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PLANS AND DOCUMENTS
referred to in the ULDA
APPROVAL dated 15 / 6 /12

CALOUNDRA SOUTH MASTERPLAN
PRELIMINARY BULK EARTHWORKS STRATEGY

STOCKLAND DEVELOPMENT PTY LTD

31 May 2012
N11100CER01F

AMENDED IN RED
13 JUN 2012
By: (name)
of the ULDA

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DOCUMENT CONTROL

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F	31/05/12	Minor Amendments	TS	BT	BT

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APPENDICES

1 EXECUTIVE SUMMARY

This document provides a framework and sets the principles and objectives for the earthworks strategy for the future Caloundra South development. This includes establishment of design guidelines, the extent of cutting and filling across the site and principles and objectives for construction phase water quality management for the development.

Earthworks operations across the site are expected to comprise conventional operations which will include:

- Ground preparatory work such as draining areas in advance of earthworks operations through constructed open channels;
- Clearing and Grubbing;
- Stripping of topsoil;
- Earthworks on leads (cutting, loading, carting, place and compact); and
- Erosion and sediment control.

The earthworks modelling has been undertaken with regards to:

- Groundwater regime;
- Acid sulphate soils strategy;
- Vegetation and waterway constraints; and
- Flooding and drainage (accounting for climate change).

The bulk earthworks modelling for the site has been undertaken using 12d for the Northern, Western and Southern Precincts, as well as the Town Centre. This involved modelling the earthworks necessary to create free draining fill platforms that achieve 1 in 100 year flood immunity. Major roads and drainage channels were considered (at a high level) in this exercise. ~~The bulk earthworks also considers the provision of a detention basin on Stockland's land immediately to the west of the Bruce Highway.~~

The earthworks modelling has been undertaken for the three precincts using a compaction factor of 0.87 applied to the cut volume (Bulking Factor 1.15). The total earthworks volumes for each precinct that have been identified through these investigations is summarised in Appendix F.

Furthermore, this report establishes that the design storm event of 125mm rainfall depth be used for sediment basin design/sizing, which is higher than the 5-day 95th percentile rainfall depth for Caloundra and also higher than both the 10-day 90th percentile and 20-day 75th percentile rainfall depths for Coolum (being the closest locality from both a geographical and rainfall depth perspective). Captured runoff will then be treated and discharged in accordance with the following water quality objectives:

- TSS discharge limit of 20mg/L;
- pH: 6.5 to 8.5;
- Discharge turbidity (NTU) to be less than 10% above background; and
- Nutrients (Nitrogen and Phosphorous) to be managed through Sediment Control.

Furthermore, 'better than best practice' erosion controls are proposed, with the main objective being to minimise time of exposure for disturbed areas.

It is noted that further site testing, reporting, and detailed design is proposed to be undertaken to achieve the objectives of this report, which are also set out within

2 INTRODUCTION

2.1 Background

Brown Consulting (QLD) Pty Ltd have been commissioned by Stockland Caloundra Downs Pty Ltd to prepare a conceptual bulk earthworks strategy for the Caloundra South development project. This report is in support of a Masterplan application to the Urban Land Development Authority. This earthworks assessment demonstrates that works typical of this type of development can be undertaken in an environmentally sensitive manner without adverse impacts on the receiving environment.

It is envisaged that this document sets the framework and principles typical of what is required for a development of this type and scale. It is anticipated that the general objectives and principles set out in this plan will inform preparation of detailed design outcomes for future reconfiguration and design development phases of the project.

During these subsequent phases of the development, further reporting and investigations will need to be undertaken which may be precinct specific and would include the following

- Detailed bulk earthworks design documentation;
- Erosion and Sediment Hazard Investigation Report;
- Concept Erosion and Sediment Control Report; and
- Construction Phase Site Based Management Plan.

This report establishes a Preliminary Earthworks Strategy for the site and sets out the general requirements and identifies the extent and scale of earthworks operations.

2.2 Site Description

Caloundra South is a major master planned community situated to the Southwest of existing residential areas at Caloundra and Little Mountain. It is proposed the development will consist of approximately 20,000 residential dwellings in its final form, plus various commercial, industrial, community purpose and open space precincts.

Figure 1 : Subject Site Locality Map

3 ROLE OF THIS PRELIMINARY BULK EARTHWORKS STRATEGY

This preliminary bulk earthworks strategy has been prepared to identify the intended site wide approach to the management of earth works for Caloundra South. In particular subsequent applications are to be generally consistent with:

- The primary cut and fill locations identified in Appendix C of this report including the retention of the key ridge lines that have been identified in these plans;
- The Design Development methodology outlined in Section 4 of this report
- The construction staging methodology outlined in Section 5 of this report;
- The water quality measures outlined in Section 6 of this report; and
- The environmental control measures outlined in Section 7 of this report

4 DESIGN DEVELOPMENT METHODOLOGY

The conceptual bulk earthworks strategy has been developed in order to show that the proposed Masterplan can be undertaken with regards to bulk earthworks and the relevant constraints. The key constraints considered and design assumptions are summarised in the following sections of this report.

4.1 Regional Flooding

The key constraint considered in the strategy is regional flooding. BMT-WBM have undertaken flood modelling across the site in its entirety. The flood modelling has been undertaken with assumptions made for the impact of climate change on flood levels.

As the flood modelling has been undertaken with consideration to climate change, all developable areas have been designed to be Q100 immune, plus 500mm freeboard. This is in accordance with Sunshine Coast Council (Caloundra Area) policy.

This bulk earthworks strategy can now also be used to inform any future iterations of the flood modelling, to provide an accurate representation of the site once developed.

4.2 Local Flooding

The strategy has been developed with due regard to localised flooding with reference to the relevant design standards, including Council's DDPSP, Austroads, QUDM and Queensland Streets.

The main consideration with respect to local flooding is minimising Q100 flows in roadways to 250mm in depth. As such, the strategy incorporates a number of drainage channels throughout the precincts whereby catchment sizes dictate that road capacities are inadequate to cater for flows. Whilst these drainage designs are not intended to be final design, the intent is to show that the development can be adequately serviced from a drainage/local flooding perspective.

4.3 Other Design Considerations/Assumptions

Whilst flooding was the key constraint considered in the development of the strategy, a number of other factors were considered, as follows:

- Groundwater: Consideration has been given to the groundwater table and its proximity to the surface. This will be addressed in main by construction management, as detailed in Section 4.1 of this report;
- Acid sulphate soils: Filling and excavations for only necessary infrastructure will occur below RL5.0m. Consistent with advice from Dobos & Associates, this strategy is considered manageable from an ASS perspective;
- Environmental constraints: the strategy has been undertaken so as to minimise impacts to areas of environmental importance. Proposed earthworks areas are contained outside of core environmental areas, with minimal works to occur inside passive open space areas to

facilitate drainage of development areas. Waterbody and wetland locations have been determined in consultation with ARUP, WBM and Stockland.

- A potential fill source is identified west of the Bruce Highway (located outside the UDA). This provides an opportunity to assist with a range of outcomes including an additional fill source to minimise reduction of key ridge lines, provide opportunities to improve the flood immunity of the Bruce Highway and potential location to store storm water that may be harvested from the site. Further investigations and approvals will be required to utilise this opportunity.

The following assumptions should also be noted with respect to design development:

- 600mm road pavement depth has been assumed for the purpose of quantities. Only major roads have been modelled, as per the Masterplan;
- 300mm topsoil strip depth assumed. Variance of topsoil depth will impact quantities;
- Waterbodies (lakes) have been modelled assuming a maximum depth of 3m; wetlands have been modelled assuming a maximum depth of 1m, which is consistent with advice from BMT-WBM;
- Channel designs are based on high level assumptions only, locations/widths/depths are indicative only. Channel grades have been set at 0.1% which is consistent with advice from BMT-WBM; and
- Cut/fill volumes are conceptual only and will need to be refined at REC /detail design phase. A compaction factor of 0.87 (Bulking factor of 1.15) has been applied to cut volumes.

As can be seen above, sufficient detail has been considered in the bulk earthworks modelling to allow the strategy to be fully informed and the Masterplan layout validated from a bulk earthworks perspective. Whilst extra detail will be necessary for construction, the strategy informs the intent of any future applications and demonstrates that an earthworks solution for the site is achievable.

5 CONSTRUCTION STAGING

This section of the report outlines each stage of construction and the protective measures to be implemented as construction progresses. Details of mitigation measures to be installed will be further detailed at the Reconfiguration of a Lot phase.

5.1 Phase 1 – Pre-Construction/Groundwater Management

As the site is subject in some locations to a relatively high groundwater, open drains may need to be established in various locations throughout the site prior to bulk earthworks being undertaken as a pre-construction requirement.

The location and extent of any pre-drainage to be installed will be determined on site, 12-24 months in advance of construction. At this time a pre-drainage strategy will be developed determining locations, spacing and sizing of open drains (expected spacing of drains is 50-100m). This will need to consider final bulk earthworks modelling, results of groundwater modelling and permeability of soils.

Open drains will then be cut excavated at locations as determined by the pre-drainage strategy and subsequently stabilised. Stabilisation will occur progressively and follow directly behind open drain excavation to minimise the duration of exposed surfaces. This stabilisation is required to prevent scour of the drain itself and prevent sediment laden runoff during preconstruction. Stabilisation can be undertaken via a range of methods including turfing, grass seeding, hydro mulching, mulching, Geofabric etc. Actual measures of stabilisation will be determined dependent upon site conditions at the time of construction.

5.2 Phase 2 – Site Preparation

Initial site establishment will be undertaken as a part of this phase of construction conjunction with installation of all initial erosion and sediment control measures. At this phase all shake down devices, sediment fences, sediment basins, diversion drains, rock check dams and all other erosion and sediment control devices are to be installed. This is to occur prior to any soil disturbance or clearing of vegetation, other than that which is necessary to facilitate installation of said erosion and sediment controls.

5.3 Phase 3 – Bulk Earthworks

This construction phase involves undertaking of major bulk earthworks across the site. During bulk earthworks, all abovementioned devices are to be maintained and reinstated as necessary. Sediment basins shall be treated and pumped down after all rain events, to ensure runoff storage capacity is maintained. Depths of cut and fill up to 4m (excluding bridge abutments, wetlands and other features) are expected and are to be undertaken using dry excavation methods.

During this construction phase the entry roads to the subject site shall be swept daily and as directed by the Superintendent.

5.4 Phase 4 – Progressive Stabilisation

It is proposed that all areas within the site are to be stabilised as soon as practical within 5 days of earthworks completion. Stabilisation will consist of both short term and long term stabilisation.

Short term stabilisation will consist of covering disturbed areas with a suitable product such as hydromulch, mulch, enviromulch, Geofabric etc. Long term stabilisation will be achieved through drill seeding, hydromulch, enviromulch etc. Due to the importance of stabilisation, it is proposed that short term measures will be reinstated as required until long term stabilisation is achieved, to ensure stabilisation is maintained.

5.5 Phase 5 – Decommissioning

Once effective stabilisation has been achieved, sediment basins and cutoff drains can be decommissioned. These areas will then also be stabilised. It is proposed that other measures (e.g. sediment fences) can remain in place to provide further protection during subsequent phases of development, i.e. building construction

6 STATUTORY CONSTRUCTION PHASE WATER QUALITY OBJECTIVES

The *Environmental Protection Act (1994)* aims to protect the environment by directing all personnel to review and where possible, adopt better environmental management practices. Specifically, the Act specifies that one must not carry out an activity that causes, or is likely to cause environmental harm unless all reasonable and practicable measures have been taken to prevent or minimise the harm.

The Act also requires that, should one become aware that environmental harm is occurring or likely to occur, that appropriate action be taken to report such occurrence. Reporting the incident to one's Employer and/or the administering authority can satisfy this obligation.

Chapter 1 of Sunshine Coast Council's 'Manual for Erosion and Sediment Control' (November 2008) outlines site discharge quality limits for the construction phase of developments. Sunshine Coast Council adopts an upper limit for the discharge of total suspended solids of 50mg/L. This limit is currently adopted by many governing agencies including Brisbane City Council and the Department of Environmental Resource Management. Further to this, the draft guideline prepared by DERM, titled 'EPA Best Practice Urban Stormwater Management – Erosion and Sediment Control' also specifies that captured runoff should be treated to an upper TSS limit of 50mg/L, but also states that 30mg/L should be targeted.

The draft guideline prepared by DERM also specifies the following stormwater quality treatment guidelines (Table 6, page 25) which are appropriate in this instance:

- pH: 6.5 to 8.5;
- Discharge turbidity (NTU) to be less than 10% above background;
- Nutrients (Nitrogen and Phosphorous) to be managed through Sediment Control; and
- Capture first 15mm/day of runoff.

7 IMPLEMENTATION OF ENVIRONMENTAL CONTROL MEASURES

7.1 General

The flowchart located in Appendix D details the processes to be implemented throughout the planning and design (both ROL/MCU and OPW) phase in order to achieve the desired environmental outcomes (DEO's) for this development.

It is intended that this document sets the framework and principles for construction phase water quality management. This document may need to be reviewed and updated dependent on regulations and statutory changes.

The construction phase water quality management strategy will include the following:

- Sediment basins;
- Separation of clean water flows and flows from disturbed areas via cutoff drains;
- Construction of contour banks and lined cutoff drains in earthworks areas;
- Minimisation of exposed areas;
- Conventional measures such as sediment fences and rock check dams where appropriate; and;
- Progressive stabilisation.

These measures and their implementation is detailed in further sections of this report. Whilst further devices may be implemented during future phases of development (both design and construction) and it is acknowledged that this is an ever expanding element of development with new innovations being created on a daily basis, it is proposed the following primary devices/controls will be implemented as a basis for construction phase water quality management.

It is noted that treatment devices will be contained within the development footprint, with no impact on conservation areas, other than the discharge of captured and treated runoff.

7.2 Design Phase

As part of the submission of a Reconfiguration of a Lot application, the constraints and mitigation measures need to be determined in order to develop the site whilst achieving the DEO's. These include site investigations to determine soil parameters and other site constraints, subsequent preparation of an Erosion and Sediment Hazard Investigation report by a suitably qualified geotechnical/environmental consultant and preparation of a Concept Erosion and Sediment Control Report.

This concept design will need to be developed in conjunction with the relevant authorities (to ensure achieved outcomes suit all stakeholders) and will require input into the subdivision layout to ensure appropriate measures and controls can be practically implemented.

The concept design will then be developed into a full Erosion and Sediment Control Design at Operational Works application phase.

It is noted that Acid Sulphates Soil treatment is addressed in the Acid Sulphate Management Plan prepared by Dr. Steve Dobos. These treatment measures will be incorporated into future design.

7.3 Performance Measures

It is proposed that better than best practice erosion and sediment control measures are to be implemented on site, to ensure the DEO's are met.

7.3.1 Progressive Stabilisation

A key to managing construction phase water quality is preventing erosion at the source. This will be undertaken by minimising the area exposed at any one time, and also by stabilising exposed areas in a timely manner.

It is proposed that all areas within the site are to be stabilised within 5 days of earthworks completion. Stabilisation will consist of both short term and long term stabilisation.

Short term stabilisation will consist of covering disturbed areas with a suitable product such as hydromulch, mulch, enviromulch, Geofabric etc. Long term stabilisation will be achieved through drill seeding, hydromulch, enviromulch etc. Due to the importance of stabilisation, it is proposed that short term measures will be reinstated as required until long term stabilisation is achieved, to ensure stabilisation is maintained.

Sterile and native grass species will be used to prevent spread of weeds and future impact on native vegetation.

7.3.2 Cutoff Drains

Cutoff drains will be installed throughout the site. These drains will be used both to convey upstream clean water flows through/around the site and also to direct runoff from disturbed areas to sediment basins.

All cutoff drains will be stabilised immediately following construction, with turf, Geofabric or other suitable alternative, dependent on site conditions and design flow velocities within the drains. Drains within the disturbed area will be spaced at a maximum of 80m to minimise the potential for erosion from high sheet flows, and will also have rock check dams installed at spacings suitable to the design gradient.

All cutoff drains will be designed to both convey and be structurally stable for the 1 in 10 year ARI event.

7.3.3 Sediment Fences

Sediment fences will be installed to provide further protection and retention of runoff from disturbed areas. These will be strategically placed along contours and will include overflow weirs to prevent both scour and failure of the devices.

7.3.4 Sediment Basins

Sediment basins will be installed on site to capture all runoff from disturbed areas throughout construction. Captured runoff will then be treated and discharged into downstream, stabilised areas. The design of sediment basins is detailed in Sunshine Coast Council's 'Manual for Erosion and Sediment Control' (Maroon Manual, November 2008). The following extract from the Maroon Manual specifies the following rainfall depths for a range of design storms across the Sunshine Coast.

Table 6-2 Rainfall depths for Maroochy and Caloundra stations

Location	2-day rainfall depths (mm)					5-day rainfall depths (mm)				
	75th %ile	80th %ile	85th %ile	90th %ile	95th %ile	75th %ile	80th %ile	85th %ile	90th %ile	95th %ile
Maroochy Shire										
Coolum	20.8	25.8	32.8	45.0	67.2	37.2	46.3	56.7	75.4	108.9
Kenilworth	17.3	22.0	28.7	38.6	57.4	29.6	36.6	46.6	61.0	89.9
Mapleton	22.8	28.0	35.6	48.1	73.8	39.4	47.4	58.6	78.8	121.2
Nambour	19.8	25.2	32.6	44.2	69.6	35.2	43.4	55.4	75.7	115.5
Caloundra City										
Beerwah	18.3	22.9	30.5	42.2	66.3	32.9	41.1	52.0	69.9	108.0
Beerburrum	18.0	23.1	30.0	39.8	61.8	32.6	39.4	48.8	65.2	98.0
Caloundra	21.6	26.7	34.3	47.0	71.1	37.0	45.8	57.7	77.0	110.4
Landsborough	23.9	29.0	37.1	49.6	76.2	38.6	47.0	59.2	78.8	120.4
Maleny	23.4	28.7	36.4	48.8	76.2	40.2	48.6	60.9	82.3	127.8
Mooloolah	25.4	31.8	40.2	54.9	85.1	43.0	52.8	67.3	89.4	139.0

Location	10-day rainfall depths (mm)					20-day rainfall depths (mm)				
	75th %ile	80th %ile	85th %ile	90th %ile	95th %ile	75th %ile	80th %ile	85th %ile	90th %ile	95th %ile
Maroochy Shire										
Coolum	63.7	76.9	95.7	119.1	165.8	123.7	142.5	165.6	201.0	277.0
Kenilworth	48.2	59.2	73.4	95.0	136.7	92.4	110.3	130.0	163.8	221.1
Mapleton	65.6	78.4	97.4	128.0	189.8	125.6	148.6	181.9	223.3	320.2
Nambour	61.1	74.5	92.8	124.0	182.5	122.2	144.5	171.8	216.8	294.3

Figure 4.1: Design Rainfall Depths from Maroon Manual.

The Maroon Manual specifies that for standard situations a 5-day rainfall depth, should be adopted, with the 75th and 80th percentile events used for non-sensitive and sensitive catchments respectively.

Due to the sensitive nature of the site, and also with a view to achieving 'better than best practice' outcomes, it is proposed that a design rainfall depth of 125mm is adopted for all sediment basin design within future applications. It is noted that this is somewhat higher than the 5-day 95th percentile rainfall depth for Caloundra and also higher than both the 10-day 90th percentile and 20-day 75th percentile rainfall depths for Coolum (being the closest locality from both a geographical and rainfall depth perspective).

Further to this, it is proposed that all captured runoff will be treated to a maximum Total Suspended Solids concentration of 20mg/L before discharge to downstream, stabilised areas. It is noted, as per Section 3 of this report, an upper limit of 50mg/L TSS is considered best practice. All captured runoff shall be treated (flocculated) and discharged within 3 days of the cessation of the rain event, where practical.

Captured runoff will also be treated to the parameters specified in Section 2 above, that is:

- pH: 6.5 to 8.5;
- Discharge turbidity (NTU) to be less than 10% above background;
- Nutrients (Nitrogen and Phosphorous) to be managed through Sediment Control; and
- Capture first 15mm/day of runoff.

Water discharged from sediment basins will be discharged to stabilised downstream areas, and the flows will be adequately spread to avoid concentration and subsequent erosion.

Sample sediment basin designs can be found in Appendix E of this report. It is noted that the soil parameters adopted are from maps within the Maroon Manual and actual soil data will be collated at the ROL/MCU Application Phase and incorporated into the design as necessary.

Sediment basins will also be constructed with stabilised inlets and outlets (catering for the 1 in 10 year ARI storm event), to prevent further erosion and will also be structurally designed for the 1 in 100 year ARI storm event.

7.4 Construction Phase

Once both the concept and subsequently the detailed design has been undertaken, commencement of construction can occur subsequent to the Principal Contractor preparing a Construction Phase Site Based Management Plan (SBMP). This plan will incorporate a number of items including, water quality management, waste management, UXO, noise pollution, air quality, flora/fauna, cultural heritage, contaminated land etc. The following details the aspects that will be included as a minimum. The SBMP is also subject to Superintendent approval prior to commencement of construction.

7.4.1 General

The SBMP should incorporate all details of the Erosion and Sediment Control Design. Any amendments to the approved design shall also be detailed in the SBMP and subsequently approved by the superintendent.

7.4.2 Responsibility

The Principal Contractor is responsible for the implementation of the SBMP at all times during construction.

The contractor's site manager must be knowledgeable and experienced in the requirements of environmental management. All construction and site staff are responsible for ensuring that activities are undertaken in a manner that prevents or minimises potential impacts, in accordance with this report. A copy of this report must be kept on site and available at all times.

7.4.3 Training

As part of the site induction program, the contractor's staff will be trained by suitably qualified and experienced person/s in the requirements of erosion and sediment control and the SBMP. The training will cover issues such as:

- General environmental duty and the duty to notify;
- Acceptable and unacceptable practices for the site;
- Identification of the appropriate person to report to in the instance of environmental issues; and
- The requirements of the SBMP.

A register of site induction and environmental training shall be maintained and available for inspection upon request.

7.4.4 Maintenance and Monitoring Requirements

This section of details the monitoring and maintenance regime which is to be undertaken during the construction period. Two procedures are to be used, visual inspection of erosion and sediment control devices and water quality monitoring.

7.4.4.1 Visual Inspection of Devices

Visual inspection of all sediment and erosion control measures shall be undertaken by the nominated environmental representative (or other, as approved by the Superintendent) of the Principal Contractor. Inspections shall be undertaken on a daily basis, as well as before any rainfall events with the potential to generate stormwater runoff on site. Installation dates for erosion and sediment control measures shall also be recorded.

Visual inspection of erosion and sediment control measures shall include checking of functionality of device, distinguish any faults with device and instigate the necessary corrective action to be undertaken in order for the device to function correctly. Any necessary corrective actions should be undertaken within two days of the inspection or immediately if a rainfall event is imminent.

The visual inspection checklist shall be completed and forwarded to the Superintendent on a weekly basis.

A sample checklist is included in Appendix B.

7.4.4.2 *Water Quality Monitoring*

Water quality monitoring shall be undertaken by the nominated environmental representative (or other, as approved by the Superintendent) of the Principal Contractor. Monitoring shall occur during and after any rainfall events which generate stormwater runoff on site or alternatively as directed by the Superintendent. Approximate test locations will be identified as a part of future reporting.

Monitoring shall include NTU readings. Prior to soil disturbance works commencing, lab tests shall be undertaken to calibrate NTU readings to TSS readings in mg/L for site soils and subsoils, results of said calibration shall be provided to the Superintendent. Readings shall be taken at all outlets from the site. Monitoring reports shall be forwarded to the Superintendent on a weekly basis and immediately following any rainfall event.

A sample water quality monitoring spreadsheet is included in Appendix A.

7.4.5 Non-Conformance and Corrective Action

The Principal Contractor's site manager shall identify any non-conformances with the requirements of this report. Non-conformance shall be provided to the Superintendent immediately and an appropriate Corrective Action developed as soon as practically possible. The Corrective Action shall then be undertaken by the Principal Contractor in a timeframe agreed by all parties.

The Superintendent will, as necessary, incorporate the outcomes of any Corrective Action into the Erosion and Sediment Control Design, with the contractor incorporating the outcome into the SBMP.

Any non-conformances and corrective action undertaken will be documented in the monthly report. Appendix E sets out a general framework for management, reporting, actions and responsibilities required to be met during construction.

7.5 Superintendent's Responsibilities

Contractually, the Principal Contractor will be responsible for meeting General Environmental Duty during the construction phase. However, the Superintendent's role will include regular site auditing, general inspections and compliance with relevant plans/reports. This will include resolution of non-conformances.

8 CONCLUSION

The Caloundra South Masterplan has been developed for submission to the ULDA to allow a Masterplan approval to be granted over the site. The modelling has been undertaken with sufficient detail to validate and support the Masterplan from a bulk earthworks perspective. The bulk earthworks strategy will inform future applications and allow detailed design to occur in a manner which complies with the intent of the strategy.

Furthermore, it is necessary for all developments to be conscious of possible erosion and sedimentation and their possible impacts on the environment. This report aims to outline measures that if implemented correctly, will minimise the impact of this development on the environment by setting the framework for development of future erosion and sediment control strategies which include 'better than best practice' measures. This includes installation of erosion and sediment control devices, minimising and reducing time of exposure of soils and a monitoring and maintenance program to ensure that measures are in place and functioning in accordance with this plan.

Sufficient information has been provided to show that earthworks to the proposed development site can be adequately managed and do not present a significant environmental risk. Whilst it is noted that these details are preliminary only and further design development is necessary, the information provided supports the application to the ULDA for Masterplan approval and demonstrates that earthworks can be undertaken within the requirements of the relevant environmental legislation.

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APPENDIX A

Water Quality Monitoring

SEDIMENT AND EROSION CONTROL MEASURES

WATER QUALITY MONITORING

Project:	Caloundra South
Principal:	Stockland Caloundra Downs
Civil Engineering Consultant:	Brown Consulting
Superintendent:	Brent Thomas
Contractor:	TBA
Project Supervisor:	TBA
Job Number:	N10050
Council Reference:	NA

Inspection Details

Date:
Time:
Inspected By:
Others Present:

Reason For Inspection:

- ☐ Weekly Monitoring
- ☐ Before Rainfall Event
- ☐ After Rainfall Event
- ☐ Other (please specify):

Date	Location	Comments

Comments:

Signed:

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APPENDIX B

Visual Inspection Checklist

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SEDIMENT AND EROSION CONTROL MEASURES

VISUAL INSPECTION CHECKLIST

Project:	Caloundra South
Principal:	Stockland Caloundra Downs
Civil Engineering Consultant:	Brown Consulting
Superintendent:	Brent Thomas
Contractor:	TBA
Project Supervisor:	TBA
Job Number:	N10050
Council Reference:	NA

Inspection Details

Date:
Time:
Inspected By:
Others Present:

Reason For Inspection:

- ☐ Daily Monitoring
- ☐ Before Rainfall Event
- ☐ After Rainfall Event
- ☐ Other (please specify):

Item Monitored	Date Installed	Condition Acceptable (Yes/No)	Corrective Action Required	Date Corrective Action Undertaken
Soillocker				
Sediment Fence				
Rock Filter Dams				
Stormwater Outlets				
Overland Flow				
Embankments				
Waterways				
Ground Cover				
Other				

Comments:	Signed:

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APPENDIX C

Drawing Nos. N11100-SK400, SK405 to N11100-SK410
Prepared by Brown Consulting (QLD) Pty Ltd

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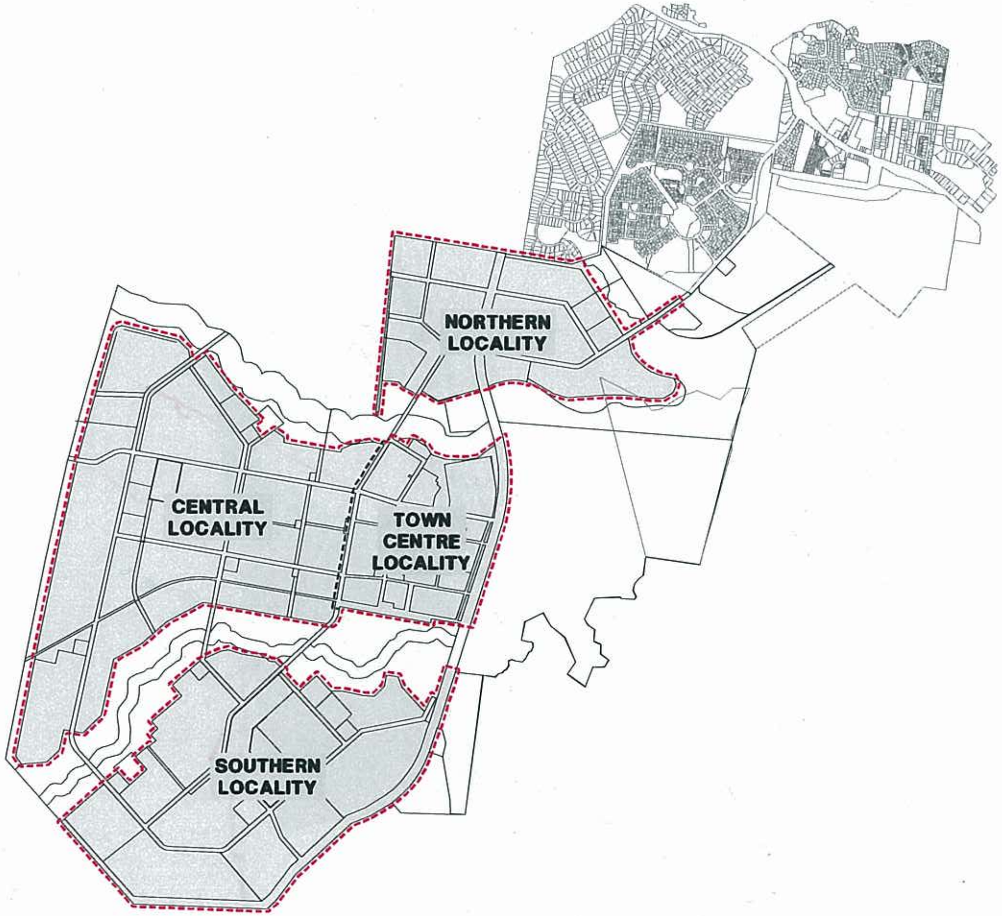
PRELIMINARY BULK EARTHWORKS STRATEGY
STOCKLAND PTY LTD

DRAWING INDEX

PRELIMINARY BULK EARTHWORKS		REV
N11100-SK400	SITE LOCALITY PLAN & DRAWING INDEX	H
N11100-SK405	PRELIMINARY BULK EARTHWORKS WESTERN DETENTION BASIN	F
N11100-SK406	DEPTH RANGE NORTHERN LOCALITY	E
N11100-SK407	DEPTH RANGE CENTRAL LOCALITY, WESTERN DETENTION BASIN & TOWN CENTRE LOCALITY	F
N11100-SK408	DEPTH RANGE SOUTHERN LOCALITY	E
N11100-SK409	OVERALL SITE DEVELOPMENT AREA BELOW THE Q100 LEVEL OVERALL (CONTOURS)	F
N11100-SK410	OVERALL SITE DEPTH RANGES	E



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FILE: N11100-SK400.dwg DATE: 31-05-2012 TIME: 15:18
Xref's: X-N11100-BASE-SCENARIO & X-N11100-L-TIT2 USR: chris osullivan

ISSUE	DESIGN	DRAWN	DATE	AMENDMENT DETAILS
	PP	PP	09.12.11	
G	PEP	DM	24.05.12	DRAWING INDEX REVISED
H	TS	CD	30.05.12	DRAWING INDEX UPDATED
I	TS	CD	31.05.12	DRAWING INDEX UPDATED
J				
K				
L				

DESIGN CHECK
DRAWN CHECK
SCALE (METRIC)
MICROFILM No.
PROJECT No. N11100

SURVEYOR: RPS GROUP
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CLIENT: STOCKLAND PTY LTD

PROJECT: CALOUNDRA SOUTH PRELIMINARY BULK EARTHWORKS

BROWN *Smart Consulting*

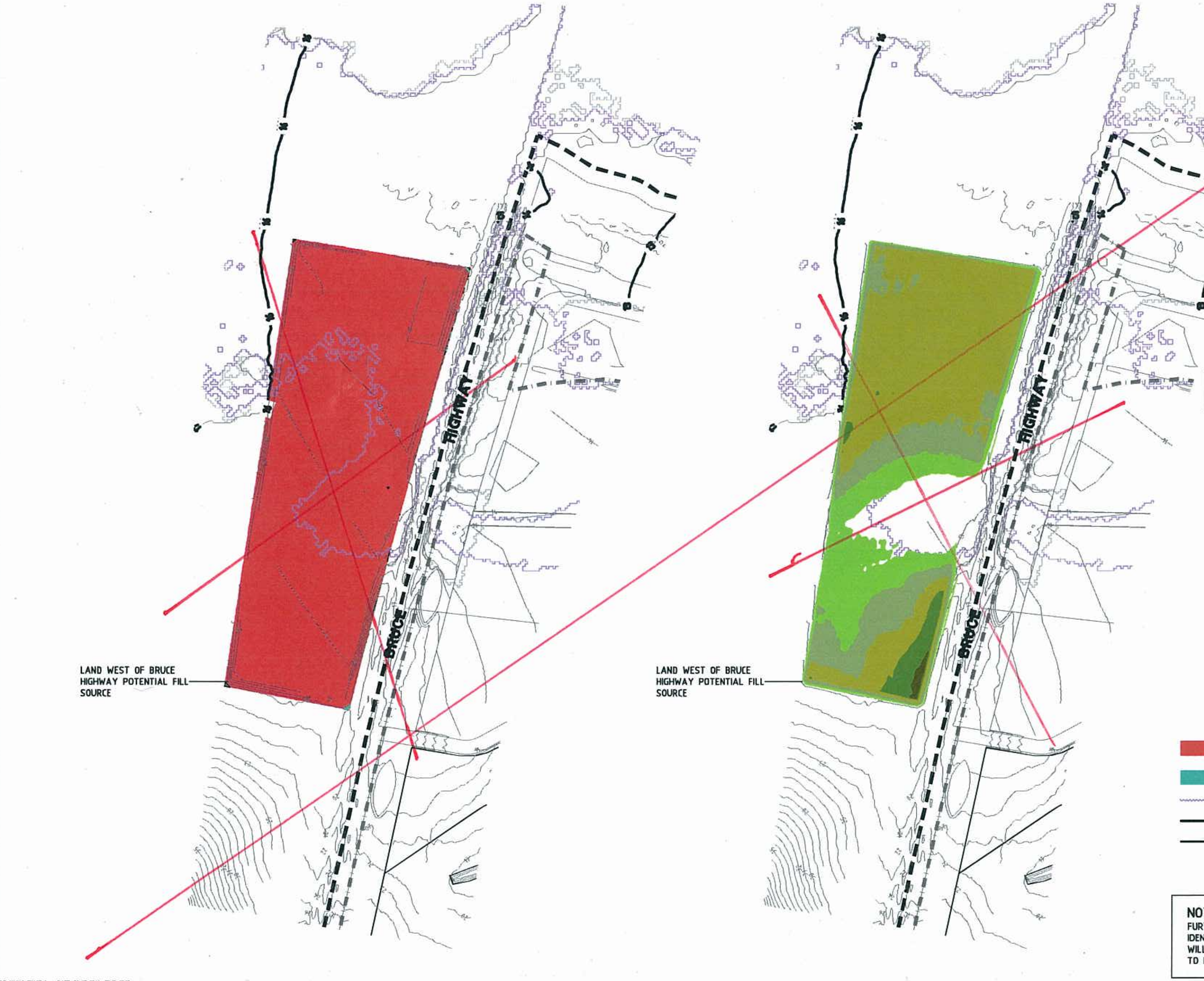
CONSULT AUSTRALIA

Brown Consulting (QLD) Pty Ltd

DRAWING TITLE: SITE LOCALITY PLAN & DRAWING INDEX

DRAWING NUMBER: N11100-SK400

ISSUE: I



WESTERN DETENTION BASIN IS A POTENTIAL FILL SOURCE SUBJECT TO FUTURE APPROVALS

LEGEND

PRELIMINARY SOURCE LOCATIONS

- -10.0m TO -5.0m
- -5.0m TO -4.0m
- -4.0m TO -3.0m
- -3.0m TO -2.0m
- -2.0m TO -1.0m

PRELIMINARY FILL LOCATIONS

- 1.0m TO 2.0m
- 2.0m TO 3.0m
- 3.0m TO 4.0m
- 4.0m TO 5.0m
- 5.0m TO 10.0m
- AREA SUBJECT TO MINOR WORKS (I.E. LESS THAN 1.0m GROUND LEVEL CHANGE)

LEGEND

- PRELIMINARY FILL SOURCE LOCATION
- PRELIMINARY FILL LOCATIONS
- PRE DEVELOPMENT Q100 LINE
- POST DEVELOPMENT Q100 CONTOUR
- RIDGE LINE TO BE RETAINED
- SITE BOUNDARY
- EXTENT OF DEVELOPABLE FOOTPRINT

NOTE:
FURTHER DETAIL IN RELATION TO THE CUT AND FILL LOCATIONS IDENTIFIED WITHIN THIS PRELIMINARY BULK EARTHWORKS STRATEGY WILL BE PROVIDED AS PART OF SUBSEQUENT APPLICATIONS AND IS TO BE GENERALLY CONSISTENT WITH PART 3 OF THIS STRATEGY

FILE: N11100-SK405.dwg DATE: 31-05-2012 TIME: 15:17
Xref's: X-N11100-4-TIT X-N11100-BASE-SCENARIO 4 X-N11100-4-CUTFILL X-N11100-4-CONT Q100 X-N11100-4-Q100-DEVELOPED X-N11100-4-CONT SUPER 5000 SCALE X-N11100-4-COLOUR RANGE MP2 USR: chris oculliven

ISSUE	DESIGN	DRAWN	DATE	AMENDMENT DETAILS
	PP	PP	09.12.11	
A	PP	PP	15.12.2011	LOCALITY NAME AMENDED
B	PP	DM	27.04.12	EARTHWORK VOLUMES & CUT/FILL HATCH AMENDED
C	PP	DM	08.05.12	LEGEND AMENDED
D	PEP	DM	16.05.2012	REVISED FOR MASTERPLAN AMENDMENTS
E	PEP	DM	23.05.12	HATCH AMENDED
F	TS	CO	30.05.12	DEVELOPABLE FOOTPRINT ADDED

DESIGN CHECK
DRAWN CHECK

SCALE (METRES) 100 50 0 100 200
1 : 5000 (UNREDUCED)

MICROFILM No.
PROJECT No. N11100

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PROJECT: CALOUNDRA SOUTH PRELIMINARY BULK EARTHWORKS

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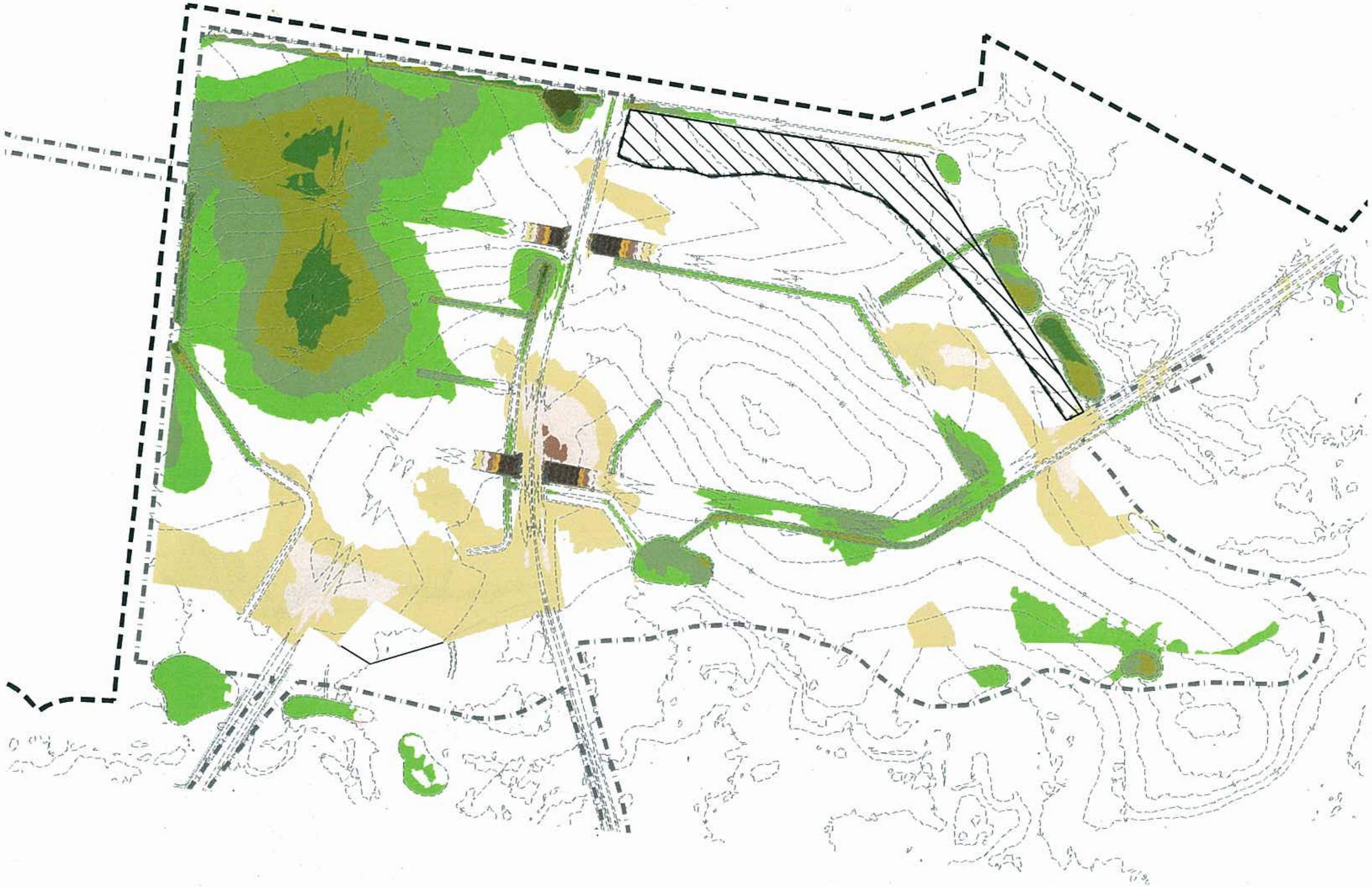
DRAWING TITLE: PRELIMINARY BULK EARTHWORKS WESTERN DETENTION BASIN POSSIBLE FILL SOURCE

DRAWING NUMBER: N11100-SK405

ISSUE: F



N

LEGEND

PRELIMINARY SOURCE LOCATIONS

- -10.0m TO -5.0m
- -5.0m TO -4.0m
- -4.0m TO -3.0m
- -3.0m TO -2.0m
- -2.0m TO -1.0m

PRELIMINARY FILL LOCATIONS

- 1.0m TO 2.0m
- 2.0m TO 3.0m
- 3.0m TO 4.0m
- 4.0m TO 5.0m
- 5.0m TO 10.0m
- AREA SUBJECT TO MINOR WORKS (I.E. LESS THAN 1.0m GROUND LEVEL CHANGE)
- WATER BUFFER AREA NOT SUBJECT TO WORKS
- SITE BOUNDARY
- EXTENT OF DEVELOPABLE FOOTPRINT

FILE: N11100-SK406.dwg DATE: 31-05-2012 TIME: 15:20
Xref's: X-N11100-4-TIT X-N11100-BASE-SCENARIO 4 X-N11100-4-COLOUR RANGE MP1 X-N11100-4-CONT SUPER 5000 SCALE USR: chris osullivan

PRINT ISSUE	DESIGNED	DRAWN	DATE	AMENDMENT DETAILS
	PP	CB	09.12.2011	
A	PP	PP	15.12.2011	LOCALITY NAME AMENDED
B	PP	PP	30.03.12	HATCH COLOUR AMENDED
C	PP	DM	27.04.12	CUT/FILL DEPTH AMENDED
D	PEP	DM	16.05.12	REVISED FOR MASTERPLAN AMENDMENTS
E	TS	CO	30.05.12	DEVELOPABLE FOOTPRINT ADDED
F				

DESIGN CHECK

DRAWN CHECK

SCALE (METRES)
100 50 0 100 200
1 : 5000 (UNREDUCED)

PROJECT No.
N11100

SURVEYOR: RPS GROUP
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PROJECT
CALOUNDRA SOUTH
PRELIMINARY BULK EARTHWORKS

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DRAWING TITLE
DEPTH RANGE
NORTHERN LOCALITY

DRAWING NUMBER
N11100-SK406

ISSUE
E

N

LEGEND

PRELIMINARY SOURCE LOCATIONS

- -10.0m TO -5.0m
- -5.0m TO -4.0m
- -4.0m TO -3.0m
- -3.0m TO -2.0m
- -2.0m TO -1.0m

PRELIMINARY FILL LOCATIONS

- 1.0m TO 2.0m
- 2.0m TO 3.0m
- 3.0m TO 4.0m
- 4.0m TO 5.0m
- 5.0m TO 10.0m
- AREA SUBJECT TO MINOR WORKS (I.E. LESS THAN 1.0m GROUND LEVEL CHANGE)
- WATER BUFFER AREA NOT SUBJECT TO WORKS
- SITE BOUNDARY
- EXTENT OF DEVELOPABLE FOOTPRINT

FILE: N11100-SK407.dwg DATE: 31-05-2012 TIME: 15:29
Xref's: X-N11100-L-TIT X-N11100-L-COLOUR RANGE PP2 X-N11100-BASE - SCENARIO 4 X-N11100-4-CONT SUPER 10000 SCALE BSH: civic sullivan

ISSUED	ISSUED FOR	DRAWN	CHECKED	DATE	AMENDMENT DETAILS
A	PP	PP	CS	09.12.2011	
B	PP	PP	CS	15.12.2011	LOCALITY NAME AMENDED
C	PP	PP	DH	30.03.12	HATCH COLOUR AMENDED
D	PP	PP	DH	27.04.12	CUT/FILL DEPTH AMENDED
E	PEP	PP	DH	14.05.12	REVISED FOR MASTERPLAN AMENDMENTS
F	TS	PP	DH	23.05.12	HATCH AMENDED
			CS	30.05.12	DEVELOPABLE FOOTPRINT ADDED

DESIGN CHECK:

DRAWN CHECK:

SCALE (METRIC): 1 : 10000 (UNREDUCED)

MICROFILM No.:

PROJECT No.: N11100

SURVEYOR: RPS GROUP
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APPROVED: BRENT THOMAS RPEQ 7662, BROCK GITSON RPEQ 7084

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CLIENT: STOCKLAND PTY LTD

PROJECT: CALOUNDRA SOUTH PRELIMINARY BULK EARTHWORKS

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DRAWING TITLE: DEPTH RANGE CENTRAL, WESTERN & TOWN CENTRE

DRAWING NUMBER: N11100-SK407

ISSUE: F

FILE: N11100-SK408.dwg DATE: 31-05-2012 TIME: 15:20
Xref's: X-N11100-4-TIT X-N11100-BASE-SCENARIO 4 X-N11100-4-COLOUR RANGE MP3 X-N11100-4-CONT SUPER 5000 SCALE USR: chris sullivan

AMENDMENTS	DESIGN	DRAWN	DATE	AMENDMENT DETAILS
	PP	PP	09.12.11	
A	PP	PP	15.12.2011	LOCALITY NAME AMENDED
B	PP	PP	30.03.12	HATCH COLOUR AMENDED
C	PP	DM	27.04.12	CUT/FILL DEPTH AMENDED
D	PEP	DM	16.05.12	REVISED FOR MASTERPLAN AMENDMENTS
E	TS	CD	30.05.12	DEVELOPABLE FOOTPRINT ADDED
F				

DESIGN CHECK

DRAWN CHECK

SCALE (METRES)

100 50 0 100 200

1 : 5000 (UNREDUCED)

MICROFILM No.

PROJECT No.
N11100

SURVEYOR: RPS GROUP
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PROJECT
CALOUNDRA SOUTH
PRELIMINARY BULK EARTHWORKS

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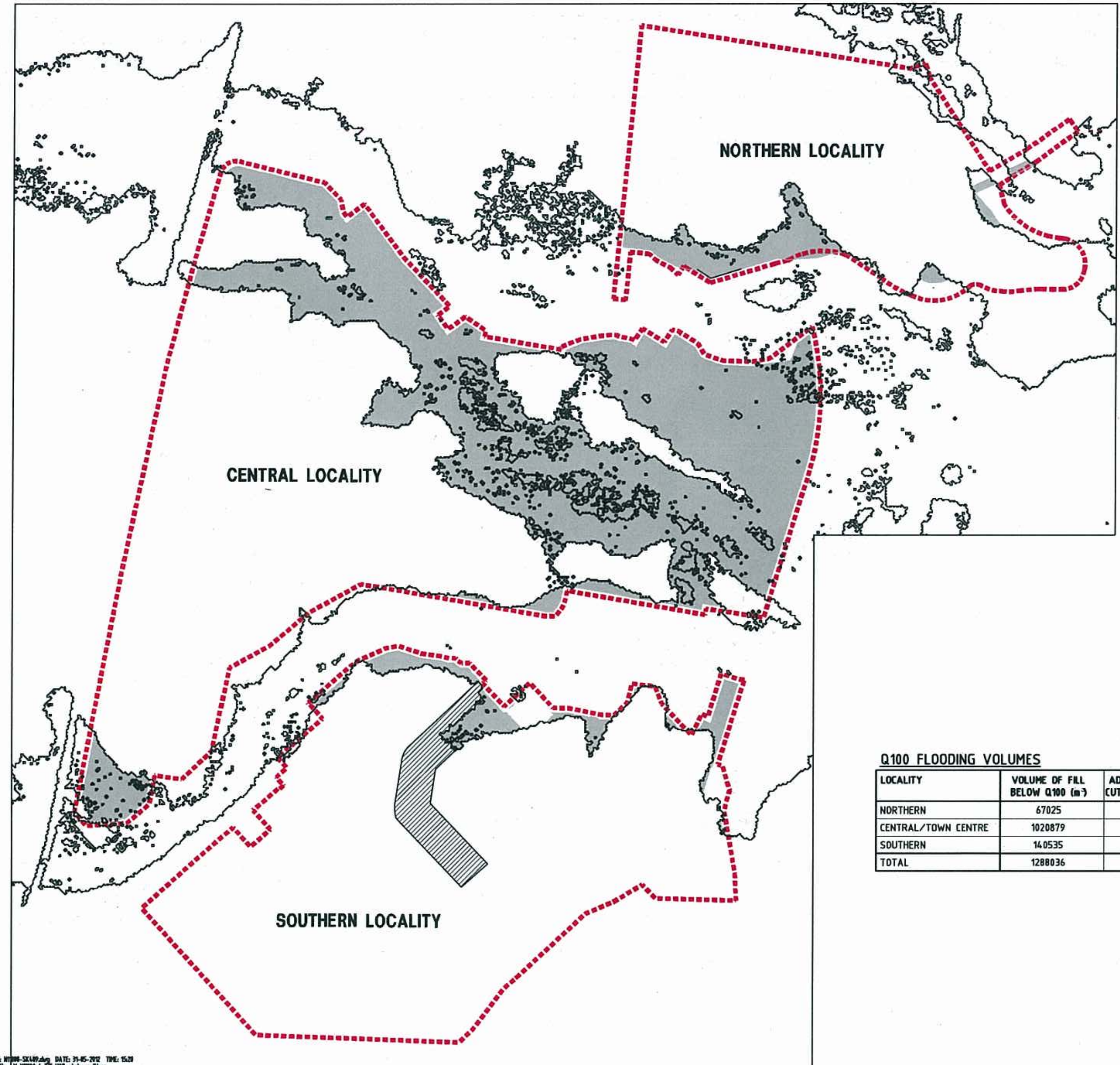
DRAWING TITLE
DEPTH RANGE
SOUTHERN LOCALITY

DRAWING NUMBER
N11100-SK408

ISSUE
E



Q100 FLOODING VOLUMES

LOCALITY	VOLUME OF FILL BELOW Q100 (m³)	ADDITIONAL STORAGE CUT IN Q100 AREA (m³)	NET VOLUME OF FILL IN FLOOD PLAIN (m³)	AREA OF FILL BELOW Q100 LEVEL	AVERAGE DEPTH OF FILL BELOW Q100 LEVEL
NORTHERN	67025	19034	107588	239374	0.28
CENTRAL/TOWN CENTRE	1020879	42476	978403	3152438	0.32
SOUTHERN	140535	409167	-268632	441823	0.32
TOTAL	1288036	470677	817359	4028046	0.30

LEGEND

- Q100 LINE
- DEVELOPMENT AREA BELOW THE Q100 LINE.
- COMPENSATORY CUTTING ADJACENT TO Q100 AREA.
- LOCALITY BOUNDARIES

ISSUE			DATE	AMENDMENT DETAILS
	PEP	CD	28.03.12	
A	PP	PP	04.04.12	DRAWING RE-ISSUED & RE-NUMBERED
B	PP	PP	18.04.12	FLOODING TABLE AMENDED
C	PP	DM	27.04.12	EARTHWORK VOLUMES & CUT/FILL HATCH AMENDED
D	PEP	DM	16.05.12	REVISED FOR MASTERPLAN AMENDMENTS
E	-	-	-	-
F	TS	CB	30.05.12	NEW PLAN

SCALE (METRES) 1 : 15000 (A1)

PROJECT No. N11100

SURVEYOR: RPS GROUP
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BRENT THOMAS RPEQ 7862
BROCK KITSON RPEQ 7806

FOR & ON BEHALF OF BROWN CONSULTING (QLD) PTY LTD

CLIENT: STOCKLAND PTY LTD

PROJECT: CALOUNDRA SOUTH PRELIMINARY BULK EARTHWORKS

BROWN *Smart Consulting*

Brown Consulting (QLD) Pty Ltd

DRAWING TITLE: OVERALL SITE DEVELOPMENT AREA BELOW THE Q100 LEVEL OVERALL (CONTOURS)

DRAWING NUMBER: N11100-SK409 ISSUE: F

ISSUE	DATE	AMENDMENT DETAILS
A	28.03.12	
B	04.04.12	DRAWING RE-ISSUED & RE-NUMBERED
C	27.04.12	CUT/FILL DEPTH AMENDED
D	16.05.12	REVISED FOR MASTERPLAN AMENDMENTS
E	30.05.12	NEW PLAN

SCALE: 1 : 15000 (A1)

PROJECT No. N11100

SURVEYOR: RPS GROUP
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APPROVED: BRENT THOMAS RPEQ 7862, BROCK KITSON RPEQ 7884
FOR & ON BEHALF OF BROWN CONSULTING (QLD) PTY LTD

CLIENT: STOCKLAND PTY LTD

PROJECT: CALOUNDRA SOUTH PRELIMINARY BULK EARTHWORKS

BROWN *Smart Consulting*

DRAWING TITLE: OVERALL SITE DEPTH RANGES

DRAWING NUMBER: N11100-SK410

ISSUE: E

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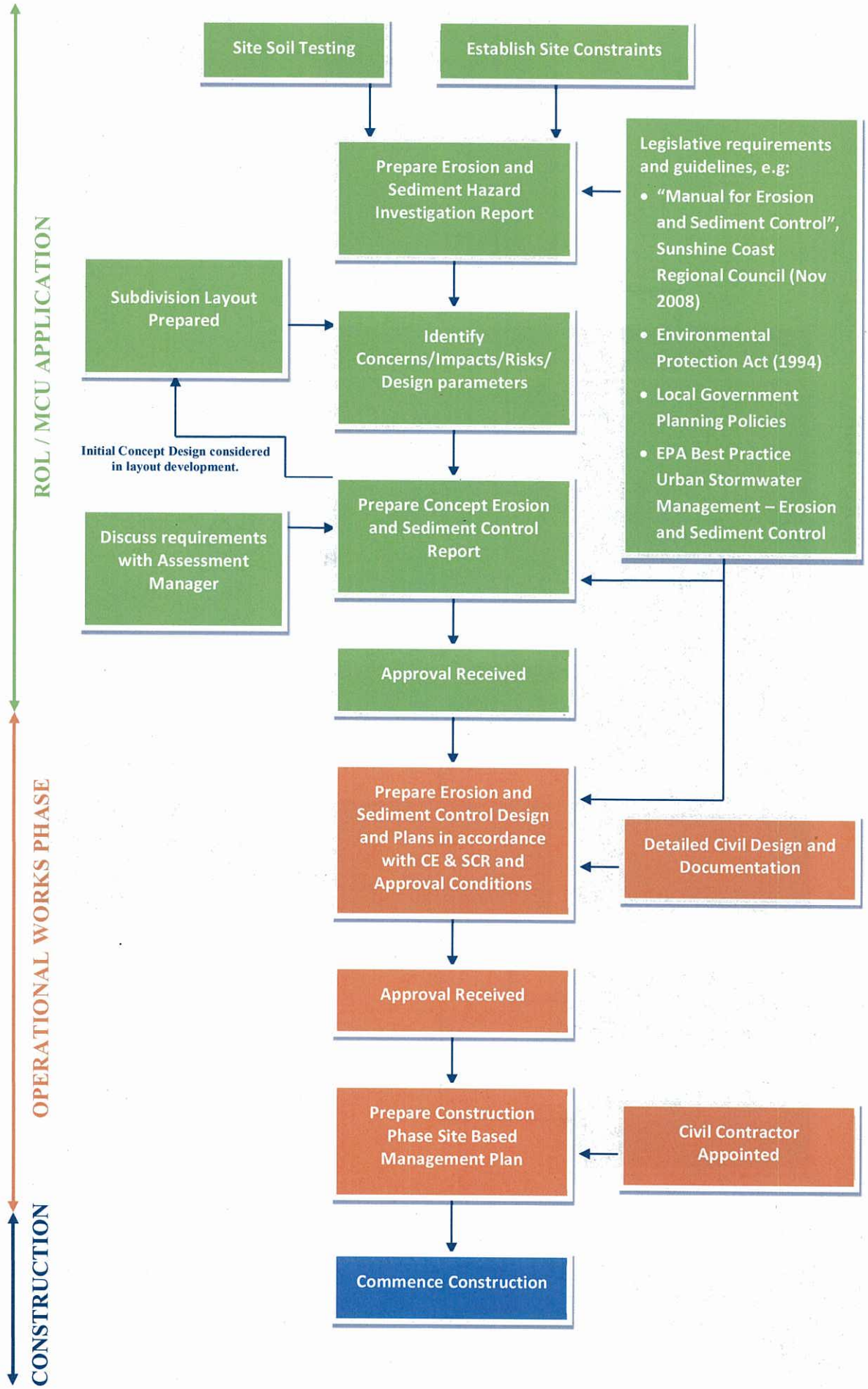
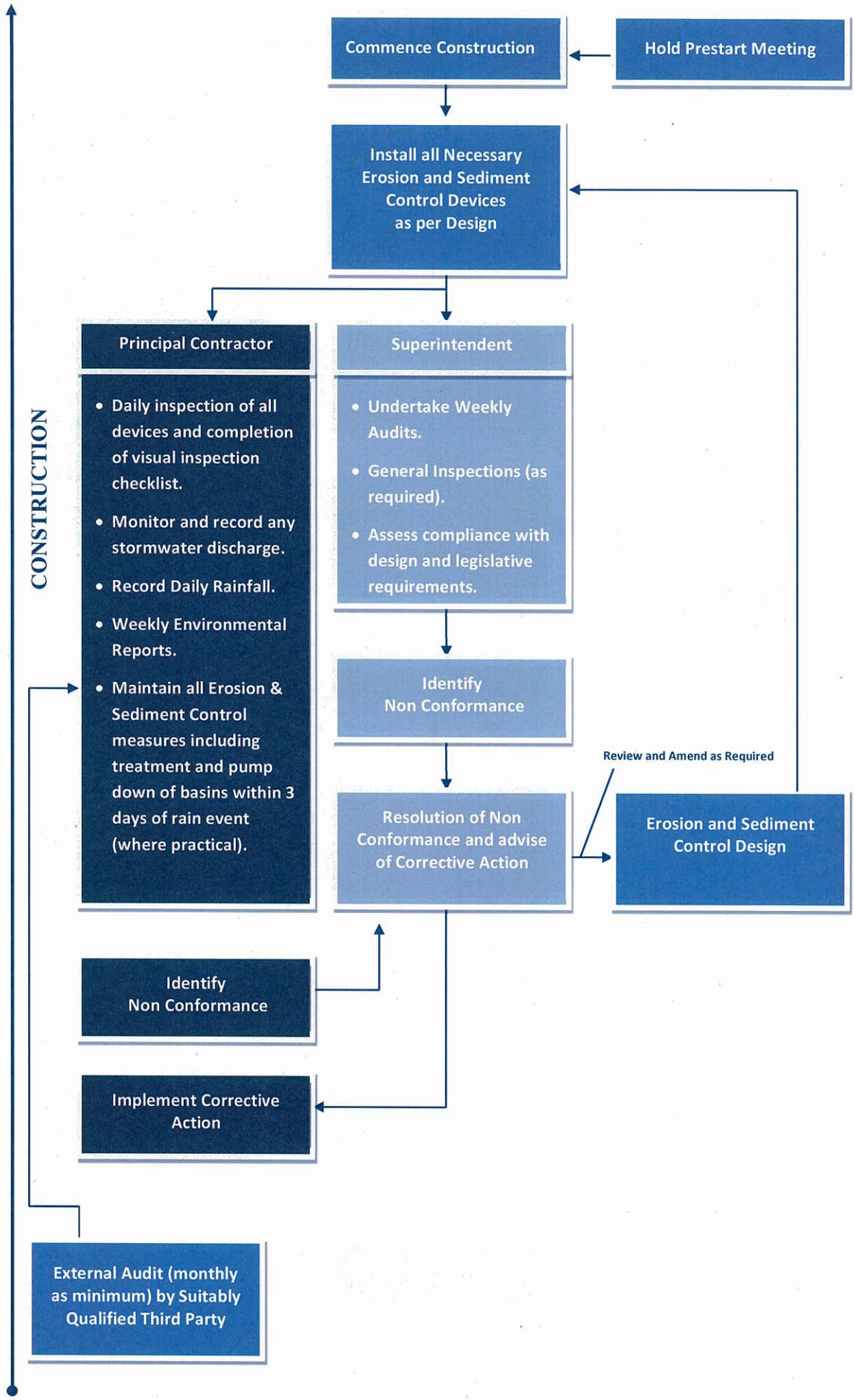
APPENDIX D

Flow Chart – Environmental Outcomes


ROL / MCU APPLICATION
OPERATIONAL WORKS PHASE
CONSTRUCTION
Site Soil Testing
Establish Site Constraints
Prepare Erosion and Sediment Hazard Investigation Report
Legislative requirements and guidelines, e.g:
• "Manual for Erosion and Sediment Control", Sunshine Coast Regional Council (Nov 2008)
• Environmental Protection Act (1994)
• Local Government Planning Policies
• EPA Best Practice Urban Stormwater Management – Erosion and Sediment Control
Subdivision Layout Prepared
Identify Concerns/Impacts/Risks/ Design parameters
Initial Concept Design considered in layout development.
Discuss requirements with Assessment Manager
Prepare Concept Erosion and Sediment Control Report
Approval Received
Prepare Erosion and Sediment Control Design and Plans in accordance with CE & SCR and Approval Conditions
Detailed Civil Design and Documentation
Approval Received
Prepare Construction Phase Site Based Management Plan
Civil Contractor Appointed
Commence Construction


CONSTRUCTION
Commence Construction
Hold Prestart Meeting
Install all Necessary Erosion and Sediment Control Devices as per Design
Principal Contractor
Daily inspection of all devices and completion of visual inspection checklist.
Monitor and record any stormwater discharge.
Record Daily Rainfall.
Weekly Environmental Reports.
Maintain all Erosion & Sediment Control measures including treatment and pump down of basins within 3 days of rain event (where practical).
Superintendent
Undertake Weekly Audits.
General Inspections (as required).
Assess compliance with design and legislative requirements.
Identify Non Conformance
Resolution of Non Conformance and advise of Corrective Action
Review and Amend as Required
Erosion and Sediment Control Design
Identify Non Conformance
Implement Corrective Action
External Audit (monthly as minimum) by Suitably Qualified Third Party

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APPENDIX E

Sample Sediment Basin Designs

Type D Sediment Basin (Catchment 1 and 2)

Catchment Characteristics

Total Catchment Area	=	6.8
Disturbed Catchment Area	=	6.8
RUSLE Value	=	250tonnes/ha/yr

Settling Zone Volume

The settling zone volume for *Type D* soils is calculated based on 125mm rainfall depth.

$$\text{Volume} = 10 \times C_v \times A \times 125\text{mm}$$

Where:

- 10 - a unit conversion factor
- C_v - the volumetric runoff coefficient, defined as that portion of rainfall that runs off as stormwater over the 5-day period
- A - is area of catchment in hectares

Therefore:

$$\text{Volume} = 10 \times 0.4 \times 5 \times 125$$
$$= 3400 \quad (V_A)$$

Sediment Storage Zone Volume

The sediment storage volume is taken as the larger of 30% of the capacity of the sediment basin or as two months soil loss as calculated by the RUSLE.

$$\text{Sediment Storage Zone}_{\text{2month soil loss}} = 0.17 \times A \times \text{RUSLE} / 1.3$$

Where:

- 0.17 - a factor to convert the annual calculated soil loss to the 2-month soil loss
- A - the disturbed site area
- RUSLE - the RUSLE value for the site
- 1.3 - a factor for converting tonnes to cubis metres, assuming a typical density of saturated sediment

$$\text{Sediment Storage Zone}_{\text{2month soil loss}} = 0.17 \times 5 \times 250 / 1.3$$
$$= 222.3077$$

$$\text{Sediment Storage Zone}_{\text{30\% Settling Zone Volume}} = 1020$$

$$\text{Sediment Storage Zone}_{\text{Greater}} = 750 \ (V_B)$$

Total Basin Volume

$$\text{Volume} = V_A + V_B$$
$$= 4150 \ m^3$$

Type D Sediment Basin (Catchment 3)

Catchment Characteristics

Total Catchment Area	=	0.65
Disturbed Catchment Area	=	0.65
RUSLE Value	=	250tonnes/ha/yr

Settling Zone Volume

The settling zone volume for *Type D* soils is calculated based on 125mm rainfall depth.

$$\text{Volume} = 10 \times C_v \times A \times 125\text{mm}$$

Where:

- 10 - a unit conversion factor
- C_v - the volumetric runoff coefficient, defined as that portion of rainfall that runs off as stormwater over the 5-day period
- A - is area of catchment in hectares

Therefore:

$$\text{Volume} = 10 \times 0.4 \times 0.65 \times 125$$
$$= 325 \quad (V_A)$$

Sediment Storage Zone Volume

The sediment storage volume is taken as the larger of 30% of the capacity of the sediment basin or as two months soil loss as calculated by the RUSLE.

$$\text{Sediment Storage Zone}_{\text{2month soil loss}} = 0.17 \times A \times \text{RUSLE} / 1.3$$

Where:

- 0.17 - a factor to convert the annual calculated soil loss to the 2-month soil loss
- A - the disturbed site area
- RUSLE - the RUSLE value for the site
- 1.3 - a factor for converting tonnes to cubis metres, assuming a typical density of saturated sediment

$$\text{Sediment Storage Zone}_{\text{2month soil loss}} = 0.17 \times 0.65 \times 250 / 1.3$$
$$= 22$$

$$\text{Sediment Storage Zone}_{\text{30\% Settling Zone Volume}} = 97.5$$

$$\text{Sediment Storage Zone}_{\text{Greater}} = 97.5 \ (V_B)$$

Total Basin Volume

$$\text{Volume} = V_A + V_B$$
$$= 422.5 \ m^3$$

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APPENDIX F

Preliminary Bulk Earthworks Volumes

Summary of Preliminary Bulk Earthworks Volumes for Caloundra South

Precinct	Cut (m^3)	Fill (m^3)	Import/Spoil (-/+)	Comments
Northern	1,288,800	828,000	+460,000	Exported to Western Precinct & Town Centre
Western and Town Centre	1,827,000	4,850,500	-460,000 -1,540,500 -1,023,000	Import from Northern Import form Southern Import from potential Detention Basin
Southern	2,897,200	1,356,700	+1,540,500	Exported to Western Precinct and Town Centre.
Potential Detention Basin (West of Bruce Highway)	1,023,000	0	+1,023,000	Exported to Western Precinct & Town Centre
Totals:	**7,036,000**	**7,036,000**	**0**	**Balance Achieved.**

Note: These volumes will be subject to further refinements at subsequent application stages. Detention Basin West of Bruce Highway is a potential fill source only and will be subject to future approvals.