White Rock Wind Farm
Stage 1

CEMP Annex E – Construction Soil and Water Quality Management Plan

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Prepared by: Environmental Resources Management (ERM)
For: White Rock Wind Farm Pty Ltd

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Document Control

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	TBA	Contractor SECO (3)

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1 INTRODUCTION

This Construction Soil and Water Quality Management Plan (CSWQMP) is a sub-plan of the White Rock Wind Farm (WRWF) Stage 1 Construction Environmental Management Plan (CEMP). It has been prepared by Environmental Resources Management Australia Pty Ltd (ERM) on behalf of White Rock Wind Farm Pty Ltd (WRWFPL). Its purpose is to identify the risks arising and management measures for implementation to address the potential impacts to soil and water quality during the construction of WRWF Stage 1 (or the Project).

1.1 PURPOSE AND SCOPE

The CSWQMP is required under Minister's Condition of Approval (MCoA) E22(d) of the Project Approval for the development and operation of the wind farm. It will also support compliance with EPL 20665.

The CSWQMP serves as a framework management document and outlines the fundamental principles to be followed in the planning and implementation of erosion and sediment control measures during construction of the Project.

The purpose of this CSWQMP is as an overarching management document. It does not include detailed engineering design of structures, nor does it provide plans showing the layout of all erosion controls across the site. However it does identify the variation in risk across the Stage 1 footprint based on risk factors such as soil types present, vegetation cover, steepness of slope, extent of soil disturbance and anticipated level of controls required for respective locations.

Progressive Erosion and Sediment Control Plans (ESCPs) are to be prepared, before earthworks are undertaken, for the purpose of identifying specific controls for respective work locations. The ESCPs can be prepared once detailed design plans are available, particularly the detailed road and drainage designs. Additional information on the need for and content of Progressive ESCPs is provided in *Section 5.*

This CSWQMP:

- provides a description of the Project and key erosion and sediment control risks;
- outline measures to ensure that soil and water management is undertaken in accordance with section 120 of the *Protection of the Environment Operations Act 1997;*
- assesses the erosion hazard at the site;
- provides directions for installing, monitoring and maintaining a suite of erosion and sediment controls;

- describes how WRWFPL and the construction contractors will manage and control sediment, erosion and water quality risks associated with the construction of the Project;
- describes management measures to be used to minimise surface and groundwater impacts, including details of how spoil and fill material required by the Project will be sourced, handled, stockpiled, reused and managed; erosion and sediment control measures; and the consideration of flood events;
- describes management measures for contaminated material and a contingency plan to be implemented in the case of unanticipated discovery of contaminated material during construction; and
- outlines the roles and responsibilities of those involved in the implementation of sediment, erosion and water quality management controls.

1.2 STAGE 1 CONSTRUCTION DETAILS

The WRWF gained Project Approval (MP 10 0160) on 10 July 2012 and the approval was modified on 24 July 2015 and 1 April 2016 under Part 3A of the NSW Environmental Planning and Assessment Act 1979 (EP&A Act) and is subject to the Ministers Conditions of Approval (MCoA). The Project Approval allows for construction of up to 119 wind turbines and ancillary facilities for access, substation and grid connection, electrical connection of the turbines to the substation, temporary construction facilities and permanent meteorological monitoring masts.

Stage 1 of the WRWF project involves installation of up to 70 wind turbines and associated ancillary facilities, to which the overall Construction Environmental Management Plan (CEMP) and this CSWQMP applies.

Further detailed Project information can be found in the following documents:

- White Rock Wind Farm Construction Environmental Management Plan (ERM 2016); and
- White Rock Wind Farm EA documents.

1.3 PROJECT LOCATION

The Project is to be located generally in the area between the Gwydir Highway in the north and Maybole Road in the south. The Project site is approximately 20 kilometres (km) west of Glen Innes. The Project is within two Local Government Areas (LGA), the Glen Innes Severn LGA and the Inverell Shire LGA. The Guyra Shire LGA occurs to the south of the project area.

The Project is mostly located on private lands where the landowners lease the land to WRWFPL. In addition, parts of some access routes and electrical collections circuits cross Crown lands under agreements between Crown Lands Office and WRWFPL.

The WRWF site is located in steep hilly rural land that ranges in elevation from about 1000m in the north to over 1300m on some of the higher ridges including White Rock Mountain. The land has been partly cleared to provide exotic pastures for stock (cattle and sheep) grazing. Much of the steeper land retains remnant woodland vegetation. Cleared areas are common along ridgetops to facilitate grazing and farm access.

The general layout of the WRWF site and proposed location of associated ancillary facilities is shown on *Figure 1.1.*

The Stage 1 project site includes long sections of narrow ridgetop land, some areas of gently sloping benches on the multi-layered basalt terrain, some steep sections of track where ridges slope down to the valley floor and broader gently sloping pastures at the northern end of the site and in the south. The site extends about 13km from north to south.

357500 360000 362500 365000 367500

6707500 6705000 6702500 6700000 6697500 6695000 6692500

H40 I40 E50 K50 K51 M60 L70 L71 Q70 P70 Q80 Q81 Q82 L83 M80 L80 L82 N90 L90 L100 L101 N100 Q110 R120 R121 D121 F120 F131 F132 E140 H140 K170 L170 I180 J180 J181 L180 N180 N190 N191 O190 O191 P190 R190 P170 Q170 L200

GWYDIR HIGHWAY

1 2 3 4 5 6 7 8 9 10 11 13 14 15 19 20 21 22 25 26 27 28 29 30 31 34 35 36 37 38 39 40 41 44 47 48 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 68 69 71 72 73 75 76 77 78 79 80 81 82 83 109 110 111 112 113

SWAN BROOK SPRING MOUNTAIN WHITE ROCK MOUNTAIN WATERLOO SUGARLOAF GOUGH SUGARLOAF

LEGEND

- Site Perimeter
- Cadastral Boundary
- Turbine Layout 66
- Permanent Met Mast
- Involved Residence
- Uninvolved Residence
- Neighbour Agreement
- Existing 132kV Transmission Line
- 33kV Overhead Line
- Substation / Switchyard

Original PA Approved Layout

- Operation & Maintenance Facility
- Temporary Construction Compound
- Laydown Area
- Concrete Batching Plant
- Laydown Area & Batching Plant
- Access Tracks
- 132kV Overhead Line

MOD 3 Approved Layout

- Operation & Maintenance Facility
- Temporary Construction Compound
- Laydown Area
- Concrete Batching Plant
- Access Tracks
- 132kV Overhead Line

0 500 1,000 2,000 Metres

Projection: GDA94 MGA56

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Doc Name: WRWF_MOD3_009_1H
MOD 3 Approved Layout: Overview Map
Rev 1H

Client:	Goldwind		
Drawing No:	0295776b_CEMP_C001_R4.cdr		
Date:	14/04/2016	Drawing size: A3	
Drawn by:	JC / GR	Reviewed by: TM	

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Figure 1-1 Construction Layout

White Rock Wind Farm

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2 CONSTRUCTION METHODOLOGY

This section provides an overview of the WRWF Stage 1 construction methodology as relevant to this CSWQMP and presents:

- an overview of the required WRWF works;
- a list of construction activities and their locations with the potential to generate impacts to soil and water quality and impact on water courses;
- a broad ranking of the parts of the site in terms of risks of erosion; and
- the proposed construction schedule in the context of management soil and water quality impacts.

2.1 OVERVIEW

In general, construction aspects of wind farm projects present a range of potential impact risks and management issues due to the nature of works, the times of day required for some activities and the large project areas in which works can occur. The plant, equipment and machinery, or activities to be undertaken, for the WRWF will vary throughout the Project site, depending on various stages of construction. Project activities and types of construction with the potential to generate impacts to soil and water include:

- vegetation clearing;
- excavation and heavy machinery works;
- grading/levelling;
- access road upgrades;
- trenching for underground electricity cables;
- light vehicle traffic and construction traffic;
- excavation works for wind turbine foundations ;
- reinstatement and re-contouring the surface;
- use and storage of chemicals;
- potential spills from construction plant; and
- revegetation & rehabilitation works.

Construction of the WRWF will be undertaken on behalf of WRWFPL by construction contractors:

- Fulton Hogan is undertaking Balance of Plant services for the wind farm construction; and
- TransGrid is undertaking construction of switching/substation and connection services.

2.2 CONSTRUCTION SCHEDULE

The WRWF Stage 1 construction works will extend over 2 years and will involve the following key phases identified in *Table 2.1*. A key objective for mitigating erosion risk will be to limit duration of exposure of disturbed areas and to rehabilitate these areas as soon as possible after the initial disturbance.

Table 2.1 Phases of Project Implementation

TIME	2015	2016				2017				2018
ACTIVITY	**Q4**	**Q1**	**Q2**	**Q3**	**Q4**	**Q1**	**Q2**	**Q3**	**Q4**	**Q1**
Pre-construction Phase										
Gain all pre-construction approvals										
Install Met Masts										
Construction Phase										
Site entry upgrade										
Local road upgrades										
Site establishment, compounds and amenities										
11KV Power supply										
Access Tracks, clearing and earthworks										
Prepare turbine hardstands and turbine footings										
Batch Plant operation										
Install 33kV Cabling										
Install 33kV OH Line										
Deliver Turbine components										
Erect Towers, nacelles and rotors										
Sub Station Footings										
Sub Station construction										
Install 132kV line										
Install O&M Building										
De-mobilise Site										
Restore site including on-site screen planting										

3 LEGAL AND OTHER REQUIREMENTS

3.1 LEGISLATION AND POLICIES

The applicable legal and other requirements related to soil and water quality management for the Project are outlined in *Table 3.1*.

Table 3.1 Legislation and Policies

Legislation and Policies
Commonwealth Legislation
Environment Protection and Biodiversity Conservation Act 1999
State Legislation
Environmental Planning and Assessment Act 1979
Consolidated Project Approval MP10_160 – MOD 3 (granted under EP&A Act)
Protection of the Environment and Operations Act 1997
Protection of the Environment Operations (General) Regulation 2009
Water Management Act 2000
Water Act 1912
Soil Conservation Act 1938
Work Health and Safety Act 2011

3.2 GUIDELINES AND STANDARDS

Relevant environmental standards, policies and guidelines are provided in *Table 3.2*.

Table 3.2 Environmental Standards, Policies and Guidelines

Environmental Risk Issue	Standards and Guidelines
Soil and Water	• Landcom NSW(2004), Managing Urban Stormwater Soils and Construction (Volume 1, 4th edition) "*Blue Book*" • DECC (2008) Managing Urban Stormwater Soils and Construction – Volume 2A installation of Services • DECC (2008) Managing Urban Stormwater Soils and Construction – Volume 2C Unsealed Roads • ANZECC (2000) Australian and New Zealand Guidelines for Fresh and Marine Water Quality Guidelines

Landcom (2004) and DECC (2008) guidelines are referenced in this CSWQMP as they are widely recognised as the benchmark erosion and sediment control manuals in NSW.

Detailed construction advice for a wide range of erosion and sediment control practices is provided in Landcom (2004), including a set of Standard Drawings (abbreviated SDs). A number of these SDs relevant to this Project have been reproduced in *Annex A*.

3.3 MINISTER'S CONDITIONS OF APPROVAL

The Project was granted Project Approval by the Minister for Planning on 10 July 2012 and this approval was modified on 24 July 2015 and 1 April 2016. The Minister's Conditions of Approval (MCoA) (Annex J of this CEMP) include a number of conditions (C8, E15, E21 and E22) relating to soil and water quality management as presented in *Table 3.3*.

3.4 EPL 20665

EPL 20665 is required for the scheduled development works for the wind farm construction. WRWFPL and its contractors must comply with the EPL requirements. The EPL is provided as Annex K of the CEMP.

3.5 STATEMENT OF COMMITMENTS

Under the now repealed Part 3A reforms, Proponents were required to provide a Statement of Commitments (SoC) on how they propose to implement measures for environmental mitigation, management and monitoring for the Project. The SoC relating to soil and water quality management during construction are presented in *Table 3.4*.

Table 3.3 Minister's CoA Relating to Soil and Water during Construction

Document Reference	CoA	Requirement	Section this is Addressed
Project Approval (MP 10 0160)	C8	*Except as may be provided by an EPL, the project shall be constructed and operated to comply with section 120 of the Protection of the Environment Operations Act 1997, which prohibits the pollution of waters.*	Section 5
	E15	*Soil and water management measures consistent with Managing Urban Stormwater - Soils and Construction Vols 1 and 2, 4th Edition (Landcom, 2004) shall be employed during the construction of the project to minimise soil erosion and the discharge of sediment and other pollutants to land and/or waters.*	Section 5
	E21	*Prior to the commencement of construction, or as otherwise agreed by the Director- General, the Proponent shall prepare and implement (following approval) a Construction Environmental Management Plan for the project. The Plan shall outline the environmental management practices and procedures that are to be followed during construction, and shall be prepared in consultation with the relevant agencies and in accordance with the Guideline for the Preparation of Environmental Management Plans (Department of infrastructure, Planning and Natural Resources, 2004). The Plan shall include, but not necessarily be limited to:* ……. *e) details of how environmental performance will be managed and monitored to meet acceptable outcomes, including what actions will be taken to address identified potential adverse environmental impacts (including any impacts arising from the staging of the construction of the project). ln particular, the following environmental performance issues shall be addressed in the Plan:* …… *(iv) soil and water quality and spoil management;* ……..... *(vii) soil contamination, hazardous material and waste management;*	Section 5, 6 and 7
	E22	*As part of the Construction Environmental Management Plan for the project required under condition E21 the Proponent shall prepare and implement:* …… *d) a Construction Soil and Water Quality Management Plan to manage surface and groundwater impacts during construction of the project. The plan shall be developed in consultation with NOW and include, but not necessarily be limited to:* *(i) details of construction activities and their locations, which have the potential to impact on water courses, storage facilities, stormwater flows, and groundwater;*	This CSWQMP

Document Reference	CoA	Requirement	Section this is Addressed
		(ii) surface water and ground water impact assessment criteria consistent with Australian and New Zealand Environment Conservation Council (ANZECC) guidelines; *(iii) (management measures to be used to minimise surface and groundwater impacts, including details of how spoil and fill material required by the project will be sourced, handled, stockpiled, reused and managed; erosion and sediment control measures; and the consideration of flood events;* *(iv) management measures for contaminated material and a contingency plan to be implemented in the case of unanticipated discovery of contaminated material during construction;* *(v) a description of how the effectiveness of these actions and measures would be monitored during the proposed works, clearly indicating how often this monitoring would be undertaken, the locations where monitoring would take place, how the results of the monitoring would be recorded and reported, and, if any exceedance of the criteria is detected how any non-compliance can be rectified; and* *(vi) mechanisms for the monitoring, review and amendment of this plan.*	

Table 3.4 SoC Relating to Soil and Water during Construction

Document Reference	SoC	Commitment	Section this is Addressed
White Rock Wind Farm Environmental Assessment (EPURON, 2011)	39	*Ensure infrastructure, including turbines, tracks, substations, control buildings, stockpiles, and site compounds and turnaround areas, is not sited within 40 metres of a major drainage line or water course, where practical.*	Section 5
	40	*Prepare a Sediment & Erosion Control Plan as part of the Construction Environmental Management Plan. Soil and water management practices would be developed as set out in Soils and Construction Vol. 1 (Landcom 2004)*	Section 5
	41	*Ensure all vehicles onsite follow established trails and minimise onsite movements.*	Section 5 and CTAMP
	42	*Design concrete batch plants to ensure concrete wash would not be subjected to uncontrolled release. Bunded areas of the batching plant to contain peak rainfall events and remediate after the completion of the construction phase. Waste sludge would be recovered from the settling pond and used in the production of road base manufactured onsite. The waste material would be taken from the batching plant to be blended in the road base elsewhere onsite.*	Section 5

Document Reference	SoC	Commitment	Section this is Addressed
	43	*As soon as practical, stabilise exposed or clear areas to minimise erosion and sedimentation that can potential pollute and dam watercourses in the area.*	Section 5
	44	*A Spill Response Plan would be prepared as part of the CEMP and OEMP.*	Section 5
	45	*At the conclusion of the construction period, where practical, the disturbed areas of the site would be rehabilitated to a level suitable for the ongoing agricultural use of the land. The topsoil removed for construction activities would be stockpiled and reused for the rehabilitation of the areas around the turbine foundations, lay down and hardstand areas and along the access tracks.*	Section 5
	46	*Consult with involved property owners in relation to areas of land potentially contaminated by past land use and manage impacts in these areas to avoid affecting the any areas of contamination.*	WRWFPL has consulted with landowners and no areas of contamination were identified.
	47	*The Proponent would prepare a protocol in the instance that suspected contamination is unexpectedly found. Should contamination or potential contamination be disturbed during excavation works, the area would be assessed by appropriately qualified consultants and DECCW would be notified if warranted.*	Section 5
	48	*Concrete wash would be deposited in an excavated area, below the level of the topsoil, or in an approved landfill site. Where possible, waste water and solids would be reused onsite.*	Section 5
	49	*Access routes and tracks would be confined to already disturbed areas, where practical. All contractors would be advised to keep to established tracks.*	Section 5 and CTAMP

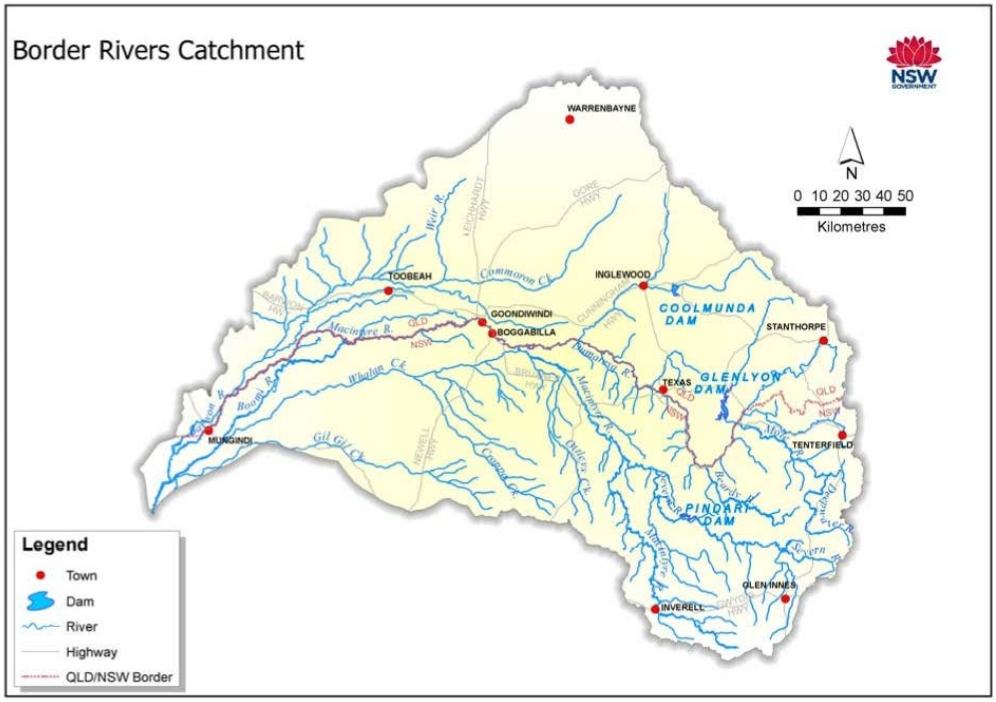
3.6 ASSESSMENT BACKGROUND

Assessment of current soil and water quality conditions and potential impacts was undertaken by EPURON (2011) as part of the Environmental Assessment and are summarised and expanded upon below.

3.6.1 Site Details

The Project boundary extends from Maybole Road in the south to the Gwydir Highway in the north. This area constitutes part of the Great Dividing Range in northern New South Wales and is within the southeastern part of the Border Rivers Catchment as shown in the Figure below (NOW, 2012). Rivers in this area flow generally to the northwest and inland.

Figure 3.1 Border Rivers Catchment



The site varies from undulating hills with some areas of moderately steep slopes that extend down to small level valleys with numerous saddles and small knolls situated off the main ridgeline. The site has higher elevations in the southern portion with spot heights of 1,421m AHD and decreases in elevation to about 1,000 m in the north near the Gwydir Highway (EPURON, 2011).

3.6.2 Climate

Climatic factors such as rainfall and temperature patterns are relevant to the ESCP in a number of ways. Rainfall is the main agent of erosion and therefore, wet or stormy months with intensive rainfall events are more likely to generate erosion-causing rainfall than dry months. Climatic factors control soil moisture regimes and will have an influence on revegetation timing and methods.

Climate data was sourced from weather stations nearest the study area that recorded the desired information. In general, rainfall decreases to the west towards Inverell and the inland plains country. The following weather stations were used to provide an overview of site climatic conditions:

- temperature and rainfall data from Glen Innes Agriculture Research Station 56013 (1910 - present), Latitude: 29.70° S, Longitude: 151.69° E; and
- rainfall and evaporation Data from Glen Innes Agriculture Research Station 56013 (1910 – present for rainfall data and 1971 – present for evaporation data), Latitude: 29.70° S, Longitude: 151.69° E.

On average January is the warmest month with an average daily temperature of 25.4 ^{o}C. The coldest month is typically July with an average daily temperature of 12.5 ^{o}C.

The mean annual rainfall at the Glen Innes Agriculture Research Station is 840.6mm. On average, December is the wettest month with a mean monthly rainfall of 109.8mm, while April is the driest month with an average of 41.5mm. Annual average evaporation rates exceed annual average precipitation rates by approximately one and a half times. Rainfall and evaporation data sourced from the Glen Innes Agriculture Research Station (56013) is provided in *Table 3.5.* From this it can be seen that rainfall is commonly summer and spring dominant, and therefore erosion causing rains are more likely to occur during these seasons. Snow occurs occasionally on the higher areas and sometimes light snowfalls can occur as low as Glen Innes township. *Annex B* provides Intensity-Frequency-Duration (IFD) data for Glen Innes.

Table 3.5 Rainfall and Evaporation Data for the Glen Innes Area

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ann
Mean monthly rainfall (mm)	105.2	93.7	69.9	41.5	48.6	52.6	55.2	48.5	54.5	75.6	90.8	109.8	840.6
Mean monthly evaporation (mm)	167.4	134.4	127.1	93	62	45	52.7	77.5	108	139.5	150	170.5	1314

1. Rainfall and evaporation data from Glen Innes Agriculture Research Station 56013 (1910 – present) Latitude: 29.70° S, Longitude: 151.69° E

3.6.3 Site Geology

The Preliminary Geotechnical Investigation Report (GHD 2015) described the geological context as follows:

The Grafton 1:250 000 Scale Map Sheet, Geological Survey of NSW (1976) describes the following geological units to occur at the site locality:

- Tertiary Volcanics (Tv) – comprising basalts and dolerites with associated highly reactive residual clay soil profile;

- Permian Volcanics (P**lv**) – comprising intermediate to acid volcanics with minor interbedded sediments; and

- Quaternary Stream Alluvium (Qa) – comprising clays silts sands and minor gravel, typically occurring in vicinity of the lower lying drainage lines and creeks.

The materials encountered during the investigation were generally consistent with the above geological map descriptions, with the soil profile being dominated by the Tertiary Vocanics unit.

The Permian Volcanics (Plv) unit are generally mapped as having limited surface exposure regionally and within the site area.

The main geological units are described in more detail in the following sections.

Tertiary Volcanics

The Tertiary Volcanics is an extrusive igneous rock generally comprising alkaline basalt which covers a large area of the Glen Innes region including the proposed White Rock Wind Farm site.

This unit was formed by a series of eruptions from small vent complexes, with lava flows distributed radially from eruption points. These lava flows are generally thinly stacked and vary significantly in thickness from several metres to several hundred metres, often interspersed with weathered clay soil layers (i.e. palaeosol horizons). Where fresh, the basalt is generally of high to very high intact rock strength.

These volcanic rock types weather (decompose) in a variety of different ways, with all the minerals eventually converting to clay and iron oxides. Since there is little quartz in the original rock fabric the final weathering product is often a base rich, grey to grey-brown, heavy soil of high plasticity. Core stones (floaters) of basalt occasionally occur in the weathered clay, which vary from cobble to larger boulder size. Another feature of basaltic soils is the development of calcareous nodules, which have been precipitated at various parts of the profile.

Outcrops of basalt rock (stony rises) are visible at different locations across the wind farm site. The stony rises generally present themselves as irregular boulder shaped protrusions imbedded in the existing ground surface.

A large vent complex referred to as the Maybole Volcano is situated immediately south of the proposed wind farm site and 13 km directly west of the town of Glencoe, NSW. Volcanic materials associated with this vent complex are described as ranging from basaltic to complex pyroclastic and volcanoclastic materials.

Permian Volcanics

Geological notes from the 1992 Field Conference of the New England District (Geological Society of Australia, Queensland Division) describe the Permian Volcanics to typically underlie the Tertiary Volcanics unit, covering an extensive area across the New England Tablelands region.

The Permian Volcanics were formed from a major episode of volcanic activity throughout the region which produced extensive, complex sequences of intermediate to acidic volcanic materials ranging from Andesite to Rhyolite.

Regional mapping suggests that this unit may occur locally at surface or shallow depth in the vicinity of turbines 30 to 32, in the vicinity of Spring Creek.

3.6.4 Soils

Soils at the site are derived from the local geology and reflect the lateral and vertical variations in the geology. As indicated above, basalt is the dominant rock type for the locality. The basalt is typically layered and gives rise to a benched terrain. The benches generally represent massive basalt layers and hard resistant material. Intervening softer less resistant horizons have been associated with greater degree of erosion and on steep slopes, small sections of cliff can be seen to have underlying softer and more eroded horizons.

Plate 1 ***Photo of Basalt outcrop on northern side of White Rock Mountain showing layering of Basalt and variation in rock strength.***

Source: WRWFPL 2015

The results of the geotechnical fieldwork (GHD, 2015) indicate that the subsurface conditions are reasonably consistent across the wind farm site.

The subsurface conditions encountered within the test sites during the investigation are summarised as follows, from upper layers to lower layers:

- **Topsoil: Clayey SAND (SC) / Sandy CLAY (CL-CH) –** dark grey to reddish brown, soft to firm or very loose to loose with fine rootlets. Inclusions of surface basaltic cobble and small boulders. Extending to between 0.04 m and 0.40 m depth below the existing surface level;

- **Residual Soil: CLAY / Sandy CLAY (CL-CH) or Clayey SAND (SC) -** grey brown to red brown, firm to hard or loose to medium dense, dry to moist. Contains larger basalt corestones (floaters) ranging from cobble through to small boulder size, high strength rock in a soil matrix. Extending to between 1.3 m and 5.5 m below ground level; and

- **Basalt: Extremely Weathered to Fresh -** orange brown to grey, variably weathered, fractured, extremely low to extremely high strength rock. Encountered to the maximum investigation depth of 16.66 m below ground surface level.

Basalt bedrock was found to underlie the residual soils in a majority of the test sites undertaken across the wind farm site. The variably weathered basalt rock was encountered at depths ranging between 1.3 m and 5.5 m below the ground surface level. Three field Emerson tests undertaken by GHD (2015) identified that the soils 'exhibit potentially unfavourable erosion (dispersive) characteristics'.

3.6.5 Potential Acid Sulfate Soils

Review of the Australian Soil Research Information System (CSIRO 2006) identified that there is no known occurrence of Potential Acid Sulfate Soils within the Project site.

3.6.6 Vegetation

Vegetation cover plays a significant role in the effective management of erosion. Preventing soils from being exposed to the erosive forces of wind and water by providing a layer of vegetation can reduce erosion and subsequent sedimentation. An understanding of the vegetation composition before disturbance allows for planning for rehabilitation activities to revegetate the site to a condition similar to the pre-disturbance state.

The long agricultural use of the site has resulted in it largely consisting of pasture grasses with little overstorey vegetation and areas of remnant woodland vegetation.

3.6.7 Watercourses

EPURON (2011) identified that the site contains a number of watercourses which are predominantly first order streams with some second order streams. The turbines are located on the higher ground and the access tracks and underground cabling follows the ridgelines between the high ground locations. The layout of the wind turbines, the access tracks and underground cabling mostly avoids any significant watercourses. No third order water courses are proposed to be crossed for access tracks or cabling. The location of the watercourses is shown in *Figure 3.2*. The eastern areas of the project drain to the north while the western areas drain to the west.

GWYDIR HIGHWAY
ILPARRAN ROAD
SWAN BROOK
WELLINGROVE CREEK
HAYMARKET ROAD
SPRING MOUNTAIN ROAD
KELLEYS ROAD
BEARDY WATERS
MAYBOLE ROAD
GRAHAMS VALLEY ROAD
BACK CREEK

Legend

- Turbine Layout 66
- Access Track
- Creeks / Drainage Lines
- 20 m Contour
- Project Area

N

0 0.5 1 1.5km

Source:
Geoscience Australia Geodata V3
Goldwind Turbine Layout 66 and Contours
LPI Imagery WMS Service (2015) : Date of imagery 2012

Client:	Goldwind		
Drawing No:	0295776m_SWQ_G002_R05.mxd		
Date:	14/04/2016	Drawing Size:	A3
Drawn By:	GR	Reviewed By:	TM

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Figure 3.2 - Topography and Watercourse Locations

White Rock Wind Farm
Construction Soil and Water Management Plan

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3.6.8 Groundwater

GHD (2015) details the preliminary geotechnical investigation undertaken at the site, with mention of groundwater at the site. The key findings of the report are summarised below:

- groundwater was not encountered during the excavation of 19 test pits or the drilling of the twelve boreholes during the investigation. Though it is noted that groundwater observations are not possible at depth during the drilling of the boreholes as water is used as a drilling fluid during rock coring;
- though groundwater was not observed during geotechnical works, localised seepage due to perched groundwater tables may occur during wetter parts of the year; and
- GHD (2015) state that permanent groundwater table is not expected to occur within the upper 3.5m of the soil profile.

The depth of the permanent water table makes it unlikely that it will be encountered during site construction works. However, GHD (2015) note that minor groundwater seepage could be expected during periods of wet weather and that the contractor should make provision to deal with groundwater, as and when encountered. Dewatering management measures are discussed in *Table 5.4*.

3.6.9 Flooding

Local Environment Plan (LEP) mapping does not include flood mapping for the LGAs encompassed by the Project. The risk of flooding is negligible given that:

- the turbines and the bulk of the wind farm's associated infrastructure will be positioned on crests or upper hillslopes;
- no third order watercourses are within the Project site; and
- the topography of the location does not have areas (low lying) that would be subject to inundation.

A summary of the key impacts identified in this assessment is provided below.

3.6.10 Summary of Key Impacts

The construction of the WRWF Project has the potential to impact on the current soils and landform of the site through those activities identified in *Section 2.1*. These works have the potential to alter and degrade the sites natural soils and landform through increasing the possibilities of:

- accelerating erosion in disturbed areas;
- causing sedimentation of watercourses;
- potential pollution of watercourses;
- changing hydrology and drainage paths, which can potentially increase the area's chance of dryland salinity; and
- impact on the ground stability.

EPURON (2011) indicated that areas at particular risk on the site are areas of steeper slopes and thinner soils. During the design phase, amendments to the infrastructure layout, and in particular access tracks, were made to reduce the overall environmental impact. Most of the access tracks follow the tops of ridgelines where the turbine sites are located but in places, the access tracks will be cut into side slopes and, these locations will require increased attention for preparation of the ESCPs and conducting of earthworks and construction of drainage. Application of the controls in this CSWQMP will be used to minimise excavation works and prevent erosion and sedimentation through appropriate and adequate management and rehabilitation measures.

3.7 RELATED MANAGEMENT PLANS

This CSWQMP forms part of an overarching Construction Environmental Management Plan (CEMP) for the Project. Where relevant, reference should also be made to the other Sub-Plans for the Project list in *Table 3.6*.

Table 3.6 Relevant Project Sub-Plans and EPA Licence Requirements

CEMP Annex	Environmental Sub-Plan
Annex B	Construction Compound and Ancillary Facilities Management Plan (CCAFMP)
Annex C	Construction Noise and Vibration Management Plan (CNVMP)
Annex D	Construction Traffic and Access Management Plan (CTAMP)
Annex E	Construction Soil and Water Quality Management Plan (CSWQMP) (This Plan)
Annex F	Construction Heritage Management Plan (CHMP)
Annex G	Construction Flora and Fauna Management Plan (CFFMP)
Annex K	EPL 20665

3.8 CONSULTATION

The draft CSWQMP was issued to the Department of Primary Industries – Water on 4 September 2015. Comments on the draft were provided on 14 September 2015 and are attached in *Annex C.* The two comments include the following and have been addressed within this plan:

- the need to obtain the required licences to account for the volume of groundwater extracted from excavations during dewatering; and
- identification that all works in waterfront land should be consistent with the Department of Primary Industries – Water's 'Guidelines for Controlled Activities 2012'.

Further consultation, including consultation with the Department of Primary Industries (Fisheries) regarding the design of the crossing(s), in accordance with MCoA C9 and reference to *Why do Fish Need to Cross the Road – fish passage – requirements for waterway crossings* (Fairfull and Witheridge, 2003) will be undertaken should later design changes necessitate a watercourse crossing.

4 OBJECTIVES AND PERFORMANCE TARGETS

4.1 OBJECTIVES

The primary **objective** of this CSWQMP is to minimise erosion, manage sediment and minimise impacts on water quality consistent with relevant State policies and guidelines. This can be achieved by:

- minimising ground disturbance during construction activities;
- stripping, stockpiling and conserving topsoil for later use in rehabilitation;
- managing the flow of stormwater through and around construction areas;
- diverting stormwater runoff away from construction areas and separating construction runoff from disturbed areas, where practicable;
- conveying runoff from disturbed areas to sediment traps to capture sediment and minimise water pollution;
- installing, monitoring and maintaining erosion and sediment controls in accordance with relevant guidelines and standard industry practice;
- ensuring storage and handling of fuels and hazardous chemicals is in accordance with EPA guidelines, to prevent release of hazardous materials to the environment;
- progressive rehabilitation of the site, as soon as practicably possible, with vegetation including pasture grasses, to stabilise the site and restore its agricultural viability; and
- complying with the requirements of applicable legislation and the Minister's Conditions of Approval for the Project (as modified).

4.2 PERFORMANCE TARGETS

Targets for soil and water quality management issues associated with the construction of the Project are provided below:

- 100% compliance with all applicable legislation, regulations, standards, codes and licenses that relate to the Project;
- no significant degradation to the environment, including existing drainage lines and watercourses as a result of construction activities;
- no sediment entrained in water leaving the construction site in quantities outside of guideline criteria;
- standard industry environmental management practices implemented for soil and water quality; and

implementation of measures listed in the Statement of Commitments.

5 EROSION HAZARD ASSESSMENT AND MANAGEMENT STRATEGY

The following sections provide an assessment of the erosion hazard at the site, identify the erosion and sediment controls that will be suited, and provide design criteria for those controls.

5.1 EROSION HAZARD ASSESSMENT

An assessment of the erosion hazard of the site was undertaken using the Revised Universal Soil Loss Equation (RUSLE). The RUSLE provides a prediction of the long term average annual soil loss from erosion at a specific site according to specific management practices.

The RUSLE equation is represented by:

$$A = R K LS P C$$

where,

A = calculated soil loss (tonnes/ha/yr)

R = rainfall erosivity factor

R is calculated from the following formula:

$R = 164.74 (1.1177)^S S^{0.6444}$

where,

S = 2-year ARI, 6 hour ARI rainfall event.

This formula yields an R-factor of 1630 for the WRWF site.

K =soil erodibility factor

The K-factor for the site was conservatively estimated as 0.05. This K-factor is considered conservative as it is at the average to higher end of the range for K-factors for soil landscapes across the state. This is considered an appropriate k-factor given that three field Emerson tests undertaken by GHD (2015) identified that the soils 'exhibit potentially unfavourable erosion (dispersive) characteristics'.

LS = slope length/gradient factor

The slope length/gradient correlation was obtained from Table A1 of Landcom (2004) following interpretation of the site topographic map. Generally the slope length/gradient factor was taken conservatively as 100m, the whole length of the area of disturbance (Landcom 2004). Reduction in this slope length will reduce the soil loss. Gradients were calculated at each location and were taken as the worst case slope for the location.

P = erosion control practice factor

P-factor taken as 1.3, as recommended for construction sites by Landcom (2004).

C = ground cover and management factor.

The C-factor applied to the site was 1.0, typical of bare, compacted soil, and reflective of soil conditions on construction sites. The C-factor of 1.0 is also recommended by Landcom (2004) for construction sites.

The calculated soil loss and erosion hazard as determined from RUSLE are provided in *Table 5.1*.

Table 5.1 RUSLE Soil Loss Calculations for the Site Work Areas

Site Location	Substation and 132kV switching station	Laydown Area 2	Southern Satellite Office / Laydown Area 3	Concrete Batch Plant	Operation and Maintenance Facility	Northern Construction Compound / Laydown Area 1
Disturbed catchment area (ha)[1]	1	0.7	1.5	0.5	1	1
RUSLE Factors						
Rainfall erosivity (R-factor)	1630	1630	1630	1630	1630	1630
Soil erodibility (K-factor)	0.05	0.05	0.05	0.05	0.05	0.05
Slope length (m)	100	100	100	100	100	100
Slope gradient (%)	7	10	6	2	6	6
Length/gradient (LS-factor)	2.02	1.03	1.68	0.44	1.68	1.68
Erosion control practice (P-factor)	1.3	1.3	1.3	1.3	1.3	1.3
Ground cover (C-factor)	1.0	1.0	1.0	1.0	1.0	1.0
Calculations						
Soil loss (m3/ha/yr)	165	266	137	36	137	137
Basin Required	Yes	Yes	No	No	No	No

1. Assumed that perimeter control will limit the catchment area to that of the disturbed catchment (through upslope diversion bunds).
2. Turbine locations have not been assessed – further discussion on turbine site and why the erosion hazard of these sites are low are provided in *Section 5.10.3.*

Figures contained in *Annex A* of the CEMP displays the location each of the aforementioned compounds and laydown yards.

5.2 DESIGN ARIS AND CALCULATION OF PEAK FLOWS FOR CONTROLS DEVICES

Many erosion and sediment devices, particularly those associated with the conveyance of concentrated water flows, must be designed for the predicted stormwater flows they will carry. This is to ensure that devices are sized to convey and remain stable during the predicted peak flows during the design storm event.

Landcom NSW (2004) (the "Blue Book") recommends average recurrence intervals (ARIs) for design of erosion and sediment controls as shown in *Table* 5.2. All earthworks, including waterways/drains/spillways and their outlets, will be constructed to be stable in at least the 10-year ARI, time of concentration (tc) storm event.

Table 5.2 Design ARIs in Years for Erosion and Sediment Controls

Control Measure Life	0-12 months	12-28 months	> 4 years
Diversion bank	1-10	10-20	Further design required
Level spreader	1-10	10-50	Further design required
Sediment trap	1-5	5-20	Further design required

1. Landcom (2004)

To calculate design flows requires knowledge of catchment areas as well as historical hydrological data on rainfall intensity, frequency and duration (IFD). An IFD table was developed for the site using the process outlined in Australian Rainfall and Runoff (Pilgrim, 1987) and a copy is provided in *Annex B*.

Data from the IFD table will be used to calculate peak flows and design control measures for individual catchments, during preparation of the Progressive ESCPs. Designs will be undertaken by suitably experienced personnel.

5.3 STAGING OF WORK

Works shall not commence in any area until the Progressive ESCP for the area has been approved by the ER and the relevant erosion and sediment controls described in the ESCP for that area have been installed. The appropriate order in staging of works is presented in *Table 5.4*.

5.4 WATER SUPPLY

Site water use will be predominantly for use in concrete batch plant and for dust suppression. The project will avoid the reliance on potable supplies as far as practicable. Arrangements are being negotiated for access to farm dam supplies and water access licences under Chapter 3 of the Water Management Act will be obtained for taking water from these water supplies. A nominal allowance will also be added to cover dewatering of groundwater seepage into excavations should the need arise.

5.5 EROSION CONTROL

Appropriate erosion control measures (in accordance with the relevant ESCP) will be implemented during construction activities as provided in *Table 5.4*.

5.6 STORMWATER MANAGEMENT

The stormwater management controls presented in *Table 5.4* will apply to all construction activities and will be utilised during construction.

5.7 SEDIMENT CONTROL

Sediment traps work most effectively by damming water and allowing sediment to settle under gravity in relatively quiescent conditions. As such, they will generally be installed in areas of sheet flow. Construction of sediment traps in areas of concentrated flow (eg drains, waterways) will be avoided, as they have limited effectiveness in these areas and can lead to scouring and unwanted damage.

A range of materials may be used to construct sediment traps, such as woven geotextiles, earth, rock, mulch or crushed concrete. Certified weed-free straw bales may also be used, but hay bales will be avoided as they provide a potential source of weed seeds.

The sediment control measures presented in *Table 5.4* will apply to all construction activities and will be utilised during construction.

5.7.1 Sediment Basins

Sediment basins have been included as a treatment method on the site where area for construction is available and the average annual soil loss as predicted by the RUSLE is greater than 150 cubic metres/hectare/year (Landcom, 2004).

The sediment basins will require stringent management of water quality parameters and capacities to ensure they operate at optimum efficiency and the potential for environmental impacts to downstream watercourses is minimised.

Water from the sediment basins can be used for construction activities such as dust suppression, meeting compaction requirements and watering revegetated/landscaping areas.

The sediment basins volumes provided in this ESCP represent the minimum recommended volume for the calculated catchment areas. Basins with greater volumes can be established to provide higher levels of protection or provide additional water sources for Project activities. In any case the required volume for the sediment settling zone is to be provided in between storm events.

Design Criteria

The sediment basin design procedure as outlined in Landcom (2004) was used to design the Type D/F sediment basins required on the site. Assumptions used in the design of the basins included:

- the design storm event was the 75%ile, 5 day storm event of 26.7mm for a construction period of each pad site of under three months (as interpolated from Table 6.3a of Landcom (2004) as the worst case for locations on the Northern Tablelands and North Western Slopes);

- the basins have been designed to the most stringent criteria of the soil types (Type D) given the description of the soil by GHD (2015) exhibiting dispersive characteristics;

- the upslope diversion bunds will be constructed prior to topsoil stripping commencing, thus reducing the disturbed catchment area available to generate runoff to be directed to a basin and treated;

- a volumetric runoff coefficient of 0.56 (worst case scenario of Soil hydrological Group D from Table C9 (Landcom 2004), design event of between 26 and 30mm, from Table F2 of Landcom 2004);

- a worst case scenario of slope length of 100m (maximum for most sites) and the worst case gradient observed within each site;

- the length to width ratio of the basin will be at least 3:1 where design permits (the use of baffles will be considered during the detailed design); and

- the treated discharge waters should not exceed 50 milligrams/litre (mg/L) of suspended sediment in the design storm event.

The sediment basin design characteristics are provided in *Table 5.3* and Standard Drawing SD6-4 of *Annex A*, displays design features of a Type D (wet) basin.

Table 5.3 Sediment Basin Design Characteristics

Site Name	Total Catchment Area (ha)	Settling zone Volume (m^3)	Sediment Storage Volume (m^3)	Total Basin Volume (m^3)
Substation and 132kV switching station	1	150	27	177
Laydown Area 2	0.7	105	31	136

Flocculation

The sediment basins have been designed based on the soil types of the Project site which are characterised by potentially dispersible soils (GHD 2015). Fine sediment particles require a long residence time within a basin or treatment to settle out, in comparison to larger sediment particles, while dispersible sediment requires treatment to settle out. The treatment method is flocculation with a flocculant (typically gypsum) to settle out the entrained sediment and allow for the basins to be discharged.

Desilting Sediment Basins

The basin sizing constitutes a sediment storage zone to store two months soil loss as determined by the RUSLE. Hence, the basin should be desilted every two months, if the basin has been required during storm events. A graduated marker will simplify the process of identifying if the capacity of the sediment storage zone. The capacity of the sediment storage zone is provided in *Table* 5.3. Residual water needs to be removed from the basin prior to desilting. Removed sediment needs to be stored in accordance with the stockpile management procedure outlined in *Section 5.19*.

5.8 ACCESS TRACKS

Sealing of the internal access track for 50m adjacent to the intersection with the Gwydir Highway and inclusion of a cattle grid to minimise tracking of sediment onto the public road system by construction vehicles.

Ilparran Road and Kelleys, to which all other proposed site access tracks connect to the public road network, are unsealed and as such the sealing of access tracks in these locations is not proposed.

Upgrades of the intersection with the public road network are in the process of being designed. The erosion and sediment controls outlined within this report are considered suitable for these works as well.

5.9 INTERNAL ROAD NETWORK

An internal unsealed road network will be constructed to allow access to each turbine locations and substation as shown in *Figure 3.2*. The network of access tracks will be constructed to provide access to each turbine, during construction and operation, as well as access to the control room and substation. Access tracks will be a minimum of 5 metres wide (wider at bends and passing lanes) and will be all weather graded gravel tracks.

As the site is made up of variable sloping topography, tracks would be located where possible to minimise construction difficulties and the need for constructed drainage. Cut and fill would be minimised as far as possible to limit the creating of batters that will be exposed to erosion, and to reduce the need for construction of formalised table drains. This can be achieved by locating tracks along topographic high points (eg ridge lines) and avoiding tracking across steep slopes. Where necessary in steeper areas tracks will be designed to a maximum slope of 10%. Where cut and fill is required, the fill will be compacted cut material from the site. If an additional material, such as gravel and rock, is required it will be sourced from local quarries.

Detailed design of the roads is yet to be undertaken. A Progressive ESCP will be prepared to manage impacts associated with road construction and operation and will utilise the best management practices outlined in this ESCP.

All sections of access track will have an ESCP and construction will not commence until the ESCP for the section of track has been approved by the ER.

5.9.1 *Unsealed Road*

The focus of erosion and sediment control for unsealed roads will be on maintaining good stormwater drainage. The primary aim is to ensure that stormwater is readily shed from the road surface and, most importantly, is not allowed to track longitudinally along the road for any great distance. Progressive ESCPs will be prepared for the unsealed roads once the detailed road and drainage designs are available.

The measures presented in *Table 5.4* will be considered and where practicable incorporated in the road design and Progressive ESCPs.

5.9.2 *Watercourse Crossings and Works in Waterfront Land*

The site plan for the wind turbines and associated infrastructure has been designed with particular emphasis on protecting existing streams and ephemeral watercourses. The layout avoids crossing or interfering with watercourses by any infrastructure. This is to avoid and minimise any adverse impacts to the areas drainage and hydrological regime.

Should alternative routes for access tracks be identified during construction, that require waterway crossing, the measures presented in *Table 5.4* and Standard Drawing SD5-1 of *Annex A*, will be implemented.

All works in waterfront land will consider the Department of Primary Industries – Water's 'Guidelines for Controlled Activities 2012' available at http://www.water.nsw.gov.au/water-licensing/approvals/controlled-activity. The guidelines outline what should be considered in the design and construction of watercourse crossings including the importance of maintaining natural hydraulic, hydrologic, geomorphic and ecological functions of the watercourse.

If required, consultation will be undertaken with NOW and Department of Primary Industries (Fisheries) regarding the design of roadway watercourse crossings (which in the first instance will be designed with reference to *Why do Fish Need to Cross the Road – fish passage – requirements for waterway crossings* (Fairfull and Witheridge, 2003).

5.10 MAJOR CONSTRUCTION SITES

Significant earthworks and construction activities will be required at a number of locations, particularly for the temporary construction facilities (site office temporary buildings, laydown area and batching plant), operation and maintenance facility, substation, switchyard and turbine sites. In these locations, the construction areas will be prepared as stabilised "pad" sites with an aggregate or concrete seal provided to support construction activities.

At these pad sites, to reduce erosion, aid trafficability and minimise down-time during wet weather, the ground surface will be compacted and stabilised as soon as is practicable. Where aggregate is used, the placement of aggregate over base materials will reduce erosion and loss of fines from the compacted base. Aggregate will need to be "topped up" or respread from time to time.

5.10.1 Substation and Switching Station Sites

The substation and switching station will require significant earthworks to establish the site suitable for construction. Typically a 132kV substation and a switching station will occupy an area of 100 x 100m respectively (EPURON 2011). The locations currently proposed are shown in *Annex A* of the CEMP. The erosion hazard assessment determined that these locations required sediment basins during construction given the area of disturbance and the slope of the land on which they are proposed to be constructed.

A Progressive ESCP will be prepared to manage the construction impacts at the substation site.

5.10.2 Site Compound and Laydown Area

Temporary site compounds and lay down area(s) will be established for construction and turbine equipment. The site compounds will include car parking, site offices, and amenities for the construction work force, and a lay down area for the temporary storage of construction materials, plant, equipment and wind turbine components. A temporary power supply will be required to be connected to the construction compound.

The site compound and lay down areas will be located in appropriate locations on the site which provide practical access to work areas and avoid environmentally sensitive areas such as watercourses. Locations will be agreed with the site landowners. Laydown Area 2 will require a sediment basin of sizing detailed in *Table 5.3*.

Progressive ESCPs will be prepared to manage construction impacts at the site compounds.

5.10.3 Wind Turbine Footings and Hardstands

Each wind turbine tower will be mounted on a concrete reinforced footing. These footings may be of a 'gravity type' or smaller 'anchored' footing. Installation of the footing requires excavation to 2 to 4 metres to provide adequate depth for the footing and to obtain a secure base for the footing. The area where the footing is excavated has dimensions of about 20 by 30 metres (600m^2).

The hardstand areas occur next to the turbine footing and provide the working platform on which a large crane will operate to erect the components of the wind turbine. The hardstand will occupy approximately 30m by 60m (1,800m^2).

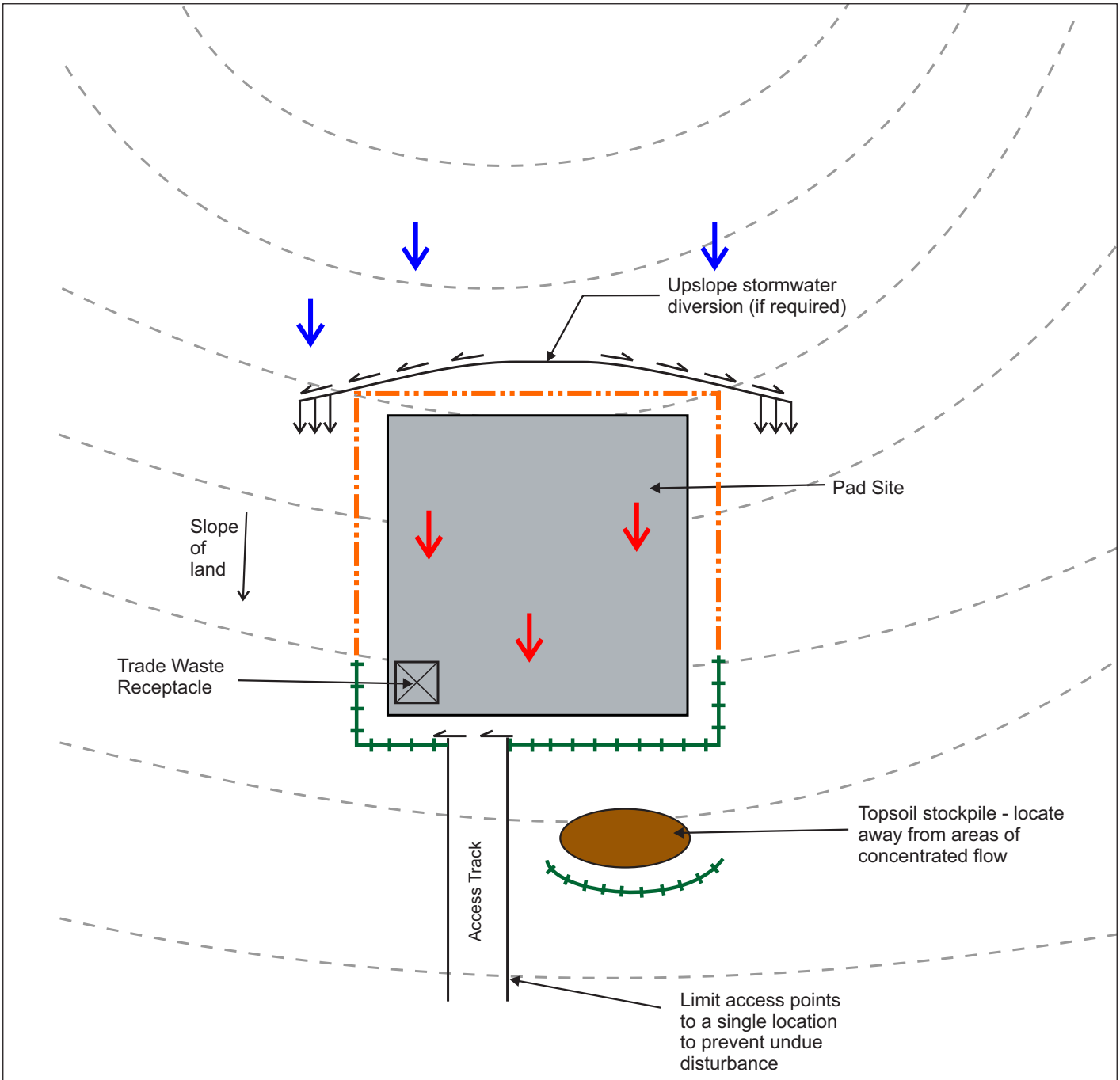
In general, the turbine sites do not normally require sediment basins due to the small area of disturbance and the relatively short turnaround in disturbing the site to stabilising with concrete or other hardstand alternative. ESCPs for the Turbine footing, hardstand, adjacent access track and 33kV cabling and any batters will identify the appropriate controls. Any turbine sites that present a risk of sediment outflow should be reviewed as to the need for additional small type 2 sediment controls.

Remaining excavated materials from footing excavation and hardstand cut will be used as fill, most likely at the turbine site or elsewhere around the site, in the construction of site access tracks or compacted equipment standing areas, subject to appropriate management to avoid the potential spread of weed species.

To secure hardstand and turbine footing sites, install erosion and sediment controls in the sequence provided in *Table 5.4*. *Figure 5.1* provides a generic erosion and sediment control plan for the turbine hardstand sites showing the indicative layout of controls.

The layout of controls at the substation, and site compounds should be similar, depending on landform, with the inclusion of a sediment basin at the low point of the substation/switching station site (with appropriate drains/bunds to convey site water to the basin).

Progressive ESCPs should be prepared for each of the key construction areas. *Figure 5.1* may be used as a guide for the sort of information that will need to be provided in the Progressive ESCPs.



Notes:

1. Monitor weather forecasts and avoid large ground disturbances prior to rain.
2. Install controls prior to disturbance.
3. Separate topsoil and subsoil during works.
4. Limit time of disturbance to minimum extent possible.
5. Progressively rehabilitate/stabilise as soon as possible.

Legend

- Earth Bank (refer to SD5-5)
- Level Spreader (refer to SD5-6)
- Sediment Fence (refer to SD6-8)
- Barrier Fence
- Topsoil Stockpile (refer to SD4-1)
- Clean Runoff
- Project Impacted Runoff
- Example Contours

N

Client:	Goldwind	
Drawing No:	0295776_WRWF_HA_C001_R0.cdr	
Date:	19/06/2015	Drawing size: A4
Drawn by:	JD	Reviewed by: TH

This figure may be based on third party data or data which has not been verified by ERM and it may not be to scale. Unless expressly agreed otherwise, this figure is intended as a guide only and ERM does not warrant its accuracy.

Figure 5.1 - Generic Erosion and Sediment Control Plan for Pad Site

White Rock Wind Farm Construction Soil and Water Quality Management Plan

Environmental Resources Management ANZ

Auckland, Brisbane, Canberra, Christchurch, Melbourne, Newcastle, Perth, Port Macquarie, Sydney

ERM

5.11 OTHER POLLUTION CONTROL AND WASTE MANAGEMENT MEASURES

All potentially contaminating materials used or stored on the site (e.g. fuel, oils) should be prevented from entering the groundwater or surface water systems. This will be achieved through control measures presented in *Table* 5.4.

5.12 TRENCHING

Approximately 46.75km of underground electricity cables linking each of the turbines to the substation, installed in a network generally following the access tracks as shown in *Figure 3.2*. In some areas trenching will need to cross watercourses. The final location would be determined during detailed design.

The 33kV underground cables would require a trench of 0.75 to one metre deep and be typically 0.3 to one metre wide, surrounded by sand for protection, and backfilled with the excavated material as soon as possible. A control and communications cable will be installed in the same trench as the electrical cable.

The erosion and sediment controls measures identified in *Table 5.4* will be applied to trenching activities.

Annex A of this CSWQMP provides a number of standard drawings describing erosion and sediment controls associated with trenching.

5.13 DEWATERING OF THE PROJECT SITE

Areas of the Project site may require dewatering during the lifetime of the construction activities. This may apply to:

- low lying depressions becoming inundated following a significant storm event;
- dewatering of open excavations following rainfall or minor seepage of groundwater; or
- dewatering of watercourses (if required) to allow for service installation (ie trenching) or installation of road crossings (culverts or causeways).

Discharged water has the potential to be contaminated with suspended sediment and therefore will be managed so that disposal does not contribute to water pollution. The controls measures identified in *Table 5.4* will be applied to during all dewatering activities.

5.14 CONCRETE BATCHING PLANT

At least one portable concrete batching plant would be required on site, to deliver the concrete requirements for the wind turbine foundations and other concrete slabs (e.g. substation and buildings). The concrete batching plants would produce up to 500 m^3 of concrete per day when a turbine foundation is being poured. The operational period would be for 14 months.

Suitable siting is of vital importance in minimising risks due to erosion and sedimentation during construction and the pollution hazard overall during operation. A concrete batching plant is likely to be sited at the northern end of the Project area on relatively level land. The position was selected to minimise potential impacts of the plant and provide an amenity buffer distance of at least 300m between the plant and sensitive receivers.

Due to the widespread extent of the site and difficulties operating a fleet of agitator trucks across the site and a significant part of the construction work being undertaken from the southern access point, a second batch plant may be operated at that location. Other batch plant sites, such as adjacent Turbine 20, may also be used for efficiency of works and to reduce impacts.

Siting will be assessed for consistency against MCoA E18 (refer to Location Criteria in CCAFMP) and also accord with the EPA Guidelines: *Environmental Guidelines for the Concrete Batching Plant Industry* (EPA, 1998), and will meet the criteria identified in *Table 5.4*.

5.15 SITE STABILISATION AND REHABILITATION

As far as practicable, works will be phased, so that manageable areas of land are exposed at any one time and ensure that site stabilisation measures are progressively installed throughout the development. Site stabilisation should be undertaken progressively as works are concluded in individual areas. The measures presented *Table 5.4* will be implemented during site stabilisation and rehabilitation works.

5.16 REQUIREMENT FOR PROGRESSIVE ESCPS

This CSWMQP will be supplemented by a series of Progressive ESCPs detailing individual control measures in key construction areas, and based on the detailed road and drainage plans. These will be prepared once the detailed design documentation is available and before works begin.

The Progressive ESCPs will be prepared in accordance with the measures presented in *Table 5.4*.

5.17 MITIGATION AND MANAGEMENT MEASURES

To achieve the soil and water quality management targets presented in *Section 4*, and meet all legal and other requirements, including MCoA and SoC presented in *Section 3,* the mitigation and management measures as identified in *Table 5.4* will be adopted. For each measure, key WRWFPL management personnel and accountabilities are provided.

Table 5.4 Mitigation and Management Measures

Factor	Management or Control Measure	Responsibility	When does this Apply?
Design ARIs and Calculation of Peak Flows for Control Devices	• all earthworks, including waterways/drains/spillways and their outlets, will be constructed to be stable in at least the 10-year ARI, time of concentration (tc) storm event in accordance with *Table 5.2*; • data from the IFD table (*Annex B*) will be used to calculate peak flows and design control measures for individual catchments, during preparation of the Progressive ESCPs. Designs will be undertaken by suitably experienced personnel; and • designs will be undertaken by suitably experienced personnel.	Construction Contractor	Preconstruction and during construction.
Staging of Works	• confine ingress to and egress from the site to as few as practical defined stabilised access points. Sediment or barrier fencing will be used to define the access point; • install sediment fence (downslope) and barrier fence (upslope) of all works areas to define the site and minimise unnecessary disturbance; • install upslope stormwater diversion drains and their stabilised outlets; • install additional sediment traps or sediment basins and their stabilised outlets as shown in the Progressive ESCP; • install earth banks or catch drains to divert runoff from construction areas to sediment traps; • clear the site and strip and stockpile topsoil and subsoil separately; • undertake essential construction works ensuring that erosion and sediment controls are regularly maintained and new controls installed as required, as works proceed; • connect roof stormwater systems to permanent drainage as soon as practicable; • on completion of construction works, replace topsoil and rehabilitate the site ensuring that permanent stabilisation is achieved within 20 days of completion of construction works; and • remove temporary erosion and sediment controls only after the areas that they protect are successfully stabilised.	Construction Contractor	Preconstruction and during construction.

Factor	Management or Control Measure	Responsibility	When does this Apply?
Erosion Control	• limit disturbance to two metres beyond the edge of any essential construction activity; • plan construction works to limit the amount of disturbed area at any one time; • provide a single stabilised site access point to each key construction area that is defined using sediment fence (downslope) and barrier fence (upslope). The access point should be stabilised by sealing with concrete or asphalt, or constructing a stabilised site access formed with loose rock fill (refer SD 6-14 in *Annex A*); • clearly visible and sturdy barrier fencing will be erected as shown in the Progressive ESCP Drawings and elsewhere at the discretion of the Site Environmental Officer to define essential construction areas and help minimise unnecessary disturbance by preventing vehicular (cars and construction machinery) and pedestrian access to restricted areas; and to help reduce wind and water erosion as a consequence. Barrier fencing will be installed upfront and before construction works commence in any given area; • divert clean stormwater from upslope of disturbed areas using earth banks or catch drains, and using energy dissipaters or level spreaders at their outlets as appropriate, to discharge stormwater in safe areas, avoiding erosion and flooding hazards. In some situations this requirement may be removed if there is minimal risk of run-on (for example on crests); • limit vehicular access to the site to that essential for construction work and ensure all vehicles park in designated areas that have been suitably stabilised (e.g. with road base); • before construction, strip topsoil and stockpile this for later use in rehabilitation; • forward stripping of vegetation and topsoils will be undertaken as close as possible (and no more than two weeks in advance of) commencement of bulk earthworks and other construction activities, in individual areas; • coordinate work schedules, if more than one contractor is working on a site, so that there are no delays in construction activities which would cause disturbed land to remain un-stabilised for longer than 2 weeks; • to prevent the spread of weeds, ensure weed-infested topsoil is kept separate from clean (weed-free) topsoil, is marked accordingly, and either buried under disturbed areas or removed for disposal at an appropriately licenced facility. Weed infested topsoil should not be used in rehabilitation; • stockpiles of topsoil (refer SD 4-1 in *Annex A*) will be located at least 5 m from areas of likely concentrated or high velocity flows, particularly the earth banks and roads. An additional buffer of at least 40 m	Construction Contractor	Preconstruction and during construction.

Factor	Management or Control Measure	Responsibility	When does this Apply?
	should be provided between stockpiles and natural waterways; • all areas of concentrated flow (diversion banks and waterways), will be designed by a suitably qualified person to convey and remain stable during the design storm event. Stabilisation with 350 gsm jute matting or equivalent may be required (refer SD 5-7 in *Annex A*); • during windy weather unsealed roads will be kept moist (not wet) by sprinkling with water to reduce wind erosion; • on completion of major works and before revegetation, reinstated subsoils should be left with a loose surface to encourage water infiltration and help with keying topsoil later. This will be very important on steeper slopes; and • final site landscaping will be undertaken as soon as practicable. Annual cover crops will be used to provide temporary cover and under-sown with the desired mix of perennial species. Revegetation details will be provided in the Progressive ESCPs.		
Stormwater Management	• divert clean stormwater away from areas to be disturbed by construction activities using earth banks or catch drains. For temporary banks construction is to follow SD 5-5 (*Annex A)* for earth banks (low flow). For permanent banks, construction is to follow SD 5-6 (*Annex A)* for earth banks (high flow). Clean water diversion banks should be installed upfront and before any earthworks commence in the areas they protect. Permanent diversion banks will be sized by a suitably qualified person, using hydrological data and design criteria provided at Section 5.5. Note that the need for upslope diversion may be removed where construction sites have minimal upslope catchment or the risk of stormwater run-on is low; • collect runoff from disturbed areas in earth banks or catch drains for diversion to sediment control structures as shown in the Progressive ESCP Drawings. For temporary banks, construction is to follow SD 5-5 (*Annex A)* for earth banks (low flow). For permanent banks, construction is to follow SD5-6 (*Annex A)* for earth banks (high flow); • install temporary earth diversion banks (refer SD 5-5 in *Annex A*) at the direction of the site manager to mitigate against unforseen erosion hazards, particularly when rain is forecast. These shall be used to shorten slope lengths, or to divert localised run-on away from high hazard areas (such as unstable batters);	Construction Contractor	Preconstruction and construction.

Factor	Management or Control Measure	Responsibility	When does this Apply?
	• check dams (SD 5-4 in *Annex A*) using rock aggregate, sandbags or geotextile "sausages" may be installed within drains and diversion channels to help reduce erosion, especially on steep sections. Care will be taken to ensure there is adequate provision for a spillway that allows flows to be retained within the diversion channel and not escape thereby potentially causing scouring and/or flooding of adjacent lands; • maintain slope lengths no greater than 80 metres in disturbed areas and preferably <50 metres on exposed road surfaces. To reduce slope lengths in construction areas install temporary earth diversion banks following SD 5-5 (*Annex A)*. On roads consider the use of cross banks and mitre drains to shed water from the surface; and • ensure roof water from site infrastructure is discharged in suitably stabilised locations to prevent erosion. Roof stormwater should be connected to the permanent drainage system as soon as practicable. Where buildings are without gutters, the ground surface beneath the roof drip-line should be stabilised with gravel or suitable non-erodible material.		
Sediment Control	• sediment traps shall be installed to treat runoff from disturbed areas and retain sediment as close as possible to its source; • when installing sediment traps, materials will be firmly anchored to the ground to prevent water passing under them. Adequate provision will be allowed for water to bypass the trap during larger storms without causing flooding or erosion of adjoining areas; • sediment fencing (refer SD 6-8 in *Annex A*) should be installed downslope of disturbed areas as shown on the Progressive ESCP Drawings and elsewhere at the discretion of the Site Environmental Manager, to retain the coarser sediment fraction; • sediment fences will have a return of 1 metre upslope at intervals of approximately 20 metres. Returns are installed to subdivide the catchment area of the sediment fence, to improve its effectiveness and help prevent structural damage during peak flows; • the catchment area of each section of fence should be small enough to limit flow if concentrated at one point to less than 50 L/s in the 10-year ARI storm event. This works out to be about 2,500 m2 at the site; • when installing sediment fence, place the fence as close as possible to along the contour, to provide a maximum surface area to the passage of stormwater;	Construction Contractor	Preconstruction and during construction.

Factor	Management or Control Measure	Responsibility	When does this Apply?
	• maintain sediment fence so that no more than 30 % of the design capacity is lost to accumulated sediment. This is achieved by removing sediment routinely; • dispose of all sediment removed from any trapping device in locations where further erosion and consequent pollution to downslope lands and waterways will not occur; • sediment basins are a specific type of sediment trap comprising large earth dams designed to capture runoff from disturbed areas, and are the most effective of all sediment trapping devices. They will be used only at the larger construction sites such as the substation site and concrete batching plant. Otherwise most of the work areas are relatively small and sediment control can be achieved using conventional sediment traps, without the use of sediment basins; and • detailed design and sizing of sediment basins, where required, will be included in the Progressive ESCPs.		
Access Tracks	• sealing of the internal access track for 50m adjacent to the intersections with the Gwydir Highway and Maybole Road, will be considered to minimise tracking of sediment onto the public road system by construction vehicles; • an agitator and wheel wash may be incorporated into or used instead of, the internal road sealing any water course crossings will be designed with pipe and culvert installations; • any access tracks requiring waterway crossing will require detailed design and will be developed by the construction contractors and associated Progressive ESCPs will be prepared; and • the ESCPs should specifically focus on measures to manage erosion in these high hazard areas though careful scheduling of work, management of stormwater and rapid rehabilitation of land disturbance.	Construction Contractor	Construction.
Internal Road Network	• a Progressive ESCP will be prepared to manage impacts associated with road construction and operation and will utilise the best management practices outlined in this ESCP.	Construction Contractor	Construction.

Factor	Management or Control Measure	Responsibility	When does this Apply?
Unsealed Roads	• as far as possible, locate tracks along ridgelines and in areas without large upslope catchments, to minimise the erosion hazard and drainage requirements; • limit the clearing width to the minimum that is practicable for the vehicles that will use the tracks and the associated cables co-located with the tracks; • retain any cleared vegetation (i.e. trees and shrubs) for use later in rehabilitation; • strip and stockpile topsoil separately for use in rehabilitation; • minimise cut and fill by constructing the road at-grade where ever possible; • ensure the road surface has a cross-sectional grade to allow free surface drainage and avoid excessive ponding and concentration of flow in wheel ruts; • employ outfall drainage where practicable to shed water over the downslope batter of the road, especially where the road alignment is generally parallel to the contours; • where the road is positioned along a crest or ridge use a crowned road surface that sheds water to both sides; • when grading roads, avoid the formation of windrows along the shoulders. These retain water on the road surface and increase erosion; • where table drains are used, ensure these are properly stabilised and install regularly spaced mitre drains to discharge water from drains, releasing this in well vegetated, stable areas, where necessary with energy dissipaters; • mitre drains shall be installed regularly to convey runoff from the road shoulders and any table drains to disposal areas away from the road alignment. As a general rule the maximum spacing between mitre drains should be 50m, however this may be further reduced in high erosion hazard areas (e.g. on steep slopes). Mitre drains should have a grade of no more than 5%. They should discharge to areas that are well stabilised and free of obstructions (e.g. large rocks, tree trunks); • cross-banks (or rollover banks) or cross-drains should be considered in in suitable locations to shed water from the road surface, discharging water in well vegetated, stable areas. Cross-banks are earth banks that extend across the road roughly perpendicular to the road alignment. They contain a bank and upstream channel to direct runoff across the road surface, to prevent the concentration of runoff along the road surface and reduce runoff velocities, thereby reducing erosion. These measures are highly useful where	Construction Contractor	Construction.

Factor	Management or Control Measure	Responsibility	When does this Apply?
	roads are aligned acutely to or perpendicular to the contours over long distances; and • stabilise road batters using a suitable combination of rolled erosion control products (RECPs) such as jute matting, mulching, spray-on stabilisation measures (e.g. hydromulching or bitumen emulsion) revegetation and hard armouring where required (e.g. within flow lines).		
Watercourse Crossings (if required)	• progressive ESCPs will be developed for all watercourse crossings (if required) and should specifically focus on measures to manage erosion in these high hazard areas through careful scheduling of work, management of stormwater and rapid rehabilitation of land disturbance; • as a minimum all watercourse crossings will be constructed in accordance with SD 5-1 in *Annex A*; and • all watercourse crossings (if required) will be designed and constructed in consultation with NOW and DPI (Fisheries) and consistent with DPI (Fisheries) guidelines, Policy and Guidelines for Fish Friendly Waterway Crossings (2004) and Why Do Fish Need to Cross the Road? Fish Passage Requirements for Waterway Crossings (2004). • Whilst a Controlled Activity Approval under the Water Management Act 2000 is not required for this project all works should be consistent with the Department of Primary Industries – Water's 'Guidelines for Controlled Activities 2012'. The guidelines outline what should be considered in the design and construction of watercourse crossings. It is important in the design of watercourse crossings the natural hydraulic, hydrologic, geomorphic and ecological functions of the watercourse are maintained.	Construction Contractor	Preconstruction and during construction.

Major Construction Sites (substation, site compound, laydown yard, tower foundations)	• construction areas will be prepared as stabilised "hardstand" sites with an aggregate or bitumen seal provided to support construction activities;
	• the ground surface will be stabilised with a suitable non-erodible base material such as compacted crushed sandstone, and overlain by durable aggregate;
	• progressive ESCP will be prepared to manage construction impacts at all construction sites;
	• to secure hardstand sites install erosion and sediment controls in the following sequence:
	  • install sediment fence downslope of all areas to be disturbed prior to any new land disturbance;
	  • stabilise batters as soon as practicable after formation;
	  • install barrier fence around perimeter of pad sites to define the work site and to confine land disturbance to the minimum practicable area;
	  • install sediment traps where recommended;
		Construction Contractor	Construction.

Factor	Management or Control Measure	Responsibility	When does this Apply?
	• install earth banks, catch drains and pipes where indicated to divert upslope (clean) stormwater around, or if absolutely necessary, through work areas. In doing so, ensure that measures are in place to prevent runoff from disturbed areas entering clean water drains; • install temporary culverts and waterway crossings as required to convey stormwater beneath roadways; • install earth banks and catch drains to capture runoff from disturbed areas and divert this to sediment traps and basins as indicated; • strip and stockpile topsoil progressively from areas being subjected to earthworks. Stockpile locations should be away from areas of stormwater drainage, vehicular traffic and sensitive lands (e.g. river banks and riparian areas); • install stabilised site accesses and temporary access tracks where indicated; and • proceed with construction and excavation works only once the above control measures are in place		
Pollution Control and Waste Management Measures	• bulk storage areas for fuels, oils and chemicals used during construction will be contained within an impervious bund to retain any spills of more than 110% of the volume of the largest container in the bunded area.; • any spillage will be immediately contained and absorbed with a suitable absorbent material; • storage will comply with AS 1940- 1993 The Storage and Handling of Flammable and Combustible Liquids; • emergency spill clean up kits will be maintained on-site in agreed locations (including close to storage locations and maintenance vehicles) that are accessible and known to all site workers; • spill kits will be used in the event of inadvertent spills of fuels, oils, hydraulic fluids and other hazardous wastes, to contain the spill and avoid contamination of waters; • workers will be trained in the use of spill kits; • contaminated soils shall be excavated and disposed by means to be authorised by the Site Construction Manager; • Material Safety Data Sheets (MSDS) for all chemicals stored on-site will be maintained by the Site Safety Officer and made available to site personnel. Site personnel will be informed of their location as a part of the site induction;	Construction Contractor, Site Construction Manager, Site Safety Officer	Construction.

Factor	Management or Control Measure	Responsibility	When does this Apply?
	• refuelling of equipment on-site or any other activity which could result in a spillage of a chemical, fuel or lubricant will be undertaken away from drainage/stormwater lines. In the event water is polluted by chemicals and/or firefighting materials (e.g. foams) the water will be collected, and disposed at an approved Liquid Waste Treatment Facility; • a designated refuelling area and procedures shall be established with drip trays installed and spill kits on stand-by. Should refuelling in the field be required, absorptive mats and drip trays are to be used in the refuelling process; • trade waste receptacles will be provided for the safe and efficient storage of all construction and miscellaneous wastes. Recyclable materials shall be separated and recycled where possible. Otherwise, disposable wastes will be removed from site regularly and disposed by approved means;		
Trenching	• where possible, avoid trenching in areas where water flow is likely to concentrate (e.g. diversion banks and watercourses); • employ direction drilling techniques instead of trenching to lay services across watercourses, if feasible; • limit the time trenches are open at any one location to less than three days and avoid opening trenches whenever storms are forecast. Storms can occur at any time of the year, so weather forecasts will be monitored; • use common trenching for the various service and drainage connections; • protect any nearby (downslope) drainage inlets with grass filter strips and/or sediment barriers until the trench line is rehabilitated; • remove and store vegetated topsoil (sod) so that it can be replaced on the trench to provide immediate erosion protection after backfilling is completed. Store topsoil separately from any subsoil overburden so that when the trench is to be refilled, the topsoil can be replaced above the subsoil; • ensure trench widths are the minimum needed to safely install the services; • retain any cut vegetation (i.e. trees and shrubs) for placement later along the easement during rehabilitation. Any cut trees should be placed across the slope to act as windrows and slow the flow of stormwater across the disturbed easement. The cut vegetation will in addition assist erosion control by protecting the soil surface. It will also provide habitat for small mammals and reptiles, and provide sheltered niches for establishment of native plants;	Construction Contractor	Construction.

Factor	Management or Control Measure	Responsibility	When does this Apply?
	• organise service installations to enable progressive backfilling; • when trenching parallel to site contours (across grade), soil from the excavation should be placed and compacted on the uphill side of the trench to form an earth bank. This is to prevent clean stormwater entering the trench (where after it must be managed as runoff from disturbed areas) by directing stormwater around and away from the open trench. This measure may be avoided where trenches are expected to be open for less than 24 hours and where the likelihood of rain is low; • when trenching perpendicular or obliquely to site contours (down grade): • use sandbags as plugs or bulkheads across trench inverts to shorten the length of stormwater flow in the trench (so reducing erosion of soils in the trench); • ensure plugs, collars or trench stops are employed to control tunnel erosion after backfilling is completed; • provide cross banks at regular intervals to prevent concentrated water flows along the finished (backfilled) trenchline; • backfill subsoil and compact to 95 per cent Standard Proctor. Then, replace topsoil and any sod to match surrounding ground levels. Provide an appropriate allowance for settling of uncompacted backfill material (e.g. 10%); and • after backfilling, remove excess or unsuitable spoil from the site.		
Dewatering Activities	• a water access licence will be obtained to cover the extraction of water from a water source should groundwater seepage to excavations require dewatering; • when pumping site impacted water out of construction areas the pump intake will be kept as close to the surface of pools as possible to avoid sucking sediments off the bottom; • discharging runoff to a natural waterway is generally not supported; however, may be undertaken if the water is first treated to ensure turbidity is below 30 Nephelometric Turbidity Units (NTUs) and is lower in total suspended solids (TSS) concentration than upstream locations and never exceeds the regulatory water quality standard. As a general rule, discharge waters should have a TSS < 50 mg/L and pH between 6.5 and 8.5 monitoring should be undertaken prior to discharge and records retained; • during dewatering, water with a high sediment load should, wherever possible, be directed to vegetated areas. Areas will be selected that have adequate capacity to effectively remove suspended solids and	Construction Contractor	Construction.

Factor	Management or Control Measure	Responsibility	When does this Apply?
	prevent pollution of receiving waters. Precautions will be taken to ensure that such areas don't become waterlogged. Runoff from these areas should not directly enter watercourses; • sediment control structures shall be used in areas where dense vegetation is not available, to facilitate sediment settling; and • other options that may be used include the use of dewatering bags that trap sediment. Alternately, site impacted water may be used by water carts for dust suppression.		

Batching Plant	• siting will be in accordance with MCoA E18 and the EPA Guidelines: Environmental Guidelines for the Concrete Batching Plant Industry (EPA, 1998), and will meet the following criteria:
	  • location in close proximity to proposed track network, to avoid additional track construction just for access to batching plant;
	  • location within the construction site to minimise the transport distances;
	  • location on an existing clear and level area, to minimise preparatory earthworks for levelling;
	  • avoidance of identified ecologically-sensitive areas;
	  • avoidance of established drainage lines, to minimise risk of contamination of watercourses. A minimum 50m buffer to all watercourses will be provided; and
	  • location away from either on-site or off-site dwellings to minimise potential noise impacts on sensitive receivers.
	• the batching plant will be designed and operated in accordance with the EPA guidelines, based on specific best practice environmental management approaches, detailed as follows:
	  • during construction, erosion and sediment controls will be provided in accordance with instructions provided in this Plan;
	  • a progressive ESCP will be prepared for the batching plant once final siting is decided and detailed design information and final drainage plans are available;
	  • separate stormwater collection and drainage systems will be provided to allow for discharge of clean stormwater (through a system designed to minimise local erosion) and collection and reuse of contaminated stormwater (through a first flush collection pit);
	  • a stormwater recycling system will be provided with capacity sufficient to store contaminated runoff generated by 20 mm rain within 24 hours, with operating management system to use collected wastewater as soon as possible (to maintain containment capacity);
		Construction Contractor	Construction and post construction.

Factor	Management or Control Measure	Responsibility	When does this Apply?
	• suitable compounds will be provided for the placement of waste concrete and mortar slurries (either at the concrete batching plant or at individual works compounds, or both). These may comprise shallow excavations that are suitably bunded to prevent stormwater ingress. Dried concrete will be disposed by an acceptable means; • a wash bay for concrete trucks will be provided. Water discharged from the wash bay will be encouraged to evaporate and/or infiltrate the soils, and any surplus flows will be directed to sediment traps; • wet weather stormwater discharges will be monitored for pH and suspended solids and records retained; • any excess contaminated waste water will be disposed of off-site by a licensed waste contractor; and • the area of the batching plant will be fully rehabilitated after the construction phase is completed.		
Site Stabilisation and Rehabilitation	• site stabilisation will be achieved using vegetation, rock armouring, paving, concrete or any other cover that protects the ground surface against erosion; • the preferred site stabilisation method will be identified on a site by site basis and included within the Progressive ESCPs. Advice from a soil conservationist and local agronomist should be sought during this process; • when selecting stabilisation methods a key factor that will be considered is the form of water runoff over the stabilised area. Areas subject to concentrated flow (ie watercourses and drains) will require different stabilisation techniques to those subject to sheet flow; • in most areas, revegetation will be the preferred method of stabilisation and it is likely that the revegetation goal will be to use pasture grasses, to achieve a similar condition and pasture species composition to present, so that the lands may continue to be used for grazing purposes; • the revegetation program will be dictated by climatic conditions and would generally not be commenced during winter and summer, when conditions may prevent successful establishment; • annual cover crops will be used to provide temporary cover and undersown with the desired mix of perennial species. Revegetation details will be provided in the Progressive ESCPs based on the CFFMP requirements;	Construction Contractor	Construction and post construction.

Factor	Management or Control Measure	Responsibility	When does this Apply?
	• to determine appropriate stabilisation techniques in areas of concentrated flow peak flows will be calculated and stabilisation designed accordingly, by reference to guidelines such as Landcom (2004) that provide advice for acceptable velocities within vegetated channels. This detail would be outlined in the Progressive ESCPs; and • hard armouring and use of geofabrics may also be required on steep batters and would be addressed in the Progressive ESCPs.		

Progressive ESCPs	• ESCPs will be prepared by a suitably qualified professional (preferably a soil conservationist) in association with construction personnel, to formulate practical documents for field reference. This process will allow consideration of specific construction methods and will provide a sense of ownership of the proposals to all parties;
	• ESCPs will be prepared for:
	  • different stages of construction (e.g. initial clearing, grubbing, topsoil stripping and stockpiling with revision for bulk earthworks);
	  • areas of high erosion hazard, particularly those associated with creek crossings; and
	  • key Project/construction areas such as access tracks; the wind turbine pads; vegetation clearing; watercourse crossings; concrete batching plant; trenching; laydown yard and compound area; and the substation compound.
	• ESCPs will be prepared on base plans that show contours and drainage paths, the constructed drainage network (if any), limits of disturbance and extent of earthworks, location of sensitive areas and location of control measures;
	• include documentation to explain the ordering and scheduling of works, particularly the order in which the erosion and sediment controls will be installed;
	• describe specific construction details, notes and operating procedures;
	• integrate with work procedures, work method statements, activity statements and their scheduling especially in relation to culvert and bridge construction;
	• be site-specific and will not generally repeat the information contained in this ESCP and/or the contractor's EMP;
	• be given a sequential number and recorded in a register for progressive ESCPs;
		Soil Conservationist, Construction Contractor	Prior to construction and updated as required during construction.

Factor	Management or Control Measure	Responsibility	When does this Apply?
	• be controlled and distributed in accordance with the contractor's quality system procedure for document control; • the Contractor will ensure that Progressive ESCPs are developed to cover works areas as detailed above, with a particular focus on high erosion hazard areas such as waterway crossings; • The ESCPs will be submitted at least one week prior to works commencing in the respective area. The ESCPs must be approved by the ER before work commences. • the Contractor will ensure that the Progressive ESCPs are regularly reviewed and changes implemented to manage the erosion hazard and prevent pollution at the site; • additional erosion and sediment control works will be installed as might become necessary, for example due to unforeseen events or site conditions. This may be particularly relevant to initiate repairs after severe rain events; and • all subcontractors will be informed of their responsibilities in minimising the potential for soil erosion and pollution to downslope areas. Appropriate training will be provided during site inductions and tool-box talks.		

5.18 UNEXPECTED DISCOVERY OF CONTAMINATED MATERIAL PROCEDURE

1. Potential Contaminated Soil / Material Encountered during Construction Activities

The Environmental Assessment (EPURON, 2011) did not identify any areas of contamination that could be uncovered during construction. Further consultation with involved property owners will be undertaken in relation to areas of land potentially contaminated by past land use and manage impacts in these areas to avoid affecting the any areas of contamination.

Notwithstanding the above, unexpected contamination finds may arise during the course of construction works. If potential contaminated soil / material is encountered during excavation / construction activities:

- STOP ALL WORK in the immediate/affected area;
- immediately notify the Site Construction Manager and Site Environmental Officer; and
- recommence works in an alternate area where practicable.

2. Personal Protective Equipment (PPE)

Prior to any contamination investigation/management, appropriate personal protective equipment (PPE) is to be worn as per the relevant Safety Data Sheet(s) (SDS). This may include, but not be limited to:

- Eye goggles;
- Face mask;
- Rubber boots;
- Rubber gloves; and
- Work clothes (i.e. long sleeve shirt/pants and steel capped boots).

3. Undertake a Site/Area Contamination Investigation

The Site Environmental Compliance Officer is to assess the situation and if considered necessary, commission a suitably qualified contamination specialist to undertake a contamination investigation in the area of the find.

The Site Environmental Compliance Officer (in consultation with specialists) will determine the appropriate management measures to be implemented. This may include treatment or offsite disposal. If the material is to be disposed of offsite, ensure the waste facility is appropriately licensed and waste is recorded in the waste register as per the requirements of the CEMP. The material is to be classified in accordance with the Waste Classification

Guidelines (NSW EPA, 2014). A Contaminated Site Assessment report with remediation recommendations is to be provided to the Environmental Representative.

4. Remedial Action

Remedial actions are to be incorporated into specific Environmental Work Method Statements (EWMS) and training provided to site personnel and subcontractors through inductions and toolbox training sessions.

Remedial works are to be undertaken in line with the EWMS.

5. Recommence Works

Works will only recommence, once remedial works have been implemented, the results have been verified as acceptable and the Site Environmental Compliance Officer grants approval to do so following consultation with the Environmental Representative.

5.19 SPOIL AND FILL MANAGEMENT PROCEDURE

1. Classification of Spoil

Construction of the Project will involve excavation of materials at each construction area. For the purposes of this Procedure the excavated material is broadly categorised into the following classifications.

Topsoil

Topsoil is an important resource for the final rehabilitation and landscaping of the Project. To achieve a successful landscape and revegetated outcome relies upon the proper management of topsoil during the construction phase.

Virgin excavated natural material (VENM)

VENM will be encountered in the majority of the Project site that has not in any way been impacted by development or industry. During the Project VENM will be confirmed as clean through visual observation of landform, understanding of past land uses and based on findings from the geotechnical reports and site assessments.

Fill material (classified as Excavated Natural Material – ENM)

ENM Fill materials will be encountered in areas typically associated with previously developed lands (e.g. road embankments of existing roads).

Recovered Materials

The Project may seek to reuse materials recovered during construction. This may include:

- recovered aggregates;
- reclaimed asphalt pavement; and
- excavated public road material (EPRM).

Recovered resource use must comply with the relevant resource recovery orders and exemptions.

Potentially Contaminated Material

Potentially contaminated material identified during the course of the Project will be handled in accordance with the Unexpected Discovery of Contaminated Material Procedure.

2. Reuse On-site

Topsoil

Topsoil assessed as clean, and fertile will be stockpiled for reuse on site during revegetation and rehabilitation works.

Surplus topsoil that is considered to be poor quality or contaminated with weed species may be reused on site and buried in noise mounds, visual barriers or landscaping mounds/features.

VENM

The Project can reuse material on-site. Material that has been classified as VENM can be transferred to another site. No sampling or testing is required if the material is being re-used within the Project site or verified as VENM and an EPA certification issued.

If there is evidence that potentially contaminating activities previously took place on or adjacent to the excavation site then material should not be reused or certified as VENM. If there is a potential that the material is contaminated, it is must be tested and classified according to the Waste Classification Guidelines, DECCW 2014 and disposed at an appropriately licenced facility.

Fill Material

Fill materials including ENM and recovered resources can be reused within the Project for construction. If surplus material occurs, the reuse of these materials outside of the Project must conform with the Resource Recovery Exemptions of the Protection of the Environment Operations (Waste) Regulation 2014.

Contaminated Material

In accordance with the appropriate remedial actions of the Unexpected Discovery of Contaminated Material Procedure, potentially contaminated materials may be stockpiled on-site separately and resultant excavations validated to confirm removal of contaminated materials from the excavated area. If contaminated soils are intended for reuse, these stockpiled soils must be remediated and validated for suitable re-use on site. In most cases, the contaminated spoil will be disposed of off-site at a suitably licenced waste disposal facility.

3. Reuse and Disposal Off-site

Reuse off-site will only occur for material surplus to Project needs (ie spoil) or if the material is unsuitable for on-site placement. Preference for uncontaminated surplus spoil will be for offsite reuse purposes in accordance with the principles of the Resource Recovery Exemptions.

If rocks are to be reused for drain lining within the site but on different properties a method will be developed to ensure weed transfer does not occur.

Reuse and disposal of all spoil from the site must be classified in accordance with the NSW OEH Waste Classification Guidelines, Part 1: Classifying Waste (NSW EPA, 2014) or relevant resource recovery exemption. Records of all waste handled will be retained in the waste register in accordance with the CEMP.

4. Spoil and Fill Storage

Stockpiles will be established and managed in accordance with the ESCPs. Where possible, topsoil, mulch and fill to be used for construction will be placed in the location it is required to prevent double handling. Mitigation measures for each stockpile site include as a minimum:

- the perimeter of the stockpile (excluding vehicle access points) will be delineated with a bund (made out of earth/RAP or similar) or other type of fencing or barrier such as sediment fence;
- materials will not be stockpiled under the drip line of trees or native vegetation to be retained, and never pushed up around the base of trees;
- erosion and sedimentation controls will be erected between the site and any drainage lines or down-slope areas, an Erosion and Sediment Control Plan will be prepared or adjustments made to the existing Progressive ESCP;
- a diversion bund will be installed on the uphill side of the stockpile to divert water around the site;

- stockpiles of topsoil containing noxious weeds will be kept separate and signage placed, the topsoil may be buried on site in noise/visual mounds or treated in-situ;

- short-term stockpiles will be covered with plastic or kept damp to control dust where required. Long-term stockpiles (i.e. to remain for greater than 4 weeks) will kept to a maximum height of 2 metres and be stabilised with cover crop or similar within 7 days of the completion of stockpiling; and

- dust management measures (including for vehicle movements associated with stockpiling activities) will be implemented in accordance with the requirements of the air quality management measures presented in Section 6.7.1 of the CEMP.

5. Spoil and fill transportation

Transport and haulage of earthwork materials will be undertaken in accordance with the CTAMP.

5.20 TRAINING AND AWARENESS

WRWFPL will ensure that all personnel responsible for the implementing this CSWQMP are competent on the basis of education, training and experience.

All site personnel (including sub-contractors) will be provided with environmental training appropriate to their scope of activity and level of responsibility. General staff and contractors will be inducted to the Project with training provided on potential soil and water quality impacts. Details of the soil and water quality training and induction will focus on:

- objectives of the CSWQMP;

- performance goals;

- mitigation measures required to be implemented;

- soil and water quality monitoring and reporting requirements; and

- incident investigation and response.

Training is to be provided prior to start-up of any construction activities and updated if task, equipment or procedures are expected to, or have changed.

6 INSPECTION AND MONITORING

Essential to an effective system of sediment control devices, is an adequate inspection, maintenance and cleaning program. Inspections, particularly during storms, will show whether devices are operating effectively. Where a device proves inadequate, it should be quickly redesigned to make it effective (EPA, 1996).

The Site Construction Manager or Site Environment Officer will inspect the site paying particular attention to:

- ensuring barrier fencing is maintained and exclusion zones are being observed by all site workers and contractors;
- waste receptacles are emptied regularly in a manner approved by the site superintendent;
- constructing additional erosion and/or sediment control works as might become necessary to ensure the desired erosion and sediment control is achieved, i.e. make ongoing changes to the Plan;
- maintaining erosion and sediment control measures in a functioning condition until all earthworks are completed and the site is rehabilitated;
- removing trapped sediment and disposing this in safe areas;
- where concern is raised over stability of creek crossings, turbidity upstream can be monitored and compared with downstream;
- ensuring progressive and prompt rehabilitation of lands, that rehabilitation has effectively reduced the erosion hazard and that repairs or upgrades are initiated as appropriate; and
- removing temporary soil conservation structures as the last activity in the rehabilitation program.

It is recommended that an appropriately skilled Environmental Scientist or Soil Conservationist be consulted to undertake regular inspections of the erosion and sediment controls and to advise on necessary changes, to help ensure the success of the erosion and sediment control program. A recommended inspection guideline is provided in *Table 6.1*.

Table 6.1 Recommended Inspection Guideline

Installation	Problem	Frequency of inspection	Remedial action
Sediment controls, silt fences and traps	Ineffective control of sediment Poor design causing scouring around controls	Weekly in dry weather Within 24 hours of significant rainfall events (nominated as >20 mm in any 24-hour period)	Remove sediment from trap Replace/repair barrier or filter material where damaged Redesign control if ineffective or causing erosion Improve maintenance
Haul roads	Soil on haul roads Erosion on unsealed roads Dust generation on unsealed roads	Weekly in dry weather Within 24 hours of significant rainfall events (nominated as >20 mm in any 24-hour period)	Install wheel wash and rumble Grid Manually wash vehicle wheels Increase road cleaning frequency Regularly grade and maintain unsealed roads, and consider paving in problem areas; Install new drainage (eg cross banks, mitre drains) to improve problem areas
Cut-off and diversion drains	Water not diverted away from sensitive areas Erosion in drains Erosion at outlets	Weekly in dry weather Within 24 hours of significant rainfall events (nominated as >20 mm in any 24-hour period)	Replace or repair damaged drains Redesign ineffective drains Relocate incorrectly placed drains Line eroding drains and outlets with erosion-resistant materials
Stream crossings	Unstable Erosion of bed and banks mobilising sediment into stream	Weekly in dry weather Within 24 hours of significant rainfall events (nominated as >20 mm in any 24-hour period)	Stop use until installation has been redesigned Re-stabilise eroding areas employing geofabrics and hard armouring as required
Stockpiles and bare slopes	Erosion	Weekly in dry weather Within 24 hours of significant rainfall events (nominated as >20 mm in any 24-hour period)	Minimise exposure to water and wind erosion Ensure long term stockpiles are effectively stabilised

1. Modified from Victorian EPA (1996) *Environmental Guidelines for Major Construction Sites*.

7 REPORTING, INCIDENT MANAGEMENT AND REVIEW

7.1 REPORTING

All necessary reporting would be prepared and documented, covering inspection and monitoring requirements, findings and inspection times. Internal notifications and reporting regarding incidents will be done in accordance with the WRWF HSE Reporting and Investigation Procedures. All records of environmental complaints and non-conformances will be forwarded to the ER who will be involved in all investigations and approval of corrective actions to the extent required by the MCoA.

Consultants may also be required to prepare environmental reports in consultation with the head construction contractor. For example, a soil conservation consultant may be engaged to assist in the preparation of Progressive ESCPs for individual components of the construction Project.

7.2 INCIDENT MANAGEMENT

All environmental incidents (including those related to soil and water management issues) on the Project will be managed in accordance with the incident response process described in Sections 4.3 and 4.4 of the CEMP. This includes internal and external notification, recording, reporting and response processes.

7.3 CORRECTIVE ACTIONS

Where planning, checks, monitoring or testing identify that an exceedance of criteria has occurred, or a validated complaint was received, an incident report and set of corrective actions will be raised by the construction contractor (e.g. in their Health, Safety and Environmental Management System) and immediately reported to the Site Environmental Officer.

Measures already implemented, additional measures to be implemented as a result and any corrective actions will be identified and reported to the Development Compliance Manager. Actions will be implemented to the satisfaction of the Development Compliance Manager and their effectiveness confirmed to demonstrate appropriate measures have been implemented to prevent reoccurrence of impacts, as far as practical.

7.4 CSWQMP REVIEW

As with the overall CEMP, the CSWQMP will be a working document that requires review and amendment during the life of the Project. The Development Compliance Manager shall undertake a review of the CSWQMP where:

- an audit makes findings or recommendations identifying a need;
- there is a significant change to the construction schedule, the site layout or a change in the construction methodology;
- site based conditions require a change to the environmental controls and procedures identified within the CSWQMP;
- an environmental incident occurs that requires corrective actions to be incorporated in the CSWQMP; and
- directed to do so by the Environmental Representative acting within the requirements of the MCoA.

The review shall consider the environmental controls and procedures set out within the CSWQMP to make sure the environmental controls and procedures remain applicable to the activities being carried out.

Any recommendations from the review will be reported to the Site Project Manager and ER and (following adoption) be communicated to relevant stakeholders. The ER can approve CSWQMP updates if they meet the criteria nominated in Section 2.3.5 of the CEMP.

Changes to the CSWQMP will be communicated through toolbox talks to existing onsite personnel and be incorporated into environmental induction material.

REFERENCES

ANZECC (2000) Australian and New Zealand Guidelines for Fresh and Marine Water Quality Guidelines.

Department of Primary Industries – Water (2012) Guidelines for Controlled Activities 2012.

EPURON (2011) White Rock Wind Farm – Environmental Assessment.

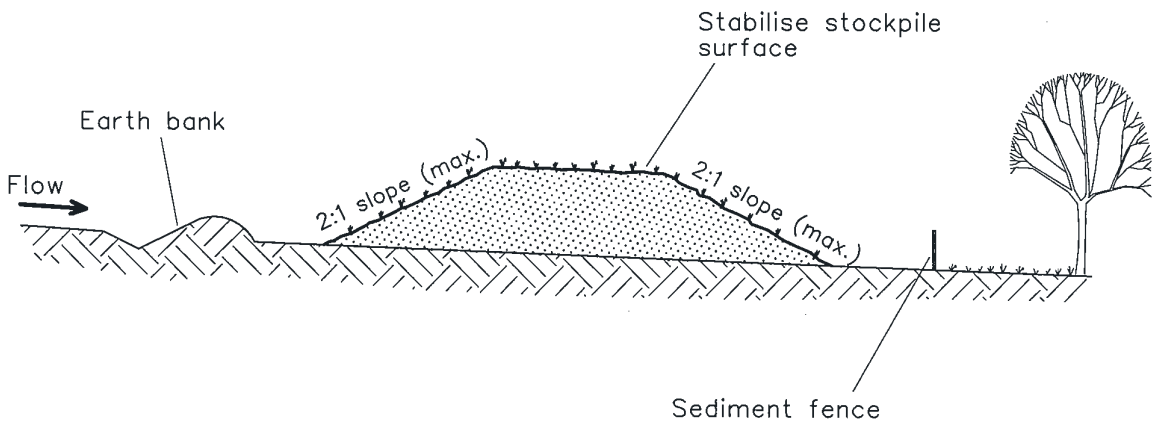
GHD (2015) White Rock Wind Farm-Preliminary Geotechnical Investigation Report.

Goldwind Australia (2015) White Rock Wind Farm Modification Application MP10_160 MOD3, Environmental Assessment Report.

Landcom (2004) Managing Urban Stormwater Soils and Construction (Volume 1, 4th edition).

Annex A

Standard Drawings (Landcom 2004)



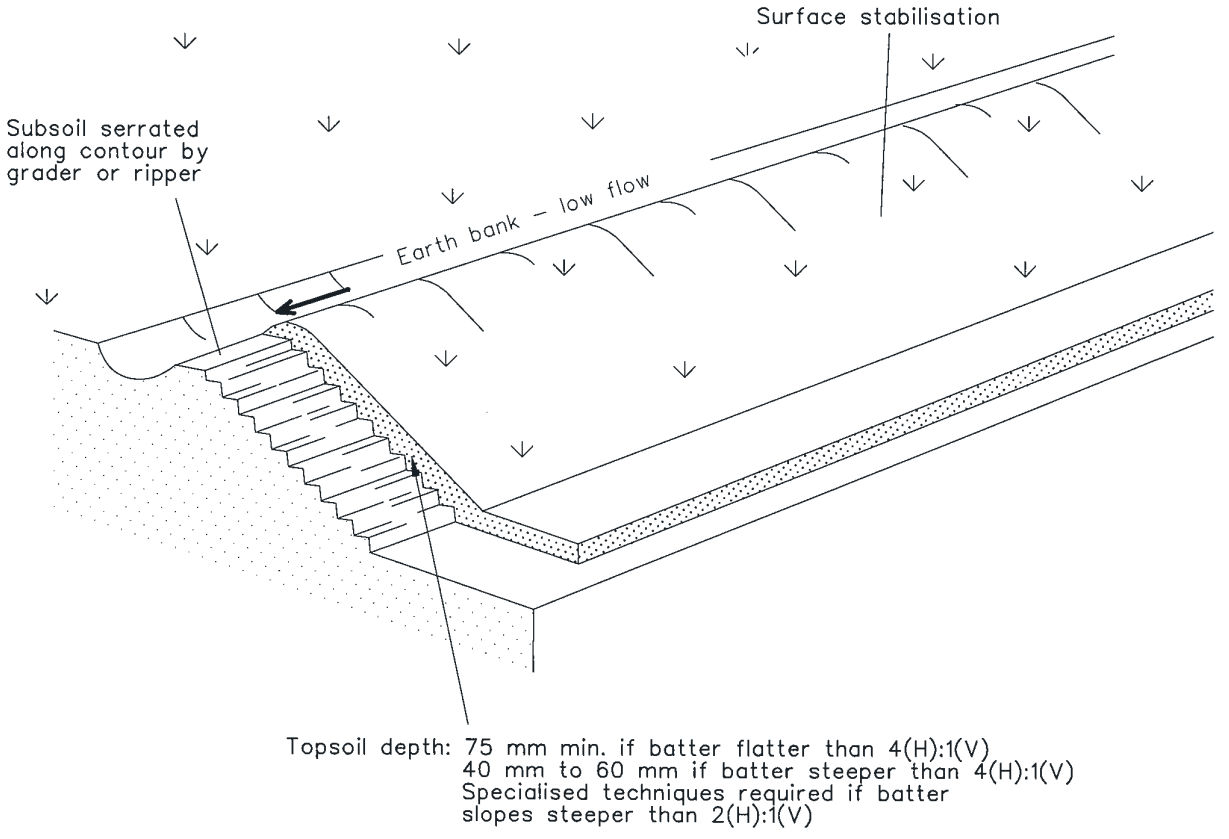
Construction Notes

1. Place stockpiles more than 2 (preferably 5) metres from existing vegetation, concentrated water flow, roads and hazard areas.
2. Construct on the contour as low, flat, elongated mounds.
3. Where there is sufficient area, topsoil stockpiles shall be less than 2 metres in height.
4. Where they are to be in place for more than 10 days, stabilise following the approved ESCP or SWMP to reduce the C-factor to less than 0.10.
5. Construct earth banks (Standard Drawing 5-5) on the upslope side to divert water around stockpiles and sediment fences (Standard Drawing 6-8) 1 to 2 metres downslope.

STOCKPILES

SD 4-1

SOURCE: Managing Urban Stormwater, Soils and Construction (Vol 1, 4th ed.)



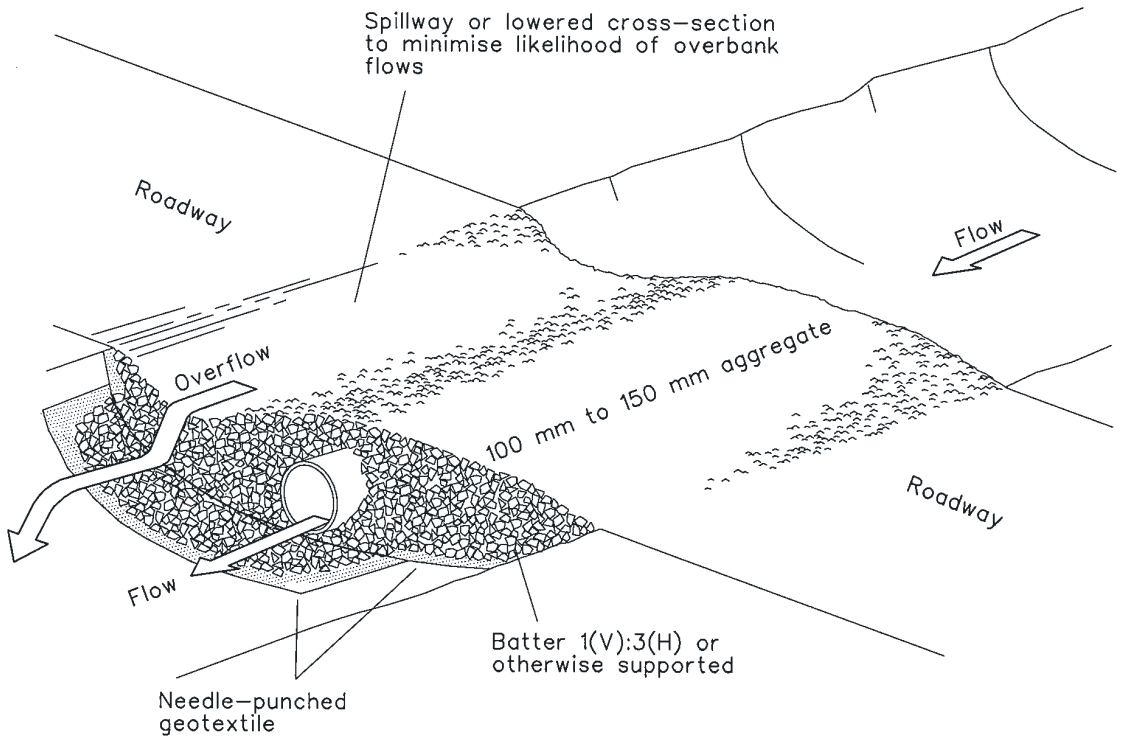
Construction Notes

1. Scarify the ground surface along the line of the contour to a depth of 50 mm to 100 mm to break up any hardsetting surfaces and to provide a good bond between the respread material and subsoil.
2. Add soil ameliorants as required by the ESCP or SWMP.
3. Rip to a depth of 300 mm if compacted layers occur.
4. Where possible, replace topsoil to a depth of 40 to 60 mm on lands where the slope exceeds 4(H):1(V) and to at least 75 mm on lower gradients.

REPLACING TOPSOIL

SD 4-2

SOURCE: Managing Urban Stormwater, Soils and Construction (Vol 1, 4th ed.)

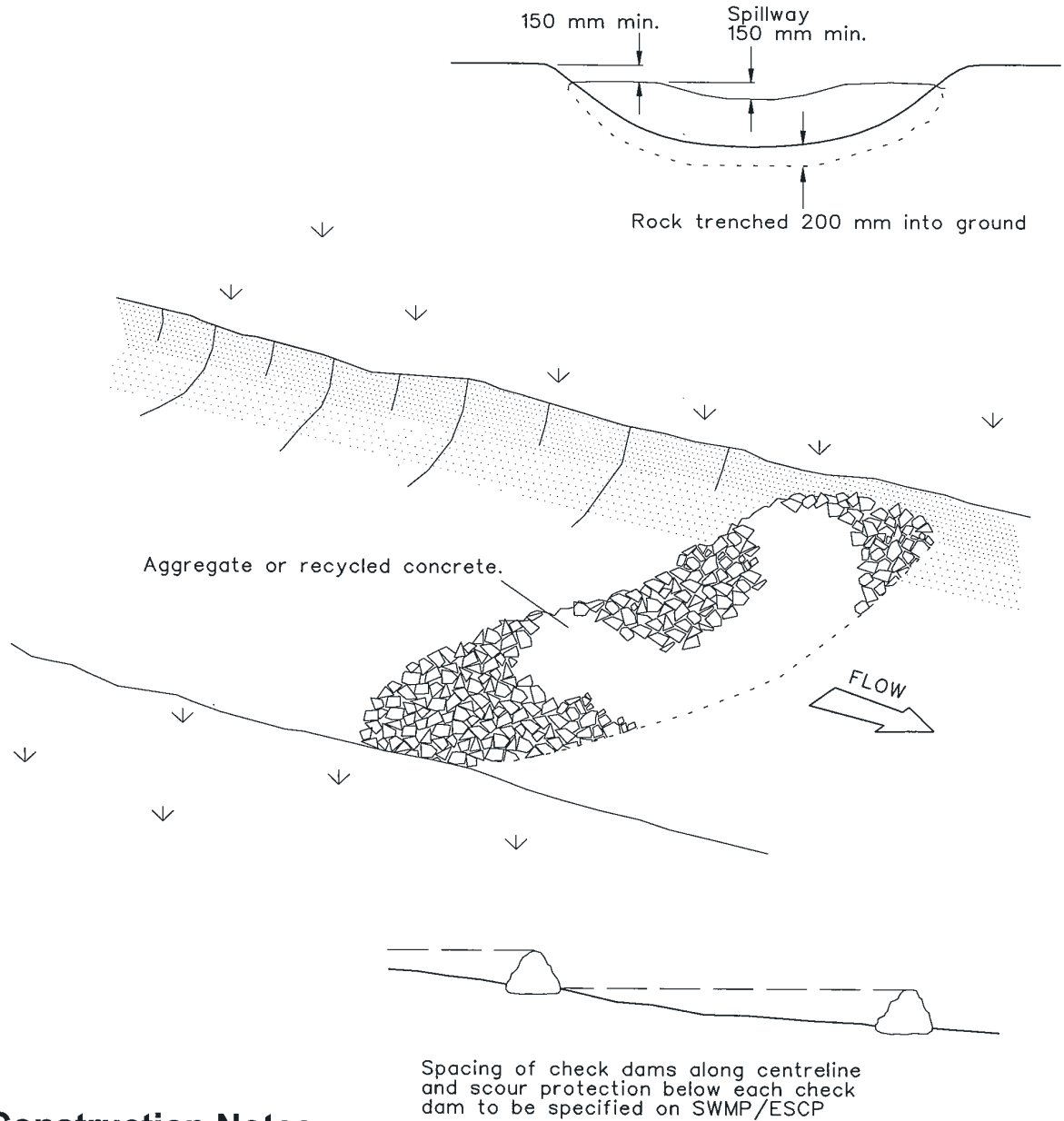


Construction Notes

1. Prohibit all traffic until the access way is constructed.
2. Strip any topsoil and place a needle-punched textile over the base of the crossing.
3. Place clean, rigid, non polluting aggregate or gravel in the 100 mm to 150 mm size class over the fabric to a minimum depth of 200 mm.
4. Provide a 3-metre wide carriageway with sufficient length of culvert pipe to allow less than a 3(H): 1 (V) slope on side batters.
5. Install a lower section to act as an emergency spillway in greater than design storm events.
6. Ensure that culvert outlets extend beyond the toe of fill embankments.

TEMPORARY WATERWAY CROSSING SD 5-1

SOURCE: Managing Urban Stormwater, Soils and Construction (Vol 1, 4th ed.)



Spacing of check dams along centreline and scour protection below each check dam to be specified on SWMP/ESCP

Construction Notes

1. Check dams can be built with various materials, including rocks, logs, sandbags and straw bales. The maintenance program should ensure their integrity is retained, especially where constructed with straw bales. In the case of bales, this might require their replacement each two to four months.

2. Trench the check dam 200 mm into the ground across its whole width. Where rock is used, fill the trenches to at least 100 mm above the ground surface to reduce the risk of undercutting.

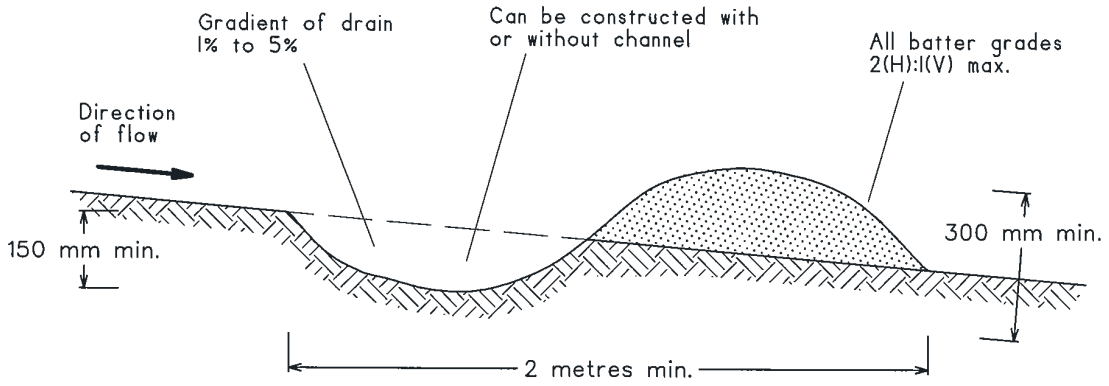
3. Normally, their maximum height should not exceed 600 mm above the gully floor. The centre should act as a spillway, being at least 150 mm lower than the outer edges.

4. Space the dams so the toe of the upstream dam is level with the spillway of the next downstream dam.

ROCK CHECK DAM

SD 5-4

SOURCE: Managing Urban Stormwater, Soils and Construction (Vol 1, 4th ed.)



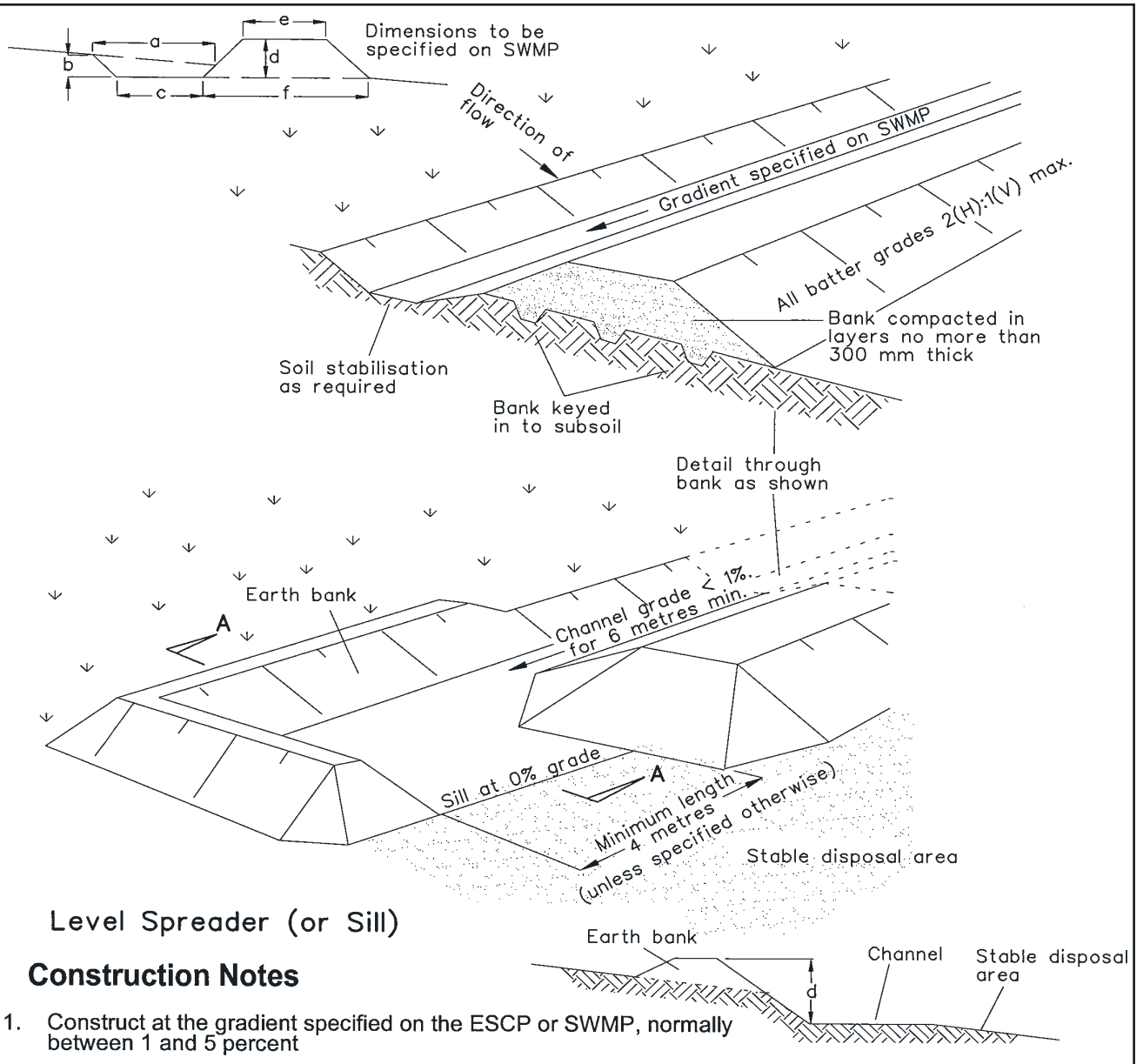
NOTE: Only to be used as temporary bank where maximum upslope length is 80 metres.

Construction Notes

1. Build with gradients between 1 percent and 5 percent.
2. Avoid removing trees and shrubs if possible - work around them.
3. Ensure the structures are free of projections or other irregularities that could impede water flow.
4. Build the drains with circular, parabolic or trapezoidal cross sections, not V shaped.
5. Ensure the banks are properly compacted to prevent failure.
6. Complete permanent or temporary stabilisation within 10 days of construction.

EARTH BANK (LOW FLOW) SD 5-5

SOURCE: Managing Urban Stormwater, Soils and Construction (Vol 1, 4th ed.)



Level Spreader (or Sill)

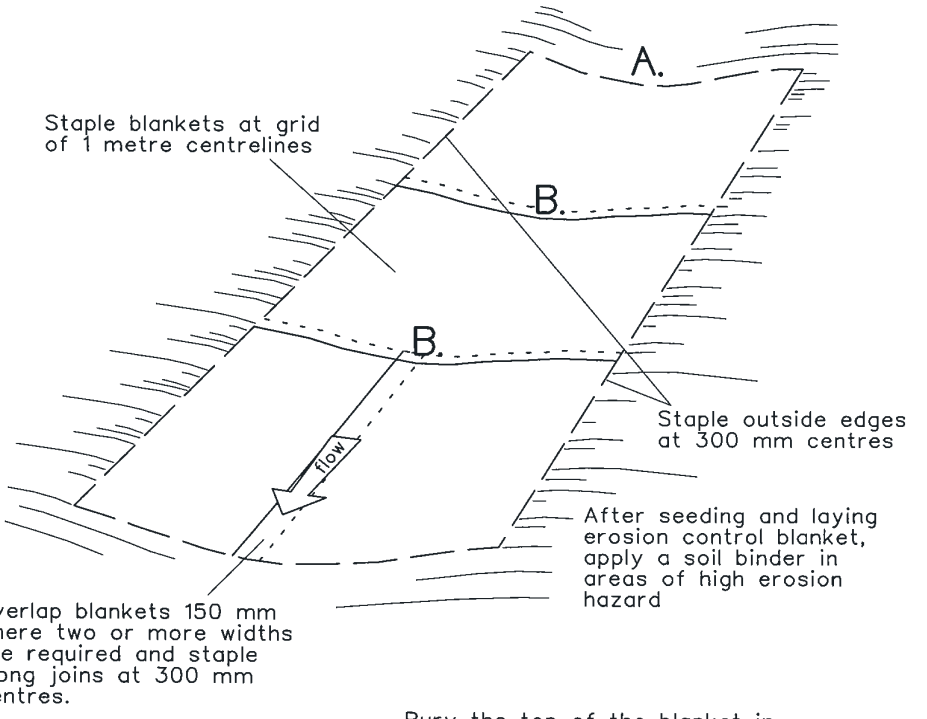
Section AA

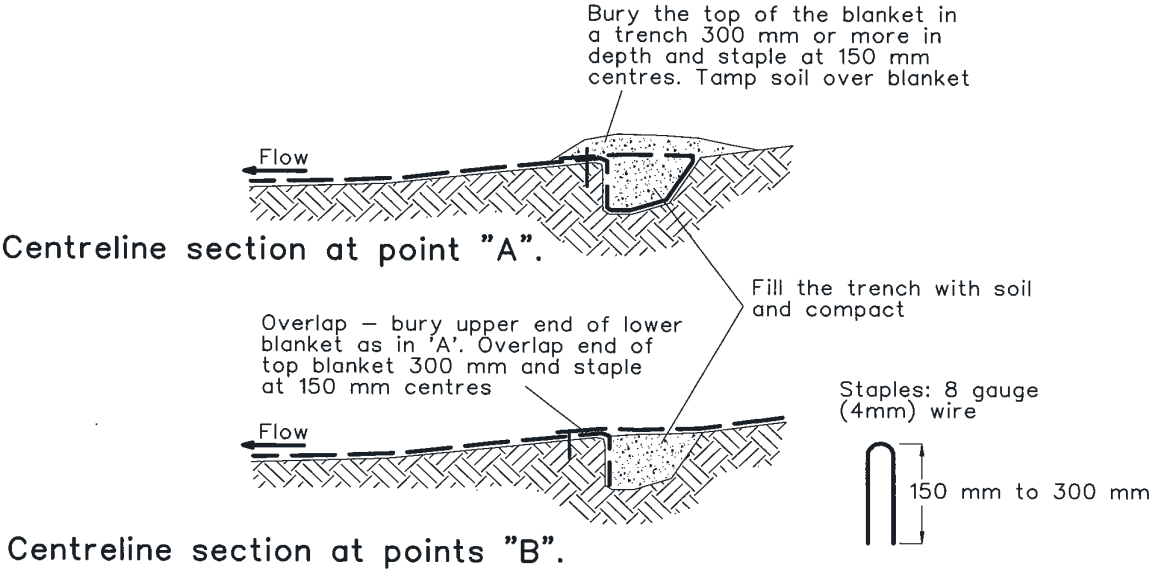
Construction Notes

1. Construct at the gradient specified on the ESCP or SWMP, normally between 1 and 5 percent
2. Avoid removing trees and shrubs if possible - work around them.
3. Ensure the structures are free of projections or other irregularities that could impede water flow.
4. Build the drains with circular, parabolic or trapezoidal cross sections, not V-shaped, at the dimensions shown on the SWMP.
5. Ensure the banks are properly compacted to prevent failure.
6. Complete permanent or temporary stabilisation within 10 days of construction following Table 5.2 in Landcom (2004).
7. Where discharging to erodible lands, ensure they outlet through a properly constructed level spreader.
8. Construct the level spreader at the gradient specified on the ESCP or SWMP, normally less than 1 percent or level.
9. Where possible, ensure they discharge waters onto either stabilised or undisturbed disposal sites within the same subcatchment area from which the water originated. Approval might be required to discharge into other subcatchments.

EARTH BANK (HIGH FLOWS) SD 5-6

SOURCE: Managing Urban Stormwater, Soils and Construction (Vol 1, 4th ed.)



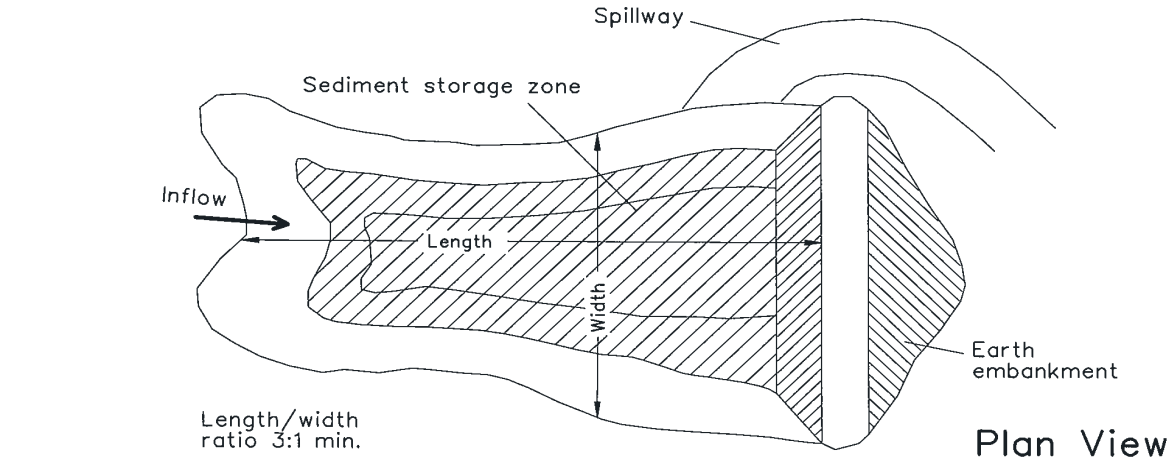


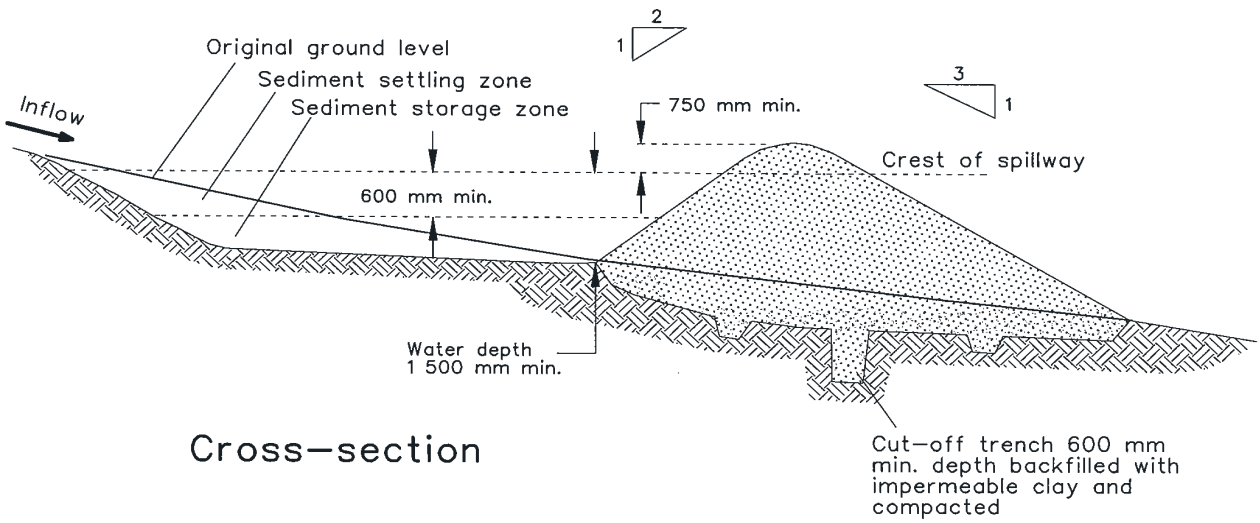
Construction Notes

1. Remove any rocks, clods, sticks or grass from the surface before laying matting
2. Ensure that topsoil is at least 75 mm deep.
3. Complete fertilising and seeding before laying the matting.
4. Ensure fabric will be continuously in contact with the soil by grading the surface carefully first.
5. Lay the fabric in "shingle-fashion", with the end of each upstream roll overlapping those downstream. Ensure each roll is anchored properly at its upslope end (Standard Drawing 5-7b).
6. Ensure that the full width of flow in the channel is covered by the matting up to the design storm event, usually in the 10-year ARI time of concentration storm event.
7. Divert water from the structure until vegetation is stabilised properly.

RECP : CONCENTRATED FLOW — SD 5-7

SOURCE: Managing Urban Stormwater, Soils and Construction (Vol 1, 4th ed.)





Construction Notes

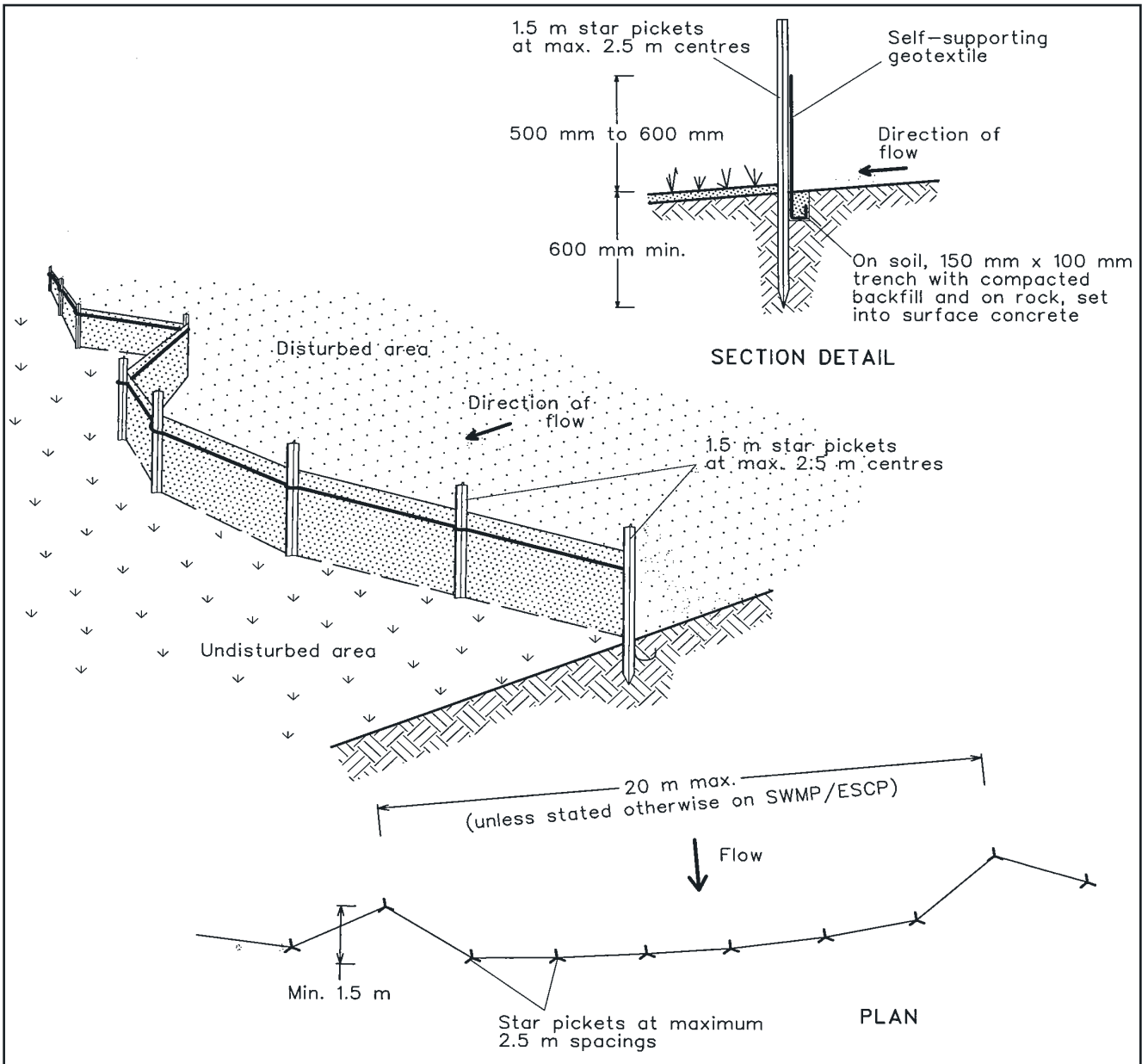
1. Remove all vegetation and topsoil from under the dam wall and from within the storage area.
2. Construct a cut-off trench 500 mm deep and 1,200 mm wide along the centreline of the embankment extending to a point on the gully wall level with the riser crest.
3. Maintain the trench free of water and recompact the materials with equipment as specified in the SWMP to 95 per cent Standard Proctor Density.
4. Select fill following the SWMP that is free of roots, wood, rock, large stone or foreign material.
5. Prepare the site under the embankment by ripping to at least 100 mm to help bond compacted fill to the existing substrate.
6. Spread the fill in 100 mm to 150 mm layers and compact it at optimum moisture content following the SWMP.
7. Construct the emergency spillway.
8. Rehabilitate the structure following the SWMP.

EARTH BASIN - WET

(APPLIES TO 'TYPE D' AND 'TYPE F' SOILS ONLY)

SD 6-4

SOURCE: Managing Urban Stormwater, Soils and Construction (Vol 1, 4th ed.)



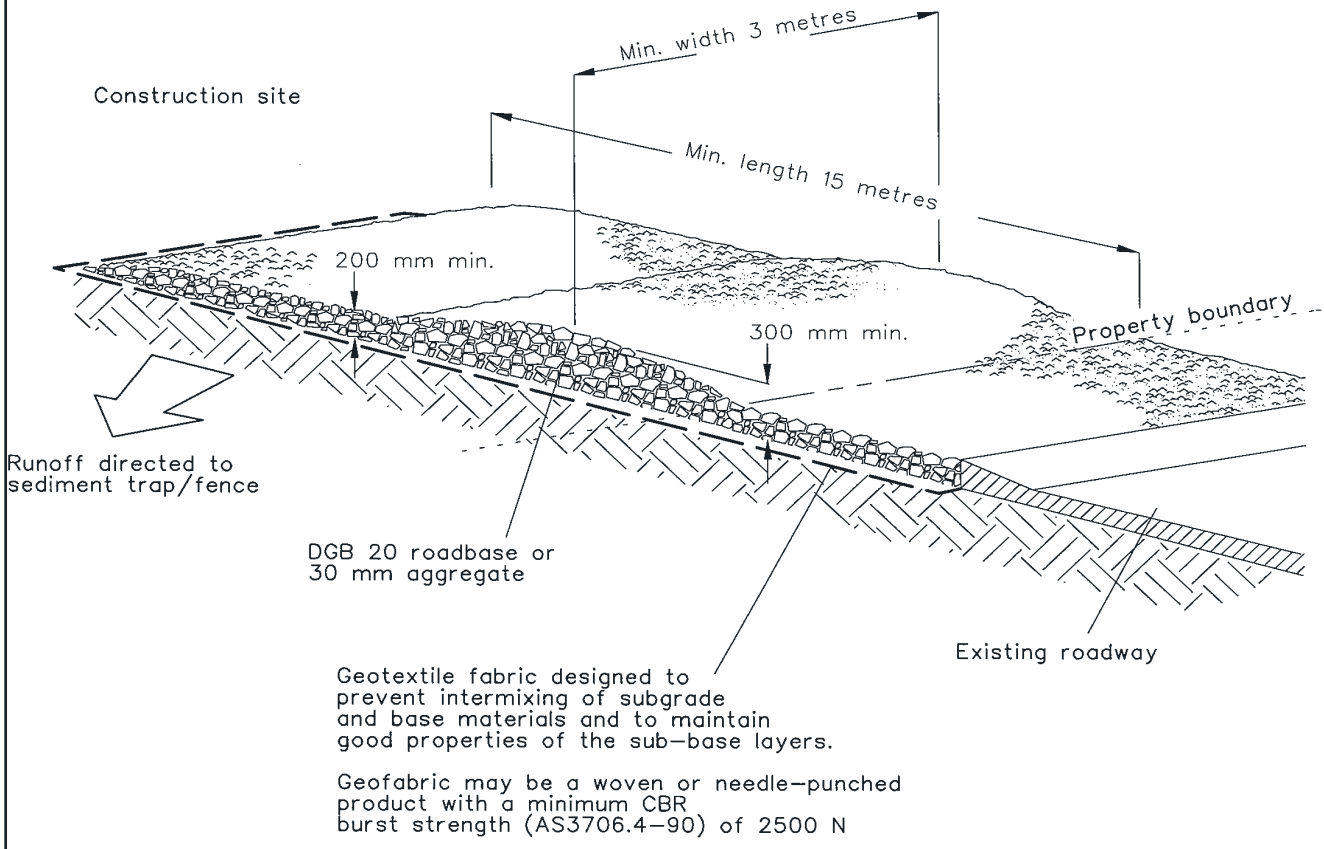
Construction Notes

1. Construct sediment fences as close as possible to being parallel to the contours of the site, but with small returns as shown in the drawing to limit the catchment area of any one section. The catchment area should be small enough to limit water flow if concentrated at one point to 50 litres per second in the design storm event, usually the 10-year event.
2. Cut a 150-mm deep trench along the upslope line of the fence for the bottom of the fabric to be entrenched.
3. Drive 1.5 metre long star pickets into ground at 2.5 metre intervals (max) at the downslope edge of the trench. Ensure any star pickets are fitted with safety caps.
4. Fix self-supporting geotextile to the upslope side of the posts ensuring it goes to the base of the trench. Fix the geotextile with wire ties or as recommended by the manufacturer. Only use geotextile specifically produced for sediment fencing. The use of shade cloth for this purpose is not satisfactory.
5. Join sections of fabric at a support post with a 150-mm overlap.
6. Backfill the trench over the base of the fabric and compact it thoroughly over the geotextile.

SEDIMENT FENCE

SD 6-8

SOURCE: Managing Urban Stormwater, Soils and Construction (Vol 1, 4th ed.)



Construction Notes

1. Strip the topsoil, level the site and compact the subgrade.
2. Cover the area with needle-punched geotextile.
3. Construct a 200-mm thick pad over the geotextile using road base or 30-mm aggregate.
4. Ensure the structure is at least 15 metres long or to building alignment and at least 3 metres wide.
5. Where a sediment fence joins onto the stabilised access, construct a hump in the stabilised access to divert water to the sediment fence

STABILISED SITE ACCESS

SD 6-14

SOURCE: Managing Urban Stormwater, Soils and Construction (Vol 1, 4th ed.)

Annex B

Intensity Frequency Duration (IFD) Chart

DURATION	1 Year	2 years	5 years	10 years	20 years	50 years	100 years
5Mins	70.1	91.9	121	140	166	202	231
6Mins	65.4	85.6	113	131	154	188	215
10Mins	53.4	69.8	91.4	105	124	151	172
20Mins	39	50.8	65.9	75.6	88.7	107	122
30Mins	31.6	41.1	53	60.7	71	85.3	96.8
1Hr	21.2	27.4	35	39.9	46.5	55.5	62.8
2Hrs	13.6	17.5	22.2	25.1	29.1	34.6	39
3Hrs	10.4	13.3	16.8	18.9	21.9	26	29.2
6Hrs	6.49	8.32	10.4	11.6	13.4	15.8	17.7
12Hrs	4.07	5.2	6.44	7.19	8.25	9.69	10.8
24Hrs	2.54	3.25	4.01	4.48	5.14	6.03	6.73
48Hrs	1.54	1.97	2.45	2.74	3.14	3.69	4.12
72Hrs	1.11	1.43	1.77	1.98	2.27	2.67	2.98

Sourced from http://www.bom.gov.au/hydro/has/cdirswebx/cdirswebx.shtml

Annex C

Consultation Records

Department of Primary Industries
Water

Contact Christie Jackson
Phone 02 6763 1426
Email christie.jackson@dpi.nsw.gov.au

Environmental Resources Management Australia
PO Box 803
NEWCASTLE NSW 2300

Our Ref: ER21209 / OUT15/25028

Email: thomas.muddle@erm.com

Attention: Thomas Muddle

Dear Mr Muddle,

White Rock Wind Farm
Construction Soil and Water Quality Management Plan

I refer to your email dated the 4 September 2015 seeking the Department of Primary Industries – Water's (DPI Water) comments on the Draft Construction Soil and Water Quality Management Plan (CSWQMP) for White Rock Wind Farm. DPI Water has reviewed the CSWQMP and our comments are outlined as follows.

- Page 34 Section 5.12 outlines that areas of the site may require dewatering during construction. It is understood the installation of the footings will require excavating to a depth of between 2 to 4 metres to provide adequate depth for the footing. It is unclear from the plan the volume of groundwater seepage anticipated, however the proponent will need to obtain the required licences to account for the volume.

- Page 43 Watercourse Crossings outlines all watercourse crossings will be designed and constructed in consultation with DPI Water and consistent with DPI Fisheries guidelines. Whilst a Controlled Activity Approval under the *Water Management Act 2000* is not required for this project as it is approved under the former Part 3A of the *Environmental Planning & Assessment Act 1979*, all works should be consistent with the Department of Primary Industries – Water's 'Guidelines for Controlled Activities 2012'. These can be located at the following link:
  http://www.water.nsw.gov.au/water-licensing/approvals/controlled-activity

  The guidelines outline what should be considered in the design and construction of watercourse crossings. It is important in the design of watercourse crossings the natural hydraulic, hydrologic, geomorphic and ecological functions of the watercourse are maintained.

If you require clarification on any of the above please contact Christie Jackson on (02) 6763 1426 at the Tamworth office.

Yours sincerely,

Mitchell Isaacs
Manager Strategic Stakeholder Liaison
14 September 2015