (excl GST)				**840,994**

Allen Price & Scarratts
Land & Development Consultants
NOWRA AND KIAMA - NSW

ESTIMATED QUANTITIES

Stg 3-Kyoga Ave

Road

ITEM	DESCRIPTION	QTY	UNIT	RATE	AMOUNT excl GST
1	**ESTABLISHMENT AND PRELIMINARIES**				
1.1	Establishment	1	Item	20,000	20,000
1.2	Set out works	1	Item	10,000	10,000
1.3	Services location	1	Item	5,000	5,000
1.4	Traffic & Pedestrian Management Plan	1	Item	10,000	10,000
1.5	Stabilised site access and wash bay	1	Each	15,000	15,000
				Subtotal	**60,000**
2	**SITE WORKS**				
2.1	Demolition (allowance)	0.0	ha	100,000	4,680
2.2	Import, place and compact select fill	420	m^3	40	16,794
2.3	Trim and compact verge areas and swales	156	m^2	5	780
2.4	Topsoil and turf verge areas and swales	156	m^2	10	1,560
2.5	Street trees	0	each	500	-
				Subtotal	**23,813.60**
3	**ROADWORKS**				
3.1	**Road Pavement (4.0m wide)**				
3.2	Trim and Compact Subgrade	390	m^2	5	1,950
3.3	Subbase DGB20 (280mm thick)	390	m^2	25	9,750
3.4	Base Course DGB20 (120mm thick)	312	m^2	15	4,680
3.5	Prime Seal	312	m^2	8	2,496
3.6	Asphalt AC10 (min 30mm thick)	312	m^2	25	7,800
				Subtotal	**26,676**
4	**STORMWATER DRAINAGE**				
4.1	DN100mm subsoil drainage	156	m	35	5,460
				Subtotal	**5,460**
5	**CONCRETE WORKS**				
5.1	Kerb - Edge strip	156	m	50	7,800
5.2	Footpath - 1.5m wide	0	m	150	-
				Subtotal	**7,800**
6	**SIGNAGE & ROAD FURNITURE**				
6.1	Signage and linemarking	78	m	15	1,170
				Subtotal	**1,170**
7	**TESTING & WAE**				
7.1	Density testing	78	m	20	1,560
7.2	Road & drainage works as executed	78	Item	15	1,170
				Subtotal	**2,730**
8	**SOIL AND WATER MANAGEMENT**				

8.1	Soil and water management	78	m	20	1,560
				Subtotal	**1,560**
9	**SERVICE CONDUIT INSTALLATION**				
9.1	Install new elec and comms road crossings	78	m	20	1,560
9.2	Install new water conduit crossings	52	m	15	780
				Subtotal	**2,340**
10	**MISCELLANEOUS**				
10.1	Road ends transition allowance	1	Each	10,000	10,000
10.2	Clean-up and disestablish	1	Item	10,000	10,000
				Subtotal	**20,000**
				Sub-total (excl GST)	**151,550**
				Contingency (30%)	**45,465**
				Total (excl GST)	**197,014**

Reticulated services

11	**Reticulated services**				
11.1	Underground electricity and street lighting	incl	Lots	8,000	-
11.2	Underground telecommunications	incl	Lots	1,000	-
11.3	Water reticulation	incl	Lots	3,000	-
11.3	Re-connections allowance	incl	Lots	10,000	-
				Subtotal	**-**
				Sub-total (excl GST)	**-**
				Contingency (30%)	**-**
				Total (excl GST)	**-**

Consultancy services

12	**Consultancy services**				
12.1	Survey, design and construction management	incl	Lots	2,500	-
12.2	Geotechnical/pavement design	incl	Lots	150	-
12.3	Electrical and street lighting design	incl	Lots	250	-
12.4	Telecommunications design	incl	Lots	80	-
				Subtotal	**-**
				Sub-total (excl GST)	**-**
				Contingency (20%)	**-**
				Total (excl GST)	**-**

Authority design and inspection fees

13	**Authority design and inspection fees**				
13.1	Electricity authority	incl	Lots	100	-
13.2	Telecommunications authority	incl	Lots	600	-
13.3	Council	incl	Lots	300	-
13.4	Water authority	incl	Lots	80	-
				Subtotal	**-**
				Sub-total (excl GST)	**-**
				Contingency (20%)	**-**
				Total (excl GST)	**-**
	Grand Total including contingency (excl GST)				**197,014**

Allen Price & Scarratts
Land & Development Consultants
NOWRA AND KIAMA - NSW

ESTIMATED QUANTITIES

Stg 3-Magnolia Avenue

Road

ITEM	DESCRIPTION	QTY	UNIT	RATE	AMOUNT excl GST
1	**ESTABLISHMENT AND PRELIMINARIES**				
1.1	Establishment	1	Item	20,000	20,000
1.2	Set out works	1	Item	10,000	10,000
1.3	Services location	1	Item	5,000	5,000
1.4	Traffic & Pedestrian Management Plan	1	Item	30,000	30,000
1.5	Stabilised site access and wash bay	1	Each	15,000	15,000
				Subtotal	**80,000**
2	**SITE WORKS**				
2.1	Demolition (allowance)	0.7	ha	100,000	67,600
2.2	Import, place and compact select fill	4579	m^3	40	183,144
2.3	Trim and compact verge areas and swales	3887	m^2	5	19,435
2.4	Topsoil and turf verge areas and swales	3380	m^2	10	33,800
2.5	Street trees	45	each	500	22,533
				Subtotal	**326,512.73**
3	**ROADWORKS**				
3.1	**Road Pavement (8.5m wide)**				
3.2	Trim and Compact Subgrade	3211	m^2	5	16,055
3.3	Subbase DGB20 (280mm thick)	3211	m^2	25	80,275
3.4	Base Course DGB20 (120mm thick)	2873	m^2	15	43,095
3.5	Prime Seal	2873	m^2	8	22,984
3.6	Asphalt AC10 (min 30mm thick)	2873	m^2	25	71,825
				Subtotal	**234,234**
4	**STORMWATER DRAINAGE**				
4.1	DN100mm subsoil drainage	676	m	35	23,660
				Subtotal	**23,660**
5	**CONCRETE WORKS**				
5.1	Kerb - Edge strip	676	m	50	33,800
5.2	Footpath - 1.5m wide	338	m	150	50,700
				Subtotal	**84,500**
6	**SIGNAGE & ROAD FURNITURE**				
6.1	Signage and linemarking	338	m	15	5,070
				Subtotal	**5,070**
7	**TESTING & WAE**				
7.1	Density testing	338	m	20	6,760
7.2	Road & drainage works as executed	338	Item	15	5,070
				Subtotal	**11,830**
8	**SOIL AND WATER MANAGEMENT**				

8.1	Soil and water management	338	m	20	6,760
				Subtotal	**6,760**
9	**SERVICE CONDUIT INSTALLATION**				
9.1	Install new elec and comms road crossings	338	m	20	6,760
9.2	Install new water conduit crossings	225	m	15	3,380
				Subtotal	**10,140**
10	**MISCELLANEOUS**				
10.1	Road ends transition allowance	2	Each	10,000	20,000
10.2	Clean-up and disestablish	1	Item	10,000	10,000
				Subtotal	**30,000**
				Sub-total (excl GST)	**812,707**
				Contingency (30%)	**243,812**
				Total (excl GST)	**1,056,519**

Reticulated services

11	**Reticulated services**				
11.1	Underground electricity and street lighting	34	Lots	8,000	272,000
11.2	Underground telecommunications	34	Lots	1,000	34,000
11.3	Water reticulation	34	Lots	3,000	102,000
11.3	Re-connections allowance	34	Lots	10,000	340,000
				Subtotal	**748,000**
				Sub-total (excl GST)	**748,000**
				Contingency (30%)	**224,400**
				Total (excl GST)	**972,400**

Consultancy services

12	**Consultancy services**				
12.1	Survey, design and construction management	34	Lots	2,500	85,000
12.2	Geotechnical/pavement design	34	Lots	150	5,100
12.3	Electrical and street lighting design	34	Lots	250	8,500
12.4	Telecommunications design	34	Lots	80	2,720
				Subtotal	**101,320**
				Sub-total (excl GST)	**101,320**
				Contingency (20%)	**20,264**
				Total (excl GST)	**121,584**

Authority design and inspection fees

13	**Authority design and inspection fees**				
13.1	Electricity authority	34	Lots	100	3,400
13.2	Telecommunications authority	34	Lots	600	20,400
13.3	Council	34	Lots	300	10,200
13.4	Water authority	34	Lots	80	2,720
				Subtotal	**36,720**
				Sub-total (excl GST)	**36,720**
				Contingency (20%)	**7,344**
				Total (excl GST)	**44,064**
	Grand Total including contingency (excl GST)				**2,194,567**

Allen Price & Scarratts
Land & Development Consultants
NOWRA AND KIAMA - NSW

ESTIMATED QUANTITIES

Stg 3-Lintern Street

Road

ITEM	DESCRIPTION	QTY	UNIT	RATE	AMOUNT excl GST
1	**ESTABLISHMENT AND PRELIMINARIES**				
1.1	Establishment	1	Item	20,000	20,000
1.2	Set out works	1	Item	10,000	10,000
1.3	Services location	1	Item	5,000	5,000
1.4	Traffic & Pedestrian Management Plan	1	Item	30,000	30,000
1.5	Stabilised site access and wash bay	1	Each	15,000	15,000
				Subtotal	**80,000**
2	**SITE WORKS**				
2.1	Demolition (allowance)	0.4	ha	100,000	43,400
2.2	Import, place and compact select fill	1243	m^3	40	49,715
2.3	Trim and compact verge areas and swales	2496	m^2	5	12,478
2.4	Topsoil and turf verge areas and swales	2170	m^2	10	21,700
2.5	Street trees	29	each	500	14,467
				Subtotal	**141,758.77**
3	**ROADWORKS**				
3.1	**Road Pavement (8.5m wide)**				
3.2	Trim and Compact Subgrade	2062	m^2	5	10,308
3.3	Subbase DGB20 (280mm thick)	2062	m^2	25	51,538
3.4	Base Course DGB20 (120mm thick)	1845	m^2	15	27,668
3.5	Prime Seal	1845	m^2	8	14,756
3.6	Asphalt AC10 (min 30mm thick)	1845	m^2	25	46,113
				Subtotal	**150,381**
4	**STORMWATER DRAINAGE**				
4.1	DN450 RRJ Class 3	39	m	250	9,750
4.2	DN900 RRJ Class 3	255	m	550	140,250
4.3	Pit (900x900)	3	each	2,500	7,500
4.4	Pit (1200x1200)	1	each	4,000	4,000
4.5	DN900mm Headwall	1	Item	3,500	3,500
4.6	DN100mm subsoil drainage	434	m	35	15,190
				Subtotal	**180,190**
5	**CONCRETE WORKS**				
5.1	Kerb - Edge strip	434	m	50	21,700
5.2	Footpath - 1.5m wide	217	m	150	32,550
				Subtotal	**54,250**
6	**SIGNAGE & ROAD FURNITURE**				
6.1	Signage and linemarking	217	m	15	3,255
				Subtotal	**3,255**
7	**TESTING & WAE**				
7.1	Density testing	217	m	20	4,340

7.2	Road & drainage works as executed	217	Item	15	3,255
				Subtotal	**7,595**
8	**SOIL AND WATER MANAGEMENT**				
8.1	Soil and water management	217	m	20	4,340
				Subtotal	**4,340**
9	**SERVICE CONDUIT INSTALLATION**				
9.1	Install new elec and comms road crossings	217	m	20	4,340
9.2	Install new water conduit crossings	145	m	15	2,170
				Subtotal	**6,510**
10	**MISCELLANEOUS**				
10.1	Road ends transition allowance	2	Each	10,000	20,000
10.2	Clean-up and disestablish	1	Item	10,000	10,000
				Subtotal	**30,000**
				Sub-total (excl GST)	**658,280**
				Contingency (30%)	**197,484**
				Total (excl GST)	**855,764**

Reticulated services

11	**Reticulated services**				
11.1	Underground electricity and street lighting	8	Lots	8,000	64,000
11.2	Underground telecommunications	8	Lots	1,000	8,000
11.3	Water reticulation	8	Lots	3,000	24,000
11.3	Re-connections allowance	8	Lots	10,000	80,000
				Subtotal	**176,000**
				Sub-total (excl GST)	**176,000**
				Contingency (30%)	**52,800**
				Total (excl GST)	**228,800**

Consultancy services

12	**Consultancy services**				
12.1	Survey, design and construction management	8	Lots	2,500	20,000
12.2	Geotechnical/pavement design	8	Lots	150	1,200
12.3	Electrical and street lighting design	8	Lots	250	2,000
12.4	Telecommunications design	8	Lots	80	640
				Subtotal	**23,840**
				Sub-total (excl GST)	**23,840**
				Contingency (20%)	**4,768**
				Total (excl GST)	**28,608**

Authority design and inspection fees

13	**Authority design and inspection fees**				
13.1	Electricity authority	8	Lots	100	800
13.2	Telecommunications authority	8	Lots	600	4,800
13.3	Council	8	Lots	300	2,400
13.4	Water authority	8	Lots	80	640
				Subtotal	**8,640**
				Sub-total (excl GST)	**8,640**
				Contingency (20%)	**1,728**
				Total (excl GST)	**10,368**
	Grand Total including contingency (excl GST)				**1,123,540**

Allen Price & Scarratts
Land & Development Consultants
NOWRA AND KIAMA - NSW

ESTIMATED QUANTITIES

Stg 3-Emora Avenue

Road

ITEM	DESCRIPTION	QTY	UNIT	RATE	AMOUNT excl GST
1	**ESTABLISHMENT AND PRELIMINARIES**				
1.1	Establishment	1	Item	20,000	20,000
1.2	Set out works	1	Item	15,000	15,000
1.3	Services location	1	Item	10,000	10,000
1.4	Traffic & Pedestrian Management Plan	1	Item	60,000	60,000
1.5	Stabilised site access and wash bay	1	Each	15,000	15,000
				Subtotal	**120,000**
2	**SITE WORKS**				
2.1	Demolition (allowance)	1.0	ha	100,000	104,200
2.2	Import, place and compact select fill	6312	m^3	40	252,470
2.3	Trim and compact verge areas and swales	5992	m^2	5	29,958
2.4	Topsoil and turf verge areas and swales	5210	m^2	10	52,100
2.5	Street trees	69	each	500	34,733
				Subtotal	**473,460.63**
3	**ROADWORKS**				
3.1	**Road Pavement (8.5m wide)**				
3.2	Trim and Compact Subgrade	4950	m^2	5	24,748
3.3	Subbase DGB20 (280mm thick)	4950	m^2	25	123,738
3.4	Base Course DGB20 (120mm thick)	4429	m^2	15	66,428
3.5	Prime Seal	4429	m^2	8	35,428
3.6	Asphalt AC10 (min 30mm thick)	4429	m^2	25	110,713
				Subtotal	**361,053**
4	**STORMWATER DRAINAGE**				
4.1	DN525 RRJ Class 3	94	m	275	25,850
4.2	DN600 RRJ Class 3	80	m	300	24,000
4.3	DN750 RRJ Class 3	29	m	375	10,875
4.4	Pit (900x900)	5	each	2,500	12,500
4.5	DN600mm Headwall	1	Item	2,500	2,500
4.6	DN750mm Headwall	1	Item	3,100	3,100
4.7	Pit (1500 x 1500)	2	each	5,000	10,000
4.8	DN1.3 x 0.3 Headwall	1	Item	3,500	3,500
4.9	1.3 x 0.3 RCBC	90	m	900	81,000
4.10	DN100mm subsoil drainage	1042	m	35	36,470
				Subtotal	**209,795**
5	**CONCRETE WORKS**				
5.1	Kerb - Edge strip	1042	m	50	52,100
5.2	Footpath - 1.5m wide	521	m	150	78,150
				Subtotal	**130,250**
6	**SIGNAGE & ROAD FURNITURE**				
6.1	Signage and linemarking	521	m	15	7,815
				Subtotal	**7,815**

7	**TESTING & WAE**				
7.1	Density testing	521	m	20	10,420
7.2	Road & drainage works as executed	521	Item	15	7,815
				Subtotal	**18,235**
8	**SOIL AND WATER MANAGEMENT**				
8.1	Soil and water management	521	m	20	10,420
				Subtotal	**10,420**
9	**SERVICE CONDUIT INSTALLATION**				
9.1	Install new elec and comms road crossings	521	m	20	10,420
9.2	Install new water conduit crossings	347	m	15	5,210
				Subtotal	**15,630**
10	**MISCELLANEOUS**				
10.1	Road ends transition allowance	5	Each	10,000	50,000
10.2	Clean-up and disestablish	1	Item	10,000	10,000
				Subtotal	**60,000**
				Sub-total (excl GST)	**1,406,659**
				Contingency (30%)	**421,998**
				Total (excl GST)	**1,828,656**

Reticulated services

11	**Reticulated services**				
11.1	Underground electricity and street lighting	36	Lots	8,000	288,000
11.2	Underground telecommunications	36	Lots	1,000	36,000
11.3	Water reticulation	36	Lots	3,000	108,000
11.3	Re-connections allowance	36	Lots	10,000	360,000
				Subtotal	**792,000**
				Sub-total (excl GST)	**792,000**
				Contingency (30%)	**237,600**
				Total (excl GST)	**1,029,600**

Consultancy services

12	**Consultancy services**				
12.1	Survey, design and construction management	36	Lots	2,500	90,000
12.2	Geotechnical/pavement design	36	Lots	150	5,400
12.3	Electrical and street lighting design	36	Lots	250	9,000
12.4	Telecommunications design	36	Lots	80	2,880
				Subtotal	**107,280**
				Sub-total (excl GST)	**107,280**
				Contingency (20%)	**21,456**
				Total (excl GST)	**128,736**

Authority design and inspection fees

13	**Authority design and inspection fees**				
13.1	Electricity authority	36	Lots	100	3,600
13.2	Telecommunications authority	36	Lots	600	21,600
13.3	Council	36	Lots	300	10,800
13.4	Water authority	36	Lots	80	2,880
				Subtotal	**38,880**
				Sub-total (excl GST)	**38,880**
				Contingency (20%)	**7,776**
				Total (excl GST)	**46,656**
	Grand Total including contingency (excl GST)				**3,033,648**

Allen Price & Scarratts
Land & Development Consultants
NOWRA AND KIAMA - NSW

ESTIMATED QUANTITIES

Stg 3-Mirreen Avenue

Road

ITEM	DESCRIPTION	QTY	UNIT	RATE	AMOUNT excl GST
1	**ESTABLISHMENT AND PRELIMINARIES**				
1.1	Establishment	1	Item	20,000	20,000
1.2	Set out works	1	Item	15,000	15,000
1.3	Services location	1	Item	10,000	10,000
1.4	Traffic & Pedestrian Management Plan	1	Item	60,000	60,000
1.5	Stabilised site access and wash bay	1	Each	15,000	15,000
				Subtotal	**120,000**
2	**SITE WORKS**				
2.1	Demolition (allowance)	1.1	ha	100,000	110,000
2.2	Import, place and compact select fill	4762	m^3	40	190,470
2.3	Trim and compact verge areas and swales	6325	m^2	5	31,625
2.4	Topsoil and turf verge areas and swales	5500	m^2	10	55,000
2.5	Street trees	73	each	500	36,667
				Subtotal	**423,761.67**
3	**ROADWORKS**				
3.1	**Road Pavement (8.5m wide)**				
3.2	Trim and Compact Subgrade	5225	m^2	5	26,125
3.3	Subbase DGB20 (280mm thick)	5225	m^2	25	130,625
3.4	Base Course DGB20 (120mm thick)	4675	m^2	15	70,125
3.5	Prime Seal	4675	m^2	8	37,400
3.6	Asphalt AC10 (min 30mm thick)	4675	m^2	25	116,875
				Subtotal	**381,150**
4	**STORMWATER DRAINAGE**				
4.1	DN450 RRJ Class 3	41	m	250	10,250
4.2	DN525 RRJ Class 3	19	m	275	5,225
4.3	DN600 RRJ Class 3	65	m	300	19,500
4.4	Pit (900x900)	4	each	2,500	10,000
4.5	DN100mm subsoil drainage	1100	m	35	38,500
				Subtotal	**83,475**
5	**CONCRETE WORKS**				
5.1	Kerb - Edge strip	1100	m	50	55,000
5.2	Footpath - 1.5m wide	550	m	150	82,500
				Subtotal	**137,500**
6	**SIGNAGE & ROAD FURNITURE**				
6.1	Signage and linemarking	550	m	15	8,250
				Subtotal	**8,250**
7	**TESTING & WAE**				
7.1	Density testing	550	m	20	11,000
7.2	Road & drainage works as executed	550	Item	15	8,250

				Subtotal	**19,250**
8	**SOIL AND WATER MANAGEMENT**				
8.1	Soil and water management	550	m	20	11,000
				Subtotal	**11,000**
9	**SERVICE CONDUIT INSTALLATION**				
9.1	Install new elec and comms road crossings	550	m	20	11,000
9.2	Install new water conduit crossings	367	m	15	5,500
				Subtotal	**16,500**
10	**MISCELLANEOUS**				
10.1	Road ends transition allowance	5	Each	10,000	50,000
10.2	Clean-up and disestablish	1	Item	10,000	10,000
				Subtotal	**60,000**
				Sub-total (excl GST)	**1,260,887**
				Contingency (30%)	**378,266**
				Total (excl GST)	**1,639,153**

Reticulated services

11	**Reticulated services**				
11.1	Underground electricity and street lighting	60	Lots	8,000	480,000
11.2	Underground telecommunications	60	Lots	1,000	60,000
11.3	Water reticulation	60	Lots	3,000	180,000
11.3	Re-connections allowance	60	Lots	10,000	600,000
				Subtotal	**1,320,000**
				Sub-total (excl GST)	**1,320,000**
				Contingency (30%)	**396,000**
				Total (excl GST)	**1,716,000**

Consultancy services

12	**Consultancy services**				
12.1	Survey, design and construction management	60	Lots	2,500	150,000
12.2	Geotechnical/pavement design	60	Lots	150	9,000
12.3	Electrical and street lighting design	60	Lots	250	15,000
12.4	Telecommunications design	60	Lots	80	4,800
				Subtotal	**178,800**
				Sub-total (excl GST)	**178,800**
				Contingency (20%)	**35,760**
				Total (excl GST)	**214,560**

Authority design and inspection fees

13	**Authority design and inspection fees**				
13.1	Electricity authority	60	Lots	100	6,000
13.2	Telecommunications authority	60	Lots	600	36,000
13.3	Council	60	Lots	300	18,000
13.4	Water authority	60	Lots	80	4,800
				Subtotal	**64,800**
				Sub-total (excl GST)	**64,800**
				Contingency (20%)	**12,960**
				Total (excl GST)	**77,760**
	Grand Total including contingency (excl GST)				**3,647,473**

Allen Price & Scarratts
Land & Development Consultants
NOWRA AND KIAMA - NSW

ESTIMATED QUANTITIES

Stg 3-Jenkins Street

Road

ITEM	DESCRIPTION	QTY	UNIT	RATE	AMOUNT excl GST
1	**ESTABLISHMENT AND PRELIMINARIES**				
1.1	Establishment	1	Item	20,000	20,000
1.2	Set out works	1	Item	15,000	15,000
1.3	Services location	1	Item	10,000	10,000
1.4	Traffic & Pedestrian Management Plan	1	Item	30,000	30,000
1.5	Stabilised site access and wash bay	1	Each	15,000	15,000
				Subtotal	**90,000**
2	**SITE WORKS**				
2.1	Demolition (allowance)	0.8	ha	100,000	76,000
2.2	Import, place and compact select fill	3704	m^3	40	148,164
2.3	Trim and compact verge areas and swales	4370	m^2	5	21,850
2.4	Topsoil and turf verge areas and swales	3800	m^2	10	38,000
2.5	Street trees	51	each	500	25,333
				Subtotal	**309,347.33**
3	**ROADWORKS**				
3.1	**Road Pavement (8.5m wide)**				
3.2	Trim and Compact Subgrade	3610	m^2	5	18,050
3.3	Subbase DGB20 (280mm thick)	3610	m^2	25	90,250
3.4	Base Course DGB20 (120mm thick)	3230	m^2	15	48,450
3.5	Prime Seal	3230	m^2	8	25,840
3.6	Asphalt AC10 (min 30mm thick)	3230	m^2	25	80,750
				Subtotal	**263,340**
4	**STORMWATER DRAINAGE**				
4.1	DN600 RRJ Class 3	23	m	300	6,900
4.2	DN750 RRJ Class 3	113	m	375	42,375
4.3	Pit (900x900)	4	each	2,500	10,000
4.4	DN750mm Headwall	1	Item	3,100	3,100
4.5	DN100mm subsoil drainage	760	m	35	26,600
				Subtotal	**88,975**
5	**CONCRETE WORKS**				
5.1	Kerb - Edge strip	760	m	50	38,000
5.2	Footpath - 1.5m wide	380	m	150	57,000
				Subtotal	**95,000**
6	**SIGNAGE & ROAD FURNITURE**				
6.1	Signage and linemarking	380	m	15	5,700
				Subtotal	**5,700**
7	**TESTING & WAE**				
7.1	Density testing	380	m	20	7,600
7.2	Road & drainage works as executed	380	Item	15	5,700

				Subtotal	**13,300**
8	**SOIL AND WATER MANAGEMENT**				
8.1	Soil and water management	380	m	20	7,600
				Subtotal	**7,600**
9	**SERVICE CONDUIT INSTALLATION**				
9.1	Install new elec and comms road crossings	380	m	20	7,600
9.2	Install new water conduit crossings	253	m	15	3,800
				Subtotal	**11,400**
10	**MISCELLANEOUS**				
10.1	Road ends transition allowance	2	Each	10,000	20,000
10.2	Clean-up and disestablish	1	Item	10,000	10,000
				Subtotal	**30,000**
				Sub-total (excl GST)	**914,662**
				Contingency (30%)	**274,399**
				Total (excl GST)	**1,189,061**

Reticulated services

11	**Reticulated services**				
11.1	Underground electricity and street lighting	42	Lots	8,000	336,000
11.2	Underground telecommunications	42	Lots	1,000	42,000
11.3	Water reticulation	42	Lots	3,000	126,000
11.3	Re-connections allowance	42	Lots	10,000	420,000
				Subtotal	**924,000**
				Sub-total (excl GST)	**924,000**
				Contingency (30%)	**277,200**
				Total (excl GST)	**1,201,200**

Consultancy services

12	**Consultancy services**				
12.1	Survey, design and construction management	42	Lots	2,500	105,000
12.2	Geotechnical/pavement design	42	Lots	150	6,300
12.3	Electrical and street lighting design	42	Lots	250	10,500
12.4	Telecommunications design	42	Lots	80	3,360
				Subtotal	**125,160**
				Sub-total (excl GST)	**125,160**
				Contingency (20%)	**25,032**
				Total (excl GST)	**150,192**

Authority design and inspection fees

13	**Authority design and inspection fees**				
13.1	Electricity authority	42	Lots	100	4,200
13.2	Telecommunications authority	42	Lots	600	25,200
13.3	Council	42	Lots	300	12,600
13.4	Water authority	42	Lots	80	3,360
				Subtotal	**45,360**
				Sub-total (excl GST)	**45,360**
				Contingency (20%)	**9,072**
				Total (excl GST)	**54,432**
	Grand Total including contingency (excl GST)				**2,594,885**

Allen Price & Scarratts
Land & Development Consultants
NOWRA AND KIAMA - NSW

ESTIMATED QUANTITIES

Stg 3-Paringa Avenue

Road

ITEM	DESCRIPTION	QTY	UNIT	RATE	AMOUNT excl GST
1	**ESTABLISHMENT AND PRELIMINARIES**				
1.1	Establishment	1	Item	20,000	20,000
1.2	Set out works	1	Item	15,000	15,000
1.3	Services location	1	Item	10,000	10,000
1.4	Traffic & Pedestrian Management Plan	1	Item	30,000	30,000
1.5	Stabilised site access and wash bay	1	Each	15,000	15,000
				Subtotal	**90,000**
2	**SITE WORKS**				
2.1	Demolition (allowance)	1.0	ha	100,000	95,600
2.2	Import, place and compact select fill	3034	m^3	40	121,356
2.3	Trim and compact verge areas and swales	5497	m^2	5	27,485
2.4	Topsoil and turf verge areas and swales	4780	m^2	10	47,800
2.5	Street trees	64	each	500	31,867
				Subtotal	**324,108.07**
3	**ROADWORKS**				
3.1	**Road Pavement (8.5m wide)**				
3.2	Trim and Compact Subgrade	4541	m^2	5	22,705
3.3	Subbase DGB20 (280mm thick)	4541	m^2	25	113,525
3.4	Base Course DGB20 (120mm thick)	4063	m^2	15	60,945
3.5	Prime Seal	4063	m^2	8	32,504
3.6	Asphalt AC10 (min 30mm thick)	4063	m^2	25	101,575
				Subtotal	**331,254**
4	**STORMWATER DRAINAGE**				
4.1	DN600 RRJ Class 3	94	m	300	28,200
4.2	DN750 RRJ Class 3	85	m	375	31,875
4.3	Pit (900x900)	7	each	2,500	17,500
4.4	DN750mm Headwall	1	Item	3,100	3,100
4.5	DN100mm subsoil drainage	956	m	35	33,460
				Subtotal	**114,135**
5	**CONCRETE WORKS**				
5.1	Kerb - Edge strip	956	m	50	47,800
5.2	Footpath - 1.5m wide	478	m	150	71,700
				Subtotal	**119,500**
6	**SIGNAGE & ROAD FURNITURE**				
6.1	Signage and linemarking	478	m	15	7,170
				Subtotal	**7,170**
7	**TESTING & WAE**				
7.1	Density testing	478	m	20	9,560
7.2	Road & drainage works as executed	478	Item	15	7,170

				Subtotal	**16,730**
8	**SOIL AND WATER MANAGEMENT**				
8.1	Soil and water management	478	m	20	9,560
				Subtotal	**9,560**
9	**SERVICE CONDUIT INSTALLATION**				
9.1	Install new elec and comms road crossings	478	m	20	9,560
9.2	Install new water conduit crossings	319	m	15	4,780
				Subtotal	**14,340**
10	**MISCELLANEOUS**				
10.1	Road ends transition allowance	4	Each	10,000	40,000
10.2	Clean-up and disestablish	1	Item	10,000	10,000
				Subtotal	**50,000**
				Sub-total (excl GST)	**1,076,797**
				Contingency (30%)	**323,039**
				Total (excl GST)	**1,399,836**

Reticulated services

11	**Reticulated services**				
11.1	Underground electricity and street lighting	41	Lots	8,000	328,000
11.2	Underground telecommunications	41	Lots	1,000	41,000
11.3	Water reticulation	41	Lots	3,000	123,000
11.3	Re-connections allowance	41	Lots	10,000	410,000
				Subtotal	**902,000**
				Sub-total (excl GST)	**902,000**
				Contingency (30%)	**270,600**
				Total (excl GST)	**1,172,600**

Consultancy services

12	**Consultancy services**				
12.1	Survey, design and construction management	41	Lots	2,500	102,500
12.2	Geotechnical/pavement design	41	Lots	150	6,150
12.3	Electrical and street lighting design	41	Lots	250	10,250
12.4	Telecommunications design	41	Lots	80	3,280
				Subtotal	**122,180**
				Sub-total (excl GST)	**122,180**
				Contingency (20%)	**24,436**
				Total (excl GST)	**146,616**

Authority design and inspection fees

13	**Authority design and inspection fees**				
13.1	Electricity authority	41	Lots	100	4,100
13.2	Telecommunications authority	41	Lots	600	24,600
13.3	Council	41	Lots	300	12,300
13.4	Water authority	41	Lots	80	3,280
				Subtotal	**44,280**
				Sub-total (excl GST)	**44,280**
				Contingency (20%)	**8,856**
				Total (excl GST)	**53,136**
	Grand Total including contingency (excl GST)				**2,772,188**

Allen Price & Scarratts
Land & Development Consultants
NOWRA AND KIAMA - NSW

ESTIMATED QUANTITIES

Stg 3-Restella Avenue

Road

ITEM	DESCRIPTION	QTY	UNIT	RATE	AMOUNT excl GST
1	**ESTABLISHMENT AND PRELIMINARIES**				
1.1	Establishment	1	Item	20,000	20,000
1.2	Set out works	1	Item	15,000	15,000
1.3	Services location	1	Item	10,000	10,000
1.4	Traffic & Pedestrian Management Plan	1	Item	30,000	30,000
1.5	Stabilised site access and wash bay	1	Each	15,000	15,000
				Subtotal	**90,000**
2	**SITE WORKS**				
2.1	Demolition (allowance)	0.8	ha	100,000	75,600
2.2	Import, place and compact select fill	3661	m^3	40	146,456
2.3	Trim and compact verge areas and swales	4347	m^2	5	21,735
2.4	Topsoil and turf verge areas and swales	3780	m^2	10	37,800
2.5	Street trees	50	each	500	25,200
				Subtotal	**306,791.40**
3	**ROADWORKS**				
3.1	**Road Pavement (8.5m wide)**				
3.2	Trim and Compact Subgrade	3591	m^2	5	17,955
3.3	Subbase DGB20 (280mm thick)	3591	m^2	25	89,775
3.4	Base Course DGB20 (120mm thick)	3213	m^2	15	48,195
3.5	Prime Seal	3213	m^2	8	25,704
3.6	Asphalt AC10 (min 30mm thick)	3213	m^2	25	80,325
				Subtotal	**261,954**
4	**STORMWATER DRAINAGE**				
4.1	DN100mm subsoil drainage	756	m	35	26,460
				Subtotal	**26,460**
5	**CONCRETE WORKS**				
5.1	Kerb - Edge strip	756	m	50	37,800
5.2	Footpath - 1.5m wide	378	m	150	56,700
				Subtotal	**94,500**
6	**SIGNAGE & ROAD FURNITURE**				
6.1	Signage and linemarking	378	m	15	5,670
				Subtotal	**5,670**
7	**TESTING & WAE**				
7.1	Density testing	378	m	20	7,560
7.2	Road & drainage works as executed	378	Item	15	5,670
				Subtotal	**13,230**
8	**SOIL AND WATER MANAGEMENT**				

8.1	Soil and water management	378	m	20	7,560
				Subtotal	**7,560**
9	**SERVICE CONDUIT INSTALLATION**				
9.1	Install new elec and comms road crossings	378	m	20	7,560
9.2	Install new water conduit crossings	252	m	15	3,780
				Subtotal	**11,340**
10	**MISCELLANEOUS**				
10.1	Road ends transition allowance	4	Each	10,000	40,000
10.2	Clean-up and disestablish	1	Item	10,000	10,000
				Subtotal	**50,000**
				Sub-total (excl GST)	**867,505**
				Contingency (30%)	**260,252**
				Total (excl GST)	**1,127,757**

Reticulated services

11	**Reticulated services**				
11.1	Underground electricity and street lighting	39	Lots	8,000	312,000
11.2	Underground telecommunications	39	Lots	1,000	39,000
11.3	Water reticulation	39	Lots	3,000	117,000
11.3	Re-connections allowance	39	Lots	10,000	390,000
				Subtotal	**858,000**
				Sub-total (excl GST)	**858,000**
				Contingency (30%)	**257,400**
				Total (excl GST)	**1,115,400**

Consultancy services

12	**Consultancy services**				
12.1	Survey, design and construction management	39	Lots	2,500	97,500
12.2	Geotechnical/pavement design	39	Lots	150	5,850
12.3	Electrical and street lighting design	39	Lots	250	9,750
12.4	Telecommunications design	39	Lots	80	3,120
				Subtotal	**116,220**
				Sub-total (excl GST)	**116,220**
				Contingency (20%)	**23,244**
				Total (excl GST)	**139,464**

Authority design and inspection fees

13	**Authority design and inspection fees**				
13.1	Electricity authority	39	Lots	100	3,900
13.2	Telecommunications authority	39	Lots	600	23,400
13.3	Council	39	Lots	300	11,700
13.4	Water authority	39	Lots	80	3,120
				Subtotal	**42,120**
				Sub-total (excl GST)	**42,120**
				Contingency (20%)	**8,424**
				Total (excl GST)	**50,544**
	Grand Total including contingency (excl GST)				**2,433,165**

Allen Price & Scarratts
Land & Development Consultants
NOWRA AND KIAMA - NSW

ESTIMATED QUANTITIES

Stg 3-Davistown Road

Road

ITEM	DESCRIPTION	QTY	UNIT	RATE	AMOUNT excl GST
1	**ESTABLISHMENT AND PRELIMINARIES**				
1.1	Establishment	1	Item	20,000	20,000
1.2	Set out works	1	Item	15,000	15,000
1.3	Services location	1	Item	10,000	10,000
1.4	Traffic & Pedestrian Management Plan	1	Item	60,000	60,000
1.5	Stabilised site access and wash bay	1	Each	15,000	15,000
				Subtotal	**120,000**
2	**SITE WORKS**				
2.1	Demolition (allowance)	0.8	ha	100,000	84,200
2.2	Import, place and compact select fill	1170	m^3	40	46,810
2.3	Trim and compact verge areas and swales	4842	m^2	5	24,208
2.4	Topsoil and turf verge areas and swales	4210	m^2	10	42,100
2.5	Street trees	56	each	500	28,067
				Subtotal	**225,383.97**
3	**ROADWORKS**				
3.1	**Road Pavement (8.5m wide)**				
3.2	Trim and Compact Subgrade	4000	m^2	5	19,998
3.3	Subbase DGB20 (280mm thick)	4000	m^2	25	99,988
3.4	Base Course DGB20 (120mm thick)	3579	m^2	15	53,678
3.5	Prime Seal	3579	m^2	8	28,628
3.6	Asphalt AC10 (min 30mm thick)	3579	m^2	25	89,463
				Subtotal	**291,753**
4	**STORMWATER DRAINAGE**				
4.1	Pit (1500 x 1500)	2	each	5,000	10,000
4.2	DN1.3 x 0.3 Headwall	2	Item	3,500	7,000
4.3	1.3 x 0.3 RCBC	34	m	900	30,600
4.4	DN100mm subsoil drainage	842	m	35	29,470
				Subtotal	**77,070**
5	**CONCRETE WORKS**				
5.1	Kerb - Edge strip	842	m	50	42,100
5.2	Footpath - 1.5m wide	421	m	150	63,150
				Subtotal	**105,250**
6	**SIGNAGE & ROAD FURNITURE**				
6.1	Signage and linemarking	421	m	15	6,315
				Subtotal	**6,315**
7	**TESTING & WAE**				
7.1	Density testing	421	m	20	8,420
7.2	Road & drainage works as executed	421	Item	15	6,315
				Subtotal	**14,735**

8	**SOIL AND WATER MANAGEMENT**				
8.1	Soil and water management	421	m	20	8,420
				Subtotal	**8,420**
9	**SERVICE CONDUIT INSTALLATION**				
9.1	Install new elec and comms road crossings	421	m	20	8,420
9.2	Install new water conduit crossings	281	m	15	4,210
				Subtotal	**12,630**
10	**MISCELLANEOUS**				
10.1	Road ends transition allowance	4	Each	10,000	40,000
10.2	Clean-up and disestablish	1	Item	10,000	10,000
				Subtotal	**50,000**
				Sub-total (excl GST)	**911,557**
				Contingency (30%)	**273,467**
				Total (excl GST)	**1,185,024**

Reticulated services

11	**Reticulated services**				
11.1	Underground electricity and street lighting	37	Lots	8,000	296,000
11.2	Underground telecommunications	37	Lots	1,000	37,000
11.3	Water reticulation	37	Lots	3,000	111,000
11.3	Re-connections allowance	37	Lots	10,000	370,000
				Subtotal	**814,000**
				Sub-total (excl GST)	**814,000**
				Contingency (30%)	**244,200**
				Total (excl GST)	**1,058,200**

Consultancy services

12	**Consultancy services**				
12.1	Survey, design and construction management	37	Lots	2,500	92,500
12.2	Geotechnical/pavement design	37	Lots	150	5,550
12.3	Electrical and street lighting design	37	Lots	250	9,250
12.4	Telecommunications design	37	Lots	80	2,960
				Subtotal	**110,260**
				Sub-total (excl GST)	**110,260**
				Contingency (20%)	**22,052**
				Total (excl GST)	**132,312**

Authority design and inspection fees

13	**Authority design and inspection fees**				
13.1	Electricity authority	37	Lots	100	3,700
13.2	Telecommunications authority	37	Lots	600	22,200
13.3	Council	37	Lots	300	11,100
13.4	Water authority	37	Lots	80	2,960
				Subtotal	**39,960**
				Sub-total (excl GST)	**39,960**
				Contingency (20%)	**7,992**
				Total (excl GST)	**47,952**
	Grand Total including contingency (excl GST)				**2,423,488**

Allen Price & Scarratts
Land & Development Consultants
NOWRA AND KIAMA - NSW

ESTIMATED QUANTITIES

Stg 3-Lilli Pilli Street

Road

ITEM	DESCRIPTION	QTY	UNIT	RATE	AMOUNT excl GST
1	**ESTABLISHMENT AND PRELIMINARIES**				
1.1	Establishment	1	Item	20,000	20,000
1.2	Set out works	1	Item	15,000	15,000
1.3	Services location	1	Item	10,000	10,000
1.4	Traffic & Pedestrian Management Plan	1	Item	60,000	60,000
1.5	Stabilised site access and wash bay	1	Each	15,000	15,000
				Subtotal	**120,000**
2	**SITE WORKS**				
2.1	Demolition (allowance)	0.9	ha	100,000	87,000
2.2	Import, place and compact select fill	5102	m^3	40	204,083
2.3	Trim and compact verge areas and swales	5003	m^2	5	25,013
2.4	Topsoil and turf verge areas and swales	4350	m^2	10	43,500
2.5	Street trees	58	each	500	29,000
				Subtotal	**388,595.50**
3	**ROADWORKS**				
3.1	**Road Pavement (8.5m wide)**				
3.2	Trim and Compact Subgrade	4133	m^2	5	20,663
3.3	Subbase DGB20 (280mm thick)	4133	m^2	25	103,313
3.4	Base Course DGB20 (120mm thick)	3698	m^2	15	55,463
3.5	Prime Seal	3698	m^2	8	29,580
3.6	Asphalt AC10 (min 30mm thick)	3698	m^2	25	92,438
				Subtotal	**301,455**
4	**STORMWATER DRAINAGE**				
4.1	DN600 RRJ Class 3	60	m	300	18,000
4.2	DN750 RRJ Class 3	86	m	375	32,250
4.3	DN900 RRJ Class 3	98	m	550	53,900
4.4	Pit (900x900)	1	each	2,500	2,500
4.5	Pit (1200x1200)	4	each	4,000	16,000
4.6	DN900mm Headwall	1	Item	3,500	3,500
4.7	DN100mm subsoil drainage	870	m	35	30,450
				Subtotal	**156,600**
5	**CONCRETE WORKS**				
5.1	Kerb - Edge strip	870	m	50	43,500
5.2	Footpath - 1.5m wide	435	m	150	65,250
				Subtotal	**108,750**
6	**SIGNAGE & ROAD FURNITURE**				
6.1	Signage and linemarking	435	m	15	6,525
				Subtotal	**6,525**
7	**TESTING & WAE**				
7.1	Density testing	435	m	20	8,700
7.2	Road & drainage works as executed	435	Item	15	6,525

				Subtotal	**15,225**
8	**SOIL AND WATER MANAGEMENT**				
8.1	Soil and water management	435	m	20	8,700
				Subtotal	**8,700**
9	**SERVICE CONDUIT INSTALLATION**				
9.1	Install new elec and comms road crossings	435	m	20	8,700
9.2	Install new water conduit crossings	290	m	15	4,350
				Subtotal	**13,050**
10	**MISCELLANEOUS**				
10.1	Road ends transition allowance	4	Each	10,000	40,000
10.2	Clean-up and disestablish	1	Item	10,000	10,000
				Subtotal	**50,000**
				Sub-total (excl GST)	**1,168,901**
				Contingency (30%)	**350,670**
				Total (excl GST)	**1,519,571**

Reticulated services

11	**Reticulated services**				
11.1	Underground electricity and street lighting	11	Lots	8,000	88,000
11.2	Underground telecommunications	11	Lots	1,000	11,000
11.3	Water reticulation	11	Lots	3,000	33,000
11.3	Re-connections allowance	11	Lots	10,000	110,000
				Subtotal	**242,000**
				Sub-total (excl GST)	**242,000**
				Contingency (30%)	**72,600**
				Total (excl GST)	**314,600**

Consultancy services

12	**Consultancy services**				
12.1	Survey, design and construction management	11	Lots	2,500	27,500
12.2	Geotechnical/pavement design	11	Lots	150	1,650
12.3	Electrical and street lighting design	11	Lots	250	2,750
12.4	Telecommunications design	11	Lots	80	880
				Subtotal	**32,780**
				Sub-total (excl GST)	**32,780**
				Contingency (20%)	**6,556**
				Total (excl GST)	**39,336**

Authority design and inspection fees

13	**Authority design and inspection fees**				
13.1	Electricity authority	11	Lots	100	1,100
13.2	Telecommunications authority	11	Lots	600	6,600
13.3	Council	11	Lots	300	3,300
13.4	Water authority	11	Lots	80	880
				Subtotal	**11,880**
				Sub-total (excl GST)	**11,880**
				Contingency (20%)	**2,376**
				Total (excl GST)	**14,256**
	Grand Total including contingency (excl GST)				**1,887,763**

Allen Price & Scarratts
Land & Development Consultants
NOWRA AND KIAMA - NSW

ESTIMATED QUANTITIES

Stg 3-Pine Avenue

Road

ITEM	DESCRIPTION	QTY	UNIT	RATE	AMOUNT excl GST
1	**ESTABLISHMENT AND PRELIMINARIES**				
1.1	Establishment	1	Item	20,000	20,000
1.2	Set out works	1	Item	15,000	15,000
1.3	Services location	1	Item	10,000	10,000
1.4	Traffic & Pedestrian Management Plan	1	Item	60,000	60,000
1.5	Stabilised site access and wash bay	1	Each	15,000	15,000
				Subtotal	**120,000**
2	**SITE WORKS**				
2.1	Demolition (allowance)	1.1	ha	100,000	107,200
2.2	Import, place and compact select fill	7871	m^3	40	314,837
2.3	Trim and compact verge areas and swales	6164	m^2	5	30,820
2.4	Topsoil and turf verge areas and swales	5360	m^2	10	53,600
2.5	Street trees	71	each	500	35,733
				Subtotal	**542,190.13**
3	**ROADWORKS**				
3.1	**Road Pavement (8.5m wide)**				
3.2	Trim and Compact Subgrade	5092	m^2	5	25,460
3.3	Subbase DGB20 (280mm thick)	5092	m^2	25	127,300
3.4	Base Course DGB20 (120mm thick)	4556	m^2	15	68,340
3.5	Prime Seal	4556	m^2	8	36,448
3.6	Asphalt AC10 (min 30mm thick)	4556	m^2	25	113,900
				Subtotal	**371,448**
4	**STORMWATER DRAINAGE**				
4.1	DN100mm subsoil drainage	1072	m	35	37,520
				Subtotal	**37,520**
5	**CONCRETE WORKS**				
5.1	Kerb - Edge strip	1072	m	50	53,600
5.2	Footpath - 1.5m wide	536	m	150	80,400
				Subtotal	**134,000**
6	**SIGNAGE & ROAD FURNITURE**				
6.1	Signage and linemarking	536	m	15	8,040
				Subtotal	**8,040**
7	**TESTING & WAE**				
7.1	Density testing	536	m	20	10,720
7.2	Road & drainage works as executed	536	Item	15	8,040
				Subtotal	**18,760**
8	**SOIL AND WATER MANAGEMENT**				

8.1	Soil and water management	536	m	20	10,720
				Subtotal	**10,720**
9	**SERVICE CONDUIT INSTALLATION**				
9.1	Install new elec and comms road crossings	536	m	20	10,720
9.2	Install new water conduit crossings	357	m	15	5,360
				Subtotal	**16,080**
10	**MISCELLANEOUS**				
10.1	Road ends transition allowance	4	Each	10,000	40,000
10.2	Clean-up and disestablish	1	Item	10,000	10,000
				Subtotal	**50,000**
				Sub-total (excl GST)	**1,308,758**
				Contingency (30%)	**392,627**
				Total (excl GST)	**1,701,386**

Reticulated services

11	**Reticulated services**				
11.1	Underground electricity and street lighting	55	Lots	8,000	440,000
11.2	Underground telecommunications	55	Lots	1,000	55,000
11.3	Water reticulation	55	Lots	3,000	165,000
11.3	Re-connections allowance	55	Lots	10,000	550,000
				Subtotal	**1,210,000**
				Sub-total (excl GST)	**1,210,000**
				Contingency (30%)	**363,000**
				Total (excl GST)	**1,573,000**

Consultancy services

12	**Consultancy services**				
12.1	Survey, design and construction management	55	Lots	2,500	137,500
12.2	Geotechnical/pavement design	55	Lots	150	8,250
12.3	Electrical and street lighting design	55	Lots	250	13,750
12.4	Telecommunications design	55	Lots	80	4,400
				Subtotal	**163,900**
				Sub-total (excl GST)	**163,900**
				Contingency (20%)	**32,780**
				Total (excl GST)	**196,680**

Authority design and inspection fees

13	**Authority design and inspection fees**				
13.1	Electricity authority	55	Lots	100	5,500
13.2	Telecommunications authority	55	Lots	600	33,000
13.3	Council	55	Lots	300	16,500
13.4	Water authority	55	Lots	80	4,400
				Subtotal	**59,400**
				Sub-total (excl GST)	**59,400**
				Contingency (20%)	**11,880**
				Total (excl GST)	**71,280**
	Grand Total including contingency (excl GST)				**3,542,346**

Allen Price & Scarratts
Land & Development Consultants
NOWRA AND KIAMA - NSW

ESTIMATED QUANTITIES

Stg 3-McCauley Street

Road

ITEM	DESCRIPTION	QTY	UNIT	RATE	AMOUNT excl GST
1	**ESTABLISHMENT AND PRELIMINARIES**				
1.1	Establishment	1	Item	20,000	20,000
1.2	Set out works	1	Item	10,000	10,000
1.3	Services location	1	Item	5,000	5,000
1.4	Traffic & Pedestrian Management Plan	1	Item	10,000	10,000
1.5	Stabilised site access and wash bay	1	Each	15,000	15,000
				Subtotal	**60,000**
2	**SITE WORKS**				
2.1	Demolition (allowance)	0.2	ha	100,000	20,800
2.2	Import, place and compact select fill	342	m^3	40	13,675
2.3	Trim and compact verge areas and swales	1196	m^2	5	5,980
2.4	Topsoil and turf verge areas and swales	1040	m^2	10	10,400
2.5	Street trees	14	each	500	6,933
				Subtotal	**57,788.53**
3	**ROADWORKS**				
3.1	**Road Pavement (8.5m wide)**				
3.2	Trim and Compact Subgrade	988	m^2	5	4,940
3.3	Subbase DGB20 (280mm thick)	988	m^2	25	24,700
3.4	Base Course DGB20 (120mm thick)	884	m^2	15	13,260
3.5	Prime Seal	884	m^2	8	7,072
3.6	Asphalt AC10 (min 30mm thick)	884	m^2	25	22,100
				Subtotal	**72,072**
4	**STORMWATER DRAINAGE**				
4.1	DN100mm subsoil drainage	208	m	35	7,280
				Subtotal	**7,280**
5	**CONCRETE WORKS**				
5.1	Kerb - Edge strip	208	m	50	10,400
5.2	Footpath - 1.5m wide	104	m	150	15,600
				Subtotal	**26,000**
6	**SIGNAGE & ROAD FURNITURE**				
6.1	Signage and linemarking	104	m	15	1,560
				Subtotal	**1,560**
7	**TESTING & WAE**				
7.1	Density testing	104	m	20	2,080
7.2	Road & drainage works as executed	104	Item	15	1,560
				Subtotal	**3,640**
8	**SOIL AND WATER MANAGEMENT**				

8.1	Soil and water management	104	m	20	2,080
				Subtotal	**2,080**
9	**SERVICE CONDUIT INSTALLATION**				
9.1	Install new elec and comms road crossings	104	m	20	2,080
9.2	Install new water conduit crossings	69	m	15	1,040
				Subtotal	**3,120**
10	**MISCELLANEOUS**				
10.1	Road ends transition allowance	4	Each	10,000	40,000
10.2	Clean-up and disestablish	1	Item	10,000	10,000
				Subtotal	**50,000**
				Sub-total (excl GST)	**283,541**
				Contingency (30%)	**85,062**
				Total (excl GST)	**368,603**

Reticulated services

11	**Reticulated services**				
11.1	Underground electricity and street lighting	10	Lots	8,000	80,000
11.2	Underground telecommunications	10	Lots	1,000	10,000
11.3	Water reticulation	10	Lots	3,000	30,000
11.3	Re-connections allowance	10	Lots	10,000	100,000
				Subtotal	**220,000**
				Sub-total (excl GST)	**220,000**
				Contingency (30%)	**66,000**
				Total (excl GST)	**286,000**

Consultancy services

12	**Consultancy services**				
12.1	Survey, design and construction management	10	Lots	2,500	25,000
12.2	Geotechnical/pavement design	10	Lots	150	1,500
12.3	Electrical and street lighting design	10	Lots	250	2,500
12.4	Telecommunications design	10	Lots	80	800
				Subtotal	**29,800**
				Sub-total (excl GST)	**29,800**
				Contingency (20%)	**5,960**
				Total (excl GST)	**35,760**

Authority design and inspection fees

13	**Authority design and inspection fees**				
13.1	Electricity authority	10	Lots	100	1,000
13.2	Telecommunications authority	10	Lots	600	6,000
13.3	Council	10	Lots	300	3,000
13.4	Water authority	10	Lots	80	800
				Subtotal	**10,800**
				Sub-total (excl GST)	**10,800**
				Contingency (20%)	**2,160**
				Total (excl GST)	**12,960**
	Grand Total including contingency (excl GST)				**703,323**

Allen Price & Scarratts
Land & Development Consultants
NOWRA AND KIAMA - NSW

ESTIMATED QUANTITIES

Stg 3-Grevillia Avenue

Road

ITEM	DESCRIPTION	QTY	UNIT	RATE	AMOUNT excl GST
1	**ESTABLISHMENT AND PRELIMINARIES**				
1.1	Establishment	1	Item	20,000	20,000
1.2	Set out works	1	Item	15,000	15,000
1.3	Services location	1	Item	30,000	30,000
1.4	Traffic & Pedestrian Management Plan	1	Item	10,000	10,000
1.5	Stabilised site access and wash bay	1	Each	15,000	15,000
				Subtotal	**90,000**
2	**SITE WORKS**				
2.1	Demolition (allowance)	0.9	ha	100,000	90,600
2.2	Import, place and compact select fill	3681	m^3	40	147,251
2.3	Trim and compact verge areas and swales	5210	m^2	5	26,048
2.4	Topsoil and turf verge areas and swales	4530	m^2	10	45,300
2.5	Street trees	60	each	500	30,200
				Subtotal	**339,398.90**
3	**ROADWORKS**				
3.1	**Road Pavement (8.5m wide)**				
3.2	Trim and Compact Subgrade	4304	m^2	5	21,518
3.3	Subbase DGB20 (280mm thick)	4304	m^2	25	107,588
3.4	Base Course DGB20 (120mm thick)	3851	m^2	15	57,758
3.5	Prime Seal	3851	m^2	8	30,804
3.6	Asphalt AC10 (min 30mm thick)	3851	m^2	25	96,263
				Subtotal	**313,929**
4	**STORMWATER DRAINAGE**				
4.1	DN750 RRJ Class 3	58	m	375	21,750
4.2	Pit (900x900)	1	each	2,500	2,500
4.3	DN100mm subsoil drainage	906	m	35	31,710
				Subtotal	**55,960**
5	**CONCRETE WORKS**				
5.1	Kerb - Edge strip	906	m	50	45,300
5.2	Footpath - 1.5m wide	453	m	150	67,950
				Subtotal	**113,250**
6	**SIGNAGE & ROAD FURNITURE**				
6.1	Signage and linemarking	453	m	15	6,795
				Subtotal	**6,795**
7	**TESTING & WAE**				
7.1	Density testing	453	m	20	9,060
7.2	Road & drainage works as executed	453	Item	15	6,795
				Subtotal	**15,855**

8	**SOIL AND WATER MANAGEMENT**				
8.1	Soil and water management	453	m	20	9,060
				Subtotal	**9,060**
9	**SERVICE CONDUIT INSTALLATION**				
9.1	Install new elec and comms road crossings	453	m	20	9,060
9.2	Install new water conduit crossings	302	m	15	4,530
				Subtotal	**13,590**
10	**MISCELLANEOUS**				
10.1	Road ends transition allowance	4	Each	10,000	40,000
10.2	Clean-up and disestablish	1	Item	10,000	10,000
				Subtotal	**50,000**
				Sub-total (excl GST)	**1,007,838**
				Contingency (30%)	**302,351**
				Total (excl GST)	**1,310,189**

Reticulated services

11	**Reticulated services**				
11.1	Underground electricity and street lighting	54	Lots	8,000	432,000
11.2	Underground telecommunications	54	Lots	1,000	54,000
11.3	Water reticulation	54	Lots	3,000	162,000
11.3	Re-connections allowance	54	Lots	10,000	540,000
				Subtotal	**1,188,000**
				Sub-total (excl GST)	**1,188,000**
				Contingency (30%)	**356,400**
				Total (excl GST)	**1,544,400**

Consultancy services

12	**Consultancy services**				
12.1	Survey, design and construction management	54	Lots	2,500	135,000
12.2	Geotechnical/pavement design	54	Lots	150	8,100
12.3	Electrical and street lighting design	54	Lots	250	13,500
12.4	Telecommunications design	54	Lots	80	4,320
				Subtotal	**160,920**
				Sub-total (excl GST)	**160,920**
				Contingency (20%)	**32,184**
				Total (excl GST)	**193,104**

Authority design and inspection fees

13	**Authority design and inspection fees**				
13.1	Electricity authority	54	Lots	100	5,400
13.2	Telecommunications authority	54	Lots	600	32,400
13.3	Council	54	Lots	300	16,200
13.4	Water authority	54	Lots	80	4,320
				Subtotal	**58,320**
				Sub-total (excl GST)	**58,320**
				Contingency (20%)	**11,664**
				Total (excl GST)	**69,984**
	Grand Total including contingency (excl GST)				**3,117,677**

Allen Price & Scarratts
Land & Development Consultants
NOWRA AND KIAMA - NSW

ESTIMATED QUANTITIES

Stg 3-Davis Avenue

Road

ITEM	DESCRIPTION	QTY	UNIT	RATE	AMOUNT excl GST
1	**ESTABLISHMENT AND PRELIMINARIES**				
1.1	Establishment	1	Item	20,000	20,000
1.2	Set out works	1	Item	15,000	15,000
1.3	Services location	1	Item	30,000	30,000
1.4	Traffic & Pedestrian Management Plan	1	Item	10,000	10,000
1.5	Stabilised site access and wash bay	1	Each	15,000	15,000
				Subtotal	**90,000**
2	**SITE WORKS**				
2.1	Demolition (allowance)	0.8	ha	100,000	84,800
2.2	Import, place and compact select fill	4179	m^3	40	167,171
2.3	Trim and compact verge areas and swales	4876	m^2	5	24,380
2.4	Topsoil and turf verge areas and swales	4240	m^2	10	42,400
2.5	Street trees	57	each	500	28,267
				Subtotal	**347,017.87**
3	**ROADWORKS**				
3.1	**Road Pavement (8.5m wide)**				
3.2	Trim and Compact Subgrade	4028	m^2	5	20,140
3.3	Subbase DGB20 (280mm thick)	4028	m^2	25	100,700
3.4	Base Course DGB20 (120mm thick)	3604	m^2	15	54,060
3.5	Prime Seal	3604	m^2	8	28,832
3.6	Asphalt AC10 (min 30mm thick)	3604	m^2	25	90,100
				Subtotal	**293,832**
4	**STORMWATER DRAINAGE**				
4.1	DN900 RRJ Class 3	68	m	550	37,400
4.2	Pit (1200x1200)	1	each	4,000	4,000
4.3	DN900mm Headwall	1	Item	3,500	3,500
4.4	DN100mm subsoil drainage	848	m	35	29,680
				Subtotal	**74,580**
5	**CONCRETE WORKS**				
5.1	Kerb - Edge strip	848	m	50	42,400
5.2	Footpath - 1.5m wide	424	m	150	63,600
				Subtotal	**106,000**
6	**SIGNAGE & ROAD FURNITURE**				
6.1	Signage and linemarking	424	m	15	6,360
				Subtotal	**6,360**
7	**TESTING & WAE**				
7.1	Density testing	424	m	20	8,480
7.2	Road & drainage works as executed	424	Item	15	6,360
				Subtotal	**14,840**

8	**SOIL AND WATER MANAGEMENT**				
8.1	Soil and water management	424	m	20	8,480
				Subtotal	**8,480**
9	**SERVICE CONDUIT INSTALLATION**				
9.1	Install new elec and comms road crossings	424	m	20	8,480
9.2	Install new water conduit crossings	283	m	15	4,240
				Subtotal	**12,720**
10	**MISCELLANEOUS**				
10.1	Road ends transition allowance	4	Each	10,000	40,000
10.2	Clean-up and disestablish	1	Item	10,000	10,000
				Subtotal	**50,000**
				Sub-total (excl GST)	**1,003,830**
				Contingency (30%)	**301,149**
				Total (excl GST)	**1,304,979**

Reticulated services

11	**Reticulated services**				
11.1	Underground electricity and street lighting	56	Lots	8,000	448,000
11.2	Underground telecommunications	56	Lots	1,000	56,000
11.3	Water reticulation	56	Lots	3,000	168,000
11.3	Re-connections allowance	56	Lots	10,000	560,000
				Subtotal	**1,232,000**
				Sub-total (excl GST)	**1,232,000**
				Contingency (30%)	**369,600**
				Total (excl GST)	**1,601,600**

Consultancy services

12	**Consultancy services**				
12.1	Survey, design and construction management	56	Lots	2,500	140,000
12.2	Geotechnical/pavement design	56	Lots	150	8,400
12.3	Electrical and street lighting design	56	Lots	250	14,000
12.4	Telecommunications design	56	Lots	80	4,480
				Subtotal	**166,880**
				Sub-total (excl GST)	**166,880**
				Contingency (20%)	**33,376**
				Total (excl GST)	**200,256**

Authority design and inspection fees

13	**Authority design and inspection fees**				
13.1	Electricity authority	56	Lots	100	5,600
13.2	Telecommunications authority	56	Lots	600	33,600
13.3	Council	56	Lots	300	16,800
13.4	Water authority	56	Lots	80	4,480
				Subtotal	**60,480**
				Sub-total (excl GST)	**60,480**
				Contingency (20%)	**12,096**
				Total (excl GST)	**72,576**
	Grand Total including contingency (excl GST)				**3,179,411**

Allen Price & Scarratts
Land & Development Consultants
NOWRA AND KIAMA - NSW

ESTIMATED QUANTITIES

Stg 3-Dilgara Avenue

Road

ITEM	DESCRIPTION	QTY	UNIT	RATE	AMOUNT excl GST
1	**ESTABLISHMENT AND PRELIMINARIES**				
1.1	Establishment	1	Item	20,000	20,000
1.2	Set out works	1	Item	10,000	10,000
1.3	Services location	1	Item	5,000	5,000
1.4	Traffic & Pedestrian Management Plan	1	Item	10,000	10,000
1.5	Stabilised site access and wash bay	1	Each	15,000	15,000
				Subtotal	**60,000**
2	**SITE WORKS**				
2.1	Demolition (allowance)	0.7	ha	100,000	69,800
2.2	Import, place and compact select fill	3129	m^3	40	125,176
2.3	Trim and compact verge areas and swales	4014	m^2	5	20,068
2.4	Topsoil and turf verge areas and swales	3490	m^2	10	34,900
2.5	Street trees	47	each	500	23,267
				Subtotal	**273,210.37**
3	**ROADWORKS**				
3.1	**Road Pavement (8.5m wide)**				
3.2	Trim and Compact Subgrade	3316	m^2	5	16,578
3.3	Subbase DGB20 (280mm thick)	3316	m^2	25	82,888
3.4	Base Course DGB20 (120mm thick)	2967	m^2	15	44,498
3.5	Prime Seal	2967	m^2	8	23,732
3.6	Asphalt AC10 (min 30mm thick)	2967	m^2	25	74,163
				Subtotal	**241,857**
4	**STORMWATER DRAINAGE**				
4.1	DN100mm subsoil drainage	698	m	35	24,430
				Subtotal	**24,430**
5	**CONCRETE WORKS**				
5.1	Kerb - Edge strip	698	m	50	34,900
5.2	Footpath - 1.5m wide	349	m	150	52,350
				Subtotal	**87,250**
6	**SIGNAGE & ROAD FURNITURE**				
6.1	Signage and linemarking	349	m	15	5,235
				Subtotal	**5,235**
7	**TESTING & WAE**				
7.1	Density testing	349	m	20	6,980
7.2	Road & drainage works as executed	349	Item	15	5,235
				Subtotal	**12,215**

8	**SOIL AND WATER MANAGEMENT**				
8.1	Soil and water management	349	m	20	6,980
				Subtotal	**6,980**
9	**SERVICE CONDUIT INSTALLATION**				
9.1	Install new elec and comms road crossings	349	m	20	6,980
9.2	Install new water conduit crossings	233	m	15	3,490
				Subtotal	**10,470**
10	**MISCELLANEOUS**				
10.1	Road ends transition allowance	2	Each	10,000	20,000
10.2	Clean-up and disestablish	1	Item	10,000	10,000
				Subtotal	**30,000**
				Sub-total (excl GST)	**751,647**
				Contingency (30%)	**225,494**
				Total (excl GST)	**977,142**

Reticulated services

11	**Reticulated services**				
11.1	Underground electricity and street lighting	20	Lots	8,000	160,000
11.2	Underground telecommunications	20	Lots	1,000	20,000
11.3	Water reticulation	20	Lots	3,000	60,000
11.3	Re-connections allowance	20	Lots	10,000	200,000
				Subtotal	**440,000**
				Sub-total (excl GST)	**440,000**
				Contingency (30%)	**132,000**
				Total (excl GST)	**572,000**

Consultancy services

12	**Consultancy services**				
12.1	Survey, design and construction management	20	Lots	2,500	50,000
12.2	Geotechnical/pavement design	20	Lots	150	3,000
12.3	Electrical and street lighting design	20	Lots	250	5,000
12.4	Telecommunications design	20	Lots	80	1,600
				Subtotal	**59,600**
				Sub-total (excl GST)	**59,600**
				Contingency (20%)	**11,920**
				Total (excl GST)	**71,520**

Authority design and inspection fees

13	**Authority design and inspection fees**				
13.1	Electricity authority	20	Lots	100	2,000
13.2	Telecommunications authority	20	Lots	600	12,000
13.3	Council	20	Lots	300	6,000
13.4	Water authority	20	Lots	80	1,600
				Subtotal	**21,600**
				Sub-total (excl GST)	**21,600**
				Contingency (20%)	**4,320**
				Total (excl GST)	**25,920**
	Grand Total including contingency (excl GST)				**1,646,582**

Allen Price & Scarratts
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NOWRA AND KIAMA - NSW

ESTIMATED QUANTITIES

Stg 3-Illawong Close

Road

ITEM	DESCRIPTION	QTY	UNIT	RATE	AMOUNT excl GST
1	**ESTABLISHMENT AND PRELIMINARIES**				
1.1	Establishment	1	Item	20,000	20,000
1.2	Set out works	1	Item	10,000	10,000
1.3	Services location	1	Item	5,000	5,000
1.4	Traffic & Pedestrian Management Plan	1	Item	10,000	10,000
1.5	Stabilised site access and wash bay	1	Each	15,000	15,000
				Subtotal	**60,000**
2	**SITE WORKS**				
2.1	Demolition (allowance)	0.5	ha	100,000	47,000
2.2	Import, place and compact select fill	2368	m^3	40	94,723
2.3	Trim and compact verge areas and swales	2703	m^2	5	13,513
2.4	Topsoil and turf verge areas and swales	2350	m^2	10	23,500
2.5	Street trees	31	each	500	15,667
				Subtotal	**194,402.17**
3	**ROADWORKS**				
3.1	**Road Pavement (8.5m wide)**				
3.2	Trim and Compact Subgrade	2233	m^2	5	11,163
3.3	Subbase DGB20 (280mm thick)	2233	m^2	25	55,813
3.4	Base Course DGB20 (120mm thick)	1998	m^2	15	29,963
3.5	Prime Seal	1998	m^2	8	15,980
3.6	Asphalt AC10 (min 30mm thick)	1998	m^2	25	49,938
				Subtotal	**162,855**
4	**STORMWATER DRAINAGE**				
4.1	DN100mm subsoil drainage	470	m	35	16,450
				Subtotal	**16,450**
5	**CONCRETE WORKS**				
5.1	Kerb - Edge strip	470	m	50	23,500
5.2	Footpath - 1.5m wide	235	m	150	35,250
				Subtotal	**58,750**
6	**SIGNAGE & ROAD FURNITURE**				
6.1	Signage and linemarking	235	m	15	3,525
				Subtotal	**3,525**
7	**TESTING & WAE**				
7.1	Density testing	235	m	20	4,700
7.2	Road & drainage works as executed	235	Item	15	3,525
				Subtotal	**8,225**

8	**SOIL AND WATER MANAGEMENT**				
8.1	Soil and water management	235	m	20	4,700
				Subtotal	**4,700**
9	**SERVICE CONDUIT INSTALLATION**				
9.1	Install new elec and comms road crossings	235	m	20	4,700
9.2	Install new water conduit crossings	157	m	15	2,350
				Subtotal	**7,050**
10	**MISCELLANEOUS**				
10.1	Road ends transition allowance	1	Each	10,000	10,000
10.2	Clean-up and disestablish	1	Item	10,000	10,000
				Subtotal	**20,000**
				Sub-total (excl GST)	**535,957**
				Contingency (30%)	**160,787**
				Total (excl GST)	**696,744**

Reticulated services

11	**Reticulated services**				
11.1	Underground electricity and street lighting	24	Lots	8,000	192,000
11.2	Underground telecommunications	24	Lots	1,000	24,000
11.3	Water reticulation	24	Lots	3,000	72,000
11.3	Re-connections allowance	24	Lots	10,000	240,000
				Subtotal	**528,000**
				Sub-total (excl GST)	**528,000**
				Contingency (30%)	**158,400**
				Total (excl GST)	**686,400**

Consultancy services

12	**Consultancy services**				
12.1	Survey, design and construction management	24	Lots	2,500	60,000
12.2	Geotechnical/pavement design	24	Lots	150	3,600
12.3	Electrical and street lighting design	24	Lots	250	6,000
12.4	Telecommunications design	24	Lots	80	1,920
				Subtotal	**71,520**
				Sub-total (excl GST)	**71,520**
				Contingency (20%)	**14,304**
				Total (excl GST)	**85,824**

Authority design and inspection fees

13	**Authority design and inspection fees**				
13.1	Electricity authority	24	Lots	100	2,400
13.2	Telecommunications authority	24	Lots	600	14,400
13.3	Council	24	Lots	300	7,200
13.4	Water authority	24	Lots	80	1,920
				Subtotal	**25,920**
				Sub-total (excl GST)	**25,920**
				Contingency (20%)	**5,184**
				Total (excl GST)	**31,104**
	Grand Total including contingency (excl GST)				**1,500,072**

Allen Price & Scarratts
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NOWRA AND KIAMA - NSW

Key Assumptions

Cost estimates have been prepared on the basis on Allen Price & Scarratts drawings K128161_151 to 162, Rev P0.A15

No investigation, survey or design has been undertaken to assist with the preparation of the quantities and cost estimates.

No investigation in relation into any utility services locations, sizing, or current/future capacity of utility services has been undertaken.

No investigation in relation into any sewerage or water reticulation location, sizing, or current/future capacity of has been undertaken.

No liaison has been undertaken with any service authority or the local Council to ascertain their requirements in relation to design or construction requirements.

No geotechnical investigation has been undertaken.

Cost estimates have been prepared for budget estimate forecasting only and should not be relied upon as a true reflection of the costs associated with land raising of this nature given the lack of investigation, survey and design available at the time of preparing the estimates.

Allen Price & Scarratts
Land & Development Consultants
NOWRA AND KIAMA - NSW

ESTIMATED QUANTITIES

Stg 1-Shelly Beach Road, Sher Close

Road

ITEM	DESCRIPTION	QTY	UNIT	RATE	AMOUNT excl GST
1	**ESTABLISHMENT AND PRELIMINARIES**				
1.1	Establishment	1	Item	20,000	20,000
1.2	Set out works	1	Item	15,000	15,000
1.3	Services location	1	Item	10,000	10,000
1.4	Traffic & Pedestrian Management Plan	1	Item	30,000	30,000
1.5	Stabilised site access and wash bay	1	Each	15,000	15,000
				Subtotal	**90,000**
2	**SITE WORKS**				
2.1	Demolition (allowance)	1.4	ha	100,000	143,800
2.2	Import, place and compact select fill	5872	m^3	40	234,882
2.3	Trim and compact verge areas and swales	8269	m^2	5	41,343
2.4	Topsoil and turf verge areas and swales	7190	m^2	10	71,900
2.5	Street trees	96	each	500	47,933
				Subtotal	**539,858**
3	**ROADWORKS**				
3.1	**Road Pavement (8.5m wide)**				
3.2	Trim and Compact Subgrade	6831	m^2	5	34,153
3.3	Subbase DGB20 (280mm thick)	6831	m^2	25	170,763
3.4	Base Course DGB20 (120mm thick)	6112	m^2	15	91,673
3.5	Prime Seal	6112	m^2	8	48,892
3.6	Asphalt AC10 (min 30mm thick)	6112	m^2	25	152,788
				Subtotal	**498,267**
4	**STORMWATER DRAINAGE**				
4.1	0.5 x 0.3 RCBC	85	m	700	59,500
4.2	Pit (900x900)	9	each	2,500	22,500
4.3	DN450mm Headwall	1	Item	1,500	1,500
4.3	DN525mm Headwall	3	Item	2,000	6,000
4.1	DN450 RRJ Class 3	122	m	250	30,500
4.4	DN525 RRJ Class 3	250	m	275	68,750
4.4	DN100mm subsoil drainage	1438	m	35	50,330
				Subtotal	**239,080**
5	**CONCRETE WORKS**				
5.1	Kerb - Edge strip	1438	m	50	71,900
5.2	Footpath - 1.5m wide	719	m	150	107,850
				Subtotal	**179,750**
6	**SIGNAGE & ROAD FURNITURE**				
6.1	Signage and linemarking	719	m	15	10,785
				Subtotal	**10,785**
7	**TESTING & WAE**				
7.1	Density testing	719	m	20	14,380
7.2	Road & drainage works as executed	719	Item	15	10,785

				Subtotal	**25,165**
8	**SOIL AND WATER MANAGEMENT**				
8.1	Soil and water management	719	m	20	14,380
				Subtotal	**14,380**
9	**SERVICE CONDUIT INSTALLATION**				
9.1	Install new elec and comms road crossings	719	m	20	14,380
9.2	Install new water conduit crossings	479	m	15	7,190
				Subtotal	**21,570**
10	**MISCELLANEOUS**				
10.1	Road ends transition allowance	1	Each	10,000	10,000
10.2	Clean-up and disestablish	1	Item	10,000	10,000
				Subtotal	**20,000**
				Sub-total (excl GST)	**1,638,855**
				Contingency (30%)	**491,657**
				Total (excl GST)	**2,130,512**

Reticulated services

11	**Reticulated services**				
11.1	Underground electricity and street lighting	83	Lots	8,000	664,000
11.2	Underground telecommunications	83	Lots	1,000	83,000
11.3	Water reticulation	83	Lots	3,000	249,000
11.3	Re-connections allowance	83	Lots	10,000	830,000
				Subtotal	**1,826,000**
				Sub-total (excl GST)	**1,826,000**
				Contingency (30%)	**547,800**
				Total (excl GST)	**2,373,800**

Consultancy services

12	**Consultancy services**				
12.1	Survey, design and construction management	83	Lots	2,500	207,500
12.2	Geotechnical/pavement design	83	Lots	150	12,450
12.3	Electrical and street lighting design	83	Lots	250	20,750
12.4	Telecommunications design	83	Lots	80	6,640
				Subtotal	**247,340**
				Sub-total (excl GST)	**247,340**
				Contingency (20%)	**49,468**
				Total (excl GST)	**296,808**

Authority design and inspection fees

13	**Authority design and inspection fees**				
13.1	Electricity authority	83	Lots	100	8,300
13.2	Telecommunications authority	83	Lots	600	49,800
13.3	Council	83	Lots	300	24,900
13.4	Water authority	83	Lots	80	6,640
				Subtotal	**89,640**
				Sub-total (excl GST)	**89,640**
				Contingency (20%)	**17,928**
				Total (excl GST)	**107,568**
	Grand Total including contingency (excl GST)				**4,908,688**

Allen Price & Scarratts
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NOWRA AND KIAMA - NSW

ESTIMATED QUANTITIES

Stg 1-Swale

Swale

ITEM	DESCRIPTION	QTY	UNIT	RATE	AMOUNT excl GST
1	**ESTABLISHMENT AND PRELIMINARIES**				
1.1	Establishment	1	Item	10,000	10,000
1.2	Set out works	1	Item	10,000	10,000
1.3	Services location	1	Item	5,000	5,000
1.4	Traffic & Pedestrian Management Plan	1	Item	5,000	5,000
				Subtotal	**30,000**
2	**SITE WORKS**				
2.1	Demolition (allowance)	6.0	each	25,000	150,000
				Subtotal	**150,000**
3	**Swale - rectangular, vertical sides**				
3.1	Swale cost estimate	6000	m2	25	150,000
3.2	Retaining walls	710	m2	800	568,000
				Subtotal	**718,000**
4	**Road culvert crossings**				
4.1	3 x 2.7 x 0.6 RCBC	73	m	3,000	219,000
4.2	3 x 2.7 x 0.6 Headwall	6	each	10,000	60,000
4.3	DN450 RRJ Class 3	36	m	250	9,000
4.4	Pit (900x900)	2	each	2,500	5,000
4.5	DN450mm Headwall	2	Item	1,500	3,000
				Subtotal	**296,000**
5	**SOIL AND WATER MANAGEMENT**				
5.1	Soil and water management	355	m	20	7,100
				Subtotal	**7,100**
6	**Consultancy services**				
6.1	Survey, design and construction management	1	Item	20,000	20,000
6.2	Geotechnical	1	Item	10,000	10,000
				Subtotal	**30,000**
				Sub-total (excl GST)	**1,231,100**
				Contingency (30%)	**369,330**
				Total (excl GST)	**1,600,430**

Allen Price & Scarratts
Land & Development Consultants
NOWRA AND KIAMA - NSW

ESTIMATED QUANTITIES

Stg 2-Kendall Road

Road

ITEM	DESCRIPTION	QTY	UNIT	RATE	AMOUNT excl GST
1	**ESTABLISHMENT AND PRELIMINARIES**				
1.1	Establishment	1	Item	20,000	20,000
1.2	Set out works	1	Item	15,000	15,000
1.3	Services location	1	Item	10,000	10,000
1.4	Traffic & Pedestrian Management Plan	1	Item	30,000	30,000
1.5	Stabilised site access and wash bay	1	Each	15,000	15,000
				Subtotal	**90,000**
2	**SITE WORKS**				
2.1	Demolition (allowance)	1.2	ha	100,000	118,000
2.2	Import, place and compact select fill	2474	m^3	40	98,942
2.3	Trim and compact verge areas and swales	6785	m^2	5	33,925
2.4	Topsoil and turf verge areas and swales	5900	m^2	10	59,000
2.5	Street trees	79	each	500	39,333.33
				Subtotal	**349,200.33**
3	**ROADWORKS**				
3.1	**Road Pavement (8.5m wide)**				
3.2	Trim and Compact Subgrade	5605	m^2	5	28,025
3.3	Subbase DGB20 (280mm thick)	5605	m^2	25	140,125
3.4	Base Course DGB20 (120mm thick)	5015	m^2	15	75,225
3.5	Prime Seal	5015	m^2	8	40,120
3.6	Asphalt AC10 (min 30mm thick)	5015	m^2	25	125,375
3.7	Extra-over for monument replacement	1	Item	50,000	50,000
				Subtotal	**458,870**
4	**STORMWATER DRAINAGE**				
4.1	DN450 RRJ Class 3	81	m	250	20,250
4.2	1.6 x 0.9 RCBC	51	m	1,300	66,300
4.3	Pit (900x900)	2	each	2,500	5,000
4.4	Pit (1800x1800)	1	each	6,000	6,000
4.5	1.6 x 0.9 Headwall	1	Item	5,000	5,000
4.6	DN100mm subsoil drainage	1180	m	35	41,300
				Subtotal	**143,850**
5	**CONCRETE WORKS**				
5.1	Kerb - Edge strip	1180	m	50	59,000
5.2	Footpath - 1.5m wide	590	m	150	88,500
				Subtotal	**147,500**
6	**SIGNAGE & ROAD FURNITURE**				
6.1	Signage and linemarking	590	m	15	8,850
				Subtotal	**8,850**
7	**TESTING & WAE**				
7.1	Density testing	590	m	20	11,800

7.2	Road & drainage works as executed	590	Item	15	8,850
				Subtotal	**20,650**
8	**SOIL AND WATER MANAGEMENT**				
8.1	Soil and water management	590	m	20	11,800
				Subtotal	**11,800**
9	**SERVICE CONDUIT INSTALLATION**				
9.1	Install new elec and comms road crossings	590	m	20	11,800
9.2	Install new water conduit crossings	393	m	15	5,900
				Subtotal	**17,700**
10	**MISCELLANEOUS**				
10.1	Road ends transition allowance	4	Each	10,000	40,000
10.2	Clean-up and disestablish	1	Item	10,000	10,000
				Subtotal	**50,000**
				Sub-total (excl GST)	**1,298,420**
				Contingency (30%)	**389,526**
				Total (excl GST)	**1,687,946**

Reticulated services

11	**Reticulated services**				
11.1	Underground electricity and street lighting	44	Lots	8,000	352,000
11.2	Underground telecommunications	44	Lots	1,000	44,000
11.3	Water reticulation	44	Lots	3,000	132,000
11.3	Re-connections allowance	44	Lots	10,000	440,000
				Subtotal	**968,000**
				Sub-total (excl GST)	**968,000**
				Contingency (30%)	**290,400**
				Total (excl GST)	**1,258,400**

Consultancy services

12	**Consultancy services**				
12.1	Survey, design and construction management	44	Lots	2,500	110,000
12.2	Geotechnical/pavement design	44	Lots	150	6,600
12.3	Electrical and street lighting design	44	Lots	250	11,000
12.4	Telecommunications design	44	Lots	80	3,520
				Subtotal	**131,120**
				Sub-total (excl GST)	**131,120**
				Contingency (20%)	**26,224**
				Total (excl GST)	**157,344**

Authority design and inspection fees

13	**Authority design and inspection fees**				
13.1	Electricity authority	44	Lots	100	4,400
13.2	Telecommunications authority	44	Lots	600	26,400
13.3	Council	44	Lots	300	13,200
13.4	Water authority	44	Lots	80	3,520
				Subtotal	**47,520**
				Sub-total (excl GST)	**47,520**
				Contingency (20%)	**9,504**
				Total (excl GST)	**57,024**
	Grand Total including contingency (excl GST)				**3,160,714**

Allen Price & Scarratts
Land & Development Consultants
NOWRA AND KIAMA - NSW

ESTIMATED QUANTITIES

Stg 2-Greenfield Road

Road

ITEM	DESCRIPTION	QTY	UNIT	RATE	AMOUNT excl GST
1	**ESTABLISHMENT AND PRELIMINARIES**				
1.1	Establishment	1	Item	20,000	20,000
1.2	Set out works	1	Item	15,000	15,000
1.3	Services location	1	Item	10,000	10,000
1.4	Traffic & Pedestrian Management Plan	1	Item	30,000	30,000
1.5	Stabilised site access and wash bay	1	Each	15,000	15,000
				Subtotal	**90,000**
2	**SITE WORKS**				
2.1	Demolition (allowance)	0.8	ha	100,000	76,400
2.2	Import, place and compact select fill	2364	m^3	40	94,552
2.3	Trim and compact verge areas and swales	4393	m^2	5	21,965
2.4	Topsoil and turf verge areas and swales	3820	m^2	10	38,200
2.5	Street trees	51	each	500	25,467
				Subtotal	**256,583**
3	**ROADWORKS**				
3.1	**Road Pavement (8.5m wide)**				
3.2	Trim and Compact Subgrade	3629	m^2	5	18,145
3.3	Subbase DGB20 (280mm thick)	3629	m^2	25	90,725
3.4	Base Course DGB20 (120mm thick)	3247	m^2	15	48,705
3.5	Prime Seal	3247	m^2	8	25,976
3.6	Asphalt AC10 (min 30mm thick)	3247	m^2	25	81,175
				Subtotal	**264,726**
4	**STORMWATER DRAINAGE**				
4.1	DN100mm subsoil drainage	764	m	35	26,740
				Subtotal	**26,740**
5	**CONCRETE WORKS**				
5.1	Kerb - Edge strip	764	m	50	38,200
5.2	Footpath - 1.5m wide	382	m	150	57,300
				Subtotal	**95,500**
6	**SIGNAGE & ROAD FURNITURE**				
6.1	Signage and linemarking	382	m	15	5,730
				Subtotal	**5,730**
7	**TESTING & WAE**				
7.1	Density testing	382	m	20	7,640
7.2	Road & drainage works as executed	382	Item	15	5,730
				Subtotal	**13,370**

8	**SOIL AND WATER MANAGEMENT**				
8.1	Soil and water management	382	m	20	7,640
				Subtotal	**7,640**
9	**SERVICE CONDUIT INSTALLATION**				
9.1	Install new elec and comms road crossings	382	m	20	7,640
9.2	Install new water conduit crossings	255	m	15	3,820
				Subtotal	**11,460**
10	**MISCELLANEOUS**				
10.1	Road ends transition allowance	2	Each	10,000	20,000
10.2	Clean-up and disestablish	1	Item	10,000	10,000
				Subtotal	**30,000**
				Sub-total (excl GST)	**801,749**
				Contingency (30%)	**240,525**
				Total (excl GST)	**1,042,274**

Reticulated services

11	**Reticulated services**				
11.1	Underground electricity and street lighting	45	Lots	8,000	360,000
11.2	Underground telecommunications	45	Lots	1,000	45,000
11.3	Water reticulation	45	Lots	3,000	135,000
11.3	Re-connections allowance	45	Lots	10,000	450,000
				Subtotal	**990,000**
				Sub-total (excl GST)	**990,000**
				Contingency (30%)	**297,000**
				Total (excl GST)	**1,287,000**

Consultancy services

12	**Consultancy services**				
12.1	Survey, design and construction management	45	Lots	2,500	112,500
12.2	Geotechnical/pavement design	45	Lots	150	6,750
12.3	Electrical and street lighting design	45	Lots	250	11,250
12.4	Telecommunications design	45	Lots	80	3,600
				Subtotal	**134,100**
				Sub-total (excl GST)	**134,100**
				Contingency (20%)	**26,820**
				Total (excl GST)	**160,920**

Authority design and inspection fees

13	**Authority design and inspection fees**				
13.1	Electricity authority	45	Lots	100	4,500
13.2	Telecommunications authority	45	Lots	600	27,000
13.3	Council	45	Lots	300	13,500
13.4	Water authority	45	Lots	80	3,600
				Subtotal	**48,600**
				Sub-total (excl GST)	**48,600**
				Contingency (20%)	**9,720**
				Total (excl GST)	**58,320**
	Grand Total including contingency (excl GST)				**2,548,514**

Allen Price & Scarratts
Land & Development Consultants
NOWRA AND KIAMA - NSW

ESTIMATED QUANTITIES

Stg 2-Echuca Road

Road

ITEM	DESCRIPTION	QTY	UNIT	RATE	AMOUNT excl GST
1	**ESTABLISHMENT AND PRELIMINARIES**				
1.1	Establishment	1	Item	20,000	20,000
1.2	Set out works	1	Item	10,000	10,000
1.3	Services location	1	Item	10,000	10,000
1.4	Traffic & Pedestrian Management Plan	1	Item	30,000	30,000
1.5	Stabilised site access and wash bay	1	Each	15,000	15,000
				Subtotal	**85,000**
2	**SITE WORKS**				
2.1	Demolition (allowance)	0.5	ha	100,000	46,000
2.2	Import, place and compact select fill	1304	m^3	40	52,174
2.3	Trim and compact verge areas and swales	2645	m^2	5	13,225
2.4	Topsoil and turf verge areas and swales	2300	m^2	10	23,000
2.5	Street trees	31	each	500	15,333
				Subtotal	**149,732**
3	**ROADWORKS**				
3.1	**Road Pavement (8.5m wide)**				
3.2	Trim and Compact Subgrade	2185	m^2	5	10,925
3.3	Subbase DGB20 (280mm thick)	2185	m^2	25	54,625
3.4	Base Course DGB20 (120mm thick)	1955	m^2	15	29,325
3.5	Prime Seal	1955	m^2	8	15,640
3.6	Asphalt AC10 (min 30mm thick)	1955	m^2	25	48,875
				Subtotal	**159,390**
4	**STORMWATER DRAINAGE**				
4.1	DN100mm subsoil drainage	460	m	35	16,100
				Subtotal	**16,100**
5	**CONCRETE WORKS**				
5.1	Kerb - Edge strip	460	m	50	23,000
5.2	Footpath - 1.5m wide	230	m	150	34,500
				Subtotal	**57,500**
6	**SIGNAGE & ROAD FURNITURE**				
6.1	Signage and linemarking	230	m	15	3,450
				Subtotal	**3,450**
7	**TESTING & WAE**				
7.1	Density testing	230	m	20	4,600
7.2	Road & drainage works as executed	230	Item	15	3,450
				Subtotal	**8,050**

8	**SOIL AND WATER MANAGEMENT**				
8.1	Soil and water management	230	m	20	4,600
				Subtotal	**4,600**
9	**SERVICE CONDUIT INSTALLATION**				
9.1	Install new elec and comms road crossings	230	m	20	4,600
9.2	Install new water conduit crossings	153	m	15	2,300
				Subtotal	**6,900**
10	**MISCELLANEOUS**				
10.1	Road ends transition allowance	2	Each	10,000	20,000
10.2	Clean-up and disestablish	1	Item	10,000	10,000
				Subtotal	**30,000**
				Sub-total (excl GST)	**520,722**
				Contingency (30%)	**156,217**
				Total (excl GST)	**676,939**

Reticulated services

11	**Reticulated services**				
11.1	Underground electricity and street lighting	27	Lots	8,000	216,000
11.2	Underground telecommunications	27	Lots	1,000	27,000
11.3	Water reticulation	27	Lots	3,000	81,000
11.3	Re-connections allowance	27	Lots	10,000	270,000
				Subtotal	**594,000**
				Sub-total (excl GST)	**594,000**
				Contingency (30%)	**178,200**
				Total (excl GST)	**772,200**

Consultancy services

12	**Consultancy services**				
12.1	Survey, design and construction management	27	Lots	2,500	67,500
12.2	Geotechnical/pavement design	27	Lots	150	4,050
12.3	Electrical and street lighting design	27	Lots	250	6,750
12.4	Telecommunications design	27	Lots	80	2,160
				Subtotal	**80,460**
				Sub-total (excl GST)	**80,460**
				Contingency (20%)	**16,092**
				Total (excl GST)	**96,552**

Authority design and inspection fees

13	**Authority design and inspection fees**				
13.1	Electricity authority	27	Lots	100	2,700
13.2	Telecommunications authority	27	Lots	600	16,200
13.3	Council	27	Lots	300	8,100
13.4	Water authority	27	Lots	80	2,160
				Subtotal	**29,160**
				Sub-total (excl GST)	**29,160**
				Contingency (20%)	**5,832**
				Total (excl GST)	**34,992**
	Grand Total including contingency (excl GST)				**1,580,683**

Allen Price & Scarratts
Land & Development Consultants
NOWRA AND KIAMA - NSW

ESTIMATED QUANTITIES

Stg 2-Myrtle Road

Road

ITEM	DESCRIPTION	QTY	UNIT	RATE	AMOUNT excl GST
1	**ESTABLISHMENT AND PRELIMINARIES**				
1.1	Establishment	1	Item	20,000	20,000
1.2	Set out works	1	Item	10,000	10,000
1.3	Services location	1	Item	10,000	10,000
1.4	Traffic & Pedestrian Management Plan	1	Item	30,000	30,000
1.5	Stabilised site access and wash bay	1	Each	15,000	15,000
				Subtotal	**85,000**
2	**SITE WORKS**				
2.1	Demolition (allowance)	0.4	ha	100,000	35,400
2.2	Import, place and compact select fill	518	m^3	40	20,723
2.3	Trim and compact verge areas and swales	2036	m^2	5	10,178
2.4	Topsoil and turf verge areas and swales	1770	m^2	10	17,700
2.5	Street trees	24	each	500	11,800
				Subtotal	**95,800**
3	**ROADWORKS**				
3.1	**Road Pavement (8.5m wide)**				
3.2	Trim and Compact Subgrade	1682	m^2	5	8,408
3.3	Subbase DGB20 (280mm thick)	1682	m^2	25	42,038
3.4	Base Course DGB20 (120mm thick)	1505	m^2	15	22,568
3.5	Prime Seal	1505	m^2	8	12,036
3.6	Asphalt AC10 (min 30mm thick)	1505	m^2	25	37,613
				Subtotal	**122,661**
4	**STORMWATER DRAINAGE**				
4.1	DN100mm subsoil drainage	354	m	35	12,390
				Subtotal	**12,390**
5	**CONCRETE WORKS**				
5.1	Kerb - Edge strip	354	m	50	17,700
5.2	Footpath - 1.5m wide	177	m	150	26,550
				Subtotal	**44,250**
6	**SIGNAGE & ROAD FURNITURE**				
6.1	Signage and linemarking	177	m	15	2,655
				Subtotal	**2,655**
7	**TESTING & WAE**				
7.1	Density testing	177	m	20	3,540
7.2	Road & drainage works as executed	177	Item	15	2,655
				Subtotal	**6,195**

8	**SOIL AND WATER MANAGEMENT**				
8.1	Soil and water management	177	m	20	3,540
				Subtotal	**3,540**
9	**SERVICE CONDUIT INSTALLATION**				
9.1	Install new elec and comms road crossings	177	m	20	3,540
9.2	Install new water conduit crossings	118	m	15	1,770
				Subtotal	**5,310**
10	**MISCELLANEOUS**				
10.1	Road ends transition allowance	2	Each	10,000	20,000
10.2	Clean-up and disestablish	1	Item	10,000	10,000
				Subtotal	**30,000**
				Sub-total (excl GST)	**407,801**
				Contingency (30%)	**122,340**
				Total (excl GST)	**530,141**

Reticulated services

11	**Reticulated services**				
11.1	Underground electricity and street lighting	14	Lots	8,000	112,000
11.2	Underground telecommunications	14	Lots	1,000	14,000
11.3	Water reticulation	14	Lots	3,000	42,000
11.3	Re-connections allowance	14	Lots	10,000	140,000
				Subtotal	**308,000**
				Sub-total (excl GST)	**308,000**
				Contingency (30%)	**92,400**
				Total (excl GST)	**400,400**

Consultancy services

12	**Consultancy services**				
12.1	Survey, design and construction management	14	Lots	2,500	35,000
12.2	Geotechnical/pavement design	14	Lots	150	2,100
12.3	Electrical and street lighting design	14	Lots	250	3,500
12.4	Telecommunications design	14	Lots	80	1,120
				Subtotal	**41,720**
				Sub-total (excl GST)	**41,720**
				Contingency (20%)	**8,344**
				Total (excl GST)	**50,064**

Authority design and inspection fees

13	**Authority design and inspection fees**				
13.1	Electricity authority	14	Lots	100	1,400
13.2	Telecommunications authority	14	Lots	600	8,400
13.3	Council	14	Lots	300	4,200
13.4	Water authority	14	Lots	80	1,120
				Subtotal	**15,120**
				Sub-total (excl GST)	**15,120**
				Contingency (20%)	**3,024**
				Total (excl GST)	**18,144**
	Grand Total including contingency (excl GST)				**998,749**

Allen Price & Scarratts
Land & Development Consultants
NOWRA AND KIAMA - NSW

ESTIMATED QUANTITIES

Stg 1-Rickard Road

Road

ITEM	DESCRIPTION	QTY	UNIT	RATE	AMOUNT excl GST
1	**ESTABLISHMENT AND PRELIMINARIES**				
1.1	Establishment	1	Item	20,000	20,000
1.2	Set out works	1	Item	15,000	15,000
1.3	Services location	1	Item	10,000	10,000
1.4	Traffic & Pedestrian Management Plan	1	Item	30,000	30,000
1.5	Stabilised site access and wash bay	2	Each	15,000	30,000
				Subtotal	**105,000**
2	**SITE WORKS**				
2.1	Demolition (allowance)	1.3	ha	100,000	126,000
2.2	Import, place and compact select fill	7497	m^3	40	299,894
2.3	Trim and compact verge areas and swales	7245	m^2	5	36,225
2.4	Topsoil and turf verge areas and swales	6300	m^2	10	63,000
2.5	Street trees	84	each	500	42,000
				Subtotal	**567,119**
3	**ROADWORKS**				
3.1	**Road Pavement (8.5m wide)**				
3.2	Trim and Compact Subgrade	5985	m^2	5	29,925
3.3	Subbase DGB20 (280mm thick)	5985	m^2	25	149,625
3.4	Base Course DGB20 (120mm thick)	5355	m^2	15	80,325
3.5	Prime Seal	5355	m^2	8	42,840
3.6	Asphalt AC10 (min 30mm thick)	5355	m^2	25	133,875
				Subtotal	**436,590**
4	**STORMWATER DRAINAGE**				
4.1	Pit (900x900)	2	each	2,500	5,000
4.2	DN375 RRJ Class 3	28	m	200	5,600
4.3	Pit (1500 x 1500)	3	each	5,000	15,000
4.4	DN1.2 x 0.3 Headwall	3	Item	3,500	10,500
4.5	1.2 x 0.3 RCBC	54	m	900	48,600
4.6	DN100mm subsoil drainage	1260	m	35	44,100
				Subtotal	**128,800**
5	**CONCRETE WORKS**				
5.1	Kerb - Edge strip	1260	m	50	63,000
5.2	Footpath - 1.5m wide	630	m	150	94,500
				Subtotal	**157,500**
6	**SIGNAGE & ROAD FURNITURE**				
6.1	Signage and linemarking	630	m	15	9,450
				Subtotal	**9,450**
7	**TESTING & WAE**				
7.1	Density testing	630	m	20	12,600

7.2	Road & drainage works as executed	630	Item	15	9,450
				Subtotal	**22,050**
8	**SOIL AND WATER MANAGEMENT**				
8.1	Soil and water management	630	m	20	12,600
				Subtotal	**12,600**
9	**SERVICE CONDUIT INSTALLATION**				
9.1	Install new elec and comms road crossings	630	m	20	12,600
9.2	Install new water conduit crossings	420	m	15	6,300
				Subtotal	**18,900**
10	**MISCELLANEOUS**				
10.1	Road ends transition allowance	4	Each	10,000	40,000
10.2	Clean-up and disestablish	1	Item	10,000	10,000
				Subtotal	**50,000**
				Sub-total (excl GST)	**1,508,009**
				Contingency (30%)	**452,403**
				Total (excl GST)	**1,960,412**

Reticulated services

11	**Reticulated services**				
11.1	Underground electricity and street lighting	58	Lots	8,000	464,000
11.2	Underground telecommunications	58	Lots	1,000	58,000
11.3	Water reticulation	58	Lots	3,000	174,000
11.3	Re-connections allowance	58	Lots	10,000	580,000
				Subtotal	**1,276,000**
				Sub-total (excl GST)	**1,276,000**
				Contingency (30%)	**382,800**
				Total (excl GST)	**1,658,800**

Consultancy services

12	**Consultancy services**				
12.1	Survey, design and construction management	58	Lots	2,500	145,000
12.2	Geotechnical/pavement design	58	Lots	150	8,700
12.3	Electrical and street lighting design	58	Lots	250	14,500
12.4	Telecommunications design	58	Lots	80	4,640
				Subtotal	**172,840**
				Sub-total (excl GST)	**172,840**
				Contingency (20%)	**34,568**
				Total (excl GST)	**207,408**

Authority design and inspection fees

13	**Authority design and inspection fees**				
13.1	Electricity authority	58	Lots	100	5,800
13.2	Telecommunications authority	58	Lots	600	34,800
13.3	Council	58	Lots	300	17,400
13.4	Water authority	58	Lots	80	4,640
				Subtotal	**62,640**
				Sub-total (excl GST)	**62,640**
				Contingency (20%)	**12,528**
				Total (excl GST)	**75,168**
	Grand Total including contingency (excl GST)				**3,901,788**

Allen Price & Scarratts
Land & Development Consultants
NOWRA AND KIAMA - NSW

ESTIMATED QUANTITIES

Stg 1-Sorrento Road

Road

ITEM	DESCRIPTION	QTY	UNIT	RATE	AMOUNT excl GST
1	**ESTABLISHMENT AND PRELIMINARIES**				
1.1	Establishment	1	Item	20,000	20,000
1.2	Set out works	1	Item	15,000	15,000
1.3	Services location	1	Item	10,000	10,000
1.4	Traffic & Pedestrian Management Plan	1	Item	30,000	30,000
1.5	Stabilised site access and wash bay	2	Each	15,000	30,000
				Subtotal	**105,000**
2	**SITE WORKS**				
2.1	Demolition (allowance)	1.2	ha	100,000	115,000
2.2	Import, place and compact select fill	5778	m^3	40	231,135
2.3	Trim and compact verge areas and swales	6613	m^2	5	33,063
2.4	Topsoil and turf verge areas and swales	5750	m^2	10	57,500
2.5	Street trees	77	each	500	38,333
				Subtotal	**475,031**
3	**ROADWORKS**				
3.1	**Road Pavement (8.5m wide)**				
3.2	Trim and Compact Subgrade	5463	m^2	5	27,313
3.3	Subbase DGB20 (280mm thick)	5463	m^2	25	136,563
3.4	Base Course DGB20 (120mm thick)	4888	m^2	15	73,313
3.5	Prime Seal	4888	m^2	8	39,100
3.6	Asphalt AC10 (min 30mm thick)	4888	m^2	25	122,188
				Subtotal	**398,475**
4	**STORMWATER DRAINAGE**				
4.1	Pit (900x900)	5	each	2,500	12,500
4.2	Pit (1200 x 1200)	2	each	4,000	8,000
4.3	DN450 RRJ Class 3	19	m	250	4,750
4.4	DN600 RRJ Class 3	152	m	300	45,600
4.5	DN900 RRJ Class 3	106	m	550	58,300
4.6	DN450mm Headwall	1	Item	1,500	1,500
4.7	DN600mm Headwall	1	Item	2,500	2,500
4.8	DN900mm Headwall	1	Item	3,500	3,500
4.9	1.5 x 0.9 RCBC	25	m	1,300	32,500
4.10	DN100mm subsoil drainage	1150	m	35	40,250
				Subtotal	**209,400**
5	**CONCRETE WORKS**				
5.1	Kerb - Edge strip	1150	m	50	57,500
5.2	Footpath - 1.5m wide	575	m	150	86,250
				Subtotal	**143,750**
6	**SIGNAGE & ROAD FURNITURE**				
6.1	Signage and linemarking	575	m	15	8,625
				Subtotal	**8,625**

7	**TESTING & WAE**				
7.1	Density testing	575	m	20	11,500
7.2	Road & drainage works as executed	575	Item	15	8,625
				Subtotal	**20,125**
8	**SOIL AND WATER MANAGEMENT**				
8.1	Soil and water management	575	m	20	11,500
				Subtotal	**11,500**
9	**SERVICE CONDUIT INSTALLATION**				
9.1	Install new elec and comms road crossings	575	m	20	11,500
9.2	Install new water conduit crossings	383	m	15	5,750
				Subtotal	**17,250**
10	**MISCELLANEOUS**				
10.1	Road ends transition allowance	3	Each	10,000	30,000
10.2	Clean-up and disestablish	1	Item	10,000	10,000
				Subtotal	**40,000**
				Sub-total (excl GST)	**1,429,156**
				Contingency (30%)	**428,747**
				Total (excl GST)	**1,857,903**

Reticulated services

11	**Reticulated services**				
11.1	Underground electricity and street lighting	53	Lots	8,000	424,000
11.2	Underground telecommunications	53	Lots	1,000	53,000
11.3	Water reticulation	53	Lots	3,000	159,000
11.3	Re-connections allowance	53	Lots	10,000	530,000
				Subtotal	**1,166,000**
				Sub-total (excl GST)	**1,166,000**
				Contingency (30%)	**349,800**
				Total (excl GST)	**1,515,800**

Consultancy services

12	**Consultancy services**				
12.1	Survey, design and construction management	53	Lots	2,500	132,500
12.2	Geotechnical/pavement design	53	Lots	150	7,950
12.3	Electrical and street lighting design	53	Lots	250	13,250
12.4	Telecommunications design	53	Lots	80	4,240
				Subtotal	**157,940**
				Sub-total (excl GST)	**157,940**
				Contingency (20%)	**31,588**
				Total (excl GST)	**189,528**

Authority design and inspection fees

13	**Authority design and inspection fees**				
13.1	Electricity authority	53	Lots	100	5,300
13.2	Telecommunications authority	53	Lots	600	31,800
13.3	Council	53	Lots	300	15,900
13.4	Water authority	53	Lots	80	4,240
				Subtotal	**57,240**
				Sub-total (excl GST)	**57,240**
				Contingency (20%)	**11,448**
				Total (excl GST)	**68,688**
	Grand Total including contingency (excl GST)				**3,631,919**

Allen Price & Scarratts
Land & Development Consultants
NOWRA AND KIAMA - NSW

ESTIMATED QUANTITIES

Stg 1-Gordon Road

Road

ITEM	DESCRIPTION	QTY	UNIT	RATE	AMOUNT excl GST
1	**ESTABLISHMENT AND PRELIMINARIES**				
1.1	Establishment	1	Item	20,000	20,000
1.2	Set out works	1	Item	15,000	15,000
1.3	Services location	1	Item	10,000	10,000
1.4	Traffic & Pedestrian Management Plan	1	Item	20,000	20,000
1.5	Stabilised site access and wash bay	2	Each	15,000	30,000
				Subtotal	**95,000**
2	**SITE WORKS**				
2.1	Demolition (allowance)	0.9	ha	100,000	86,000
2.2	Import, place and compact select fill	4628	m^3	40	185,134
2.3	Trim and compact verge areas and swales	4945	m^2	5	24,725
2.4	Topsoil and turf verge areas and swales	4300	m^2	10	43,000
2.5	Street trees	57	each	500	28,667
				Subtotal	**367,526**
3	**ROADWORKS**				
3.1	**Road Pavement (8.5m wide)**				
3.2	Trim and Compact Subgrade	4085	m^2	5	20,425
3.3	Subbase DGB20 (280mm thick)	4085	m^2	25	102,125
3.4	Base Course DGB20 (120mm thick)	3655	m^2	15	54,825
3.5	Prime Seal	3655	m^2	8	29,240
3.6	Asphalt AC10 (min 30mm thick)	3655	m^2	25	91,375
				Subtotal	**297,990**
4	**STORMWATER DRAINAGE**				
4.1	DN100mm subsoil drainage	860	m	35	30,100
				Subtotal	**30,100**
5	**CONCRETE WORKS**				
5.1	Kerb - Edge strip	860	m	50	43,000
5.2	Footpath - 1.5m wide	430	m	150	64,500
				Subtotal	**107,500**
6	**SIGNAGE & ROAD FURNITURE**				
6.1	Signage and linemarking	430	m	15	6,450
				Subtotal	**6,450**
7	**TESTING & WAE**				
7.1	Density testing	430	m	20	8,600
7.2	Road & drainage works as executed	430	Item	15	6,450
				Subtotal	**15,050**
8	**SOIL AND WATER MANAGEMENT**				

8.1	Soil and water management	430	m	20	8,600
				Subtotal	**8,600**
9	**SERVICE CONDUIT INSTALLATION**				
9.1	Install new elec and comms road crossings	430	m	20	8,600
9.2	Install new water conduit crossings	287	m	15	4,300
				Subtotal	**12,900**
10	**MISCELLANEOUS**				
10.1	Road ends transition allowance	3	Each	10,000	30,000
10.2	Clean-up and disestablish	1	Item	10,000	10,000
				Subtotal	**40,000**
				Sub-total (excl GST)	**981,116**
				Contingency (30%)	**294,335**
				Total (excl GST)	**1,275,450**

Reticulated services

11	**Reticulated services**				
11.1	Underground electricity and street lighting	32	Lots	8,000	256,000
11.2	Underground telecommunications	32	Lots	1,000	32,000
11.3	Water reticulation	32	Lots	3,000	96,000
11.3	Re-connections allowance	32	Lots	10,000	320,000
				Subtotal	**704,000**
				Sub-total (excl GST)	**704,000**
				Contingency (30%)	**211,200**
				Total (excl GST)	**915,200**

Consultancy services

12	**Consultancy services**				
12.1	Survey, design and construction management	32	Lots	2,500	80,000
12.2	Geotechnical/pavement design	32	Lots	150	4,800
12.3	Electrical and street lighting design	32	Lots	250	8,000
12.4	Telecommunications design	32	Lots	80	2,560
				Subtotal	**95,360**
				Sub-total (excl GST)	**95,360**
				Contingency (20%)	**19,072**
				Total (excl GST)	**114,432**

Authority design and inspection fees

13	**Authority design and inspection fees**				
13.1	Electricity authority	32	Lots	100	3,200
13.2	Telecommunications authority	32	Lots	600	19,200
13.3	Council	32	Lots	300	9,600
13.4	Water authority	32	Lots	80	2,560
				Subtotal	**34,560**
				Sub-total (excl GST)	**34,560**
				Contingency (20%)	**6,912**
				Total (excl GST)	**41,472**
	Grand Total including contingency (excl GST)				**2,346,554**

Allen Price & Scarratts
Land & Development Consultants
NOWRA AND KIAMA - NSW

ESTIMATED QUANTITIES

Stg 1-Myler Avenue

Road

ITEM	DESCRIPTION	QTY	UNIT	RATE	AMOUNT excl GST
1	**ESTABLISHMENT AND PRELIMINARIES**				
1.1	Establishment	1	Item	20,000	20,000
1.2	Set out works	1	Item	5,000	5,000
1.3	Services location	1	Item	5,000	5,000
1.4	Traffic & Pedestrian Management Plan	1	Item	10,000	10,000
1.5	Stabilised site access and wash bay	2	Each	15,000	30,000
				Subtotal	**70,000**
2	**SITE WORKS**				
2.1	Demolition (allowance)	0.2	ha	100,000	19,000
2.2	Import, place and compact select fill	53	m^3	40	2,111
2.3	Trim and compact verge areas and swales	1093	m^2	5	5,463
2.4	Topsoil and turf verge areas and swales	950	m^2	10	9,500
2.5	Street trees	13	each	500	6,333
				Subtotal	**42,407**
3	**ROADWORKS**				
3.1	**Road Pavement (8.5m wide)**				
3.2	Trim and Compact Subgrade	903	m^2	5	4,513
3.3	Subbase DGB20 (280mm thick)	903	m^2	25	22,563
3.4	Base Course DGB20 (120mm thick)	808	m^2	15	12,113
3.5	Prime Seal	808	m^2	8	6,460
3.6	Asphalt AC10 (min 30mm thick)	808	m^2	25	20,188
				Subtotal	**65,835**
4	**STORMWATER DRAINAGE**				
4.1	DN100mm subsoil drainage	190	m	35	6,650
				Subtotal	**6,650**
5	**CONCRETE WORKS**				
5.1	Kerb - Edge strip	190	m	50	9,500
5.2	Footpath - 1.5m wide	95	m	150	14,250
				Subtotal	**23,750**
6	**SIGNAGE & ROAD FURNITURE**				
6.1	Signage and linemarking	95	m	15	1,425
				Subtotal	**1,425**
7	**TESTING & WAE**				

7.1	Density testing	95	m	20	1,900
7.2	Road & drainage works as executed	95	Item	15	1,425
				Subtotal	**3,325**
8	**SOIL AND WATER MANAGEMENT**				
8.1	Soil and water management	95	m	20	1,900
				Subtotal	**1,900**
9	**SERVICE CONDUIT INSTALLATION**				
9.1	Install new elec and comms road crossings	95	m	20	1,900
9.2	Install new water conduit crossings	63	m	15	950
				Subtotal	**2,850**
10	**MISCELLANEOUS**				
10.1	Road ends transition allowance	1	Each	10,000	10,000
10.2	Clean-up and disestablish	1	Item	10,000	10,000
				Subtotal	**20,000**
				Sub-total (excl GST)	**238,142**
				Contingency (30%)	**71,443**
				Total (excl GST)	**309,584**

Reticulated services

11	**Reticulated services**				
11.1	Underground electricity and street lighting	8	Lots	8,000	64,000
11.2	Underground telecommunications	8	Lots	1,000	8,000
11.3	Water reticulation	8	Lots	3,000	24,000
11.3	Re-connections allowance	8	Lots	10,000	80,000
				Subtotal	**176,000**
				Sub-total (excl GST)	**176,000**
				Contingency (30%)	**52,800**
				Total (excl GST)	**228,800**

Consultancy services

12	**Consultancy services**				
12.1	Survey, design and construction management	8	Lots	2,500	20,000
12.2	Geotechnical/pavement design	8	Lots	150	1,200
12.3	Electrical and street lighting design	8	Lots	250	2,000
12.4	Telecommunications design	8	Lots	80	640
				Subtotal	**23,840**
				Sub-total (excl GST)	**23,840**
				Contingency (20%)	**4,768**
				Total (excl GST)	**28,608**

Authority design and inspection fees

13	**Authority design and inspection fees**				
13.1	Electricity authority	8	Lots	100	800
13.2	Telecommunications authority	8	Lots	600	4,800
13.3	Council	8	Lots	300	2,400
13.4	Water authority	8	Lots	80	640
				Subtotal	**8,640**
				Sub-total (excl GST)	**8,640**
				Contingency (20%)	**1,728**
				Total (excl GST)	**10,368**
	Grand Total including contingency (excl GST)				**577,360**

Allen Price & Scarratts
Land & Development Consultants
NOWRA AND KIAMA - NSW

ESTIMATED QUANTITIES

Stg 1-Boongala Avenue

Road

ITEM	DESCRIPTION	QTY	UNIT	RATE	AMOUNT excl GST
1	**ESTABLISHMENT AND PRELIMINARIES**				
1.1	Establishment	1	Item	20,000	20,000
1.2	Set out works	1	Item	15,000	15,000
1.3	Services location	1	Item	10,000	10,000
1.4	Traffic & Pedestrian Management Plan	1	Item	30,000	30,000
1.5	Stabilised site access and wash bay	2	Each	15,000	30,000
				Subtotal	**105,000**
2	**SITE WORKS**				
2.1	Demolition (allowance)	0.8	ha	100,000	84,000
2.2	Import, place and compact select fill	4485	m^3	40	179,396
2.3	Trim and compact verge areas and swales	4830	m^2	5	24,150
2.4	Topsoil and turf verge areas and swales	4200	m^2	10	42,000
2.5	Street trees	56	each	500	28,000
				Subtotal	**357,546**
3	**ROADWORKS**				
3.1	**Road Pavement (8.5m wide)**				
3.2	Trim and Compact Subgrade	3990	m^2	5	19,950
3.3	Subbase DGB20 (280mm thick)	3990	m^2	25	99,750
3.4	Base Course DGB20 (120mm thick)	3570	m^2	15	53,550
3.5	Prime Seal	3570	m^2	8	28,560
3.6	Asphalt AC10 (min 30mm thick)	3570	m^2	25	89,250
				Subtotal	**291,060**
4	**STORMWATER DRAINAGE**				
4.1	Pit (900x900)	5	each	2,500	12,500
4.2	Pit (1200 x 1200)	1	each	4,000	4,000
4.3	DN600 RRJ Class 3	237	m	300	71,100
4.4	DN750 RRJ Class 3	48	m	375	18,000
4.5	DN750mm Headwall	1	Item	3,100	3,100
4.6	DN100mm subsoil drainage	840	m	35	29,400
				Subtotal	**138,100**
5	**CONCRETE WORKS**				
5.1	Kerb - Edge strip	840	m	50	42,000
5.2	Footpath - 1.5m wide	420	m	150	63,000
				Subtotal	**105,000**
6	**SIGNAGE & ROAD FURNITURE**				
6.1	Signage and linemarking	420	m	15	6,300
				Subtotal	**6,300**
7	**TESTING & WAE**				
7.1	Density testing	420	m	20	8,400

7.2	Road & drainage works as executed	420	Item	15	6,300
				Subtotal	**14,700**
8	**SOIL AND WATER MANAGEMENT**				
8.1	Soil and water management	420	m	20	8,400
				Subtotal	**8,400**
9	**SERVICE CONDUIT INSTALLATION**				
9.1	Install new elec and comms road crossings	420	m	20	8,400
9.2	Install new water conduit crossings	280	m	15	4,200
				Subtotal	**12,600**
10	**MISCELLANEOUS**				
10.1	Road ends transition allowance	2	Each	10,000	20,000
10.2	Clean-up and disestablish	1	Item	10,000	10,000
				Subtotal	**30,000**
				Sub-total (excl GST)	**1,068,706**
				Contingency (30%)	**320,612**
				Total (excl GST)	**1,389,318**

Reticulated services

11	**Reticulated services**				
11.1	Underground electricity and street lighting	45	Lots	8,000	360,000
11.2	Underground telecommunications	45	Lots	1,000	45,000
11.3	Water reticulation	45	Lots	3,000	135,000
11.3	Re-connections allowance	45	Lots	10,000	450,000
				Subtotal	**990,000**
				Sub-total (excl GST)	**990,000**
				Contingency (30%)	**297,000**
				Total (excl GST)	**1,287,000**

Consultancy services

12	**Consultancy services**				
12.1	Survey, design and construction management	45	Lots	2,500	112,500
12.2	Geotechnical/pavement design	45	Lots	150	6,750
12.3	Electrical and street lighting design	45	Lots	250	11,250
12.4	Telecommunications design	45	Lots	80	3,600
				Subtotal	**134,100**
				Sub-total (excl GST)	**134,100**
				Contingency (20%)	**26,820**
				Total (excl GST)	**160,920**

Authority design and inspection fees

13	**Authority design and inspection fees**				
13.1	Electricity authority	45	Lots	100	4,500
13.2	Telecommunications authority	45	Lots	600	27,000
13.3	Council	45	Lots	300	13,500
13.4	Water authority	45	Lots	80	3,600
				Subtotal	**48,600**
				Sub-total (excl GST)	**48,600**
				Contingency (20%)	**9,720**
				Total (excl GST)	**58,320**
	Grand Total including contingency (excl GST)				**2,895,558**

ATTACHMENT 2 – FLOOD DAMAGE SUMMARY

Davistown

Base Case														
	PMF		0.5% AEP		1% AEP		2% AEP		5%AEP		10% AEP		20% AEP		AAD
	Damages	Overfloor Flooding	Damages	Overfloor Flooding	Damages	Overfloor Flooding	Damages	Overfloor Flooding	Damages	Overfloor Flooding	Damages	Overfloor Flooding	Damages	Overfloor Flooding	
2020	$36,020,529	455	$21,855,693	270	$16,851,682	203	$12,541,391	146	$8,115,453	88	$4,793,192	52	$2,848,443	27	$1,830,052
2030	$40,634,093	503	$27,616,774	345	$22,602,698	282	$17,509,153	211	$12,541,391	146	$8,556,628	96	$5,387,512	57	$2,979,936
2050	$30,568,982	329	$21,363,008	277	$18,969,846	243	$16,342,994	219	$13,260,265	175	$10,353,679	133	$7,702,844	103	$3,499,617
2100	$11,068,217	156	$1,749,081	0	$1,685,709	0	$1,635,011	0	$1,546,289	0	$1,495,591	0	$1,457,568	0	$547,229
Masterplan - no levee															
	PMF		0.5% AEP		1% AEP		2% AEP		5%AEP		10% AEP		20% AEP		AAD
	Damages	Overfloor Flooding	Damages	Overfloor Flooding	Damages	Overfloor Flooding	Damages	Overfloor Flooding	Damages	Overfloor Flooding	Damages	Overfloor Flooding	Damages	Overfloor Flooding	
2020	$36,020,529	455	$21,855,693	270	$16,851,682	203	$12,541,391	146	$8,115,453	88	$4,793,192	52	$2,848,443	27	$1,830,052
2030	$40,634,093	503	$27,616,774	345	$22,602,698	282	$17,509,153	211	$12,541,391	146	$8,556,628	96	$5,387,512	57	$2,979,936
2050	$27,856,638	329	$21,363,008	277	$18,969,846	243	$16,342,994	219	$13,260,265	175	$10,353,679	133	$7,702,844	103	$3,492,850
2100	$54,772,653	761	$8,682,034	0	$7,617,376	0	$6,400,624	0	$5,107,824	0	$4,106,539	0	$3,219,324	0	$1,521,335
Masterplan - with levee															
	PMF		0.5% AEP		1% AEP		2% AEP		5%AEP		10% AEP		20% AEP		AAD
	Damages	Overfloor Flooding	Damages	Overfloor Flooding	Damages	Overfloor Flooding	Damages	Overfloor Flooding	Damages	Overfloor Flooding	Damages	Overfloor Flooding	Damages	Overfloor Flooding	
2020	$36,020,529	455	$21,855,693	270	$0	0	$0	0	$0	0	$0	0	$0	0	$199,040
2030	$40,634,093	503	$27,616,774	345	$22,602,698	282	$17,509,153	211	$0	0	$0	0	$0	0	$759,031
2050	$27,856,638	329	$21,363,008	277	$18,969,846	243	$16,342,994	219	$13,260,265	175	$0	133	$0	0	$1,175,755
2100	$54,772,653	761	$8,682,034	0	$7,617,376	0	$6,400,624	0	$5,107,824	0	$4,106,539	0	$3,219,324	0	$1,521,335

Empire Bay

Base Case														
	PMF		0.5% AEP		1% AEP		2% AEP		5%AEP		10% AEP		20% AEP		AAD
	Damages	Overfloor Flooding	Damages	Overfloor Flooding	Damages	Overfloor Flooding	Damages	Overfloor Flooding	Damages	Overfloor Flooding	Damages	Overfloor Flooding	Damages	Overfloor Flooding	
2020	$9,658,134	117	$5,014,885	61	$3,945,891	47	$2,560,371	29	$1,622,487	15	$1,014,816	10	$555,325	6	$382,024
2030	$11,215,199	142	$6,584,971	78	$5,291,931	64	$3,956,783	50	$2,560,371	29	$1,723,516	18	$1,069,434	12	$625,264
2050	$10,888,106	123	$6,385,030	79	$5,046,689	67	$4,157,642	52	$3,094,420	40	$2,218,784	30	$1,498,079	20	$769,863
2100	$14,389,859	196	$2,306,759	0	$2,281,410	0	$2,256,061	0	$2,243,387	0	$2,230,712	0	$2,141,991	0	$795,094
Masterplan - no levee															
	PMF		0.5% AEP		1% AEP		2% AEP		5%AEP		10% AEP		20% AEP		AAD
	Damages	Overfloor Flooding	Damages	Overfloor Flooding	Damages	Overfloor Flooding	Damages	Overfloor Flooding	Damages	Overfloor Flooding	Damages	Overfloor Flooding	Damages	Overfloor Flooding	
2020	$9,658,134	117	$5,014,885	61	$3,945,891	47	$2,560,371	29	$1,622,487	15	$1,014,816	10	$555,325	6	$382,024
2030	$11,215,199	142	$6,584,971	78	$5,291,931	64	$3,956,783	50	$2,560,371	29	$1,723,516	18	$1,069,434	12	$625,264
2050	$10,140,311	123	$6,385,030	79	$5,046,689	67	$4,157,642	52	$3,094,420	40	$2,218,784	30	$1,498,079	20	$767,998
2100	$16,938,805	234	$2,382,806	0	$2,141,991	0	$1,888,501	0	$1,647,685	0	$1,394,195	0	$1,077,333	0	$493,938

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