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# ENGINEERING REPORT

## LIFE CITY WOLLONGONG HI-TECH HOLISTIC CANCER & MEDICAL HOSPITAL FACILITY, WARWICK ST, BERKELEY

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Rev 5

PN00864.R01

AUGUST 2013

## PROJECT DETAILS

Property Address: Warwick St, Berkeley



## REPORT CERTIFICATION

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## DOCUMENT CONTROL

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## 1. INTRODUCTION

### 1.1 Context of the Report

C&M Consulting Engineers has been commissioned to undertake an engineering investigation and assessment report for the proposed Life City – Wollongong at Berkeley. The proposed development is defined as a Major Project (Critical Infrastructure) under Part 3A of the Environmental Planning and Assessment Act 1979. It is a requirement of the Director General of the Department of Planning (DoP) that an Environmental Assessment (EA) be carried out for the development.

This engineering report will be a part of the revised EA, which addresses constraints and opportunities associated with roads, earthworks, stormwater, water sensitive urban design and utility services.

The report addresses the following:

- Road Network,
- Pedestrian Access,
- Stormwater Quantity,
- Stormwater Quality,
- Water harvesting, and
- Utility Services.

The Report describes the principles and operation of the proposed infrastructure system as well as the primary components of each system. As the assessment is of an Environmental Assessment nature, the proposed measures may have to be revisited and refined in conjunction with any modifications to the final form of layout and along with other comments from Department Planning and/or Wollongong City Council. Detailed design of the final form will be provided as part of the Construction Certificate submission.

## 1.2 The Site

The subject site is located in a southern Wollongong suburb of Berkeley, approximately 11km south of the Wollongong CBD. It is bounded by the F6 Southern Freeway to the west, Nolan Street to the east, Hopeman Cres to the north and Nottingham St to the south. The access to the site is via Warwick Street to the north of the site.

The site comprises an area of 16.88 hectares consisting of three (3) separate allotments: Lot 4 DP 258635, Warwick Street; Lot 2 DP 534116, Nottingham Street; Lot 2 DP 249814, York Street. Along the southern boundaries there is a 24 metre wide easement for transmission lines. The majority of the site is zoned E3 (Environmental Management) but there is an area that is zoned R2 (residential) under the Wollongong Local Environmental Plan 1990.

The site has a dominant ridge running in an east-westerly direction accommodating reasonably steep slopes (gradients are generally 20- 30%) to the south and a gently rolling slope (gradients are generally 5-10%) towards the F6 Southern Freeway to the north-west. The site is currently vacant with natural bushland to the south of the ridge and open pastured land to the north of the ridge.

The character of the immediate locality is mixed with residential to the east of F6 Southern Freeway and industrial development to the west of the Freeway. Full context of the site as well as current planning instruments are described comprehensively in the Environmental Assessment Report.



*Figure 1 – Site Layout*

### 1.3 The Development

Life City Wollongong will be a Hi-tech Holistic Inpatient Hospital Facility providing inpatient cancer treatments and medical services and healthcare services, including:

- Hi-tech holistic cancer and medical hospital facility
- Holistic health course for Yoga, Reiki and Laughter Therapy, Meditation, Auras, and Panic Healing,
- Day surgery and Specialist rooms,
- Senior living development,
- Ancillary accommodation for employees including doctors, nurses, medical students and patients seeking outpatient services,
- A Library, Lecture Theatre, Auditorium & Conference Facilities and amphitheatre,

Full detail of the development is in the Environmental Assessment Report.

### 1.4 Engineering Objectives

The engineering objectives are to create a well linked and highly accessible layout to provide a development that responds to the topography and site constraints, and to provide a safe and environmentally friendly development. In particular:

- To ensure that transport networks are able to support the proposed development in a manner that maintains safe levels of service.
- Provide adequate and safe vehicular access to sites without compromising streetscape qualities.
- To ensure that premises are accessible to a person with a disability without discrimination
- To control stormwater runoff and minimise discharge impacts on adjoining properties and into the natural drainage system before, during and after construction.
- To ensure that the proposed development does not adversely affect the operational capacity of the downstream stormwater system.
- To ensure that the development does not impact on the water quality of adjacent properties or creeks.
- To provide for the disposal of stormwater from the site in an efficient, equitable and environmentally sensible way.
- To ensure that biodiversity and the integrity of ecological processes are not compromised by the development.
- To encourage reuse, recycling and harvesting of stormwater to reduce the reliance on potable water and wastage of water.

## 1.5 Engineering Principles

The following principles underpin the design:

- Provision of safe access links to the adjoining neighborhood – integration with Warwick Street as well as Nolan Street,
- Adopt a simple yet safe connective access system,
- Sympathetic to the terrain and landform and responsive to the existing environmental constraints,
- Develop a high quality infrastructure that integrates well with landform and drainage system
- Respond to the existing drainage system under F6 Freeway,
- Adopt water sensitive urban design principles and improve stormwater runoff quality discharging from the site to Lake Illawarra, and
- Meet triple bottom line benchmarks encompassing social, ecological, and economic factors.

## 2. RELEVANT GUIDELINES

### 2.1 Roads and Access Guidelines

Austrroads – Guide to Road Design was generally used to determine the appropriate technical design criteria for the roads including cross-section configuration, alignments, dimensions, safety requirements, linemarking and sign posting.

Other guidelines and regulations that are applicable to the development are;

- Chapter B2: Residential Subdivision of the Wollongong Development Control Plan, 2009 (DCP)
- AS 2890.1 Off Street Car Parking
- AS 2890.2 Commercial Parking Facilities
- AS 1428 Design for Access and Mobility
- AS 1742 Manual of Uniform Traffic Control Devices
- New South Wales Roads & Maritime Services (Formerly RTA) Traffic Control at Worksites manual
- Austrroads – Guide to Road Design
- Austrroads – Pavement Design for Light Traffic: Supplement to Austrroads Pavement Design Guide

### 2.2 Water Sensitive Design guidelines

Water Sensitive Urban Design (WSUD) is the term used to describe the current approach to urban planning and design that offers sustainable solutions for integrating land development with the natural water cycle. WSUD emphasises a more decentralised approach, water management that is more in tune with natural environmental processes, and the restoration of the natural water cycle in terms of surface runoff, groundwater, and evapo-transpiration. It involves integrating the potable water, stormwater and wastewater streams to mitigate the increased runoff from urban areas, decrease the volume of polluted water entering our waterways, sustain biodiversity and the integrity of ecological processes and reduce the strain on drinking water reserves.

For stormwater runoff control requirements of the WSUD, Chapter E14: Stormwater Management of the Wollongong Development Control Plan, 2009 (DCP), which outlines the objectives and standards to ensure the runoff from the development is controlled and safely conveyed to the downstream waterways.

WSUD elements are to be designed and constructed in accordance with Chapter E15: Water Sensitive Urban Design of the DCP which outlines the objectives and standards to ensure the development incorporates the principles of Ecological Sustainable Development.



In addition to above, Wollongong City Council's On-site Stormwater Detention Code, June 2006 and Council's Urban Drainage Design Manual are to be used for the technical design guideline.

### 2.2.1 Water Quantity

Drainage systems are to be designed and constructed in accordance with the DCP and Council Code specified above in conjunction with "Australian Rainfall and Runoff" published by the Institution of Engineers, Australia (1987)

In general, these standards and guides state a requirement that development must not result in downstream drainage nuisance. This, consistent with the Council Standard, means that the peak flows for a range of storm events should not increase except where regional planning has been provided for the future developments. The latter is applicable to the existing residential zoning land within the site. Where mimicking of natural flows are required, on-site detention systems are to be provided to the requirements of Council Standard.

### 2.2.2 Water Quality

The stormwater quality management strategy should be based on the current best practice to achieve pollutant load reduction targets set in Chapter 15: Water Sensitive Urban Design of the DCP.

The reduction targets applicable to this site (Industrial/Commercial) are:

**Table 1 – Water Quality Criteria**

Parameters	Reduction <sup>Note 1</sup>
Gross Pollutants	90%.
Total Suspended Solids	80%
Total Phosphorus	55%
Total Nitrogen	40%

Note 1 - Reductions in loads are relative to the pollution generated from the development without treatment

### 2.2.3 Stormwater Harvesting and Reuse

For stormwater harvesting and reuse, there are no set criteria in the DCP but is generally designed on a case by case basis. To determine the most efficient size of rainwater tanks, water demand and supply (catchment area and rainfall) must be optimally balanced.

Based on a number of published documents including WSUD Guidelines for Western Sydney the average water usage for toilet flushing is 50L/day/person and irrigation rate of 1mm depth per day.

The industrial standard for acceptable rainwater replacement with potable water is 80%.

### 2.3 Compliance with DGR

This engineering report together with the Drawings generally satisfies the Director General's Requirements (DGR) issued on 26 October 2010 for the particular conditions:

Condition 4 - Transport and Accessibility Impacts – For general traffic impacts, *Traffic and Transportation Report* by GHD should be referred. In this report we have adequately addressed the accessibility of the site.

Conditions 12 - Water Quality and Drainage

In addition to above conditions, the drawing includes Stormwater Concept Plan required under 'Plan and Documents to Accompany the Application'.

### 3. SITE WORKS

#### 3.1 Earthworks

The proposed development is sympathetic to the site topography to overcome the slopes and minimised excessive cut and fill to meet the engineering objectives. However, it is inevitable that some areas need extensive excavation and filling. Based on the preliminary grading of the roads, maximum cut of up to 4m and fill up to 3m is proposed. This cut/fill does not include building excavations.

Drawing PN-00864\_SK07 included in Appendix A shows preliminary cut and fill.

There is a small area of uncontrolled fill at the northern end of the site. The area will be remediated by removing the fill material and re-compaction in a controlled manner to AS3798. All site work will be carried out under a strict supervision of a Geotechnical Engineer to the requirement of AS 3798.

#### 3.2 Landslide Risk Management

A preliminary geotechnical investigation by Coffey Partners indicates some areas of the site are potentially at risk of landslide.

The development will be proceeded with good hillside construction practice techniques recommended by *Australian Geomechanics Society's* Landslide Risk Management 2007.

Any development proposed within the land of the landslide hazard areas need to ensure that the specific characteristics of the landslides are addressed as well as the design of the development should be implemented in consultation with the geotechnical engineers.

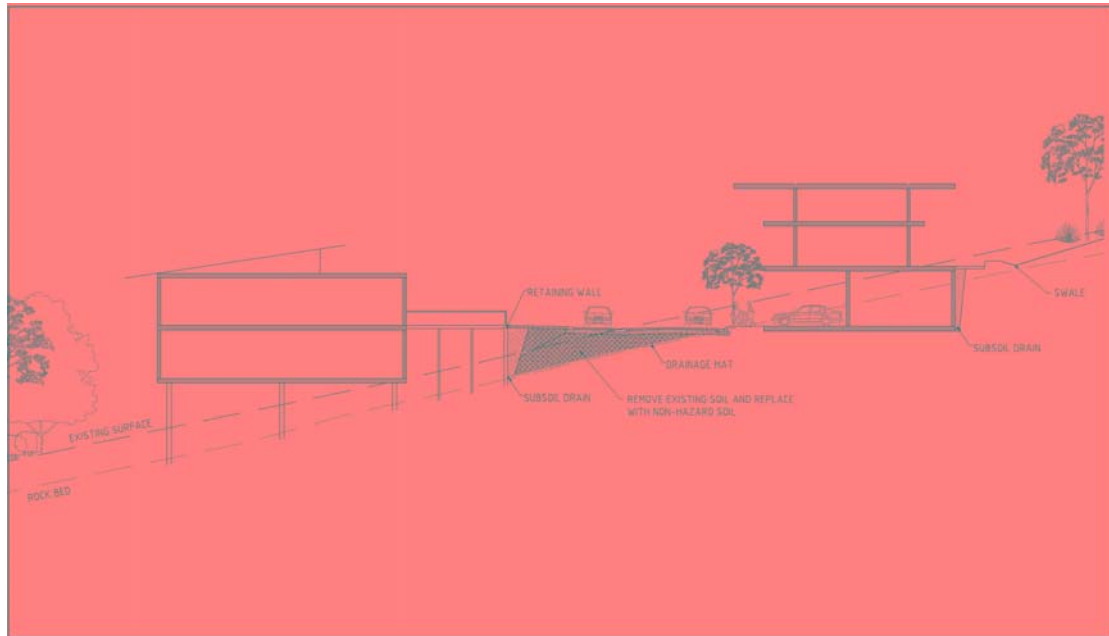
There are many typical engineering procedures that can be evaluated by the design and construction team in order to determine the most appropriate means of achieving the accepted level of risk, including:

- Removing the landslide hazard through bulk earthworks – the area of high risk has a soil cover of between 1.5m to 2m. The bulk earthworks plan PN-00864\_SK08 shows this area is generally in cut up to 3m.
- Improving the strength of the material forming the landslide hazard - Where there is no cut, eg roadways, the problematic soil will be removed and replace with stable soil to in consultation with geotechnical engineer.
- Constructing toe buttresses or retaining walls – some proposed buildings will form retaining walls. Additional retaining walls, if required, will be introduced.
- Improving surface and/or sub-surface drainage at the head of the hillside hazard – the development will have a formal drainage system. All the services will be backfilled with granular material to improve sub-surface water that maybe leaked from the services.

Other measures that can improve the landslide hazard are:

- Constructing barriers to deflect landslide debris - some proposed buildings will form retaining walls.
- Reducing the slope angle of hillside hazard;

Typical section showing the construction method is provided below. Full detail is also shown on PN-00864\_SK03 in Appendix A.



**Figure 2 – Typical Section showing the Construction Method**

### 3.3 Batters and Retaining Walls

Given the topography of the site, battered earth, retaining wall structures or a combination of these will be required to safely support the roads and buildings.

Where possible, the use of retaining wall will be limited by landscaped batters. Where retaining walls are inevitably required, high walls will be limited by combining low retaining walls with landscaped batters. This type of treatment will be aesthetically pleasing and will provide improved visual integration of natural form consistent with the surrounding environment.

The type of wall will be incorporated into the detailed landscape drawings and will be constructed of durable materials.

## 4. ROADS AND TRANSPORTATION

### 4.1 Road Planning

Traffic report prepared by GHD is included in the EA Submission. Issues relating to traffic should refer to that report including the proposed roundabout in Nolan Street. This Section addresses issues relating to the internal road works in the aspects of civil engineering works either identified in the traffic report or are deemed necessary relate to this type of development.

The proposed hierarchy of the road system is shown on Drawing PN-00864\_SK01 in Appendix A. Table 2 below summarises road widths proposed.

**Table 2: Characteristics of road types**

Road Number	Road Type	Carriageway Width (m)	Kerbside Parking	Equivalent Council Standard
1 (Ch 0 to 640)	Entry Road	9	No	Local Street with AADT between 1000-3000. <sup>Note1</sup>
1 (Ch 640-End) 2 and 7	Main Access Roads	7	No	Local Street with AADT between 300-1000. <sup>Note2</sup>
4, 5 and 6	Parking Entry Roads	6	No	Local Street with AADT < 300. <sup>Note3</sup>

Note 1 – Council standard is 9.5m but allows kerbside parking.

Note 2 – Council standard is 7.5m but allows kerbside parking.

Note 3 – Council standard is 6.5m but allows kerbside parking on one side.

The main philosophy of the road hierarchy system proposed is to provide good level of services and yet sympathetic to the topographic constraints. In comparison with Council's DCP, we believe the road widths proposed comply with the Council road system of similar roads.

All roads will have concrete kerb and gutter and carriageway surface finished with asphaltic concrete or other surfaces that are safe and durable.

Drawing PN-00864\_SK02 in Appendix A shows typical cross-section of the roads.

### 4.2 Road Alignments

The proposed road alignments generally meet the Austroads requirement. It is acknowledged that the topography is the main constraint on site, which requires a good engineering judgement to overcome the potential unsafe road alignments.

The proposed road layout incorporates the best practice for both horizontal and vertical alignments with empathise on terrain and landform. Priority has been given in the design for the safety of vehicles and pedestrians.

Where the horizontal deflection angle is greater than 70 degrees, a localised widening of the pavement has been proposed to enable larger vehicles to turn without engaging the full width of the road.

Vertical alignment, or grading, is an important factor to be considered in this development due to the terrain. Special consideration has been given to meet the sight distance requirements as well as easy access to driveways. Given the terrain it was not practical to design the road system to the desirable grade throughout the site without excessive earthworks. It is therefore, envisaged that there will be areas where vertical grades will reach up to 15% but will generally maintain to 10%.

Drawings PN-00864\_SK04 to PN-00864\_SK06 in Appendix A show vertical grades of the roads.

#### 4.3 Sight Distance Requirements

One of the most important elements in road design is to provide an adequate sight distance on both the horizontal and vertical planes. The geometry of the road, location of the intersection, clearances, boundary splays, and the extent of vegetation will affect the sight distance requirements.

Based on the AustRoads, the stopping sight distance (SSD) for cars operating speed of 50kph and reaction time of 2.5 second is 60m for an urban setting, including additional length for the grade correction.

The proposed road design generally meets the SSD but the final sight distance provisions for different conditions will be determined at the detail design stage of the roads in consideration with the final building form.

#### 4.4 Traffic Management

The objective is to provide safe roads for pedestrians, cyclists and motorists without compromising aesthetics and traffic flows. To meet this objective, measures to control vehicular speed will be implemented. To control traffic speeds, slow point devices in a form of surface textures, curves, intersections and roundabouts are strategically located to minimise the long straight leg lengths.

#### 4.5 Car parks

Off road car parks have been designed to comply with the requirements of Council DCP, AS2890.1 Off Street Parking Facilities and AS2890.2 Commercial Parking Facilities.

#### 4.6 Nolan and Warwick St Intersections

The development, as proposed, includes two (2) exit/entry points. One at the western end of Warwick Street located to the north of the site and the other from Nolan Street via Council owned Environmental Area.

Interface at the Warwick Street entry will be designed to comply with Council's standards with an entry feature that delineates between public road and private road.

The Nolan Street entry will be the main entry and the intersection treatment at Nolan Street will be dealt in the traffic report by GHD. The design of the intersection treatment will be to Council's and RMS standards.

## 5. STORMWATER MANAGEMENT

### 5.1 Introduction

#### 5.1.1 Background

The objective is to provide stormwater controls, which ensure that the proposed development does not adversely impact on the stormwater flows and water quality of waterways within, adjacent and downstream of the site.

The principles and operation of the proposed stormwater system, the primary components of the drainage system, and their sizes and locations on the site are described below. Detailed design of the drainage system will be provided as part of the detail design submission.

Increased impervious surfaces and alteration of the natural topography due to the land development have the potential to increase the flows and tend to concentrate the flows. This has the potential to impact on flood levels and erosion of the downstream drainage system. To avoid any adverse impact on the downstream drainage system, the site stormwater system is required to be planned to ensure safe conveyancing of flows through the site and within the capacity of the downstream drainage system.

The proposed drainage system including water quality is shown on Drawings PN-00864\_SK09 and PN-00864\_SK10 in Appendix A.

#### 5.1.2 Key Issues

The key issues and the mitigating measures to be employed within the proposed development site are:

- **Stormwater Flow** - Increased impervious surfaces (such as roads, roofs, carparks, etc) have the potential to increase the stormwater flows from the site during storm events. To avoid impacting on the downstream drainage system, the site stormwater system has been designed to safely convey the flows through the site and within the capacity of the downstream system. The design and operation of the proposed system is described in Section 5.2.
- **Water Quality** - Urban developments have the potential to increase gross pollutants, sediments and nutrient concentrations in stormwater runoff. To limit impact on the downstream water quality, gross pollutant traps will be provided at each stormwater outlet prior to discharging to a bioretention basin. Further, the bioretention basins will further furbish the water quality prior to discharge to the receiving downstream watercourses. The design and operation of the proposed system is described in Section 5.3.

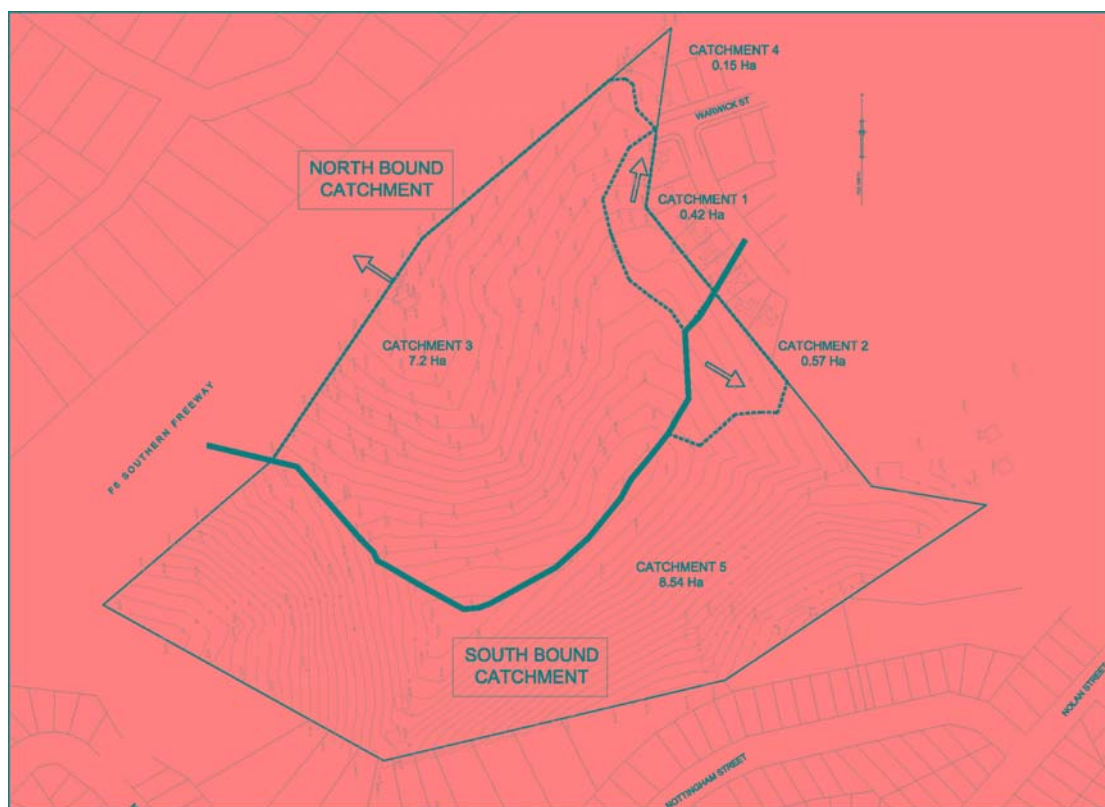
## 5.2 Runoff Control

### 5.2.1 Catchments and Existing Drainage System

The site is divided into two (2) major catchments: north bound and south bound. The North Bound catchment drains to the existing stormwater system provided for Berkeley Residential Development including a culvert under F6 Southern Freeway. 4.7 hectare of this catchment is zoned R2 (residential) under the Wollongong Local Environmental Plan 1990. According to the Council DCP (Chapter E14: Stormwater Management), this catchment is exempted from the on-site detention requirement as it is controlled by regional detention basin. However, since this development has not been considered in the design of the regional stormwater system, a local detention system is required to control the flows to meet the planned residential development condition.

The South Bound catchment which is zoned E3 (Environmental Management) under the Wollongong LEP, is left un-developed except for the access road off Nolan St.

The site can be further divided into five (5) sub-catchments based on the discharge points as shown below and described in Table 3.



*Figure 3 – Existing Catchments*



**Table 3 – Existing Catchment Description**

Catchment	Area (Ha)	Description
1	0.42	This small subcatchment drains to Warwick Street stormwater system.
2	0.57	This subcatchment discharges to the existing residential houses in Hopman Crescent and to Nolan Street. Runoff from the development in this subcatchment will be directed to Nolan Street.
3	7.2	This subcatchment drains to the existing 1200mm diameter culvert under F6 Southern Freeway.
4	0.15	This is a small subcatchment that drains to the reserve at the back of residential houses on the northern side of Warwick St, which then drains to the existing 1500mm diameter culvert under the F6 near Newcombe Street. This catchment is not subject to the development.
5	38.54	This subcatchment discharges to the existing residential houses in Nottingham Street. This catchment is not subject to the development.
<b>Total</b>	<b>16.88</b>	

### 5.2.2 Proposed Drainage System

The drainage system for the development will be designed to collect all surface runoff flows from impermeable surfaces such as roads, buildings and hard surface areas to the designated conveyancing system to the downstream drainage system in a safe manner.

The drainage system proposed for the development includes:

- A piped system to collect minor storm runoff from the developed areas,
- Grass lined swales off the edges of car parks,
- Gross pollutant traps at each minor storm outlet point;
- Rainwater tanks for each building,
- Bio-retention/Detention basins to reduce nutrient runoff and peak flows to pre-development levels.

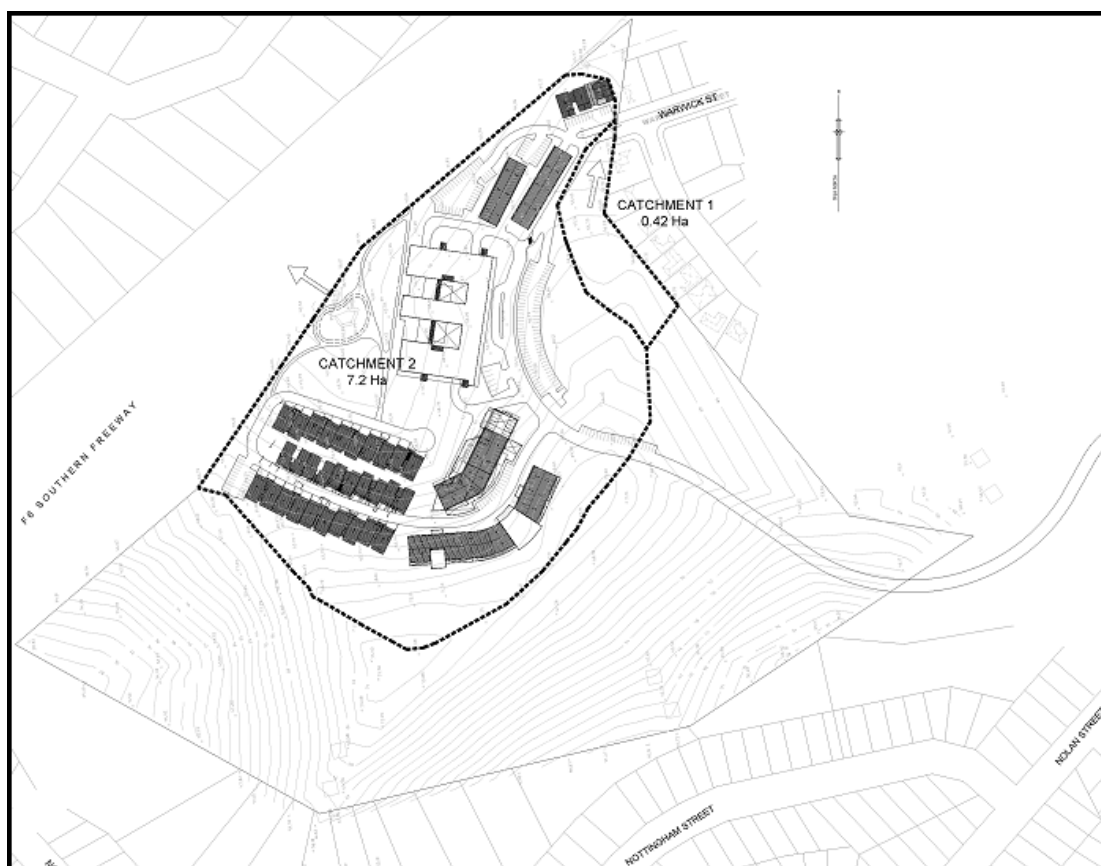
The development of the above infrastructure will be provided on an “as needs” basis and will be constructed in stages. Drawing No PN-00864\_SK09 shows the conceptual layout of the drainage system.

### 5.2.3 Preliminary Drainage Investigation

According to Council record, the site is located within 'uncategorised flood precinct'. Given the topography of the site, it is unlikely the site is in any affectation from flooding other than from the local runoff, which will be safely mitigated. Details of the mitigation works have been addressed in this report.

A preliminary assessment of the drainage systems has been carried out using Council's Urban Drainage Design Manual and On-site Detention (OSD) calculation set in Council's On-Site Stormwater Detention Code, June 2006.

The Design Manual stipulates alteration of the natural watershed during the development. This policy has been followed in the proposal. Figure 4 below shows catchment upon development of the site which is not different to the existing.



*Figure 4 – Revised Catchments*

Since the catchment is larger than 2 hectares, the OSD calculations has been performed using Drains for the Permissible Site Discharge (PSD) and Site Storage Requirements (SSR) for the 5 year ARI and 100 year ARI for subcatchment that are subject to development.

Since the site includes OSD exempted areas (currently Zoned R2), PSDs have been calculated accordingly. Table 4 below impervious areas for both existing (R2 developed) and post developed conditions.

**Table 4 – Comparison of Existing and Developed Catchments**

Subcatchment No.	Existing Catchments		Post Dev Catchment	
	Area (Ha)	% Imp	Area (Ha)	% Imp
1	0.42	40 <sup>Note1</sup>	0.42	5
2	7.2	36 <sup>Note2</sup>	0.13	50

Note 1 – From Council's Urban Drainage Design Manual.

Note 2 – From Council's Urban Drainage Design Manual. 40% of 4.3ha of R2 over 7.2ha = 24%

Table 5 below summarises results from Drains modelling.

**Table 5 – OSD Requirements**

Subcatchment No.	5 Year ARI Requirements	100yr ARI Requirements	
	PSD (m <sup>3</sup> /s)	PSD (m <sup>3</sup> /s)	SSR (m <sup>3</sup> )
1	OSD Not Required <sup>Note1</sup>		
2	1.81	3.76	1,260

Note 1 – The catchment is within OSD exempted area and the imperviousness ratio is less than 40%.

The bio-retention basins proposed on site will have additional storage for the OSD requirements. Drawing PN-00864\_SK09 shows indicative locations of the Bio-retention/OSD basins.

This investigation shows, in principle, that the proposed drainage system can achieve its main function of safe conveyancing through the site without any adverse impact both on site and downstream site. The detail design of the drainage system will be submitted with the detailed engineering design.

## 5.3 Water Quality Control

### 5.3.1 Introduction

The quality of runoff from a catchment depends upon many factors such as land use, degree of urbanisation, population density, sanitation and waste disposal practices, landform, soil types, and climate. Pollutants typically transported by runoff include litter, sediment, nutrients, oil, grease, and heavy metals. Whilst these pollutants have deleterious impact on receiving water quality, the suspended solids and nutrients are the most detrimental impact on the environment. Litter, oils, and other surfactants have an aesthetic impact.

Activity within a catchment during urbanisation includes the disturbance of vegetation, removal of topsoil, landshaping, road construction, installation of services, and building works. It is during this phase that the sediment movement is greatest and is estimated that the sediment production levels may be up to 6 times higher than under the existing conditions. However, once development is completed, the sediment loading may return to the existing level or remain at a higher level depending on land management practices.

This section of the report addresses the long term impacts of the development on water quality. For short term effects (i.e. during the construction phase) water quality control is achieved by implementing the requirements set in the Soil and Water Management Plan (Appendix F) and site specific Sedimentation & Erosion Control Plans prepared for each Stage of the construction.

### 5.3.2 Water Quality Control Measures

There are number of measures that can reduce pollutant loadings. Such measures may include:

- Litter baskets
- Gross Pollutant Traps (GPT)
- Grease and Silt Arrestors
- Grassed swales
- Vegetation Buffers
- Natural Streams
- Bioretention basin
- Wetlands
- Rainwater Tanks

Whilst all of the above are effective in reducing pollutant loadings to some degree, by far the most effective control system is a combination of two or more of the above measures in a conveyancing system, known as Treatment Train. This is because each one of the measures has a varying effectiveness for different types of pollutants.

The most effective treatment train consists of a gross pollutant trap (GPT), vegetation buffers, and either a bioretention basin or wetland. The GPT will intercept the majority of gross pollutants greater than 3mm then the vegetation buffer would filter coarse sediments before the final polishing of runoff by bioretention or a wetland.

It is proposed that this type of Treatment Train will be provided in the proposed Life City Wollongong development.

Each measure is described below:

#### Gross Pollutant Trap

As the name implies, this device is provided to trap gross pollutants including litter and sediments. The design of GPTs is site specific depending on the intended use. GPTs are generally sized to treat 50% of the 1 in 1 year storm with a pollutant holding capacity equal to a third of the annual load. In this investigation we have assumed that litter baskets will be installed within the kerb inlet pits along the proposed internal roads.

#### Vegetation Buffer

A buffer strip is a vegetated area of land which filters coarse to medium sediments by vegetation in un-channeled overland flow. It is necessarily located well upstream in a treatment train, before the flow has become concentrated into channels. It may be a physically identifiable strip of land, such as between a road and a parallel watercourse, but the buffer concept may also be used in a more notional way to model the effect of unconnected impervious areas on runoff water quality.

#### Vegetated Swale

A swale is a shallow vegetated ephemeral channel. The vegetation is often grass, but other types of vegetation may also be appropriate. Swales are typically located well upstream in a treatment train, where flows are intermittent and volumes are manageable. The standard swale in this study is based on a 1 m base width, 3 m top width, 0.3 m depth, and 50 mm high grass cover, with the length adjusted to alter the area ratio. These swales are located along the edges of on-grade carparks.

#### Rainwater Tanks

Rainwater tanks are an effective measure of removing the nutrients at source. The nutrient removal process is done by physically removing of water body thereby limiting the nutrients discharging to the waterways. Rainwater tanks are proposed throughout the development – Refer Section 5.4.

#### Bioretention

A bioretention system is a vertical filtration system that filters stormwater through a prescribed media (e.g. sandy loam) before being collected by an underlying perforated pipe for subsequent discharge to the receiving water.

The filtration media should have a permeability of at least one order of magnitude higher than the surrounding soils to ensure that the pathways of stormwater through the system is well-defined and directed at the perforated pipe underlain.

Filter effectiveness depends on both the surface area of the filter medium and the detention time in the filter, but is more sensitive to detention time. A coarser filter is less prone to clogging, but lower surface area and shorter detention times both reduce the treatment effectiveness. The standard bioretention basin in this study has an average retention depth of 300mm.

### 5.3.3 Water Quality Modelling

Water quality modelling relies on numerous factors and assumptions. There is a lack of calibrated data available within Australia, which places limits on the accuracy of water quality modelling.

The water quality model adopted for this project is the MUSIC (Model for Urban Stormwater Improvement Conceptualisation) water quality numerical model developed by the eWater. MUSIC is an event basis model, and will simulate the performance of a group of stormwater management measures, configured in series or in parallel to form a "treatment train".

The MUSIC model was generated using the historical 6-minute rainfall and available monthly evapotranspiration data for Port Kembla (BOM Station No. 67035) for a period of 10 years from 1997 to 2006. Catchment characteristics were defined using a combination of rural and urban catchments with varying imperviousness ratio to replicate the catchment for the post-development condition.

The MUSIC model layout is shown in Appendix C of this report.

The MUSIC model parameters used for the nutrient removal analysis for each treatment measure are default values set in the model.

### 5.3.4 Event Mean Concentration

MUSIC uses different event mean concentrations (EMC) to determine the pollutant loads generated by different land uses. The standard EMCs adopted within MUSIC were based on research undertaken by Duncan (1999) through the CRCCH and the results are reproduced in Australian Runoff Quality – A Guide to Water Sensitive Urban Design (ARQ).

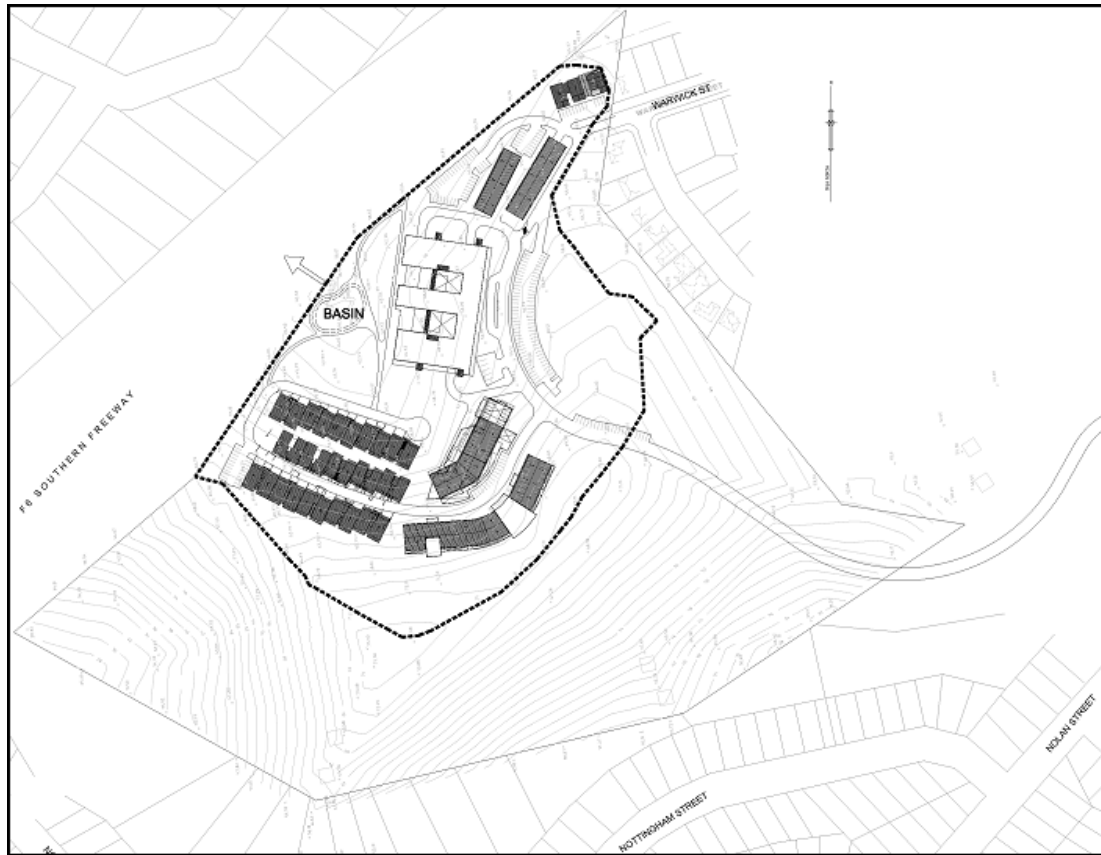
The EMC values used in the MUSIC models for this project were obtained from ARQ. Table 6 summarises the parameters used for an industrial site.

**Table 6 – EMC Parameters**

Land Use	Mean Base Flow Concentration Parameters Log <sub>10</sub> (mg/l)			Mean Storm flow Concentration Parameters Log <sub>10</sub> (mg/l)		
	TSS	TP	TN	TSS	TP	TN
Development Area	1.100	-0.820	0.320	2.200	-0.450	0.420

### 5.3.5 Configuration

Figure 5 below shows catchments associated with each basin which are same as stormwater quantity control in Section 5.2.3.



**Figure 5 – MUSIC Catchments**

Table 7 below provides the areas of catchment and basin used in the MUSIC model. As noted in Section 5.2.3, these bio-retention basins will be utilised as OSD basins for the catchment.

**Table 7 – Water Quality Control Measures**

Basin No	Catchment Area (ha)	Bioretention Area
1	7.2	900

### 5.3.6 Results of Modelling

The results of the MUSIC modelling are summarised in Table 8 below.

The total pollutant loads from the development are expressed in kilograms per year. The reduction rate is expressed as a percentage and compares the resulting pollution from the post developed site to that of the existing developed state of the site.

*Table 8 – Summary of MUSIC Model Results*

Parameter	Existing Site Load (Kg/Yr)	Developed Site Load with Treatment (Kg/Yr)	Reduction (%)	Target Achieved
GP	1,100	0	100	Yes
TSS	5,610	279	95	Yes
TP	13.0	4.35	66.5	Yes
TN	99.2	33.5	66.2	Yes

Notes:

GP = Gross Pollutants  
TSS = Total Suspended Solids  
TP = Total Phosphorus  
TN = Total Nitrogen

In all instances, the proposed water quality control measures enabled the reduction targets to be achieved for all key stormwater pollutants.

Therefore, by implementing the proposed treatment measures within the proposed development there will be no detrimental effect on the quality of stormwater running off from the site.



## 5.4 Rainwater Harvesting and Reuse

A number of the water sensitive design measures to be adopted on the site will serve to integrate elements of the water cycle to reduce the loading placed on water and wastewater infrastructure, when compared with a business as usual approach.

For the purpose of this preliminary assessment, being an initial investigation into the potential for water sensitive design, opportunities to reduce demand on potable water and to reduce wastewater exported from the development will be explored through potential use of rainwater tanks to supplement water supply and installation of AAA fittings to reduce consumption of potable water.

It is important to note that the information in this report has been compiled to show what levels of reduction in potable water demand can be achieved and some of these measures may or may not be adopted in the final design for the project.

For the purposes of this report, a water balancing study has been undertaken to determine an approximate rainwater tank capacity requirement for the development. It is important to note that the proposed development will also be assessed under the BASIX legislation and this assessment will be used to determine final rainwater tank volumes and uses for the harvested rainwater.

The capacity of the rainwater tanks is a function of the local rainfall data, the catchment areas, and the water demand (irrigation, toilet flushing) placed upon the tanks. The rainfall data, which encompasses daily rainfall for the last 10 years, was obtained from the nearby Port Kembla rainfall station recorded by the Bureau of Meteorology. The modelling is done on a building by building basis as the roof area, tank size, water demand, and irrigation areas vary from building to building.

The water balance modelling was to determine what order of potable water demand reduction could be achieved by using harvested rainwater for various uses within the development.

### 5.4.1 Modelling

The model is a daily urban water balance model which has been developed to simulate the water cycle as an integrated whole and provide a tool for investigating the use of locally generated stormwater as a substitute for potable water.

Optimised tank size generally refers to the size that gives the minimum number of days the tank to dry or surcharge for a given roof area.

For the purposes of the model, it was assumed that the captured rainwater could be used for toilet flushing and irrigational uses except the hospital building where irrigation only proposed. The daily water demand for toilet flushing in the model is 50L/day per occupant as explained in Section 2.2.3. Likewise, the water demand for the irrigation has been derived based on an average usage of 7mm of water per week.

A summary of results is provided in Table 9 and corresponding Buildings/Stages are shown in Figure 6.

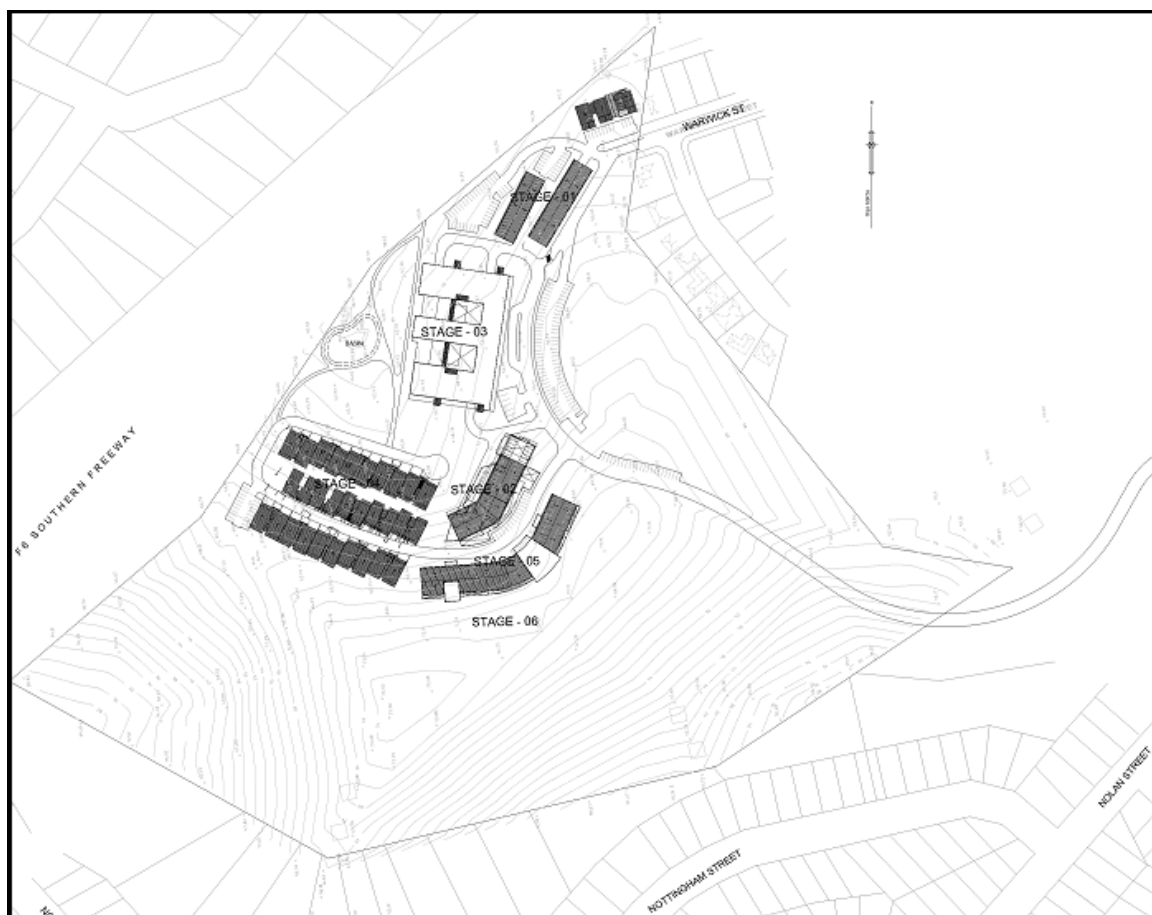


Figure 6 – Building/Stage layout

Table 9 – Summary of Water Balance Model Results

Building /Stage	Roof Area Connected (m2)	No of Occupants	Irrigation area (ha)	Rainwater Tank Size (KL)	Total Water Demand (kL/yr)	Total Rainwater Used (KL/Yr)	% Potable Water Reuse
1	2000	150	0.1	300	1925	1522	79
2	1000	45	0.1	100	775	643	83
3	4000	260	0.1	300	3130	2458	79
4	2000	60	0.1	60	940	770	82
5	2000	160	0	200	1752	1375	81

The above water balance modelling shows that an average reduction in potable water demand of up to 80% can be achieved. In addition to the above, AAA fittings and appliances can reduce the potable water consumption by a further 10 to 15%.

Adoption of the rainwater tanks will provide an integrated, sustainable approach to water cycle management on the site by meeting the objectives set. These particular strategies are being adopted in other areas demonstrating their practicability which should be applicable to the Life City Wollongong development.

## 6. UTILITY SERVICES

### 6.1 Sewer

There is a DN150 sewermain in Warwick Street which we assume is for the future residential development of the site. Based on our flow calculation this main does not have capacity to service the whole of Life City development. However, this main has capacity to service for Stages 1 and 2.

For the subsequent Stages, the sewermain needs to be extended from the DN300 main under the F6 Freeway via the public reserve at the back of residential houses on the northern side of Warwick Street.

The Feasibility Study from Sydney Water Corporation did not indicate any restrictions to the proposed development. However they have indicated that the existing sewermain may have to be extended and/or amplified to serve the development.

Sewer flow calculation for the development is included in Appendix D and the Feasibility Study from Sydney Water Corporation is in Appendix E.

### 6.2 Water

There are DN150 watermain in Nolan Street and DN100 watermain Warwick Street. It is likely that the site will be serviced by both mains. The Feasibility Study from Sydney Water Corporation did not indicate any restrictions to the proposed development. However they have indicated that the existing watermain may have to be extended and/or amplified to serve the development.

Water demand calculation for the development is included in Appendix D and the Feasibility Study from Sydney Water Corporation is in Appendix E.

### 6.3 Electricity and Telecommunications

Electricity and telecommunications (Telstra) services are all readily available adjacent to the site from Warwick Street and Nolan Street, and should not present any restrictions to the proposed development. All power, telecommunication and gas services within the development will be provided as underground services.

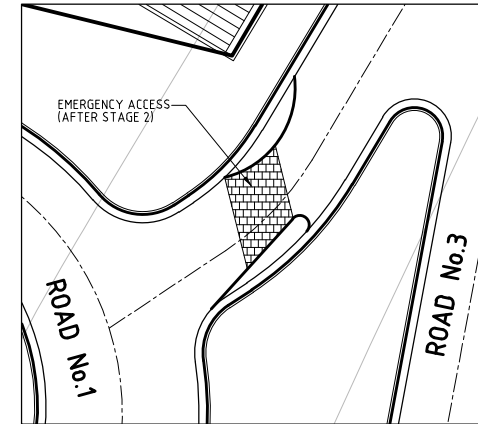
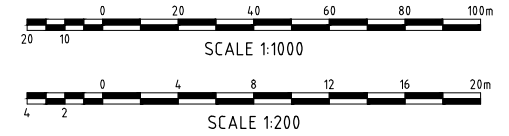
## REFERENCES

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- Wollongong DCP - Chapter E15: Water Sensitive Urban Design
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- Institute of Engineers, Aust - *Australian Rainfall and Runoff*, 1987, 3rd edition.
- Institute of Engineers, Aust - – *Australian Rainfall Quality*, 2005
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- eWater - *MUSIC Software Version 5.01*
- Austroads – Guide to Road Design, August 2009
- FAWB – Stormwater Biofiltration Systems, June 2009
- AS 2890.1      Off Street Car Parking
- AS 2890.2      Commercial Parking Facilities
- AS 1428          Design for Access and Mobility
- AS 1742          Manual of Uniform Traffic Control Devices
- New South Wales RTA - Traffic Control at Worksites manual
- Austroads – Guide to Road Design
- Austroads – Guide to Pavement Technology

## ***APPENDIX A***

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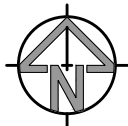
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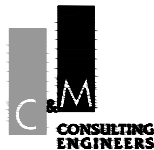
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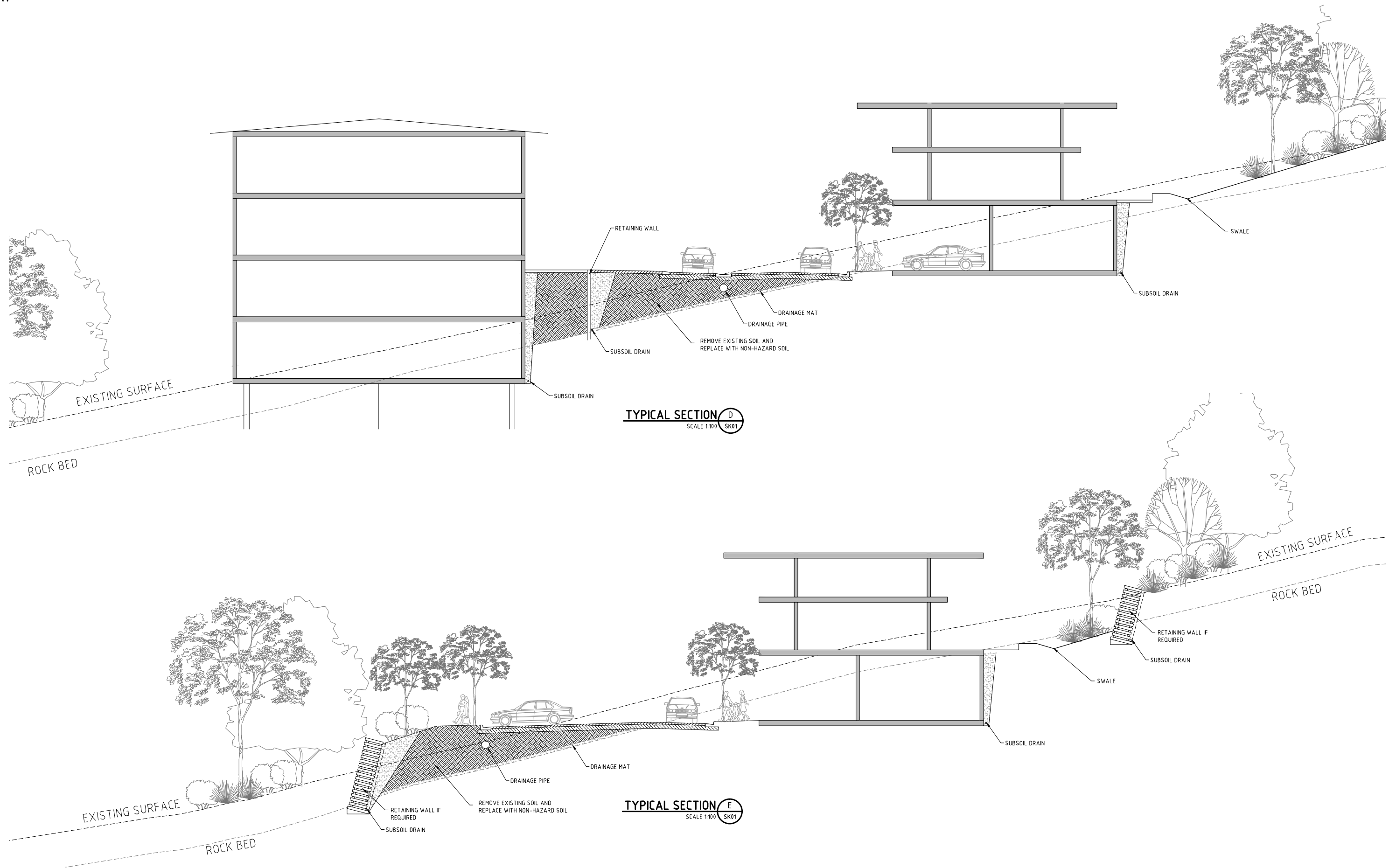
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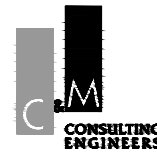
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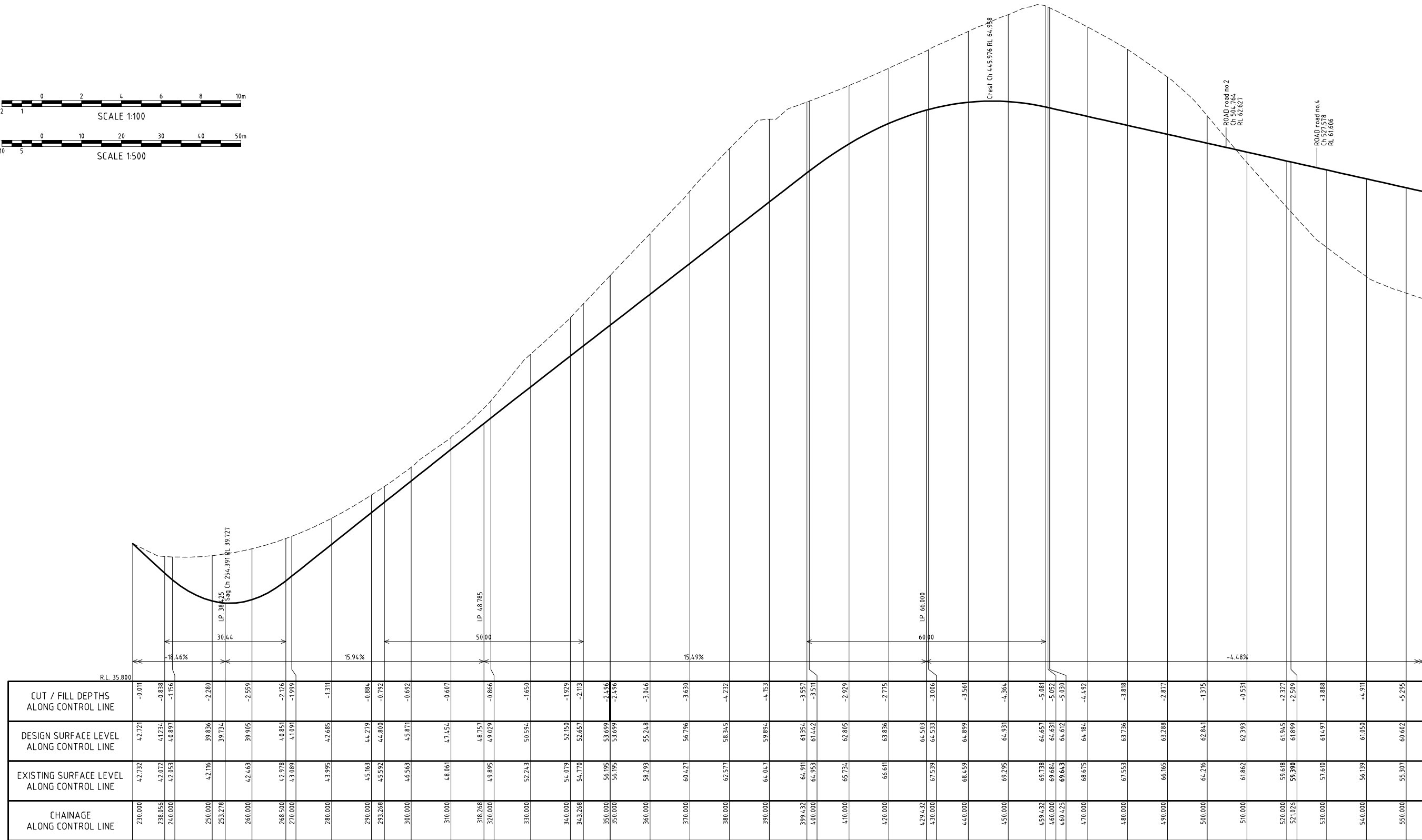
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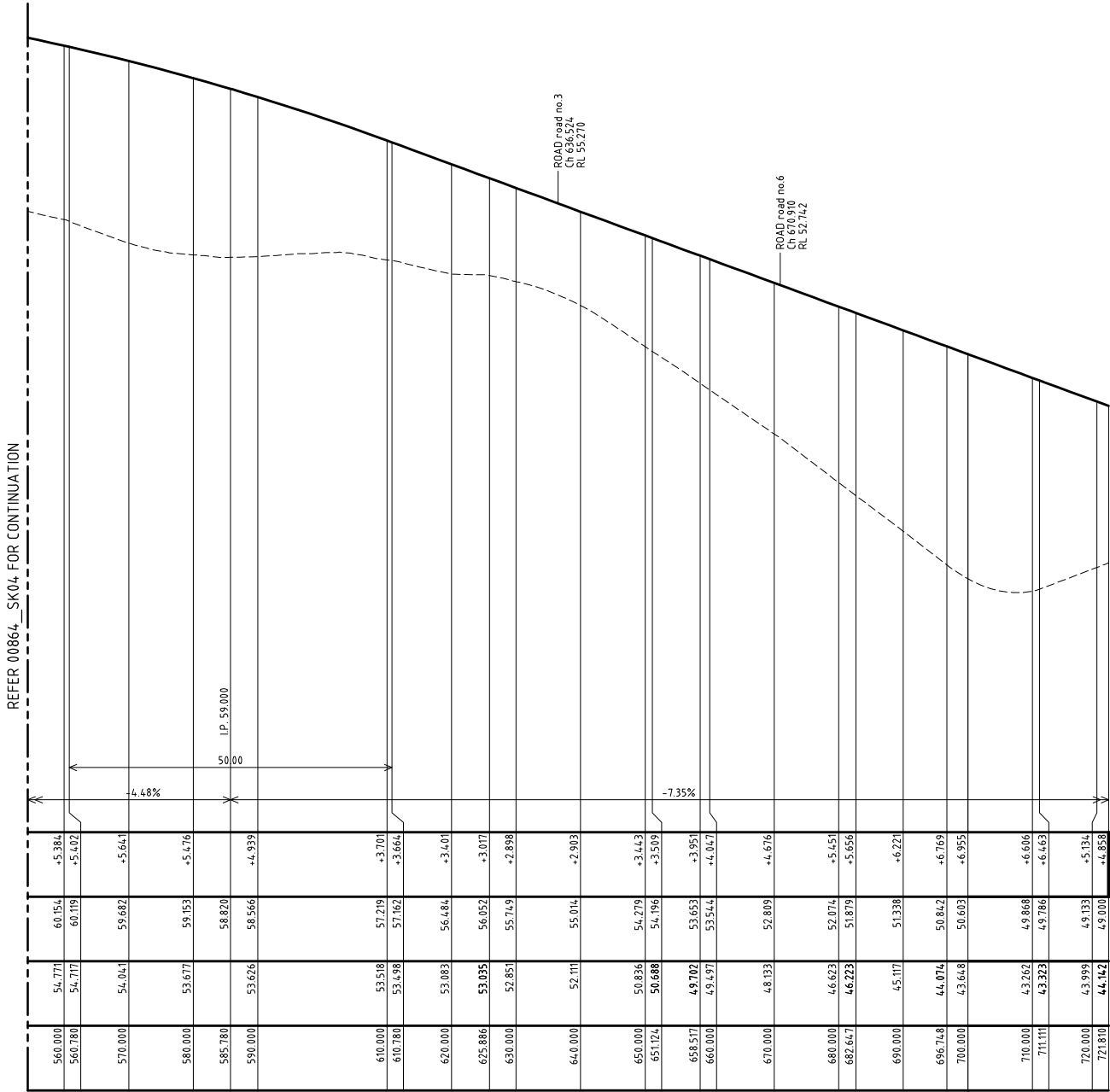
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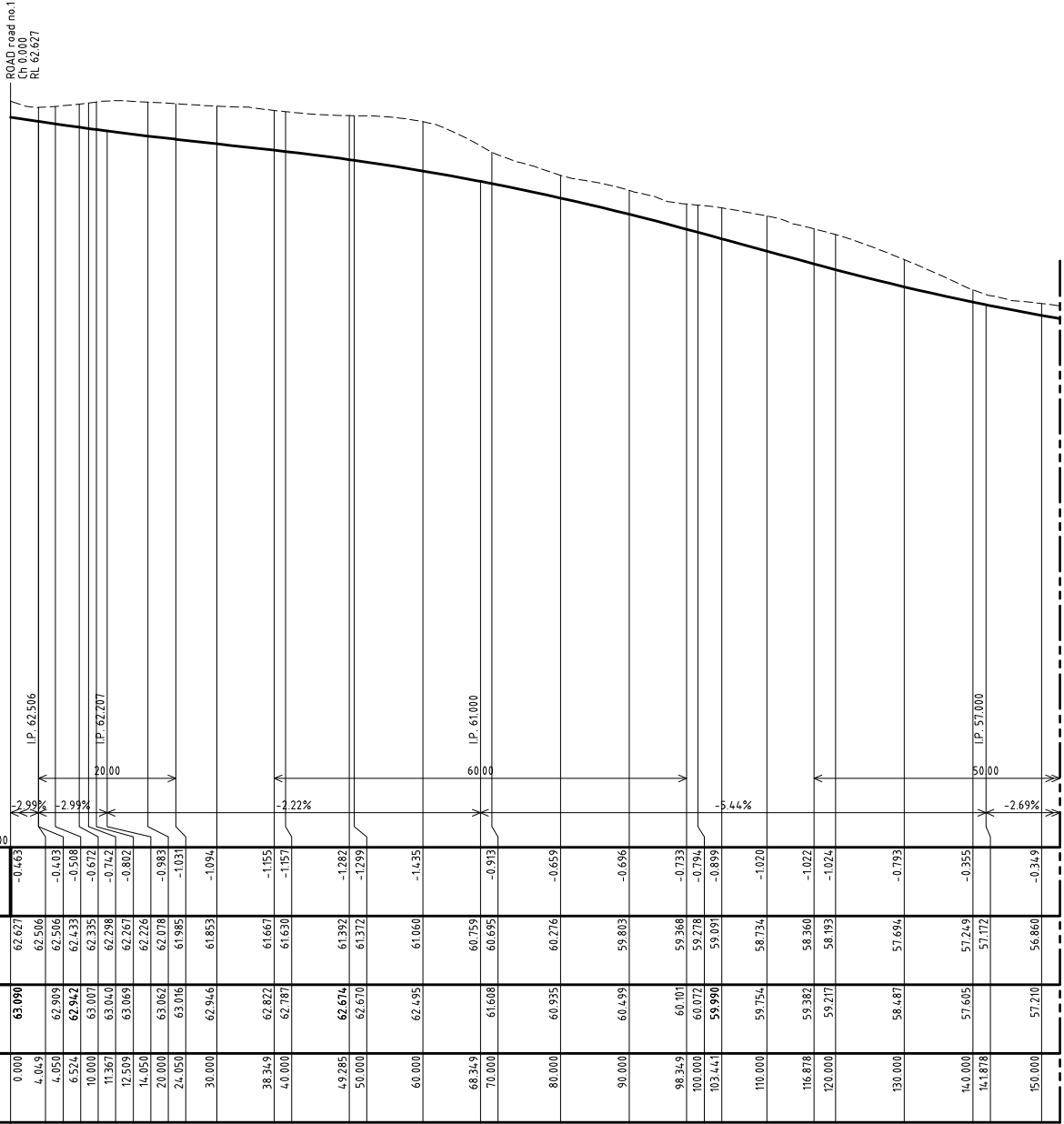
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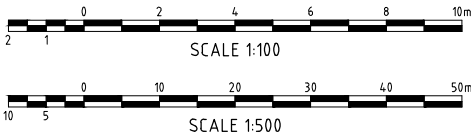


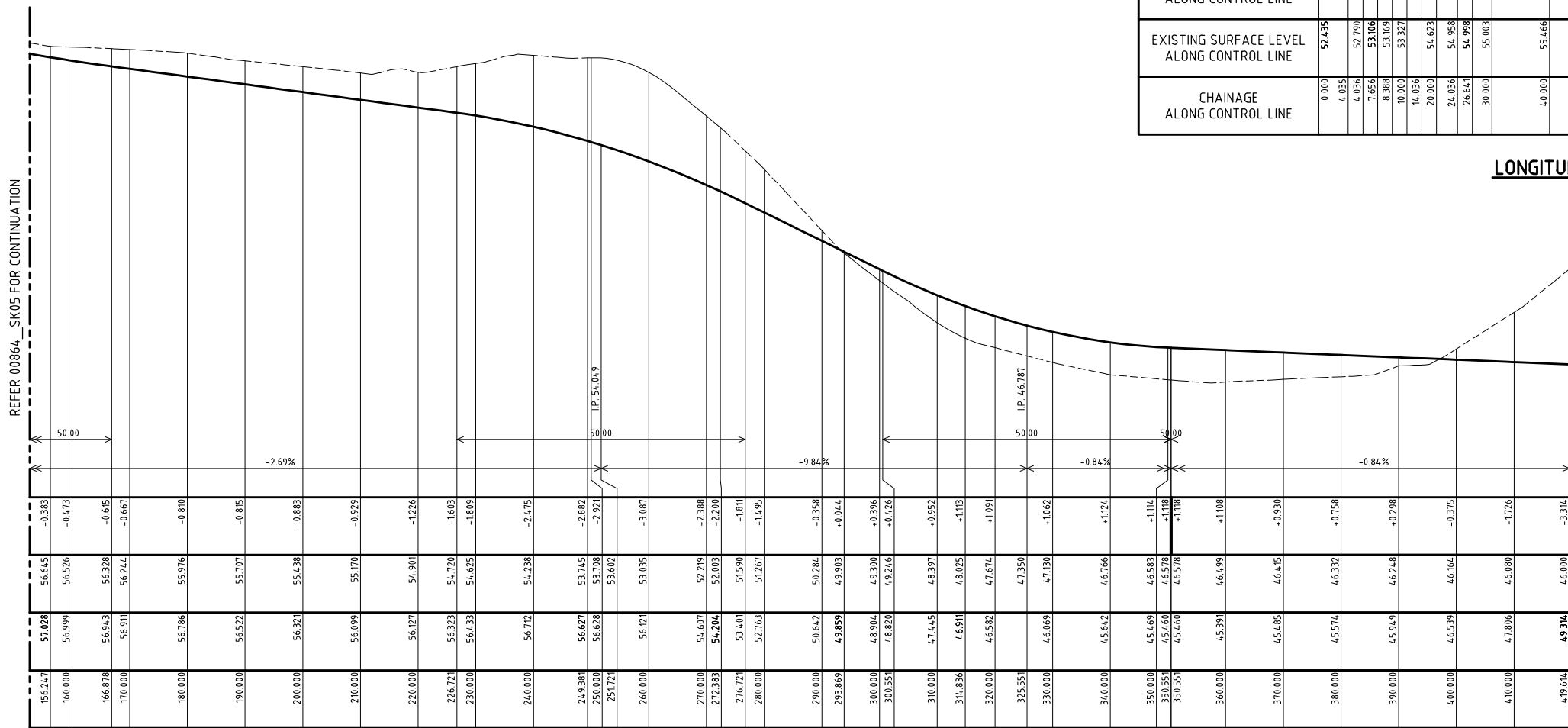
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	20.000	63.062	-1.031
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8.868	53.169	55.053	+1.884
10.000	53.327	55.036	+1.709
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20.000	54.623	55.150	+0.527
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30.000	55.003	55.574	+0.571
40.000	55.466	56.029	+0.563
50.000	56.109	56.483	+0.374
60.000	56.154	56.938	+0.784
73.332	56.287	57.544	+1.257
80.000	56.506	57.839	+1.333
80.832		57.874	
88.332	56.857	58.185	+1.328
90.000	56.944	58.251	+1.307
100.000	57.575	58.651	+1.077
110.000	58.420	59.051	+0.632
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130.000	61.786	59.851	-1.935
136.441	62.993	60.109	-2.884



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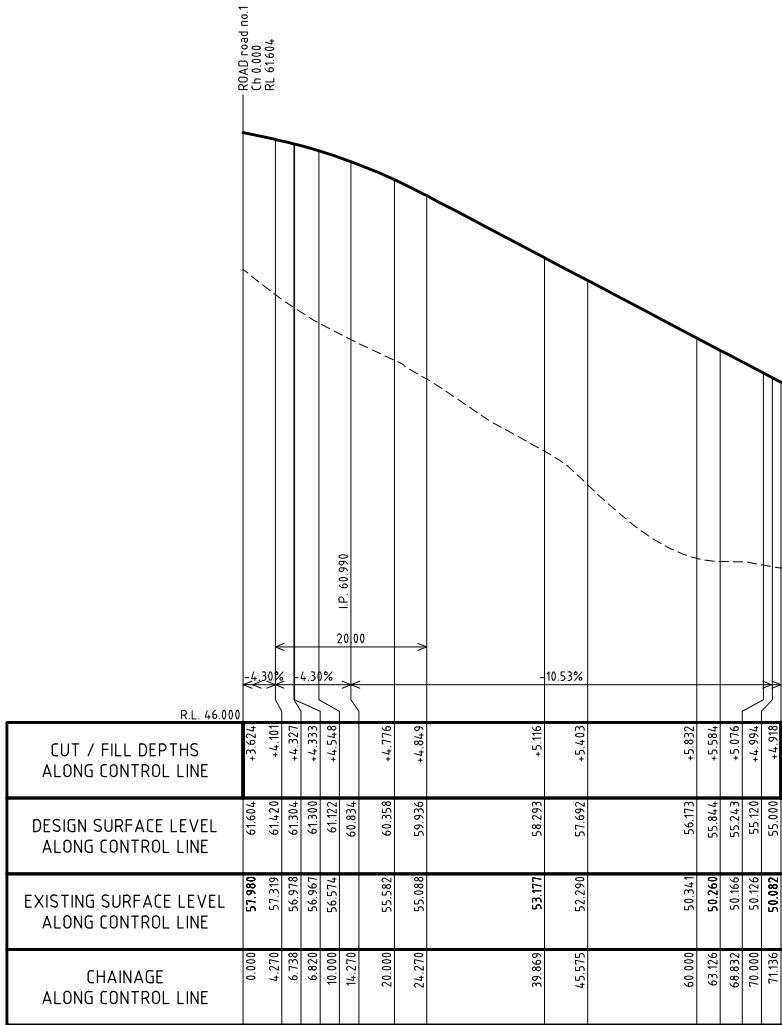
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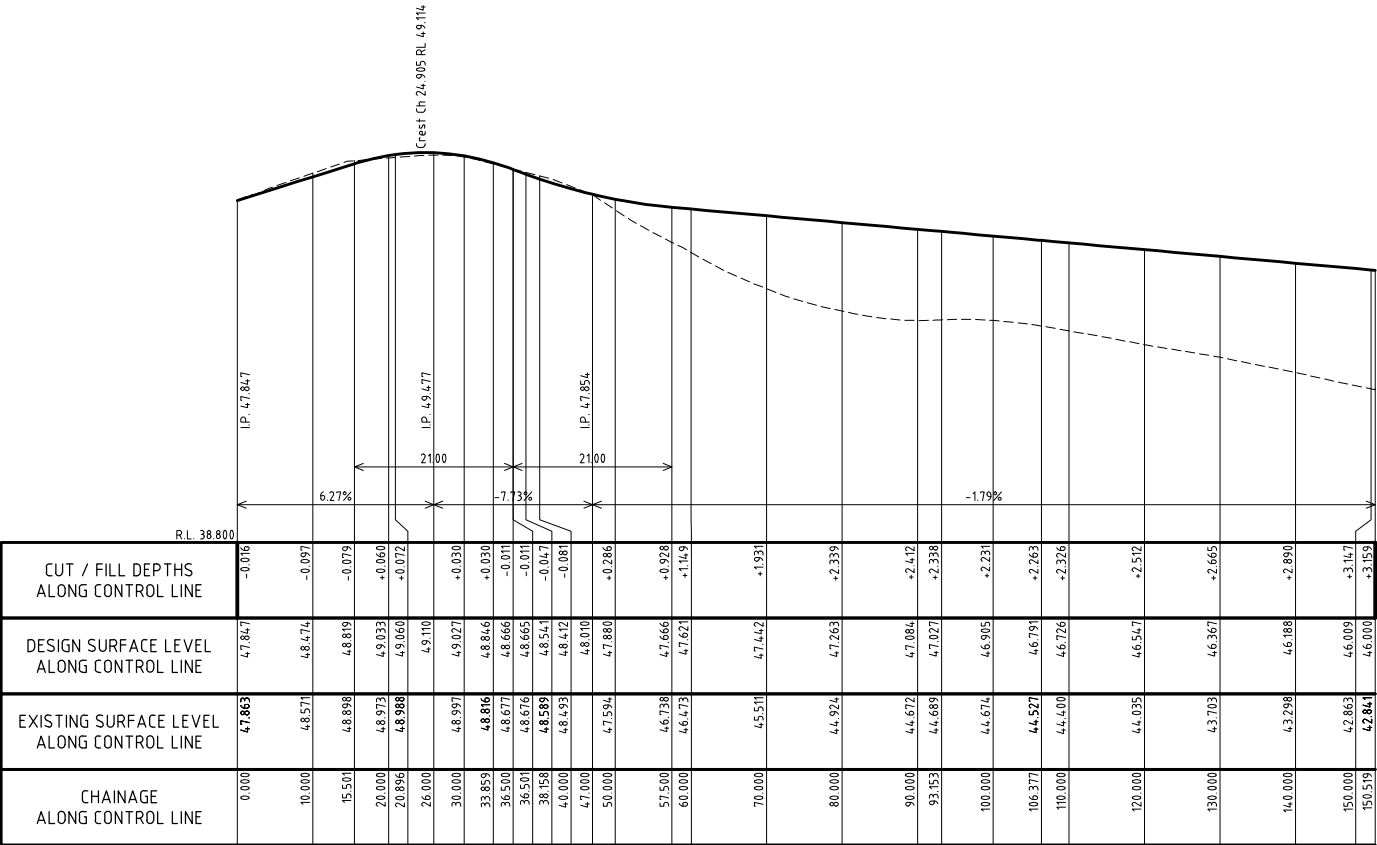
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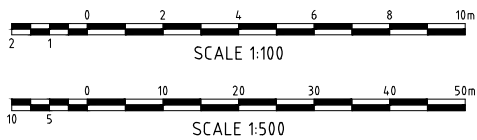
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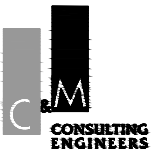


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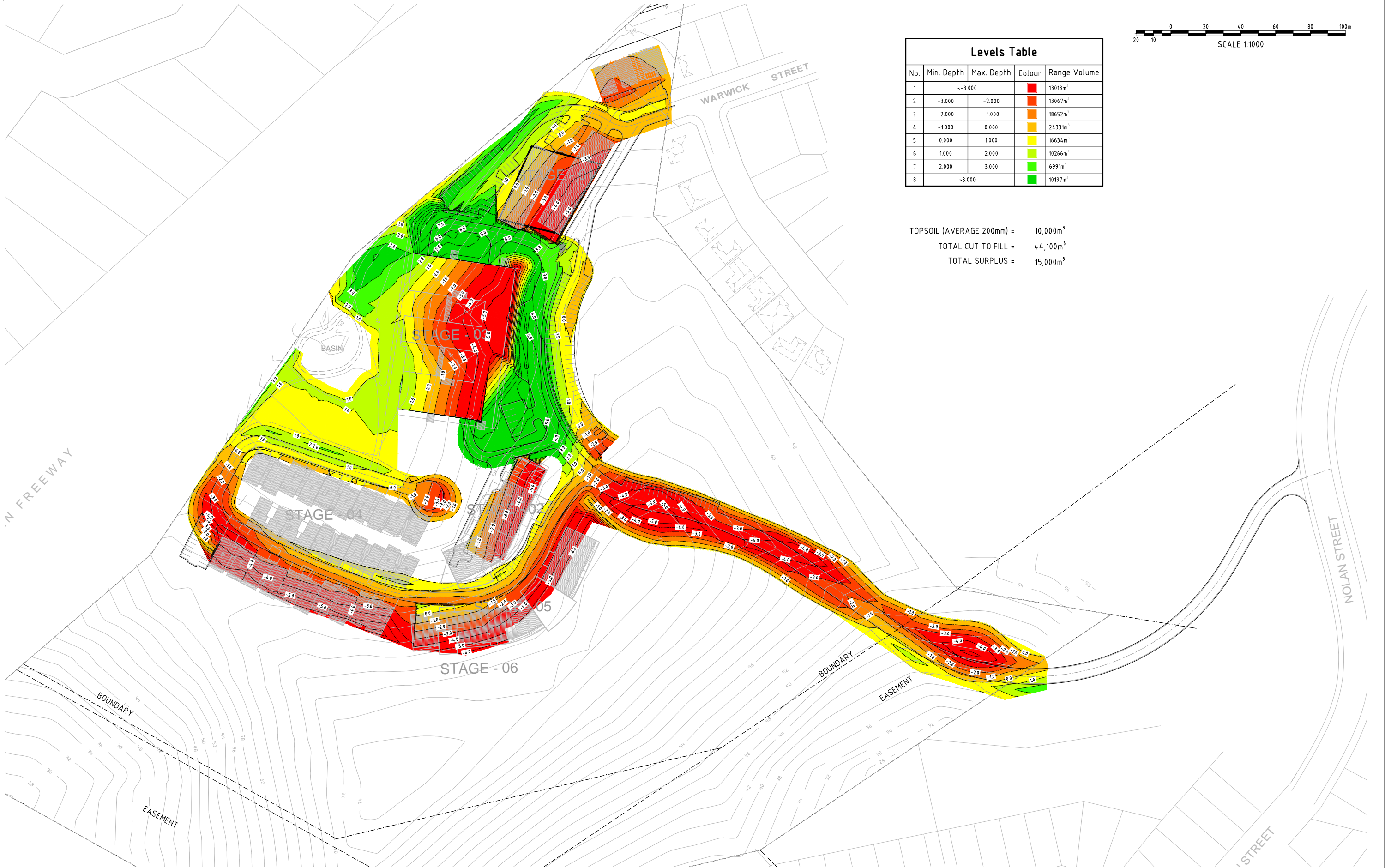


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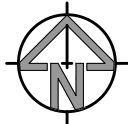
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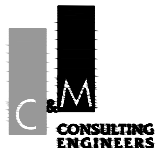


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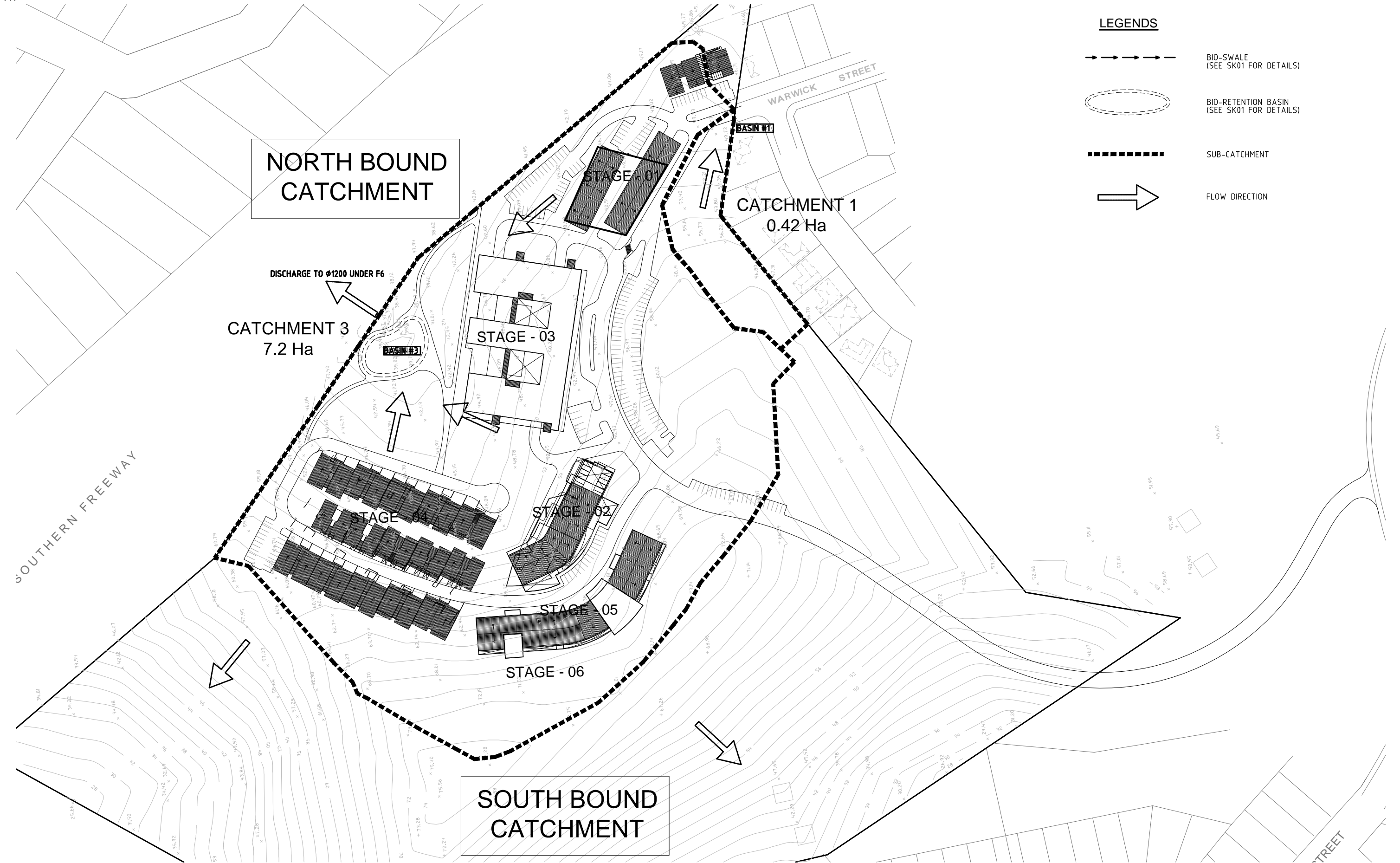
CLIENT



CIVIL AND HYDRAULIC  
ENGINEERING DESIGN AND  
PROJECT MANAGEMENT  
  
SUITE 2  
241-245 PENNANT HILLS ROAD  
CARLINGFORD NSW 2118  
  
PHONE: (02) 8209 3846  
FAX: (02) 9687 9393  
ABN 21 118 134 240

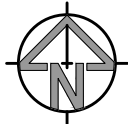
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VERIFIED	E. SHIN	DATE	24/08/12
DRAWN	J. WANG	SCALE @ A1	1:1000
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LIFE CITY WOLLONGONG			
PRELIMINARY BULK EARTHWORKS			
STATUS	MASTERPLANNING	DRAWING No.	00864_SK08
		REVISION	03

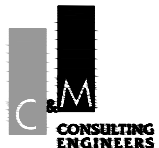


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01	W.M.	29/05/13	E.S.	29/05/13	ISSUE FOR EA SUBMISSION - REVISED LAYOUT



CLIENT
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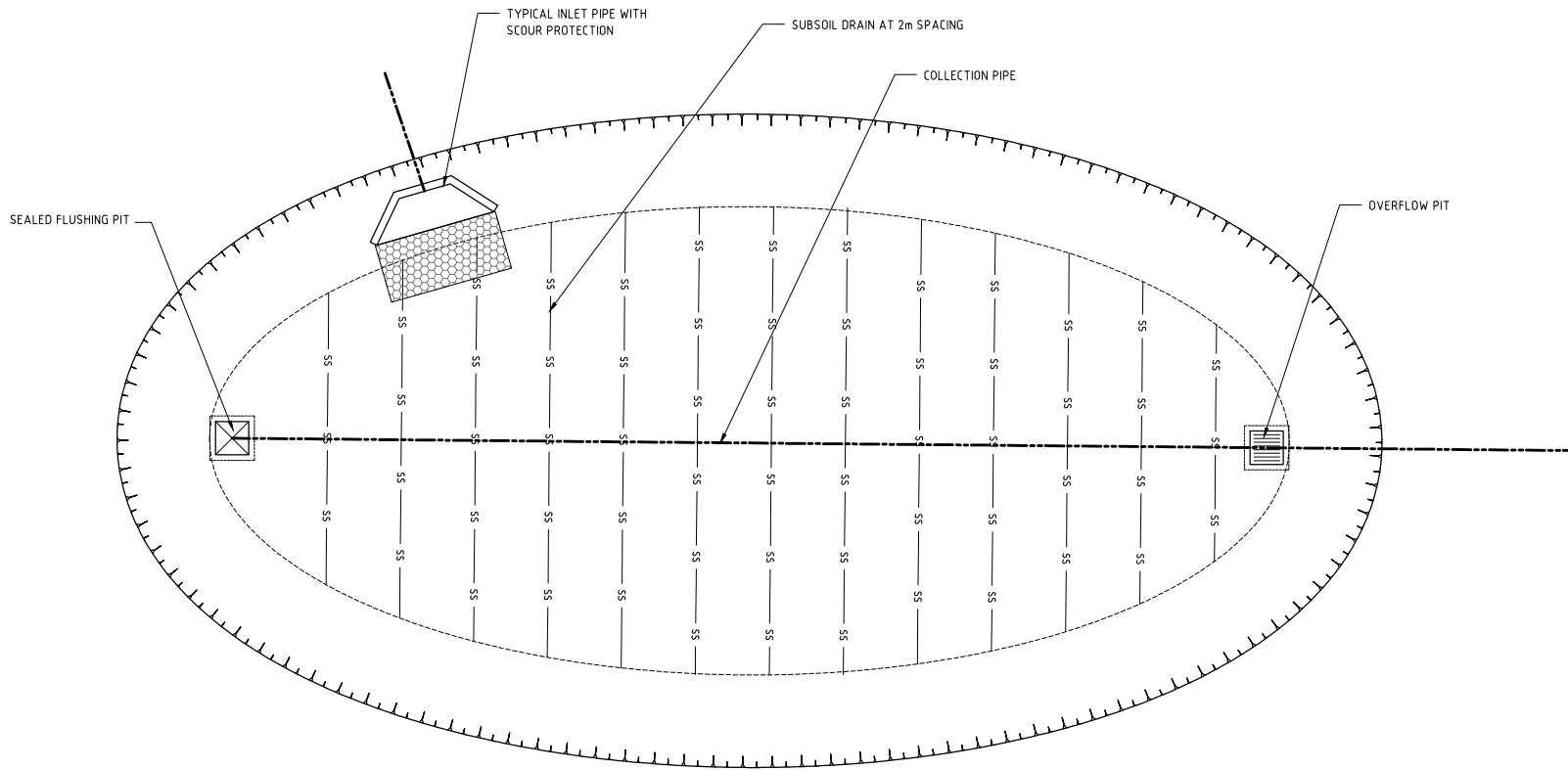


CIVIL AND HYDRAULIC  
ENGINEERING DESIGN AND  
PROJECT MANAGEMENT  
  
SUITE 2  
241-245 PENNANT HILLS ROAD  
CARLINGFORD NSW 2118  
  
PHONE: (02) 8209 3846  
FAX: (02) 9687 9393  
ABN 21 118 134 240

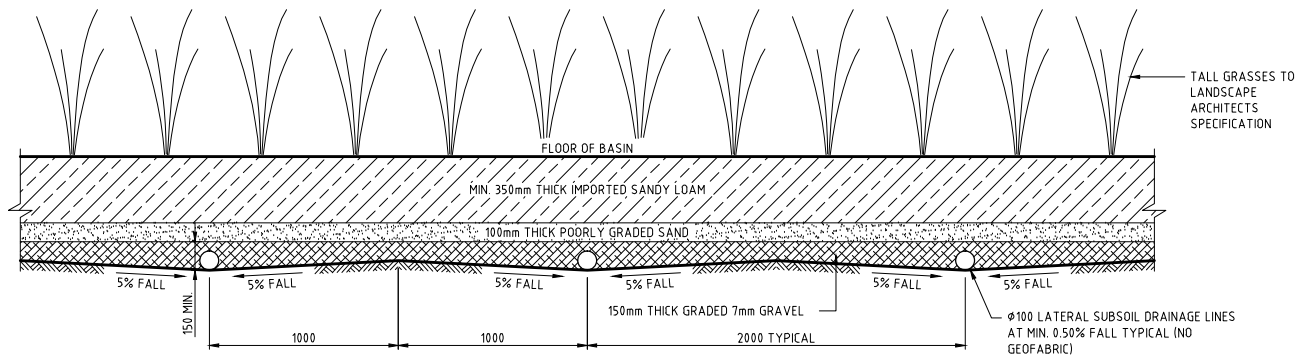
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VERIFIED	E. SHIN	DATE	24/08/12
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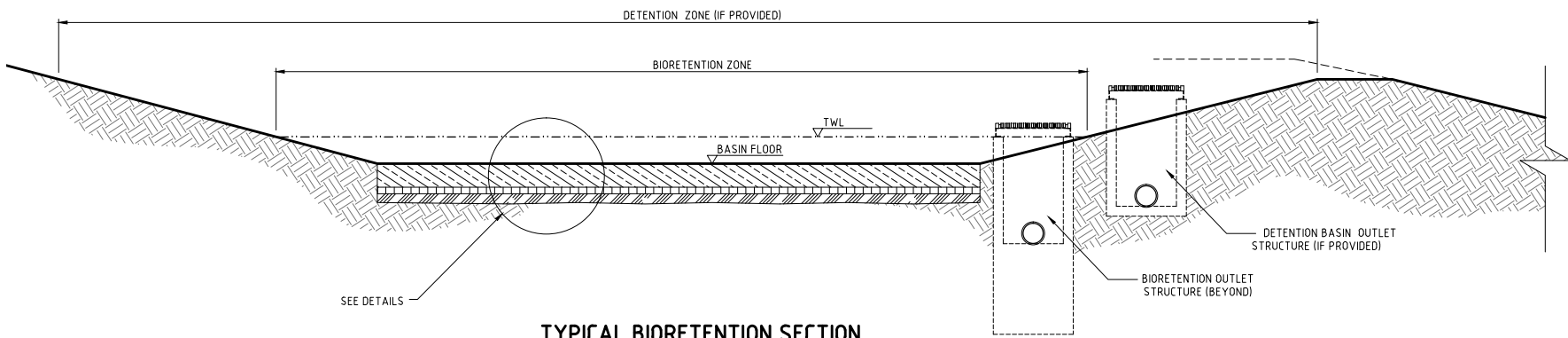
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CONCEPT STORMWATER PLAN			
STATUS	MASTERPLANNING	DRAWING No	00864_SK09
REVISION	02		



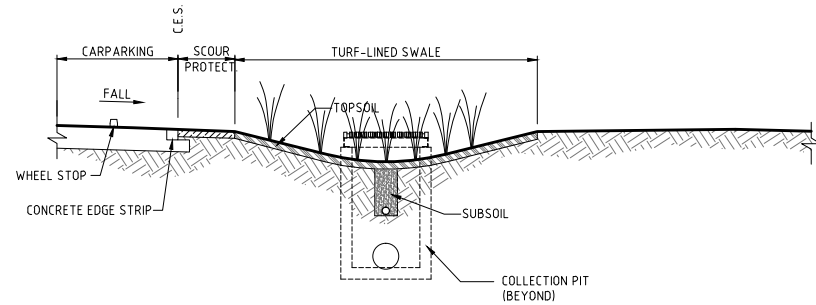
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SCALE 1:100



**TYPICAL BIO-RETENTION PROFILE PERPENDICULAR TO LATERAL SUBSOILS**  
SCALE 1:20



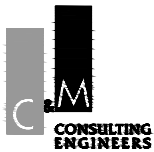
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**TYPICAL BIO-SWALE SECTION**  
SCALE 1:50

REV.	DES.	DATE	VER.	DATE	DESCRIPTION
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01	W.M.	29/05/13	E.S.	29/05/13	ISSUE FOR EA SUBMISSION - REVISED LAYOUT

CLIENT
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CIVIL AND HYDRAULIC  
ENGINEERING DESIGN AND  
PROJECT MANAGEMENT  
  
SUITE 2  
241-245 PENNANT HILLS ROAD  
CARLINGFORD NSW 2118  
  
PHONE: (02) 8209 3846  
FAX: (02) 9687 9393  
ABN 21 118 134 240

DESIGNED	W.MARTIN	DATE	24/09/12
VERIFIED	E. SHIN	DATE	24/08/12
DRAWN	W.MARTIN	SCALE @ A1	AS NOTED

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LIFE CITY WOLLONGONG			
CONCEPT STORMWATER TYPICAL SECTIONS			
STATUS	MASTERPLANNING	DRAWING No.	00864_SK10
REVISION	02		

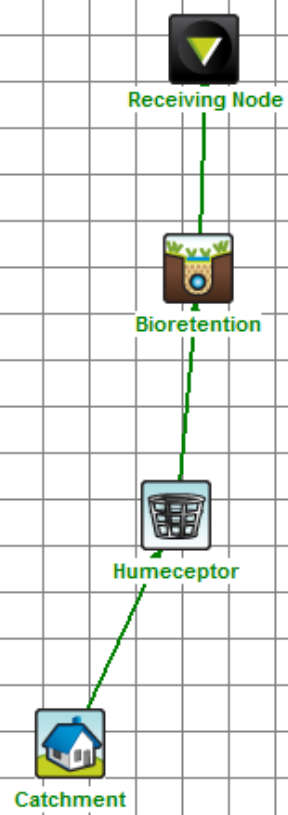


## ***APPENDIX B***

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### **MUSIC MODEL**





## ***APPENDIX C***

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### **RAINWATER BALANCE MODEL**

PROJECT:		LIFE CITY WOLLONGONG	
RAINFALL DATA:		PORT KEMBLA FROM 1996 TO 2005	
DESIGNER		ES	
DATE:			
ROOF AREA (Ha)		0.4	
NON-ROOF AREA (Ha)		0	
FRACTION IMPERVIOUS		0	
PERVIOUS LOSS COEFF		0.3	
Max Tank/pond Capacity (m3)		300	
Average Surface Area (m2)		0	
Pond base area (m2)		0	
Average Infiltration rate (mm/hr)		0	
Porosity of soil (%)		0%	
Usage:			
Total Number of occupants		260	
Toilet Flushing (l/d/person)		30	
Laundry (l/d/person)		0	
Other usage (l/d/person)		0	
Total Domestic Usage (m3/d)		7.80	
Irrigation Area (m2)		1000	
Max Irrigation Rate (mm/day)		1	
No irrigation if rainfall > (mm)		1	
Max Irrigation Usage (m3/d)		1	
Daily Infiltration (m3)		0.00	
%		0	
Irrigation water re-collected		0	

SUMMARY RESULTS

Average Annual Rainfall (mm)	947
------------------------------	-----

Total No. Days:	3653
Total # days with empty tank	750
Percentage:	20.5%
Total # days with overflow/full tank	166
Percentage:	4.5%

Total Annual Runoff Collected (KL)	3787
Average Annual Rainwater Usage (KL)	2458
% Reuse	64.9%
Total Average Annual Water Demand (KL)	3130
Average Annual Potable Water Required (KL)	671
Potable Water Usage (%)	21.5%

## ***APPENDIX D***

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### **SEWER FLOWS AND WATER DEMANDS CALCULATIONS**

## SEWER DISCHARGE

Stage	Description	Unit				EP/Unit	Total EP	
		Building GFA (m2)	Dwelling	Beds	Person			
1	<b>Day surgery &amp; Specialist Rooms;</b> Medical Centre, Child Care Centre, Respite care Centre and the initial structural works and major tree planting for Precinct B.	4000				0.0075	30	Assumed Local Commercial
2	<b>Ancillary Accommodation</b> for doctors, nurses and students.		42			2.5	105	Assumed Local Commercial
3	<b>High-Tech Holistic Cancer &amp; Medical Hospital</b> (Tertiary referral hospital) including Oncology and Holistic, Medical and Rehabilitation, Dementia and Psychiatric wings.			320		3.4	1088	Single occupancy high density dwelling units
4	<b>Seniors Living,</b> further detail landscaping to the eastern edge of Precinct B and rainforest restoration.		60			3	180	Hospitals and Nursing Homes
5	<b>Residential Care Facility and Hostel</b> with total 160 beds		120			3.4	408	Hospitals and Nursing Homes

TOTAL	1811	
FLOW	3.80	EP
	329	L/s
		KL/d

## WATER DEMAND

Stages	Zoning	Unit				Kl/d/Unit	Max Kl/d	Ratio Max/Ave	Average Kl/d
		Building GFA (ha)	Units/beds	Beds	Person				
1,4	Suburban commercial	0.7				41	29	2	14
5	District Hospital			320		0.77	246	2	123
	>140 dwellings per net ha		202			0.8	162	1.9	81

TOTAL	218
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## ***APPENDIX E***

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### **FEASIBILITY STUDY FROM SYDNEY WATER**

Case Number: **130509**

1 November 2012

LIFE CITY WOLLONGONG  
C/- Simply Water and Sewer Pty Ltd

### **FEASIBILITY LETTER**

**Developer:** LIFE CITY WOLLONGONG  
**Your reference:** 203701  
**Development:** Lot 2 DP 249814, Lot 2 DP 534116 and Lot 4 DP 258635  
Nottingham Street, Berkeley  
**Development Description:** Proposed "Hi tech holistic cancer and medical hospital facility" comprised of day surgery and specialist rooms, self-care seniors housing, cancer and medical hospital, serviced apartments, residential care facility and hostel, ancillary accommodation and research and a high school. See attached paperwork for specific details and hydraulic calculations.  
**Your application date:** 17 October 2012

Dear Applicant,

This Feasibility Letter (Letter) is a guide only. It provides general information about what Sydney Water's requirements could be if you applied to us for a Section 73 Certificate (Certificate) for your proposed development. **The information is accurate at today's date only.**

If you obtain development consent for that development from your consent authority (this is usually your local Council) they will require you to apply to us for a Section 73 Certificate. You will need to submit a new application (and pay another application fee) to us for that Certificate by using your current or another Water Servicing Coordinator (Coordinator).

Sydney Water will then send you either a:

- Notice of Requirements (Notice) and Developer Works Deed (Deed) or
- Certificate.

These documents will be the definitive statement of Sydney Water's requirements.

There may be changes in Sydney Water's requirements between the issue dates of this Letter and the Notice or Certificate. The changes may be:

- if you change your proposed development eg the development description or the plan/site layout, after today, the requirements in this Letter could change when you submit your new application; and
- if you decide to do your development in stages then you must submit a new application (and pay another application fee) for each stage.

**You have made an application for specific information. Sydney Water's possible requirements are set out on the following pages:**



## **What You Must Do To Get A Section 73 Certificate In The Future**

To get a Section 73 Certificate you must do the following things. You can also find out about this process by visiting [www.sydneywater.com.au](http://www.sydneywater.com.au) > Building and Developing > Developing Your Land.

- 1. Obtain Development Consent from the consent authority for your development proposal.**
- 2. Engage a Water Servicing Coordinator (Coordinator).**

**You must engage your current or another authorised Coordinator** to manage the design and construction of works that you must provide, at your cost, to service your development. If you wish to engage another Coordinator (at any point in this process) you must write and tell Sydney Water.

For a list of authorised Coordinators, either visit [www.sydneywater.com.au](http://www.sydneywater.com.au) > Building and Developing > Developing Your Land or call **13 20 92**.

The Coordinator will be your point of contact with Sydney Water. They can answer most questions that you might have about the process and developer charges and can give you a quote or information about costs for services/works (including Sydney Water costs).

### **3. Developer Works Deed**

**After** the Coordinator has submitted your new application, they will receive the Sydney Water Notice and Developer Works Deed. You and your accredited Developer Infrastructure Providers (Providers) will need to sign and lodge both copies of the Deed with your nominated Coordinator. After Sydney Water has signed the documents, one copy will be returned to the Coordinator.

The Deed sets out for this project:

- your responsibilities;
- Sydney Water's responsibilities; and
- the Provider's responsibilities.

**You must do all the things that we ask you to do in that Deed.** This is because your development does not have water and sewer services and you must construct and pay for the following works extensions under this Deed to provide these services.

**Note:** The Coordinator must be fully authorised by us for the whole time of the agreement.

### **4. Water and Sewer Works**

#### **4.1 Water**

Your development must have a frontage to a water main that is the right size and can be used for connection.

Sydney Water has assessed your application and found that:

- The proposed development site has to possible connection points the existing water supply system:
  - DN100 main on the eastern side of Warwick Street.
  - DN150 main on the western side of Nolan Street.
- Based on a peak instantaneous demand of 7 l/s the water supply system has adequate capacity to service the proposed development.
- You will need to provide peak water supply demands and identify proposed connection points at the Section 73 Application phase to enable Sydney Water to determine detailed water supply requirements.
- **You may need to construct water main extensions and/or amplify the existing system to serve your development.** These works must be constructed by a constructor with the appropriate capability. Your Coordinator will be able to provide further advice about this.

#### 4.2 Sewer

Your development must have a sewer main that is the right size and can be used for connection. That sewer must also have a connection point within your development's boundaries.

Sydney Water has assessed your application and found that:

- § The proposed development site has multiple DN150 sewer mains from which extensions and or amplification would be required to service the site.
- § At the Section 73 Application phase, you must provide the proposed wastewater servicing scheme for the site identifying proposed connection points and wastewater flows. The scheme plan can be in the form of a catchment plan and flow schedule showing connection to the existing system. Sydney Water will review the proposed servicing scheme and provide detailed wastewater requirements.
- **You may need to construct a waste water main extension, and/or amplify the existing sewer system to serve your development.** The terms of the Deed define these works as 'Major Works'.

## 5. Ancillary Matters

### 5.1 Asset adjustments

After Sydney Water issues this Notice (and more detailed designs are available), Sydney Water may require that the water main/sewer main/stormwater located in the footway/your property needs to be adjusted/deviated. If this happens, you will need to do this work as well as the extension we have detailed above at your cost. The work must meet the conditions of

this Notice and you will need to complete it **before we can issue the Certificate**. Sydney Water will need to see the completed designs for the work and we will require you to lodge a security. The security will be refunded once the work is completed.

### 5.2 Entry onto neighbouring property

If you need to enter a neighbouring property, you must have the written permission of the relevant property owners and tenants. You must use Sydney Water's **Permission to Enter** form(s) for this. You can get copies of these forms from your Coordinator or the Sydney Water website. Your Coordinator can also negotiate on your behalf. Please make sure that you address all the items on the form(s) including payment of compensation and whether there are other ways of designing and constructing that could avoid or reduce their impacts. You will be responsible for all costs of mediation involved in resolving any disputes. Please allow enough time for entry issues to be resolved.

### 5.3 Costs

Construction of these **future** works will require you to pay project management, survey, design and construction costs **directly to your suppliers**. Additional costs payable to Sydney Water may include:

- water main shutdown and disinfection;
- connection of new water mains to Sydney Water system(s);
- design and construction audit fees;
- contract administration, Operations Area Charge & Customer Redress prior to project finalisation;
- creation or alteration of easements etc; and
- water usage charges where water has been supplied for building activity purposes prior to disinfection of a newly constructed water main.

Note: Payment for any Goods and Services (including Customer Redress) provided by Sydney Water will be required prior to the issue of the Section 73 Certificate or release of the Bank Guarantee or Cash Bond.

Your Coordinator can tell you about these costs.

## **OTHER THINGS YOU MAY NEED TO DO**

Shown below are other things you need to do that are NOT a requirement for the Certificate. They may well be a requirement of Sydney Water in the future because of the impact of your development on our assets. You must read them before you go any further.

### **Stamping and approval of your building plans**

Please note that the building plans must be stamped and approved when each lot is developed. This can be done at a Quick Check agency. For an agency list visit [www.sydneywater.com.au](http://www.sydneywater.com.au) > Building and Developing > Quick Check or call 13 20 92).

Please note that your building plans must be stamped and approved. This can be done at a Quick Check agency. For an agency list visit [www.sydneywater.com.au](http://www.sydneywater.com.au) > Building and Developing > Quick Check or call 13 20 92.

This is not a requirement of the Certificate but the approval is needed because construction/building works may impact on existing Sydney Water assets (e.g. water and sewer mains). In any case, these works **MUST NOT** commence until Sydney Water has granted approval. Your Coordinator can tell you about the approval process including:

- Possible requirements;
- Costs; and
- Timeframes.

**Note: You must obtain our written approval before you do any work on Sydney Water's systems. Sydney Water will take action to have work stopped on the site if you do not have that approval. We will apply Section 44 of the *Sydney Water Act 1994*.**

### **Disused Sewerage Service Sealing**

Please do not forget that you must pay to disconnect all disused private sewerage services and seal them at the point of connection to a Sydney Water sewer main. This work must meet Sydney Water's standards in the NSW Code of Practice for Plumbing and Drainage (the Code) and be done by a licensed drainer. The licensed drainer must arrange for an inspection of the work by a NSW Fair Trading Plumbing Inspection Assurance Services (PIAS) officer. After that officer has looked at the work, the drainer can issue the Certificate of Compliance. The Code requires this.

### **Soffit Requirements**

Please be aware that floor levels must be able to meet Sydney Water's soffit requirements for property connection and drainage.

### **Requirements for Business Customers for Commercial and Industrial Property Developments**

If this property is to be developed for Industrial or Commercial operations, it may need to meet the following requirements:

#### **Trade Wastewater Requirements**

If this development is going to generate trade wastewater, the property owner must submit an application requesting permission to discharge trade wastewater to Sydney Water's sewerage system. You must wait for approval of this permit before any business activities can commence.

The permit application should be emailed to Sydney Water's Business Customer Services at [businesscustomers@sydneywater.com.au](mailto:businesscustomers@sydneywater.com.au)

It is illegal to discharge Trade Wastewater into the Sydney Water sewerage system without permission.

A **Boundary Trap** is required for all developments that discharge trade wastewater where arrestors and special units are installed for trade wastewater pre-treatment.

If the property development is for Industrial operations, the wastewater may discharge into a sewerage area that is subject to wastewater reuse. Find out from Business Customer Services if this is applicable to your development.

### **Backflow Prevention Requirements**

Backflow is when there is unintentional flow of water in the wrong direction from a potentially polluted source into the drinking water supply.

All properties connected to Sydney Water's supply must install a testable **Backflow Prevention Containment Device** appropriate to the property's hazard rating. Property with a high or medium hazard rating must have the backflow prevention containment device tested annually. Properties identified as having a low hazard rating must install a non-testable device, as a minimum.

Separate hydrant and sprinkler fire services on non-residential properties, require the installation of a testable double check detector assembly. The device is to be located at the boundary of the property.

Before you install a backflow prevention device:

1. Get your hydraulic consultant or plumber to check the available water pressure versus the property's required pressure and flow requirements.
2. Conduct a site assessment to confirm the hazard rating of the property and its services. Contact PIAS at NSW Fair Trading on **1300 889 099**.

For installation you will need to engage a licensed plumber with backflow accreditation who can be found on the Sydney Water website:

<http://www.sydneywater.com.au/Plumbing/BackflowPrevention/>

### **Water Efficiency Recommendations**

Water is our most precious resource and every customer can play a role in its conservation. By working together with Sydney Water, business customers are able to reduce their water consumption. This will help your business save money, improve productivity and protect the environment.

Some water efficiency measures that can be easily implemented in your business are:

- Install water efficiency fixtures to help increase your water efficiency, refer to WELS (Water Efficiency Labelling and Standards (WELS) Scheme, <http://www.waterrating.gov.au/>
- Consider installing rainwater tanks to capture rainwater runoff, and reusing it, where cost effective. Refer to <http://www.sydneywater.com.au/Water4Life/InYourBusiness/RWTCalculator.cfm>
- Install water-monitoring devices on your meter to identify water usage patterns and leaks.
- Develop a water efficiency plan for your business.

It is cheaper to install water efficiency appliances while you are developing than retrofitting them later.

### Contingency Plan Recommendations

Under Sydney Water's [customer contract](#) Sydney Water aims to provide Business Customers with a continuous supply of clean water at a minimum pressure of 15meters head at the main tap. This is equivalent to 146.8kpa or 21.29psi to meet reasonable business usage needs.

Sometimes Sydney Water may need to interrupt, postpone or limit the supply of water services to your property for maintenance or other reasons. These interruptions can be planned or unplanned.

Water supply is critical to some businesses and Sydney Water will treat vulnerable customers, such as hospitals, as a high priority.

Have you thought about a **contingency plan** for your business? Your Business Customer Representative will help you to develop a plan that is tailored to your business and minimises productivity losses in the event of a water service disruption.

For further information please visit the Sydney Water website at: <http://www.sydneywater.com.au/OurSystemsandOperations/TradeWaste/> or contact Business Customer Services on **1300 985 227** or [businesscustomers@sydneywater.com.au](mailto:businesscustomers@sydneywater.com.au)

### Fire Fighting

Definition of fire fighting systems is the responsibility of the developer and is not part of the Section 73 process. It is recommended that a consultant should advise the developer regarding the fire fighting flow of the development and the ability of Sydney Water's system to provide that flow in an emergency. Sydney Water's Operating Licence directs that Sydney Water's mains are only required to provide domestic supply at a minimum pressure of 15 m head.

A report supplying modelled pressures called the Statement of Available pressure can be purchased through any Quickcheck agent and may be of some assistance when defining the fire fighting system. The Statement of Available pressure, may advise flow limits that relate to system capacity or diameter of the main and pressure limits according to pressure management initiatives. If mains are required for fire fighting purposes, the mains shall be arranged through the water main extension process and not the Section 73 process.

### Large Water Service Connection

A water main will be available, once you have completed your drinking water main construction to provide your development with a domestic supply. The size of your development means that you will need a connection larger than the standard domestic 20 mm size.

To get approval for your connection, you will need to lodge an application with a Quick Check Agent. You, or your hydraulic consultant, may need to supply the following:

- A plan of the hydraulic layout;

- A list of all the fixtures/fittings within the property;
- A copy of the fireflow pressure inquiry issued by Sydney Water;
- A pump application form (if a pump is required);
- All pump details (if a pump is required).

You will have to pay an application fee.

Sydney Water does not consider whether a water main is adequate for fire fighting purposes for your development. We cannot guarantee that this water supply will meet your Council's fire fighting requirements. The Council and your hydraulic consultant can help.

### **Disused Water Service Sealing**

You must pay to disconnect all disused private water services and seal them at the point of connection to a Sydney Water water main. This work must meet Sydney Water's standards in the NSW Code of Practice for Plumbing and Drainage (the Code) and be done by a licensed plumber. The licensed plumber must arrange for an inspection of the work by a NSW Fair Trading Plumbing Inspection Assurance Services (PIAS) officer. After that officer has looked at the work, the drainer can issue the Certificate of Compliance. The Code requires this.

### **Private Water Services Connection and Metering**

To provide domestic water to the total development you will need to connect to the Sydney Water main. This connection must comply with the *National Plumbing and Drainage Code AS 3500* and *NSW Code of Practice for Plumbing and Drainage*. You may have to include isolation valves on either side of the connection(s) to the Sydney Water main.

Visit [www.sydneywater.com.au](http://www.sydneywater.com.au) > Plumbing > Meters > Diagrams to help position meters correctly.

For a vertical commercial/residential building, the meter servicing the residential area generally must be located in the commercial area and after all commercial off-takes.

Sydney Water will supply enough meters to meet the above guidelines but will not provide check meters. All meters **must** be placed in an accessible area that should be either:

- no more than one metre inside the property boundary **or**
- in a location acceptable to Sydney Water eg in the commercial area after all commercial off-takes.

### **Other fees and requirements**

The requirements in this Notice relate to your Certificate application only. Sydney Water may be involved with other aspects of your development and there may be other fees or requirements. These include:

- plumbing and drainage inspection costs;
- the installation of backflow prevention devices;
- trade waste requirements;

- large water connections and
- Council fire fighting requirements. (It will help you to know what the fire fighting requirements are for your development as soon as possible. Your Hydraulic Consultant can help you here.)

**No warranties or assurances can be given about the suitability of this document or any of its provisions for any specific transaction. It does not constitute an approval from Sydney Water and to the extent that it is able, Sydney Water limits its liability to the reissue of this Letter or the return of your application fee. You should rely on your own independent professional advice.**

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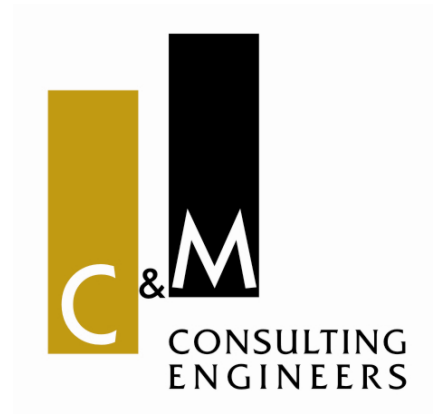
**END**



***APPENDIX F***

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**SOIL AND WATER MANAGEMENT PLAN**



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# **SOIL & WATER MANAGEMENT PLAN**

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## **LIFE CITY - WOLLONGONG**

---

### **REPORT NO. R00864-S&WMP**

### **REVISION A**

**NOVEMBER 2012**

## PROJECT DETAILS

Property Address: Warwick Street Berkeley

Development Proposal: Life City Wollongong

## REPORT CERTIFICATION

Report prepared by:



EDWARD SHIN  
Civil Engineer - Director  
B.E.(Civil) , MIEAust, CPEng,  
NPER (Civil), RPEQ

Report reviewed by:



ANTHONY MANCONE  
Civil Engineer - Director  
B.E.(Civil),Hons., MIEAust, CPEng,  
NPER (Civil), NPER (Building Services)

## DISCLAIMER

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## DOCUMENT CONTROL

REVISION	ISSUE DATE	ISSUED TO	ISSUED FOR
A	November 2012	TCG	EA Submission

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## **Preface**

This Soil and Water Management Plan (SWMP) has been prepared to supplement the Environmental Assessment (EA) for the Life City Wollongong development at Berkeley.

This SWMP has been written in accordance with the requirements of “Managing Urban Stormwater – Soils and Construction, 4<sup>th</sup> Edition (2004)” by Landcom. This SWMP shall be applied to the construction activities carried out for the development site.

Measures outlined in this Soil and Water Management Plan must be implemented prior to and maintained during and after the construction works.

It is the Contractor’s responsibility to design the sedimentation and erosion control plan for the site such that it is accordance with this Soil and Water Management Plan and the Civil Works Specification.

## General Instructions

1. The Soil and Water Management Plan (SWMP) is to be read in conjunction with the engineering plans, and any other plans or specifications that may be issued in relation to the Project.
2. Contractors shall ensure that all soil and water management works are undertaken as instructed in this specification and constructed following the guidelines stated in "Managing Urban Stormwater – Soils and Construction, 4<sup>th</sup> Edition (2004)" by Landcom.
3. The Contractor shall ensure that all subcontractors are informed of their responsibilities in minimising the potential for soil erosion and pollution to downslope areas.

## Site Constraints and Characteristics

1. The following design parameters have been assessed for the site :

Constraint	Value	(Source)*
Rainfall Erosivity (R-factor)	4500	(Appendix B - Map 11)
Soil Erodibility (K-factor)	0.022	(Table C21 – Berkeley)
Length/Slope Gradient Factor, LS	3.27	Table A1
Erosion Control Practice Factor (P-Factor)	1.3 (Compacted)	Table A2
Cover Factor (C-Factor)	1.0 (During Earthworks) 0.1 (Temporary Seeding – Post-Earthworks Operation)	Table A3
Calculated Soil Loss, A (RUSLE equation)	421 t/Ha/yr (During Earthworks) 42 t/Ha/yr (Post-Earthworks)	A = R K LS P C
Soil Loss Class	4 – Moderate	(Table 4.2)
Soil Hydrologic Group	C	(Table C21)
75 <sup>th</sup> Percentile 5-day Rainfall Event	25.4mm (Wollongong)	(Table 6.3a)
Volumetric Runoff Coefficient, Cv	0.35	(Table F2)

\* (NSW Landcom Managing Urban Stormwater Manual Reference)

- The sediment basin sizing has been conducted on a rate per hectare of disturbed area basis and has been sized in accordance with the requirements of the Landcom manual “Managing Urban Stormwater - Soils and Construction”, for Type D soils. The disturbed area within this catchment at any one time should be limited to an area for which each sediment basin can handle.

Sediment Basin Sizing Calculation for Type D Soil\*:

	<b>TOTAL</b>
Volumetric Runoff Coefficient, $C_v$	0.35 (Table F2)
75 <sup>th</sup> percentile 5 Day total rainfall depth	25.4mm
Catchment Area ( $A_c$ )	1.0 (i.e. per hectare of disturbed area)
Settling Zone Volume (per hectare), $V_{sett} = 10 \times C_v \times A_c \times R_{75th}$	89 m <sup>3</sup> /ha
Disturbed Catchment Area ( $A_d$ )	1.0 (i.e. per hectare of disturbed area)
R K L S P C	421 t/ha/yr
Sediment Zone Volume, $V_{sed} (0.17 A_d (R K L S P C) / 1.3$ $V_{sed}$ should be >30% of $V_{sett}$	55 m <sup>3</sup> /ha
<b>Total Sediment Basin Volume Required:</b>	<b>144 m<sup>3</sup>/ha of disturbed area</b>

\*(NSW Landcom Managing Urban Stormwater Manual Reference)

- The basins have been sized to accommodate the 75<sup>th</sup> percentile of 5 day continuous storm. The total volume of the basins required is given in m<sup>3</sup> per hectare of disturbed area.
- Stormwater runoff from the non-disturbed portion of the catchment outside of operating area is to be bypassed around the basins by physical means such as catch drains.

## Basin Management

- The captured stormwater in the settling zone should be drained to meet the minimum storage capacity required within a five (5) day period following rainfall, provided the acceptable water quality (NFR) and turbidity have been achieved.
- Chemical flocculent such as gypsum may be dosed to aid settling within 24 hours of conclusion of each storm. The applied dosing rates should achieve the target quality within 36 to 72 hours of the storm event.

## Land Disturbance Conditions

1. Where practicable, the soil erosion hazard shall be kept as low as possible. Limitations to access are to be in accordance with the following table:

Land use	Limitation
Access Areas	Access is to be limited to the designated work zones.
Truck Cleaning Areas	Any truck exiting out of the site shall be thoroughly cleaned and limit the exportation of soil and sediment on public roads.
Remaining Lands (Undisturbed Areas)	Entry is prohibited to remaining lands. Access is only permitted with permission from the Project Manager and/or Superintendent, to allow for thinning of growth in the interests of fire protection and/or flora and fauna management.

## Construction Sequence

Works shall be undertaken in the following sequence:

1. Install sediment fencing and cut drains to meet the requirements of the SWMP. Waste collection bins shall be installed adjacent to site office.
2. Construct stabilised site access in location nominated by the Contractor and in accordance with the Specification.
3. Install sediment control protection measures at all natural and man-made drainage structures. Maintain until all the disturbed areas are stabilised.
4. Redirect clean water around the construction site (earthworks areas).
5. Construct sediment basin(s) for disturbed areas in accordance with the rate per hectare provided in the SWMP. Install risers and two pegs in the floor of the basin and have them marked to show the top of the sediment storage zone. Ensure the basin is cleared of sediment once the design capacity is reached.
6. Clear and strip the work areas. Minimise the damage to the grass and low ground cover of non-disturbed areas.
7. Any disturbed areas, other than grading areas, shall immediately be covered with site topsoil within 7 days of clearing. Re-graded areas shall be covered with bitumen emulsion as specified.
8. Apply permanent stabilisation to the site if necessary.



## Erosion Control Requirements

- Clearly visible barrier fencing shall be installed at the discretion of the site superintendent to ensure traffic control and prohibit unnecessary site disturbance. Vehicular access to the site shall be limited to only that essential for construction work and shall enter the site only through the stabilised access points.
- All disturbed areas are to be stabilised within 14 working days of the completion of land shaping. All disturbed areas are to be protected so that the land is permanently stabilised within six months. Topsoil shall be respread over the site, other than re-grading areas, to a minimum depth of 100mm on bare but tyned soil surfaces and the site shall be revegetated in accordance with the following:

Sowing season	Seed mix
Autumn/Winter	oats@40kg/ha + Japanese millet@10kg/ha
Spring/Summer	oats@20kg/ha + Japanese millet@20kg/ha

*Note : These plant species are for temporary revegetation only. They will only provide protection from erosion for six months. Where the lots are to be left undeveloped for a longer period, the Contractor shall seek advice from the site superintendent as to more appropriate revegetation methods.*

Revegetation in accordance with the above table will be enhanced by adding lime at a rate of 4kg/tonne of topsoil and 7.5kg/tonne of subsoil.

- The long term ground cover factors for the construction works is not to exceed the following limits :

Land	Maximum C-factor	Remarks
Waterways and other areas of concentrated flows, post construction	0.05	Applies after 10 working days of completion of formation and before concentrated flows are applied. Foot and vehicular traffic is prohibited in this area and 70% ground cover is required.
Stockpiles, post construction	0.10	Applies after 10 working days from completion of formation. 60% ground cover is required.
All lands, including waterways and stockpiles, during construction.	0.15	Applies after 20 days of inactivity, even though works may be incomplete. 50% ground cover is required.

## **Sediment Control Conditions**

1. Proprietary silt fencing shall be installed by the Contractor in accordance with their approved Sediment and Erosion Control Plan and elsewhere at the discretion of the site superintendent to contain coarser sediment fractions as near as possible to their source.
2. Sediment removed from any trapping device shall be relocated where further pollution to downslope lands and waterways cannot occur.
3. Stockpiles shall be located by the Contractor in accordance with their approved Sediment and Erosion Control Plan and elsewhere at the discretion of the Project Manager and/or Superintendent. Where stockpiles are to be in place longer than 30 days they shall be stabilised by covering with mulch or with temporary vegetation.
4. Water shall be prevented from entering the permanent drainage system unless it is sediment free. Drainage pits are to be protected in accordance with the Contractor's approved Sediment and Erosion Control Plan.
5. Temporary sediment traps at pits shall be retained until after lands they are protecting are completely rehabilitated.

## **Site Maintenance Requirements**

1. Waste bins are to be provided for all construction refuse. They are to be emptied at least weekly and refuse is to be disposed in accordance with the site manager's recommendations.
2. The site manager shall inspect the site at least weekly and shall;
  - a. Ensure that all drains are operating effectively and shall make any necessary repairs;
  - b. Remove any spilled material from area subject to runoff or concentrated flow;
  - c. Remove trapped sediment where the capacity of the trapping device falls below 60%;
  - d. Inspect the sediment basins after each rainfall event and/or weekly. Ensure that all sediment is removed once the sediment storage zone is full (refer to pegs installed in basins in accordance with the SWMP). Ensure that outlet and emergency spillway works are maintained in a fully operational condition at all times.
  - e. Ensure rehabilitated lands have effectively reduced the erosion hazard and initiate upgrading or repair as appropriate;

- f. Construct additional erosion or sediment control works as may be appropriate to ensure the protection of downslope lands and waterways;
- g. Maintain erosion and sediment control measures in a fully functioning condition at all times until the site is rehabilitated;
- h. Ensure that the revegetation scheme is adhered to and that the all grass covers are kept healthy, including watering and mowing;
- i. Remove temporary soil conservation structures as the last activity in the rehabilitation program.