APA East Coast Grid Expansion, Moomba to Wilton Pipeline - MW880

Soil and Water Management Plan

Prepared for APA Group
February 2022

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Report Number

J200919 RP22

Client

APA Group

Date

4 February 2022

Version

v3 Final

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1 Introduction

1.1 Background

East Australian Pipeline Pty Ltd, part of the APA Group (APA) currently operates an underground high pressure natural gas transmission pipeline, extending from Moomba (South Australia) to Wilton (New South Wales), a distance of approximately 1,299 kilometres (km). The Moomba to Wilton Pipeline (MWP) is the mainline part of the Moomba Sydney Pipeline (MSP) and was constructed in 1976.

APA is proposing an expansion of gas transportation capacity on its East Coast Grid that links Queensland to southern markets ahead of projected 2023 supply risks. Expansion would be through the construction of additional compressor stations and associated works on both the South West Queensland Pipeline (SWQP) in Queensland and the MWP in NSW.

EMM Consulting Pty Limited (EMM) prepared Modification Report 1 (Mod Report 1) (EMM 2021a) on behalf of APA which was lodged with the Department of Planning, Industry and Environment (DPIE) for Stages 1 and 2 of the East Coast Grid Expansion (the project) and was approved on 5 October 2021. Modification 1 covers the construction and operation of two compressor stations on the MWP – Stage 1 at MW880 (Milne), and Stage 2 at MW433 (Round Hill).

1.2 Scope

This Soil and Water Management Plan (SWMP) has been prepared to describe the overarching soil and water management design approach for the development of the compressor station at MW880 and to provide erosion and sediment control guidance and standards for APA staff and contractors during construction.

APA will implement the approved SWMP, which will be incorporated as part of the project Construction Environment Management Plan (CEMP). The over-arching CEMP has been prepared in accordance with APA's Health, Safety and Environment (HSE) policies, and this SWMP will be implemented in the context of that framework.

This SWMP specifically addresses the requirements of Condition B15 of the consolidated approval:

> B15. The Proponent must prepare a Soil and Water Management Plan for the development to the satisfaction of the Planning Secretary. This plan must:
>
> a) be prepared by a suitably qualified and experienced person/s approved by the Planning Secretary;
>
> b) be prepared in consultation with Council and DPIE Water;
>
> c) be submitted to the Planning Secretary for approval prior to carrying out construction under this approval;
>
> d) includes:
>
> i) details of the sources and security of water supplies for the construction and life of the development (including authorised entitlements and licences);
>
> ii) details of water use and management on the sites;

iii) an Erosion and Sediment Control Plan, consistent with the requirements of the guideline *Managing Urban Stormwater: Soils and Construction (Landcom 2004) and the Guidelines for Controlled Activities on Waterfront Land* (NRAR 2018); and

iv) details the wastewater treatment and spray irrigation system, including measures to mitigate downstream and offsite impacts.

1.2.1 Objectives

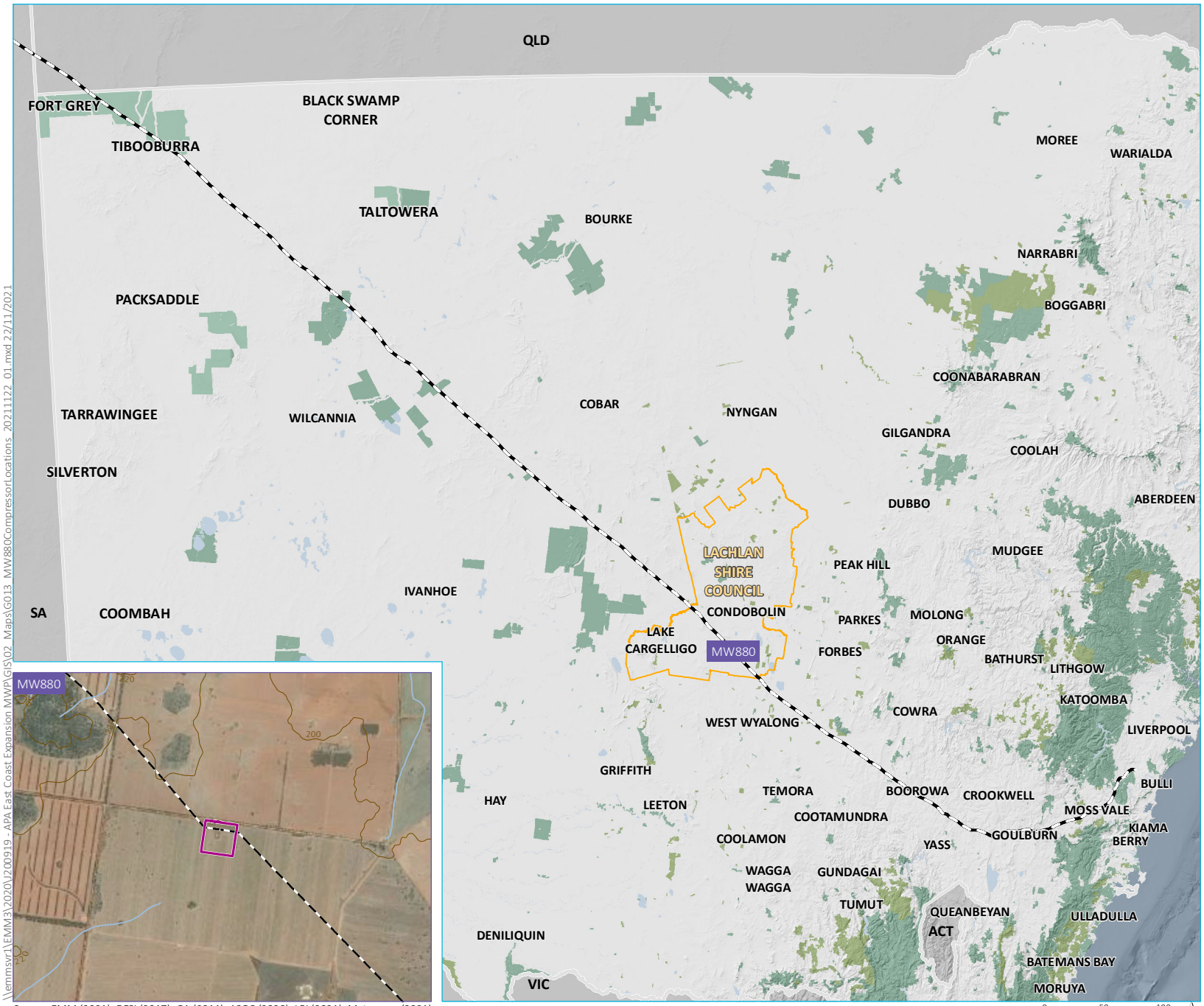
The objectives of this SWMP are to:

- minimise potential impacts on receiving land and waters from construction and commissioning activities;
- conserve and protect site soil resources; and
- ensure compliance with relevant regulatory requirements.

1.2.2 Targets

The target of the SWMP is to prevent soil erosion during and following construction:

- Minimise soil erosion within construction work areas.
- Install and maintain erosion controls in accordance with Soil and Water Plan (SWP) and Progressive Erosion and Sediment Control Plans (PESCPs).
- Stable, non-erosive landforms following rehabilitation.
- Avoidance of impacts to receiving waters off-site.



KEY

- Local government area
- State boundary
- Moomba to Wilton pipeline
- NPWS reserve
- State forest

INSET KEY

- Compressor site boundary
- Contour (10 m)
- Watercourse

Source: EMM (2021); DFSI (2017); GA (2011); ASGC (2006); LPI (2021); Metromap (2021)

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Proposed location of MW880 compressor station on the MWP

APA - East Coast Grid Expansion
MW880 Soil and Water Management Plan
Figure 1.1

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1.3 APA health, safety and environmental policy

1.3.1 Policy

APA Group Policies are the principal Health, Safety and Environment documents. These Policies are authorised by the Managing Director and are intended to ensure that systems are in place to protect the safety and health of all persons working on, or associated with, all APA operations. It also ensures the minimisation of the impact APA has on the environment to which we interact.

The Health, Safety and Environment Policy is also endorsed by the APA Health, Safety and Environment Representatives and supported by subordinate APA procedures. It is also supported by a list of specific policies and safety non-negotiables which are documents of equal importance.

It is a requirement that all employees, including contractors and subcontractors, comply with the requirements of the APA HSE Policy, as a minimum.

1.3.2 Strategy

APA aspires to provide a zero-harm work environment. APA is committed to the effective implementation of our HSE Policy and to the continual improvement of our HSE Performance.

The APA HSE Management System is called 'Safeguard' and provides a framework by which the processes relating to the company's Health, Safety and Environment activities are defined, implemented and controlled. Additionally local business unit processes and procedures / requirements, provide instruction to workers on performing activities safely.

The high-level risk HSE risk management framework (known as RCA) is shown below.

Risks

- Identify hazards that may cause harm
- Assess the risks by determining likelihood and consequence of these hazards causing harm

Controls

- Implement and maintain control measures which prevent and / or reduce consequences of harm

Assure

- Monitor and review the effectiveness of the control measures.

1.4 Roles and responsibilities

The roles and responsibilities in relation to the implementation of this SWMP and the greater CEMP are set out below.

All personnel (i.e. APA and/or contractors) must:

- Comply with the requirements of applicable environmental legislation;
- Undertake all activities in an environmentally responsible manner;
- Comply with specific requirements of the planning approval and supporting documentation;
- Conduct activities in accordance with this SWMP and the greater CEMP; and
- Participate in environmental and cultural heritage training relevant to roles and responsibilities.

Table 1.1 Environmental roles and responsibilities for APA site representatives

Role	Responsibilities
Project Manager	• Ensure project is adequately resourced. • Ensure all documentation is approved and in place in accordance with the contractual requirements.
Greenfields Project Manager	• Ensure the necessary resources and processes are in place for implementation of this SWMP and CEMP. • Ensure non-conformances are identified, recorded and reported. • Work with environmental representatives in planning and implementing environmental requirements. • Ensure legal compliance.
Supervisors	• Ensure the SWMP and CEMP requirements are implemented and maintained. • Ensure non-conformances are identified, recorded and reported. • Drive implementation of corrective actions. • Work with environmental group in planning and implementing environmental requirements.

Table 1.1 Environmental roles and responsibilities for APA site representatives

Role	Responsibilities
Project HSE Support	• Monitor the implementation and effectiveness of the Contractor's performance. • Monitor the SWMP and CEMP implementation and arrange amendments if required. • Conduct environmental auditing and monitoring. • Complete environmental statutory reporting requirements.

Table 1.2 Environmental roles and responsibilities for contractor site representatives

Role	Responsibilities
Construction Manager	• Preparation and implementation of site induction. • Ensure all project staff have a clear understanding of the environmental requirements relevant to their area of works. • Ensure all Area Managers are familiar with the approved CEMP for construction and associated documents and their responsibilities within them. • Participate and provide guidance in the regular review of the CEMP and associated documents. • Take action in the event of an emergency and allocate the required resources to minimise environmental impact. • Report any activity that has resulted, or has the potential to result, in an environmental incident to the APA HSE support and Project Manager.
Site Supervisor	• Communicate with all personnel and subcontractors regarding compliance with the approved CEMP and site specific environmental issues. • Coordinate implementation and maintenance of pollution control measures. • Identify resources required for implementation of the CEMP. • Coordinate action in emergency situations and allocate required resources in accordance with the incidents, complaints and communication action plan. • Ensure that instructions are issues and adequate information provided to field based employees which relate to environmental risks on site.
Site Operator	• Carry out the activities in accordance with the SWMP and CEMP. • Carry out the necessary monitoring and reporting requirements. • Identify and report non-conformances. • Implement corrective actions. • Work with environmental group in planning and implementing environmental requirements.
HSE Support	• Monitor the implementation and effectiveness of the SWMP and CEMP. • Conduct environmental auditing, monitoring and training. • Provide advice on environmental matters and corrective actions as requested. • Ensure all environmental and safety reporting requirements are recorded and provided to APA. • Review statutory compliance and ensure all approvals in place.

1.5 Approach and document hierarchy

A two-level approach and document hierarchy to erosion and sediment control planning and site water management has been adopted as per Landcom (2004), comprising:

- SWMP (this document); and
- Progressive Erosion and Sediment Control Plan (PESCP) (Appendix D).

This report consists of a SWMP only and does not include preparation of any PESCPs. The PESCPs will be prepared by approved erosion specialist.

This SWMP for the project provides detailed background information, erosion hazard assessment, overall drainage and water management approach, erosion and sediment control approach, design standards and management strategies.

A PESCP will ultimately be prepared for all disturbance areas, prior to disturbance commencing. The PESCPs will address erosion and sediment control for all project disturbances and will be progressively updated if required as construction works progress.

1.6 Consultation

A draft of the SWMP was sent to LSC and DPIE Water by email in November 2021 for consultation purposes. These communications and responses are included in Appendix B.

Regarding the SWMP, LSC commented that "the approach outlined appears reasonable." It is noted that LSC comments on the waste water management system have been addressed in an update to the technical specification for the camp wastewater management document.

While the SWMP was distributed to DPIE Water, no specific response was given. It is assumed that DPIE Water's feedback was incorporated in the Post-Approval Review document on the SWMP provided by DPIE. This document incorporates EMM's responses and details where this SWMP has been changed or updated in response, and is included in Appendix B.

Once the SWMP has been approved, it will be integrated into the CEMP. A hard copy of the CEMP will be kept on-site and updated as required by APA, with a controlled electronic version uploaded into the project management database. All contractors and subcontractors will be provided a copy to ensure their works are consistent with the CEMP.

1.7 Document revisions

This SWMP will be revised if required to reflect monitoring outcomes, lessons learned and as otherwise necessary in accordance with continuous improvement.

Following any revision, updated versions of the SWMP will be submitted to DPIE, DPIE (Water) and LSC.

1.8 Qualifications and experience of the author

This SWMP has been prepared by Michael Frankcombe CPESC 1351 of EMM Consulting who was approved by the DPIE to prepare the SWMP 10 November 2021 (Appendix A).

2 Legislative and guideline requirements

2.1 General

The project will be undertaken in accordance with all relevant legislation, development approval conditions, permits and licencing requirements, as described in this section.

2.2 Legislation

2.2.1 Environmental Planning and Assessment Act 1979

State Significant Infrastructure approval (SSI-15548591) was issued under section 5.25 of the *Environmental Planning and Assessment Act 1979* (EP&A Act) by the Minister for Planning and Public Spaces (5 October 2021). Relevant soil and water management, erosion and sediment control and temporary requirements are detailed in Table 2.1.

Table 2.1 SSI-15548591 soil and water management requirements

Condition number	Requirement	Where addressed
A5	The Proponent must:	
(a)	rehabilitate the sites progressively, as soon as reasonably practicable following disturbance;	s.7, T. 7.3, s.7.1.4
(b)	minimise the disturbance area at any time; and	s.7.1.2
(c)	employ interim rehabilitation strategies to minimise dust generation, soil erosion and weed incursion on parts of the sites that cannot yet be permanently rehabilitated.	s.6.2, s.7.1.4
B11	The Proponent must ensure it has sufficient water supply for all stages of the development.	S 3.1.1
B12	Prior to the commencement of construction of Stage 1, the Proponent must provide confirmation to the Department of the water suppliers to provide the necessary water volumes for the construction and operation of the site.	S 3.1.1
B14	The Proponent must:	
(a)	ensure that construction, commissioning and operation of the development does not cause any water pollution, as defined under Section 120 of the POEO act, including the management of surface water runoff and spray irrigation of treated effluent;	s.7.1.5
(b)	minimise any soil erosion associated with construction of the development in accordance with the relevant requirements in the *Managing Urban Stormwater: Soils and Construction* (Landcom 2004) manual, or its latest version; and	s.7.1.4
(c)	Ensure that construction is undertaken to minimise the impacts on watercourses by applying management measures generally in accordance with the guidance series for *Controlled Activities on Waterfront Land* (DPIE Water 2021 or latest versions).	N/A as no waterways within the project area

Table 2.1 SSI-15548591 soil and water management requirements

Condition number	Requirement	Where addressed
B15	The proponent must prepare a Soil and Water Management Plan for the development to the satisfaction of the Planning Secretary. This plan must:	This document
(a)	be prepared by a suitably qualified and experienced person/s approved by the Planning Secretary;	Appendix A
(b)	be prepared in consultation with Council and DPIE Water;	Appendix B
(c)	Be submitted to the Planning Secretary for approval prior to carrying out construction under this approval; and	Noted
(d)	Includes:	
i)	details of the sources and security of water supplies for the construction and life of the development (including authorised entitlements and licences);	s.3.11
ii)	details of water use and management on the sites;	s.7.1.5
iii)	an Erosion and Sediment Control Plan, consistent with the requirements of the guideline *Managing Urban Stormwater: Soils and Construction* (Landcom 2004) and the *Guidelines for Controlled Activities on Waterfront Land* (NRAR 2018); and	Appendix D
iv)	details the wastewater treatment and spray irrigation system, including measures to mitigate downstream and offsite impacts.	s.6.3.1

2.2.2 Protection of the Environment Operations Act 1994

The *Protection of the Environment Operations Act 1997* (PoEO Act) establishes offences for polluting the environment and procedures for the granting of licences for environmental protection including waste, air, water, land and noise pollution control. It is an offence to pollute water, air, land, noise and waste. It is also an offence to allow a substance to leak, spill or escape from its container in a manner that results or is likely to result in harm to the environment (s116).

Water pollution is prohibited under section 120 of the PoEO Act.

2.2.3 Water Management Act 2000

Controlled activities carried out in, on, or under waterfront land are regulated by the *Water Management Act 2000* (WM Act). Waterfront land includes the bed and bank of any river, lake or estuary and all land within 40 m of the highest any of the river, lake or estuary. The nearest watercourse is located 800 m south-west of the site boundary, therefore the WM Act is not applicable to this project.

2.3 Guidelines

2.3.1 Landcom 2004

Managing Urban Stormwater – Soils and Construction Volume 1 3rd edition (Landcom, 2004) provides guidance to mitigate the impacts of land disturbance in NSW on soils, landforms and receiving water by focusing on erosion sediment control for all non-rural land disturbance activities where more than 250 m^2 of land will be affected.

It is based on the premise that land degradation associated with land disturbance can be avoided or minimised, largely through appropriate planning before the commencement of earthworks and by applying the best management practices (BMP) available using a 'treatment train' approach.

SWMP's are required when the area of disturbance exceeds 2,500 m^2.

This SWMP has been prepared in accordance with the recommended requirements of section 2.3 of Landcom, 2004.

2.3.2 IECA 2015

Best Practice Erosion and Sediment Control Appendix P Land-based pipeline construction (IECA,2015) provides specific guidance on the application of best practice erosion and sediment control of land-based pipelines and associated infrastructure. Its purpose is to describe the various temporary drainage, erosion and sediment control measures that are available for use during construction of land-based pipelines and where possible, outline the circumstances in which their use is likely to be warranted.

This SWMP includes drainage, erosion and sediment control measures consistent with IECA 2015 and the identified erosion and sediment control constraints.

3 Project description

3.1 Compressor station details

The East Coast Grid Expansion in NSW will be facilitated by the construction of five compressor stations along the length of the MWP. This SWMP addresses the construction and operation of compressor station MW880 (Stage 1).

The compressor station will include:

- an enclosed gas turbine driven compressor unit;
- microturbine;
- compressor inlet/scrubber;
- a control equipment building;
- two fuel gas skids;
- air compressors and receivers;
- associated piping, electrical equipment, instrumentation, and controls;
- a station vent; and
- small accommodation and maintenance buildings for operations.

All facilities will be installed on driven piles or supported on structural steel skids over gravel sheeting, with the exception of the accommodation and maintenance buildings which will be constructed on concrete slab. The proposed site for the MW880 compressor station is on land owned by APA, being approximately 400 m x 400 m within an area of 16 ha.

3.1.1 Construction

Construction activities will be restricted to the approved Site Area. Following construction, temporary infrastructure will be removed while permanent facilities will be fenced off.

A temporary construction accommodation camp will be established on site, where mobilisation and demobilisation of the workforce will be to and from Dubbo airport for each roster.

Wastewater from the construction camp from the construction camp will be treated by a suitably designed, manufactured, installed, commissioned and operated aerated wastewater treatment system, pre-approved by the NSW Department of Health in order to satisfy the requirements of Section 68 of the *Local Government Act* 1993 and Australian Standard (AS) 1547: On-site domestic wastewater management.

At MW880, raw and potable water will be purchased under a commercial arrangement with LSC (Appendix C) and transported to site by 25 kilolitre (kL) water truck as required. The standpipe is just outside of Condobolin which is managed by the Council. LSC has confirmed their capacity to provide:

- approximately 17ML of raw water for construction; and

- approximately 16,000L – 21,000L per day of potable water for temporary camp (starting from May 2022) for 9-12 months period

Water Requirements for the different stages of construction activities are as below;

- Bulk Earthwork: daily raw water consumption 50KL/day (3 months). Out of which 15KL for dust suppression and 35KL for conditioning of soil.
- CSMPEI Construction: Raw water 20KL/day for dust suppression (6 months)
- Camp Operation: We required only portable water for Camp operation. See Table 2.1 and 2.2 of the Milne Technical Specification (attached to email).
- Camp provider will supply and install 2 50KL storage tanks to store water and distribute to Camp facilities. Transportation of portable water by truck. Approximately 92KL is estimated for 5 days of camp operation.
- Operation water source: There are 3 10KL storage tank close to permanent site facilities. 2 tanks will hold portable water, which will be transported to Site on trucks. 1 tank will be connected to the site facility to capture rainwater.

The majority of construction activities will take place between 7 am and 6 pm, seven days per week. During the commissioning phase, activities will also take place between 7 am and 6 pm, seven days per week, however for the final two weeks, commissioning activities will be 24-hours per day.

i Construction activities

Construction of the compressor stations will include the following activities:

- mobilisation of construction equipment;
- establishment of access (where required);
- establishment of construction camp accommodation and associated facilities;
- establishment of access to water supply;
- site bulk earthworks including build up to match existing levels;
- installation of steel piles;
- installation of all equipment items, skids and buildings;
- installation of associated steel structures, prefabricated piping, electrical equipment, instrumentation and controls;
- supply and install communication and controls infrastructure;
- demobilisation of construction equipment;
- rehabilitation of temporary disturbance areas; and
- pre-commissioning and commissioning of compressor station.

The anticipated workforce distribution over the 12-month construction and commissioning program is presented in Table 3.1.

Table 3.1 Monthly construction and commissioning workforce distribution

1	2	3	4	5	6	7	8	9	10	11	12
20	28	28	37	47	65	68	59	49	39	18	18

KEY

- Compressor site
- Site boundary/construction envelope
- Moomba to Wilton pipeline

Proposed site infrastructure

- Permanent
- Temporary

Existing environment

- Major road
- Waterbody

DRAFT

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Source: EMM (2021); DFSI (2017); GA (2011); ASGC (2006); LPI(2021)

0 100 200 m

GDA 1994 MGA Zone 55

N

Site layout MW880 - Milne

APA - East Coast Grid Expansion
MW880 Soil and Water Management Plan
Figure 3.1

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4 Erosion and sediment control constraints

4.1 General

This section provides a brief description of the existing environment relevant to soil and water management.

MW880 – Milne is located in central NSW in the Lachlan River catchment. Land use is dryland cropping and native vegetation.

Slope of the project construction area is 0.5% (pers.comm. A Littlewood).

4.2 Soils

A desktop soil assessment was undertaken by EMM using existing information on soils and soil environments for MW880.

A summary of the available land and soil mapping available from eSPADE (OEH 2016) characteristics and their associations is presented below.

4.2.1 Australian Soil Classification

The ASC scheme (Isbell, NCST 2021) is a multi-category scheme with soil classes defined based on diagnostic horizons and their arrangement in vertical sequence as seen in an exposed soil profile.

With reference to the NSW Soil and Land Information (SALIS) System (DPIE 2015–2020) through the 'eSPADE' Soil Profile Database (Version 2.0, OEH 2016), the soil types shown in regional soil mapping of the project area are Kandosols and Chromosols.

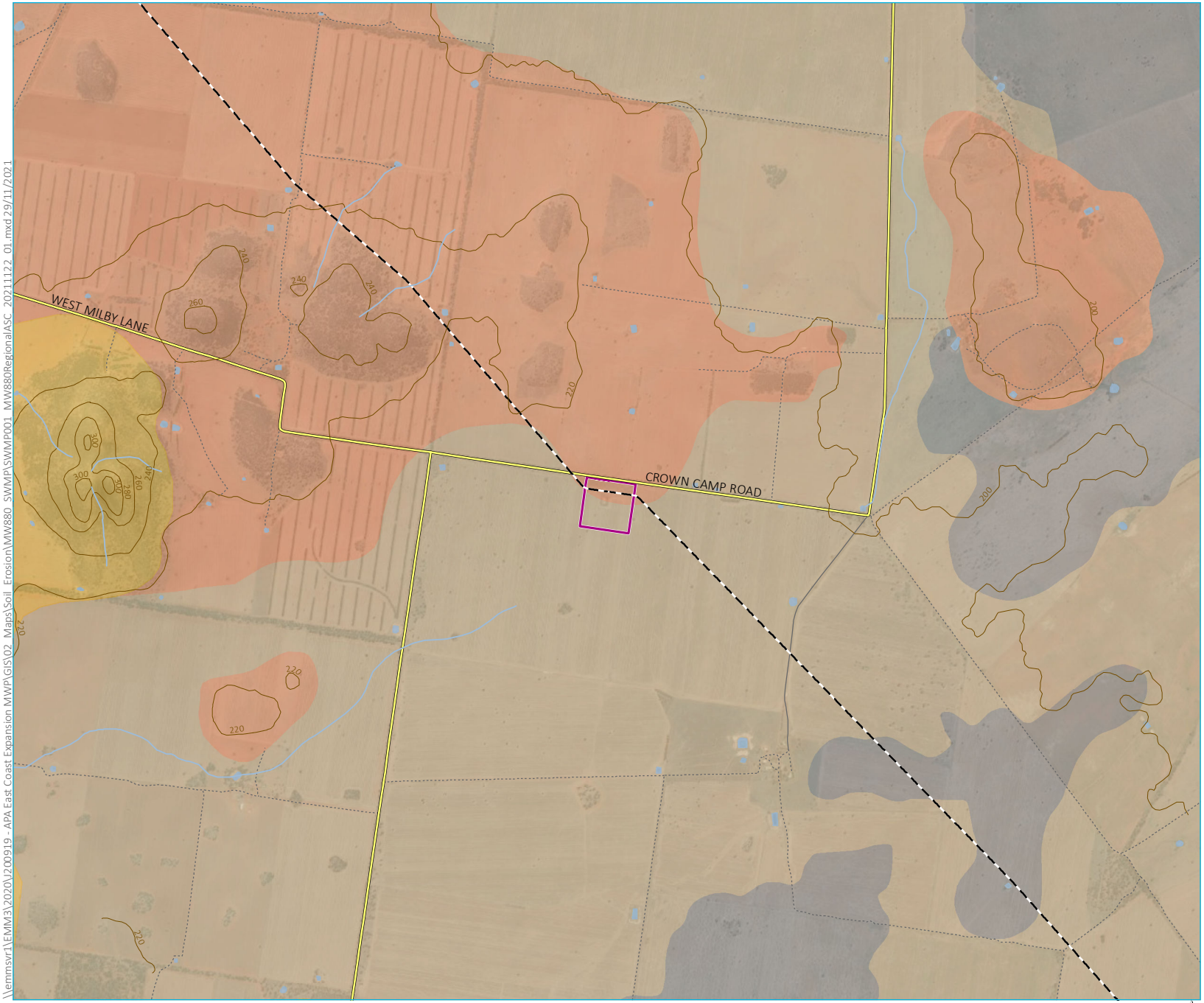
i Kandosols

Kandosols are non-texture contrast soils (with little or gradual increase in clay content with depth) that have massive (ie weakly to non-structured) subsoils (B horizons). They are found mainly in the upland areas, often in association with Dermosols, Chromosols and Kurosols. These soils can vary from stony hardsetting soils to deeper friable soils. Some may almost be texture contrast and have a bleached subsurface (A2) horizon.

ii Chromosols

Chromosols are soils that display a strong texture contrast between surface (A) horizons and subsoil (B) horizons. The upper part of the subsoil ranges from slightly acid to alkaline (pH >5.5) but is not sodic.

The ASC soil map for the project site (from OEH 2017a) is presented in Figure 4.1.



KEY

- Compressor site
- Moomba to Wilton pipeline
- Contour (10 m)

Australian Soil Classification (Order level)

- Chromosols
- Kandosols
- Rudosols and Tenosols
- Vertosols

Existing environment

- Major road
- Local road
- Vehicular track
- Watercourse
- Waterbody

Source: EMM (2021); DFSI (2017); GA (2011); ASGC (2006); LPI(2021); OEH (2016)

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MW880 Regional ASC mapping

APA - East Coast Grid Expansion
MW880 Soil and Water Management Plan
Figure 4.1

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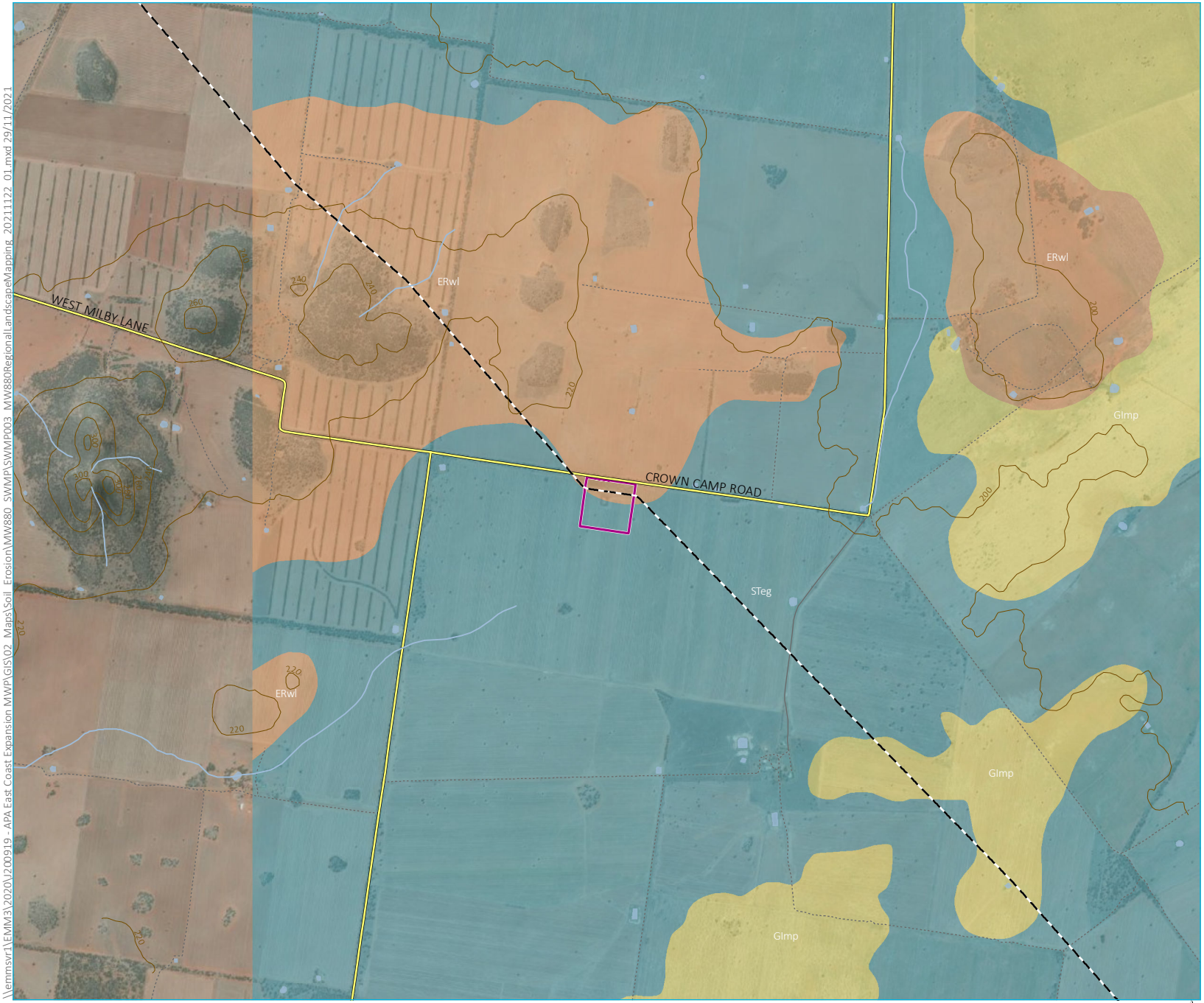
4.2.2 Soil landscapes

The MW880–Milne site lies on the Soil Landscapes of the Forbes 1:250 000 Sheet, one of the soil landscape mapping areas of central NSW mapped by King (1998). The mapped soil landscapes can be seen in Figure 4.2.

The soil landscapes of King (1998) contain some soil specific information, including classification under the ASC to a great group level. Mesonatric and subnatric Sodosols, which are sodic and strongly sodic (exchangeable sodium percentage of >6–15% and 15–25% respectively), are present in both the Weelah and Euglo soil landscapes. Land management considerations and limitations for the Weelah landscape highlights soil structure decline hazard and acid soils of low fertility with high potential aluminium toxicity (subsoils). This indicates likely acidic soil pH (Aluminium typically being a constraint when soil pH is <5.5) and soil structural decline is again typically associated with sodic or dispersive soils. The Euglo hazards include alkaline, sodic/dispersible, saline (localised) soils of low fertility, high erodibility (topsoils) with hardsetting surfaces and soil structure decline hazard which indicate or state the likely presence of sodic or dispersive soils.



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Source: EMM (2021); DFSI (2017); GA (2011); ASGC (2006); LPI(2021); OEH (2016)

MW880 Regional soil landscape mapping

APA - East Coast Grid Expansion
MW880 Soil and Water Management Plan
Figure 4.2

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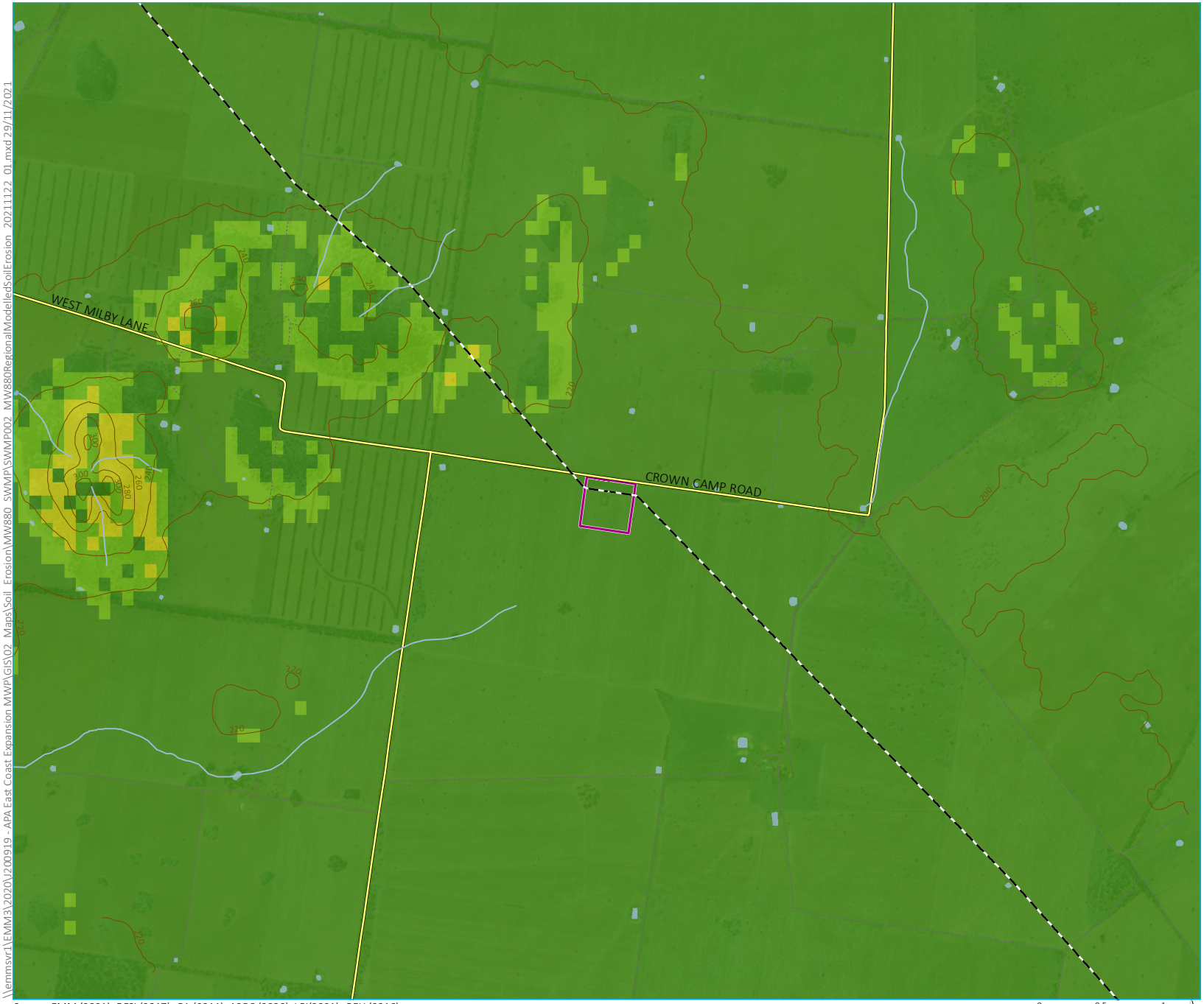
4.2.3 Modelled soil erosion potential

Modelled sheet and rill (hillslope) soil erosion potential for the project sites based on bare soil is 20 t/ha/y (OEH 2016). This modelling was undertaken using the revised universal soil loss equation (RUSLE) and rainfall-runoff erosivity factors (R-Factors) and soil erodibility factors (K-Factors) per Yang and Yu (2015) and Yang et al (2017).

The modelled K-Factor (soil erodibility) for the site ranges from 0.04–0.07 (t.ha.h)/(ha.MJ.mm) which indicate that the project soils have a high erosion potential. The modelled K-Factors apply to a maximum depth of 100 mm (Yang *et al.* 2017).

The modelled soil erosion only considers rainfall erosivity and not wind erosion hazard or soil electrochemical instability, however the recommended soil cover management and mitigation measures detailed in Section 7 address both water and wind-based erosion. Given the nature of a desktop assessment, information on the electrochemical stability of the soils is limited.



\\emmsvr1\EMM3\2020\J200919 - APA East Coast Expansion MWP\GIS\02_Maps\Soil_Erosion\MW880_SWMP\SWMP002_MW880RegionalModelledSoilErosion_20211122_01.mxd 29/11/2021

Source: EMM (2021); DFSI (2017); GA (2011); ASGC (2006); LPI(2021); OEH (2016)

MW880 Regional modelled soil erosion

APA - East Coast Grid Expansion
MW880 Soil and Water Management Plan
Figure 4.3

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4.3 Hydrologic context

The nearest mapped watercourse to the site is an unnamed 3rd order watercourse to the south of the site. Based on available terrain and geospatial data this unnamed watercourse, and the site itself, drains generally to the north-east towards Humbug Creek although APA have advised that the site drains predominantly to the south, with slight crossfall to the east (pers.comm. B Connellan). Drainage between the site and Humbug Creek has been heavily modified to suit the surrounding agricultural development. Humbug Creek in turn feeds into Banar Lake, Wallaroi Creek and ultimately the Lachlan River further to the north.

Drainage from the site will likely occur as shallow sheet flow concentrating in informal gullies and flow paths, rather than following any defined drainage line or watercourse. All local drainage features are ephemeral in nature and will flow only following significant rainfall. Aquatic habitat potential within the site and immediately downstream is minimal.

Flooding at the site is expected to occur as broad, shallow overland flow given the lack of relief, poorly defined drainage features and lack of significant upstream catchment. The specific nature of flooding conditions and risks at the site are unknown, however there are no sensitive receptors or infrastructure located close by, except for the existing MWP, associated vehicular access tracks to the site and the adjacent Crown Camp Road.

Management of surface water resources falls under the WSP for the Lachlan Unregulated River Water Sources 2012. The site is located in the Humbug Creek Water Source. In the 2020-21 financial year, all water allocations from this source were made to properties in the township of Ungarie which is located upstream on Humbug Creek approximately 28 km south-west of the site. No licensed surface water users are located immediately downstream of the site.

There are three registered groundwater bores (GW002935, GW020929, and GW002745) within 3 km of the site, registered for stock and domestic or unknown purposes. These bores show that the water bearing zone in the area surrounding the site is deeper than 26 metres below ground level (mbgl).

There are no significant Groundwater Dependent Ecosystem (GDEs) close to the site. Further downstream Humbug Creek is identified as a moderate potential terrestrial GDE, and Banar Lake is identified as a high-potential aquatic GDE.

Overall, the sensitivity of the receiving environment downstream of the site is considered low.

KEY

- Compressor site
- Moomba to Wilton pipeline
- Contour (10 m)

Existing environment

- Major road
- Local road
- Vehicular track
- Waterbody

Strahler stream order

- 1st
- 3rd

\\emmsvr1\EMM3\2020\200919 - APA East Coast Expansion MWP\GIS\02 Maps\Soil Erosion\MW880 SWMP\SWMP005 MW880WaterFeature&Catchment 20211122 01.mxd 29/11/2021

Source: EMM (2021); DFSI (2017); GA (2011); ASGC (2006); LPI(2021)

0 0.5 1 km

GDA 1994 MGA Zone 55

N

MW880 Water features and catchments

APA - East Coast Grid Expansion
MW880 Soil and Water Management Plan
Figure 4.4

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4.4 Climate and rainfall

Climate and rainfall data have been obtained from the Bureau of Meteorology (BoM) Condobolin Ag Research Station (No. 050052), where monitoring commenced in 1954. The project area has a warm temperate climate and is characterised by warm and wetter summers and cool and drier winters. Long-term average monthly rainfall data for the area (indicate a high rainfall erosivity risk from October through to March due to the summer storm season.

Long-term mean maximum and minimum annual temperature are 24.6°C and 10.2°C respectively, average annual rainfall is 456.5 mm/year and annual average pan evaporation rates between 1,600–1,800 millimetres per year (mm/year). Average monthly 9 am windspeeds range between 9.0–16.0 kilometres per hour (km/hr), being highest in October and lowest in June (BoM 2021a; BoM 2021b). Mean monthly maximum and minimum temperature and mean rainfall are presented in Figure 4.5 (after BoM 2021a).

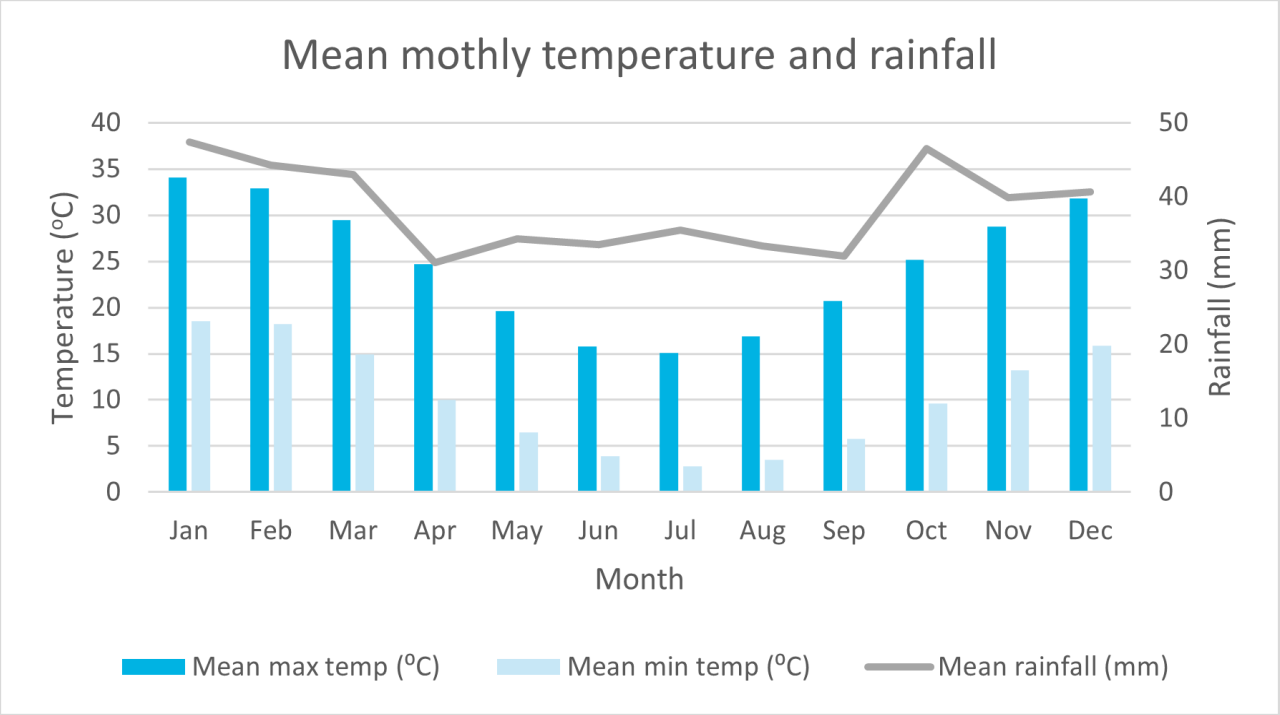


Figure 4.5 Monthly average rainfall Condobolin Ag Research Station (No. 050052)

4.4.1 Rainfall erosivity

The rainfall erosivity (R-Factor) is calculated using the formula:

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

where, S is the 2-year ARI, 6-hour rainfall event (0.5EY, 6-hour event) in mm/h (Rosewell & Turner 1992). For the project S values (BoM 2020) and the calculated R-Factor for the project is shown in Table 4.1.

Table 4.1 Project R-Factor

S (2-year ARI, 6-hour rainfall event) (mm/h)	R-Factor ($MJmmha^{-1}h^{-1}$)
5.87	990.3

5 Erosion hazard assessment

The process for the assessment of erosion hazard in NSW is detailed in section 4.4.1 of Landcom (2004). It is a two-step process that considers overall project erosion hazard in considering slope and rainfall erosivity (R-Factor) and then a more detailed assessment where land soil loss classes (SLC) are determined using annual soil loss calculated using the revised universal soil loss equation (RUSLE) using site specific slopes and a nominal slope length of 80 m. The SLC dictates specific erosion management and mitigation measures as detailed in Landcom (2004).

An assessment of the erodibility of the soil itself is important as the presence or absence of a highly erodible dispersive soil will significantly influence the project drainage, erosion and sediment control requirements.

When a sodic soil (exchangeable sodium percentage (ESP) >6%), or a magnesic soil (exchangeable magnesium percentage (EMP) >20%) contacts non-saline water, water molecules are drawn in-between the clay platelets causing the clay to swell to such an extent that individual clay platelets are separated from the aggregate. This process is known as dispersion. Dispersive soils have an extreme rill, gully and tunnel erosion risk and can erode irrespective of surface treatments (eg rock lining) applied to the soil surface.

5.1 Soil erosion hazard analysis

The erosion potential of a soil is determined by its physical and chemical properties and is expressed as its K-Factor (t.ha.h)/(ha.MJ.mm). Table 5.1 provides a soil erodibility ranking for K-Factor from Rosewell (1993).

Table 5.1 Rosewell (1993) soil erosion ranking

K-Factor (t ha h $ha^{-1}MJ^{-1}mm^{-1}$)	Erosion potential
<0.02	Low
>0.02 to <0.04	Moderate
>0.04	High

As detailed in section 4.2.2, the modelled K-Factors for the project area were determined from the eSpade 2.1 database (OEH 2016, OEH 2017e). The modelled K-Factors range from 0.04–0.07 t ha h $ha^{-1}MJ^{-1}mm^{-1}$ which indicate that the project soils have a high erosion potential.

No site soil sampling was undertaken in this assessment, however the mapped soil landscapes identifies that dispersive subsoils may be present in the project area. Loch *et al.* 1998 determined various sodic soils to have a K-Factor ranging from 0.056–0.106 t ha h $ha^{-1}MJ^{-1}mm^{-1}$. A K-Factor of 0.071 t ha h $ha^{-1}MJ^{-1}mm^{-1}$ has been adopted to determine the erosion hazard of project subsoils as a 'worst case' if sodic subsoils are exposed.

5.1.1 Slope and rainfall erosivity erosion hazard analysis

The overall project water erosion hazard is determined using the process described in section 4.4.1 of Landcom (2004); however, as it does not consider the K-Factor, the erosion hazard can be considerably underestimated. If a low erosion hazard is determined, no further delineation of erosion hazard is required. If a high erosion hazard is determined, then further assessment to determine the SLC is required.

SLCs are determined by calculating the annual average soil loss using the RUSLE with a nominal 80 m slope length and soil surface cover factor (C-Factor); RUSLE calculates the annual average erosion in tonnes per hectare (t/ha) from rill and inter-rill (sheet) erosion. It does not consider gully or tunnel erosion and does not calculate peak erosion. Landcom (2004)[1] nominates additional requirements for land of SLC 4 and higher.

The first step in the hazard assessment uses a nomograph from Figure 4.6 of Landcom (2004) (reproduced as Figure 5.1) that considers slope of the land and the Rainfall Erosivity (R-Factor) to provide a low or high erosion hazard.

The calculated R-Factor is 990.3 MJmmha^{-1}h^{-1} (section 4.4.1).

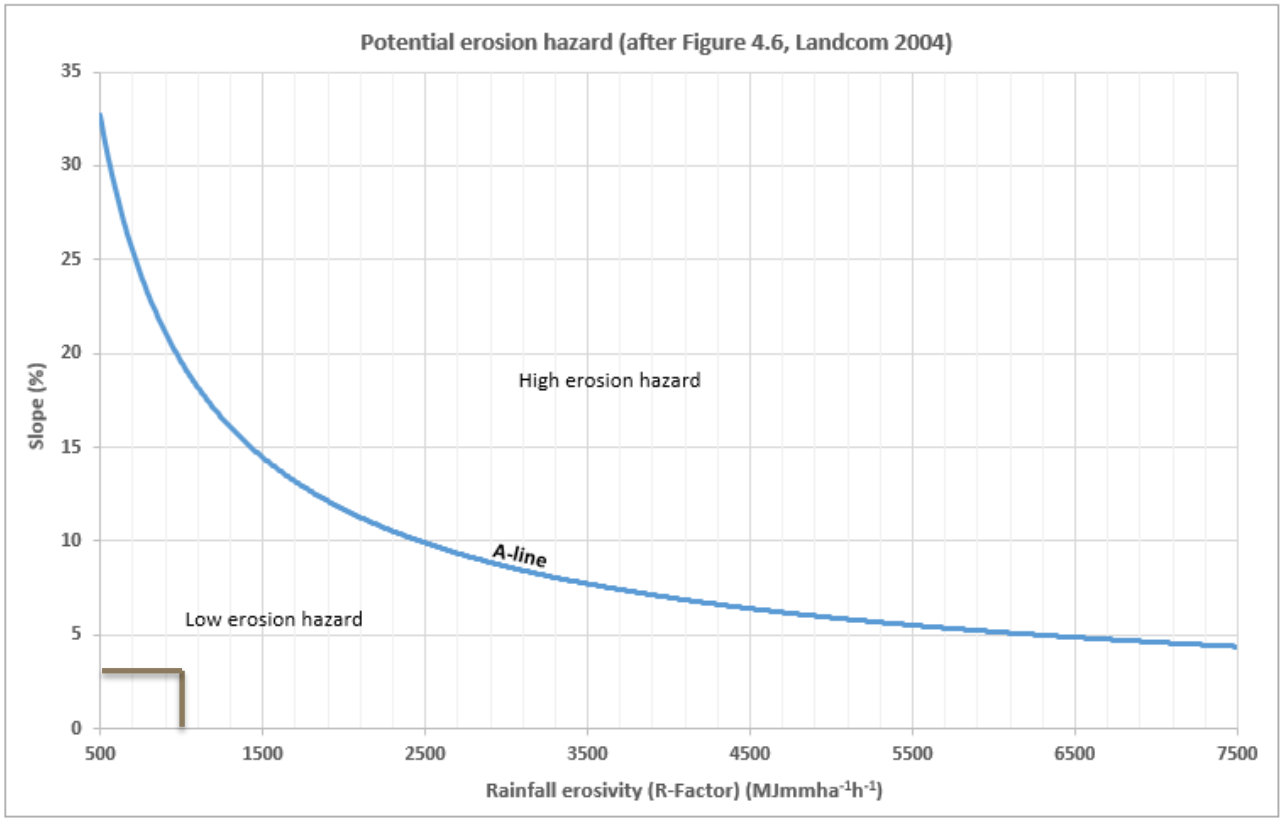


Figure 5.1 Assessment of potential erosion hazard (Landcom 2004)

Applying the project R-factors and slope to the erosion hazard nomograph results in a low erosion risk due to low slope and rainfall erosivity. On this basis, further analysis of SLCs is not required.

Even though the slope and rainfall erosion hazard risk has been assessed as low, given the predominantly semi-arid nature of the MW880 site, the low annual rainfall amounts make it challenging to establish and maintain vegetative soil surface cover. Kirby (1969) determined that peak erosion rates in natural catchments in the USA occurs where annual average rainfall ranges between 300–350 mm/yr. This means that other forms of soil surface cover such as soil stabilisation polymers, hydro-mulches and gravel mulches may be required to provide adequate erosion protection until adequate vegetation cover establishes.

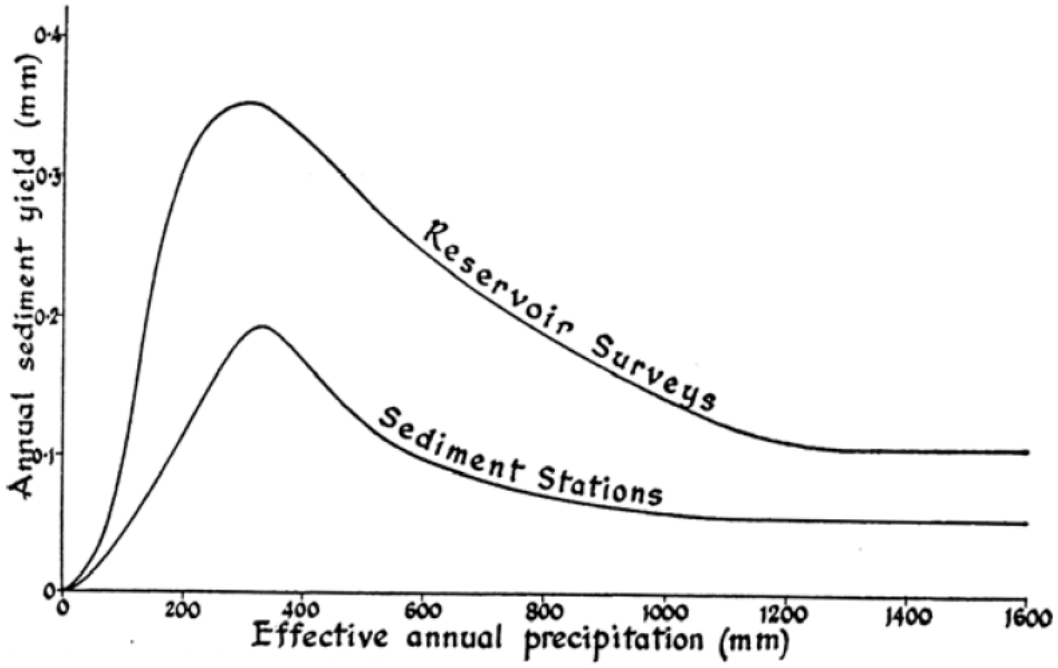


Figure 5.2 Relationship between annual rain and erosion (Kirby 1969)

5.2 Wind erosion hazard

There is no known documented method for assessing or ranking wind erosion hazard in Australia. Sandy soils are more at risk of wind erosion due to the larger soil particles drying more rapidly than smaller particles and single grained particles are easier to detach by the wind.

The erosive power of wind increases exponentially with velocity and the length of unobstructed terrain (fetch) over which the wind flows is important in allowing the wind to gain momentum and increase its erosive power (Salem 1991). Movement of highly erosive soils typically starts at a wind velocity of 25–30 kilometres per hour (km/hr) at a height of 0.3 cm above the soil surface (Hopkins *et al.* 1937).

The presence of soil surface cover (vegetation, rock, timber debris) is also critical as surface roughness decreases the velocity of the wind at the soil surface.

The generally low rainfall and high evaporation at the project sites limit the ability to germinate and sustain vegetation cover and significant areas of soil disturbance were observed during desktop assessment utilising aerial imagery.

Site specific soil sampling was not undertaken to determine soil however, vegetation cover of 50% is recommended for sandy-loams and 70% for sands to provide adequate protection from wind erosion in agricultural cropping areas (Government of SA 2020). The desk top mapping suggests that the site soils are more likely to be sandy-loams than sands.

Daily mean wind velocities measured at BoM weather stations (Table 5.2) in proximity to the sites are typically below those that would initiate wind erosion; however, it is anticipated that higher wind velocities would be anticipated during weather events that would initiate wind erosion.

The wind erosion hazard can be mitigated by the recommended control measures.

Table 5.2 Site wind speeds

BoM weather station (number)	Daily mean wind speed (9 am/3 pm) (kph)
Condobolin Ag. Research station (050052)	13.0/14.6

Further project specific management and mitigation measures are provided in section 7**.**

5.3 Erosion hazard summary

The overall erosion hazard of the compressor station and associated facilities at MW880 is low due to the flat gradient of the proposed construction areas and volume and intensity of rainfall. Erosion risk is greatest when soils are exposed to wind and rain during the clearing and early constructed phases of the project but can be readily mitigated as detailed in Section 7.

The MW880 site erosion hazard is due to the potential presence of dispersive subsoils and lower annual average rainfall, making it more challenging to establish vegetation to provide short- and long-term soil surface cover.

Calculated soil losses do not trigger the need for sediment basins and a strong focus on erosion control as recommended to minimise the generation of sediment and turbid run-off combined with conventional temporary sediment control will provide the necessary level of environmental protection.

6 Design standards

Recommended design standards for drainage, erosion and sediment control are derived from:

- legislative requirements;
- industry guidelines; and
- site-specific risk assessments for design life and consequence of failure.

The design standards for temporary drainage controls have been adopted from Landcom 2004 and these are provided Table 6.1 below.

6.1 Drainage

The minimum recommended drainage standards for the project are show below in Table 6.1.

Table 6.1 Recommended drainage design standards (IECA 2008 and Landcom 2004)

Drainage structure	Landcom (2004)
Drains	10-year ARI
Clean water diversion drains	10-year ARI
Culvert crossing	2-year ARI

Adopted from section 5 in Landcom (2004).

Several unsealed roads will be required on site for the construction and operational phases of the project.

If construction of mitre drains is necessary for internal unsealed roads, spacing of the mitre drains is generally dependent on-site topography and conditions however the horizontal spacing proposed in Table 6.2 will be used to provide guidance.

Unsealed tracks and roads are recommended to have a minimum cross slope of 4% to minimise the potential for corrugations to form (WSC 2012).

Table 6.2 Recommended mitre drain spacing (IECA 2008)

Table drain slope (%)	Horizontal spacing of mitre drains (m)
0–2%	120
>2% but ≤4%	60
>4% but ≤8%	30
> 8%	15

Adopted from Table 4.3.12 from IECA (2008)

6.2 Erosion control

Erosion control standards are generally addressed in section 6.1. There are, however, several important erosion control standards that are recommended to be adopted for the project additional to those described.

APA will adopt the target C-Factors and timings nominated in Table 6.3 for the control of sheet flow and wind erosion.

Soil covers that may be utilised on site include:

- polymer soil stabilisers;
- grasses and legumes;
- gravel; and
- hydro-mulches and Hydraulic Growth Media (HGM).

Polymer soil stabilisers, hydro-mulches and Hydraulic Growth Media (HGM) are best utilised as interim measures to rapidly establish soil cover in areas disturbed during construction. Establishment of vegetation, such as grasses and legumes, is seen as the best practice permanent soil cover measure. Gravel can be similarly utilised as a temporary measure as well as a permanent option to provide soil cover in areas where vegetation establishment is restricted.

Table 6.3 Target C factors and timing

Lands	Target C-factor	Description
Waterways and other areas subjected to concentrated flows, post construction	0.05	A target C factor of 0.05 (approx. 70% soil surface cover) will aim to be achieved ten (10) days from completion of construction and prior to exposure to concentrated flows.
All lands, including waterways and stockpiles during construction	0.15	A target C factor of 0.15 (approx. 50% soil surface cover) will aim to be achieved twenty (20) working days of inactivity or from completion of construction.
Stockpiles, post construction	0.10	A target C factor of 0.10 (approximately 60% soil surface cover) will aim to be achieved ten (10) working days from completion of construction.

For concentrated flow environments erosion protection must be employed when the maximum permissible velocity of the soil is exceeded. The maximum permissible velocities for various soil types are shown in Table 6.4.

Table 6.4 Maximum permissible velocities for various soil types (IECA 2008)

Soil description	Allowable velocity (m/s)	Anticipated to be impacted by the project	Comments
Extremely erodible soils	0.3	Yes	Dispersive clays are highly erodible at low flow velocities and must be gypsum treated or capped with stable soil.
Sandy soils	0.45	Yes	
Highly erodible soils	0.4–0.5	Yes	Highly erodible soils may include: Lithosols, Alluvials, Podzols, Silicious sands, Soloths, Solodized solonetz, Grey podzolics, some Black

Table 6.4 Maximum permissible velocities for various soil types (IECA 2008)

Soil description	Allowable velocity (m/s)	Anticipated to be impacted by the project	Comments
			earths, fine surface texture-contrast soil and Soil Groups ML and CL.
Sandy loam soils	0.5	No	
Moderately erodible soils	0.6	No	Moderately erodible soils may include: Red earths, Red or Yellow podzolics, some Black earths, Grey or Brown clays, Prairie soils and Soil Groups SW, SP, SM, SC.
Silty loam soils	0.6	No	
Low erodible soils	0.7	No	
Firm loam soils	0.7	No	
Stiff clay very colloidal soils	1.1	No	Erosion-resistant soils may include: Xanthozem, Euchrozem, Krasnozems, some Red earth soils and Soil Groups GW, GP, GM, GC, MH and CH.

Adapted from Table A23 IECA (2008)

Data in Table 6.4 demonstrate that the anticipated maximum permissible velocities for soils impacted by the project ranges from 0.3–0.5 metres per second (m/s). APA will ensure that flows are maintained below those permissible velocities for bare soils or line concentrated flow areas where the maximum permissible velocity of the soil will or is likely to be exceeded.

Channel liners appropriate for use on the project and their allowable flow velocities are provided in Table 6.5.

Table 6.5 Allowable flow velocity for various channel linings

Product	Allowable velocity (m/s)	Comments
Jute mesh with bitumen emulsion	1.3–1.7	Design life 1 year.
Coir mesh	1.7	Design life 1 to 2 years. Minimum of 400 g/m^2 is recommended.
Spray on hydro-colloid cementitious channel liner (Geospray™)	2.6–3.2	1 L water/1 kg product applied at 4 kg (of equivalent dry matter)/m^2.
Rock	Dependent of the rock size and density and shear stress from flow	Must be durable, angular igneous rock. Dispersive soil under the rock must be treated with gypsum to minimise tunnel and gully erosion.
Concrete	7	

Adapted from Tables A25 and A26 IECA (2008) and Landloch (2018).

Dispersive subsoils are anticipated to be present within the project area. Dispersive soils are sodium dominated soils with weak ionic bonding. When the soil contacts non-saline water, water molecules are drawn in-between the clay platelets causing the clay to swell to such an extent that individual clay platelets are separated from the aggregate resulting in the soil losing its structure. Magnesic soils can demonstrate similar behaviour.

Excavation of drains will be minimised to avoid disturbance to dispersive subsoils. Where diversion of flow is required, back-push diversion banks and temporary road formations to divert flow.

The most effective treatment for soil dispersion is the incorporation of calcium sulphate (gypsum) into the soil. The calcium ions in the gypsum displace the sodium ions in the soils resulting in a more cohesive soil. Lime cannot be used as lime does not dissolve at pH >6.5.

Dispersive soils disturbed by the project will be treated such that the exchangeable sodium percentage (ESP) is less than 6%.

6.3 Sediment control

It is not considered practical to construct a sediment basin on site due to the identified low rainfall erosion hazard, with the calculated soil loss is less than 20 /ha/y, well below the Landcom (2004) sediment basin trigger of 150 t/ha/y.

Sediment control will therefore be a function of erosion control and progressive stabilisation to reduce the generation of sediment and turbid run-off, and sediment control using traditional temporary controls such as sediment fences and check dams.

Temporary sediment controls will be designed and constructed to remain stable for a 10-year ARI time of concentration flow event in accordance with Landcom (2004) requirements.

6.4 Wastewater management system

APA has engaged Permeate Partners to complete a concept design of a wastewater management system for the construction camp. This has been designed in accordance with best practise and relevant guidelines (including DPIE-Water guidance document on Recycled Water Management Systems), applicable standards (including AS/NZS 1547:2012 *On-site domestic wastewater management*) and local Council requirements.

The concept design of this system is based on a maximum occupancy of 65 workers, with an assumed flow of 250 litres/person/day and a 30% contingency, giving a total design daily flow of 22 kilolitres per day.

As part of the wastewater concept design, a water balance assessment, including water modelling using the Model for Effluent Disposal Using Land Irrigation (MEDLI) Version 2 platform was undertaken to factor in potential stormwater or rainwater ingress into the wastewater system and to identify and manage potential impacts from the irrigation of wastewater to inform the LSC *Local Government Act 1993* Section 68 approval. The treatment process constitutes secondary treatment and disinfection as per the Australian Guidelines for Water Recycling 2006.

Wastewater effluent quality will comply with the following criteria in accordance with AS/NZS 1547.

Table 6.6 Spray irrigation effluent quality (AS 1547)

Parameter	Criteria
Biological Oxygen Demand (BOD)	• 90^{th} percentile ≤ 20 mg/L • 100^{th} percentile ≤ 30 mg/L
Total Suspended Solids (TSS)	• 90^{th} percentile ≤ 30 mg/L • 100^{th} percentile ≤ 45 mg/L
E. Coli	• mean ≤ cfu/100mL • 80^{th} percentile ≤ 20 cfu/100mL

Table 6.6 Spray irrigation effluent quality (AS 1547)

Parameter	Criteria
Free available chlorine	0.5 – 2.0 mg/L

The wastewater system will include a wastewater flow balance tank which can hold 22 kilolitres of waste water, which is expected to be the maximum daily amount. The wastewater system will include aeration, sedimentation filtration and disinfection prior to irrigation. The wastewater will be irrigated on the wastewater spray field with an area of 0.9 ha using low-throw fixed sprinklers. The spray field will be planted with kikuyu grass (or suitable hardy alternative) The waste water modelling and proposed irrigation application rates have been informed by site-specific soil sampling analysis.

To avoid impacts to the soil, wastewater will be irrigated at a maximum rate of 2.44 litres/m^2 per day.

6.5 Weed controls

General weed movement controls and biosecurity is contained within the CEMP Section 7.2. These include measures to avoid the introduction and spread of weeds such as vehicle and plant wash down and weed and pathogen monitoring.

Specific measures to be employed within rehabilitation to minimise weed incursion will include:

- utilisation of soil stabilising polymers on soil stockpiles to prevent weed germination or propagation; and
- use of hydromulch on exposed soils immediately following rehabilitation.

If areas of weed-infected topsoil are identified in accordance with the *Biosecurity Act 2015*, these will be eradicated prior to construction works commencing. Stockpiles of Weeds of National Significance (WONS), including any affected topsoil, will be disposed of at an appropriately licenced waste management facility, and a hydraulic growth media used if the area is to be immediately revegetated.

7 Management and mitigation measures

APA will implement reasonable and practicable measures to minimise short and long-term soil erosion, the adverse effects of sediment transport and wastewater to minimise the potential of environmental harm and to minimise damage to assets and the need for re-work during and post construction.

This will be achieved by applying the key fundamental principles of erosion and sediment control detailed in Landcom (2004) and DECC (2008) as well as utilising specialist advice to develop appropriate technical solutions to the identified site constraints and erosion hazards.

7.1.1 Appropriately integrate the development into the site

The facility design generally utilises the existing topography and minimises the need for extensive land reshaping and regrading works.

Where possible, access roads will be located to avoid areas with upstream run-on water catchments to minimise the need to construct longitudinal drainage.

Any required cut and fill will employ slope design rules and stabilisation measures guided by material erosion and agronomic characterisation of the site soils.

7.1.2 Minimise the extent and duration of soil disturbance

The highest erosion risk for the project is during the construction and rehabilitation phases when soils are stripped and any dispersive subsoils are exposed. Major land disturbing works will be scheduled to avoid the higher rainfall erosivity periods and the highest wind velocity periods where practical. If these works are carried out during periods of higher rainfall or higher wind velocity, soil and erosion control measures will be adjusted to ensure appropriate management of erosion and sediment.

Hardstands are expected to be gravel sheeted, and concreted where required. Soil stabilising polymers may be utilised to protect soil stockpiles and exposed areas.

Land disturbances will be restricted to those areas required for the current stage of works.

7.1.3 Control water movement through the site

The PESCPs prepared for each of the surface construction areas will address the temporary and permanent requirements of each area. Due to the low slope gradients, sheet flow velocities are unlikely to exceed the maximum permissible velocity of the site soils, as per IECA (2008) (Table 7.1) during the land clearing phase, however, as the soil runoff coefficients change as a result of soil compaction during the construction, higher sheet flow velocities that may exceed the maximum permissible velocities of the site soils can be anticipated.

Where nominated in the PESCP, soil stabilising polymers will be applied to exposed soils to protect them from rain drop splash erosion and sheet flows.

Site drainage will be designed to maximum sheet flow where possible. Construction of diversion drains, channels and table drains will be minimised to the maximum possible extent where practicable. Stormwater runoff from buildings will be captured in rainwater tanks for use on site, to minimise demand for imported water and reduce water movement across site.

The construction of longitudinal drainage on access roads will be avoided to the maximum possible extent with run-off turned away using back-push diversion banks instead of excavated drains where possible. Where excavated

drains are required, they will be broad based, shallow and trapezoidal shaped to minimise the depth and velocity of flow.

Drains will be lined where design flow velocity exceeds the maximum permissible velocity of the soils to protect the soil from erosion. Drain linings will be specified in the PESCPs.

Table 7.1 Maximum permissible velocities for different soil types (after IECA 2008a)

Soil description	Allowable velocity	Impacted by the project
Extremely erodible soils	0.3 m/s	Potentially
Sandy soils	0.45 m/s	Yes
Highly erodible soils	0.4 to 0.5 m/s	Yes
Sandy loam soils	0.5 m/s	Yes
Moderately erodible soils	0.6 m/s	Yes
Silty loam soils	0.6 m/s	-
Low erodible soils	0.7 m/s	-
Firm loam soils	0.7 m/s	-
Stiff clay very colloidal soils	1.1 m/s	-

The flat nature of the site and small clean run-on water catchment largely negates the need to any clean water diversion drains. This will be further assessed during the development of the ESCP. If practical to do so, any clean upstream run-on water catchment should be diverted around active construction areas. Any clean water diversions should avoid the use of excavated drains. Constructed landforms should be located to utilise the natural drainage features to the maximum practicable extent.

7.1.4 Minimise soil erosion

Due to the erosion risk associated with the presence of dispersive soils, priority will be given to the prevention, or at least minimisation, of soil erosion rather than allowing erosion to occur and relying on sediment control measures to trap and contain sediment and turbid runoff. This is particularly important where it is not possible or is impractical to divert turbid runoff to a sediment basin.

Landcom, 2004 states that sediment basins are generally required where soil loss calculations exceed 150 tonnes per hectare (t/ha/y) and/or land disturbance exceeds 2,500 m^2. The maximum disturbed area at MW880 is expected to be approximately 3.5 ha and therefore exceeds the disturbance triggers however the calculated annual average soil loss for MW880 is 93m^3/ha/y which is below the soil loss trigger.

EMM therefore considers that a focus on limiting erosion is more appropriate than controlling sedimentation for the site conditions.

Appropriate erosion protection will be incorporated into all stages of soil disturbance and should be appropriate for the erosion risk posed by the potentially dispersive or non-cohesive site soils.

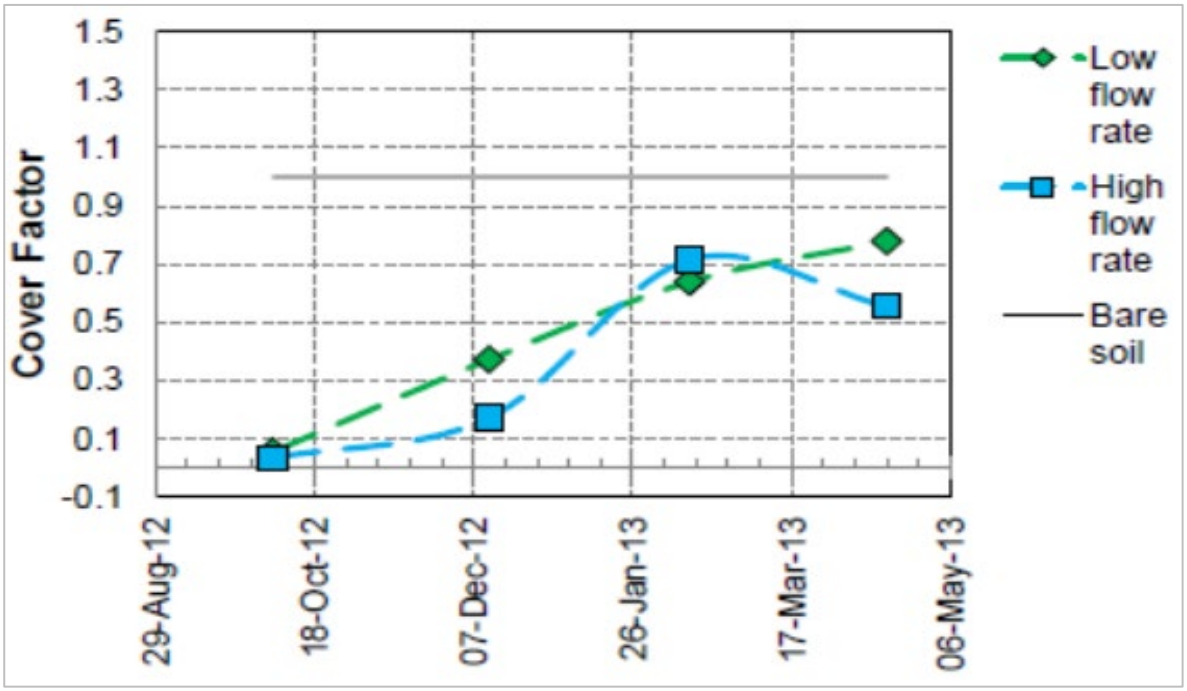
As detailed in section 7.1.3, site drainage should be designed to maximise sheet flow where possible.

A large portion of the land disturbed by the project during construction will be rehabilitated leaving approximately 1.5 ha for operations and will have a very low erosion risk. The key erosion risk areas will be any soil stockpiles or cut and fill batters and temporary construction areas.

Surface soil cover of 50% will be established to protect from wind erosion, using soil stabilising polymers, or suitable alternatives, especially in areas disturbed by construction.

i Promptly stabilise disturbed areas

Hydraulically applied soil stabilising polymers can provide erosion protection equivalent to 60% grass cover for up to three months using a 10% solution applied at 1 litres per square metre (L/m^2) (Figure 7.1; from Landloch & SEEC (2013)) and are therefore recommended as an important temporary erosion control in sheet flow environments within the site, particularly in preparation for periods of predicted rainfall, wind or during construction shut down periods.



Source: Landloch and SEEC (2013)

Figure 7.1 C-Factor assessment of soil stabilising polymers

Landcom (2004) nominates target stabilisation timing and standards for disturbed areas during construction and post-construction (Table 7.2). The project should consider these requirements.

Landcom (2004) recommends scheduling land disturbing activities for times of low rainfall erosivity in sensitive environments. Major disturbance works will be scheduled to avoid high rainfall periods (summer months), if practicable. Where works during summer months are unavoidable, erosion controls such as soil stabilising polymers or other suitable soil erosion protection will be provided to achieve C-Factors higher than 0.1 when the 3-day rainfall forecast suggests that rain is likely.

Indicative C-Factors for various erosion control and revegetation techniques can be found in Table A3 in Landcom (2004) and on reputable product suppliers web sites.

Table 7.2 Maximum C-Factors during construction and post-construction[1]

Feature/area	C-Factor	Requirement
During construction		
Waterways and land below the 2 yr ARI flood levels including stockpiles	0.10	When working in waterways and flood prone lands a C-Factor of ≤0.1 is to be achieved if the 3-day forecast indicates rain causing runoff is likely.
Land above 2 yr ARI flood levels flood levels (including stockpiles).	0.15	A C-Factor of ≤0.15 is to be achieved within 20 working days of inactivity, even though works might continue later.
Post construction		
Waterways and other areas subjected to concentrated flows	0.05	Applies after 10 working days from completion of formation and before they are allowed to carry any concentrated flows.
Stockpiles	0.10	Applies after 10 working days from completion of formation. Maximum C-Factor of 0.10 equals 60 percent ground cover
All other land	0.15	In periods of expected 'low' rainfall erosivity during the rehabilitation period, achieve a C-Factor of less than 0.15. Maximum C-factor of 0.15 equals 50% ground cover
	0.10	In periods of 'moderate' to 'high' rainfall erosivity during the rehabilitation period, achieve a C-Factor of less than 0.1. Set in motion a program that should ensure it would reduce permanently to less than 0.05 within a further 60 days.

Non-operational areas such as cut and fill batters and stockpiles will be progressively stabilised in accordance with the timeframes nominated in (Table 7.2).

7.1.5 Prevention of pollution

i Sediment control

APA will implement all reasonable and practicable measures needed to protect downstream waters and adjacent properties from the adverse effects of sediment and turbid water discharge.

As discussed in section 7.1.4, EMM considers that a focus on erosion control to minimise soil dispersion and the generation of turbid runoff will offer an appropriate level of environmental protection.

Given the sandy nature of some site soils, it is expected that runoff will infiltrate relatively quickly, and sediment will be retained close to the source. There will be a major focus on erosion control during the construction and operational phases of the project which will minimise the generation of sediment and turbid runoff.

ii Spray irrigation effluent

To avoid impacts to the soil, wastewater will be irrigated at a maximum rate of 2.44 litres/m^2 per day.

Soils in the irrigation area will be sampled and characterised to confirm the impacts of the spray effluent application rates match with what is expected from the modelling. Soil sampling will be undertaken every three months during operation, and samples will be analysed for phosphorus, nitrogen, salinity and sodium adsorption ratio. One soil sample per sampling period from the irrigation area will be sufficient due to the small size and homogenous nature

of the area. If the results of soil analysis do not match what would be predicted in the modelling, the irrigation application rate will be reduced.

If the soil in the irrigation area is visibly saturated and runoff is occurring, then wastewater irrigation will not take place.

Once the construction stage is complete and the temporary construction camp is removed, the wastewater irrigation spray field will be ripped to a depth of 100 mm; and gypsum will be applied at a rate of 3-5 tonnes per hectare depending on the structure of the soil and duration of application of effluent to the area, as requested by LSC.

iii Chemical management

Chemicals on site will be managed in accordance with appropriate measures. Site areas containing potential contaminants (such as fuel, oil, grease and chemicals) will be covered and/or bunded in accordance with Australian Standard AS1940. The storage and handling of flammable and combustible liquids will be managed to prevent contamination of stormwater runoff, with offsite disposal of captured water/contaminants. Spill management and reporting procedures will be developed and implemented for the site and contained in the CEMP.

7.1.6 Drainage, erosion and sediment control maintenance

All drainage, erosion control, sediment control and water management measures will be maintained in proper working order until their function is no longer required. To assist in achieving these requirements, PESCPs should include construction, inspection and maintenance requirements for all drainage, erosion, and sediment control measures.

Inspections will be undertaken 24 hours prior to predicted rainfall events and immediately following rainfall events that cause run-off and periods of strong winds, and weekly during periods of no rain.

All clean and dirty water, debris and sediment removed from drainage, erosion and sediment control measures must be disposed of in a manner that will not create erosion, sedimentation, or a pollution hazard.

Upon decommissioning any drainage, erosion and sediment control measures, all materials used to form the control measures should be disposed of appropriately by a suitably licenced contractor.

7.1.7 Drainage, erosion and sediment control monitoring

ESCPs are living documents that can and should be modified as site conditions change, or if the adopted control measures fail to achieve the required treatment standard. When site personnel detect a notable failure in the adopted control measures, the source of the failure will be investigated, and appropriate amendments made to the controls and ESCPs.

7.1.8 Summary of commitments

The following commitments will minimise impacts to soil and erosion associated with the project:

Table 7.3 Summary of commitments – soil and erosion

Stage	Commitment ID	Commitment
Construction	GE-01	The approved construction footprint, including vegetation clearing extent and environmental or heritage features within the construction footprint, will be clearly demarcated and identified during the construction stage with survey pegs and at some locations with flagging, bunting, barrier mesh or similar. No go zones will be clearly marked and communicated as such.
Construction	GE-02	All temporary infrastructure will be decommissioned and removed at the completion of construction.
Construction	GE-03	Rehabilitation of disturbed areas will commence progressively as soon as practicable during and after construction, and will be carried out in accordance with the SWMP and Landcom (2004).
Construction	AQ-01	Stabilisation of exposed soils will be undertaken as soon as practicable and dust suppression undertaken as required using water sprays, water extension agents, soil stabilising polymers or other media on: • unpaved work areas subject to traffic or wind; • exposed soil; • main haulage routes, as required; • sand, spoil and aggregate stockpiles; and • during the loading and unloading of dust generating materials. When water is used for dust suppression, it will not be applied in a way that causes ponding or runoff.
Design Construction Operation	WS-01	Soil characterisation will be undertaken to accurately determine site-specific erosion and effluent irrigation risk. Surface water and runoff management to be considered in the final engineering design will be detailed in the PESCPs. PESCPs will include construction, inspection and maintenance requirements for all drainage, erosion, and sediment control measures. PESCPs will include appropriate erosion and sediment controls for all stages of soil disturbance will be appropriate for the erosion risk posed by potentially dispersive or non-cohesive site soils and adjusted to account for weather events such as high winds or rainfall. PESCPs will also set out roles and responsibilities for personnel and procedures to be followed if there is a failure in the adopted control measures.
Design Construction	WS-02	Any required cut and fill will employ slope design rules and stabilisation measures guided by material erosion and agronomic characterisation of the site soils.
Design Construction	WS-03	Major land disturbance works will be scheduled to avoid periods of high wind, where practicable. Soil and erosion control measures will be adjusted to ensure appropriate management of erosion and sediment during adverse weather.
Design Construction	WS-04	Site drainage will be designed to maximise sheet flow where possible. Construction of diversion drains, channels and table drains will be minimised to the maximum possible extent where practicable.
Design Construction	WS-06	Avoid the use of excavated drains where dispersive soils are expected to be present. Constructed landforms will be located to utilise the natural drainage features to the maximum practicable extent.
Design Construction	WS-07	Priority will be given to the prevention or minimisation of soil erosion rather than allowing erosion to occur and relying on sediment control measures to trap and contain sediment and turbid runoff.
Construction	WS-08	Soils will be ameliorated by the incorporation of gypsum into the soil at rates determined by site-specific soil testing. Hardstands will be gravel sheeted or concreted, and stabilised or strengthened where required.

Table 7.3 Summary of commitments – soil and erosion

Stage	Commitment ID	Commitment
Construction	WS-09	Organic and woody wastes should be considered for soil erosion protection purposes on stockpiles and rehabilitated areas.
Design Construction	WS-10	All reasonable and practicable measures needed to protect downstream waters and adjacent properties from the adverse effects of sediment and turbid water discharge will be implemented.
Construction Operation	WS-11	Site areas containing potential contaminants (such as fuel, oil, grease and chemicals) will be covered and/or bunded in accordance with Australian Standard AS1940: The storage and handling of flammable and combustible liquids to prevent contamination of stormwater runoff, with offsite disposal of captured water/contaminants.
Design Construction Operation	WS-12	Temporary and permanent onsite wastewater management systems will: • be appropriate for each site based on consideration of the site layout, site conditions and relevant environmental constraints; and • be designed, constructed, operated, maintained and decommissioned in accordance with best practise and relevant guidelines (including WaterNSW 2019), applicable standards (including AS/NZS 1547:2012 On-site domestic wastewater management) and local Council requirements.
Design Construction Operation	WS-14	Stormwater runoff from buildings will be captured in rainwater tanks for use on site, to minimise demand for imported water.

7.2 Inspection and maintenance of control measures

Drainage, erosion and sediment control measures at all times until their function is no longer required. Technical notes for drainage, erosion and sediment control measures recommended to be used on the project will be provided in the PESCP's. These technical notes include construction and maintenance requirements for the control measures.

Inspections of control measures will be undertaken prior to predicted rainfall and following rainfall that causes run-off or weekly during dry conditions.

Inspections will be undertaken by the construction contractors Environmental Advisor or delegate. That person will have the following knowledge:

- an understanding of site environmental values that could be impacted by site construction and operation;
- an understanding of the requirements of the Project Approval that are relevant to drainage, erosion and sediment control and spray effluent water management;
- a good working knowledge of drainage, erosion and sediment control fundamentals and the project specific application thereof;
- ability to provide advice and guidance on appropriate measures and procedures to maintain the site at all time in a condition representative of regionally specific best practice, and that is reasonably likely to achieve the required standards; and
- a good working knowledge of the correct installation, operation and maintenance procedures for the full range of drainage, erosion and sediment control measures used on the project.

The construction contractor will maintain control measures to maximum practicable extent so that control measures:

- will best achieve the sites required environmental protection including achieving the water quality criteria specified in the Project Approval and this SWMP for the nominated design storm event;
- are in accordance with the specified operational standard for each drainage, erosion and sediment control measure; and
- prevents or minimises safety risks.

All water, debris and sediment removed from control measures shall be disposed of in a manner that will not create an erosion or pollution hazard.

7.3 Monitoring and adjustment of control practices

APA has adopted a hierarchical esc planning system be adopted for construction of the project consisting of an overarching project wide SWMP (this document) with PESCPs for all disturbance areas prepared by the construction contractor(s) to ensure that the project PESCPs are living documents that can and will be modified as site conditions change, or if the adopted control measures fail to achieve the desired treatment standard.

The PESCPs will be prepared and certified by a Certified Professional in Erosion and Sediment Control (CPESC).

If a site inspection or environmental monitoring identifies a significant failure of the adopted drainage, erosion and sediment control measures, a critical evaluation of the failure should be undertaken to determine the cause and appropriate modifications made to the control measures on site and PESCPs amended.

8 Inspections, maintenance and monitoring

8.1 Incidents and complaints

All incidents will be reported and investigated, and corrective actions assigned to prevent future occurrences in accordance with the CEMP.

An incident may involve:

- actual or potential pollution incidents where material harm to the environment is caused or threatened. In this case, a 'duty to notify' relevant authorities applies under the *Protection of the Environment Operations Act 1997* (POEO Act) for material harm (which includes actual or potential harm) to the health or safety of human beings or to ecosystems that is not trivial or that results in actual or potential loss or property damage exceeding a threshold dollar value; or
- any other action or activity deemed to be in non-compliance with this SWMP or associated PESCPs.

8.2 Inspections

Inspections of drainage, erosion and sediment control measures will be undertaken:

- weekly during normal construction hours;
- daily during periods of rainfall; and
- within 24-hours of the cessation of a rainfall event causing runoff to occur on or from the project (≥10 mm).

The wastewater irrigation spray field will be inspected daily to ensure the soil is not saturated.

8.3 Maintenance and remedial actions

Various types of drainage, erosion and sediment control measures will be utilised for the project. A description of the key measures used and maintenance and remedial actions likely to be required are provided in Table 8.1.

Table 8.1 Maintenance and remedial actions

Control measure	Maintenance and remedial actions
Drainage control	
Lined clean water diversion drains and banks	Repair any damage to the liner (replace, re-anchor), repair any bunding or silt fence isolating the clean water catchment from the dirty water catchment.
Dirty water diversion drains and banks	Repair any erosion, re-line if necessary.
Drain blocks	Ensure turbid water cannot enter the drain or pipe. Monitor for damage and sediment accumulation and repair as necessary.

Table 8.1 Maintenance and remedial actions

Control measure	Maintenance and remedial actions
Erosion control	
Temporary	
Polymer soil stabiliser and covers	Reapply or adjust/repair following rainfall, heavy vehicle traffic or other disturbance.
Permanent	
Gypsum amelioration of dispersive soil	Check for rill, gully and tunnel erosion. Re-test soil and incorporate additional gypsum in accordance with the soil testing results.
Lined channel, drains and batter chutes	Look for water flows under or beside the structure and repair and/or modify as necessary. Look for erosion around and downstream of the energy and repair and/or modify as necessary.
Sediment control	
Temporary	
Silt fences	Ensure silt fences pond water. If not, install additional panels. Check for blow-outs in the anchor trench. Re-anchor as necessary. Replace any ripped or damaged sediment fence.
Check dams	Check for erosion between check dams. Install additional check dams if necessary. Remove accumulated sediment.
Stabilised construction exits	Ensure rock is free from accumulated sediment. Replace as necessary.
Surface water	
Irrigation area	Check for runoff or grass death. Cease or move irrigation as required. Replant irrigation area if necessary.
Bunded areas	Check for evidence of hydrocarbon and chemical spills within bunds. Clean up as required. Treat and remove any accumulated rainwater.

9 Review and Improvement

9.1 Continuous improvement

Continuous improvement of this SWMP will be achieved by the ongoing evaluation of environmental management performance against environmental policies, objectives and targets for the purpose of identifying opportunities for improvement.

9.2 SWMP update and amendment

The SWMP will be revised whenever the construction program, scope of work or work methods change, or whenever the work methods and control structures are found to be ineffective after each site inspection, or if so, directed by authorities.

A copy of the updated plans and changes will be distributed to all relevant personnel and discussed at pre-start and toolbox talks.

10 References

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WSC 2012, *Fire and land management trail construction guidelines* July 2012, Wyong NSW.

Appendix A

Approval of suitably qualified and experienced person

Planning, Industry & Environment

Mr Brian Connellan
East Coast Grid Expansion – Access and Approvals Manager
APA Group
PO Box R41
Royal Exchange NSW 1225

09/11/2021

Dear Mr Connellan

Moomba to Wilton Pipeline MOD 1 (SSI-15548591)
Approval of Experts

I refer to your request for the Secretary's approval of suitably qualified persons to prepare the Soil and Water Management Plan for Moomba to Wilton Pipeline Modification 1.

The Department has reviewed the nominations you have provided and is satisfied that these experts are suitably qualified and experienced. The Secretary approves the appointment of:

- Mr Michael Frankcombe of EMM Consulting to prepare the Soil and Water Management Plan; and
- Mr Andrew Littlewood of Rubicon Enviro Pty Ltd to prepare the associated Erosion and Sediment Control Plan.

If you wish to discuss this matter further, please contact Gen Lucas on 9274 6489.

Yours sincerely

Stephen O'Donoghue
Director Resource Assessments

As nominee of the Secretary

Appendix B

Agency consultation

Connellan, Brian

From: Adrian Milne <>
Sent: Tuesday, 7 December 2021 8:50 AM
To: Connellan, Brian
Subject: [EXT]: RE: APA East Coast Expansion - Construction EMP

Brian,
The approach outlined appears reasonable.
It is noted that there is further work required on the waste water management system.
Kind Regards,

Adrian Milne | Director | Infrastructure Services
Lachlan Shire Council | 58-64 Molong Street | **Condobolin NSW 2877**

Find us on: Facebook Website

From: Connellan, Brian <>
Sent: Tuesday, 30 November 2021 9:37 AM
To: Adrian Milne <>
Subject: FW: APA East Coast Expansion - Construction EMP

Hi Adrian,

Please find attached a Soil and Water Management Plan prepared for the site. I believe these are now all the documents required for your reference. Please can you let me know when you might be able to provide confirmation of your review or feedback so I am able to provide to the Department?

Thank you

Brian Connellan
Environmental Assessment Advisor
ID – Infrastructure Planning and Approvals

apa.com.au

always powering ahead

From:	DPIE Water Assessments Mailbox
To:	Connellan, Brian; DPIE Water Assessments Mailbox
Cc:	Liz Rogers
Subject:	[EXT]: RE: APA East Coast Grid Expansion Stage 1 - MW880 Management Plans
Date:	Thursday, 20 January 2022 7:25:48 AM
Attachments:	image001.png image002.png image003.png

Hi Brian,

I'm checking with the relevant teams regarding your queries. I'll get back to you as soon as I hear back from them.

Regards,

Judy Court
Assistant Project Officer
Water Group|Department of Planning and Environment
T 9842 8126 | **E** judy.court@dpie.nsw.gov.au
4 Parramatta Square, 12 Darcy St, Parramatta
www.dpie.nsw.gov.au

From: Connellan, Brian <Brian.Connellan@apa.com.au>
Sent: Wednesday, 19 January 2022 9:51 AM
To: DPIE Water Assessments Mailbox <water.assessments@dpie.nsw.gov.au>
Cc: Liz Rogers <liz.rogers@dpie.nsw.gov.au>
Subject: RE: APA East Coast Grid Expansion Stage 1 - MW880 Management Plans

Thank you Judy,

I assume this is separate to the feedback we have already received from Planning? May I ask if you have much advice on both the SWMP and ESCP as my consultants are currently working through the comments from Planning and I just want to ensure we are being as efficient as possible.

Thank you

Brian Connellan
Environmental Assessment Advisor
ID – Infrastructure Planning and Approvals

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sender. Views expressed in this message are those of the individual sender.

From: DPIE Water Assessments Mailbox <water.assessments@dpie.nsw.gov.au>
Sent: Wednesday, 19 January 2022 7:14 AM
To: Connellan, Brian <Brian.Connellan@apa.com.au>
Cc: Liz Rogers <liz.rogers@dpie.nsw.gov.au>
Subject: [EXT]: RE: APA East Coast Grid Expansion Stage 1 - MW880 Management Plans

HI Brian,

Apologies for the delay in replying. We are expecting to have the advice back at the beginning of next week.

Sorry for any inconvenience this may cause.

Regards,

Judy Court
Assistant Project Officer
Water Group|Water Assessments
4 Parramatta Square, 12 Darcy St, Parramatta
www.dpie.nsw.gov.au
water.assessments@dpie.nsw.gov.au
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From: Connellan, Brian <Brian.Connellan@apa.com.au>
Sent: Tuesday, 18 January 2022 4:38 PM
To: DPIE Water Assessments Mailbox <water.assessments@dpie.nsw.gov.au>; Liz Rogers <liz.rogers@dpie.nsw.gov.au>
Subject: FW: APA East Coast Grid Expansion Stage 1 - MW880 Management Plans

Hi Judy,

I am just following up on the email below.

I look forward to hearing back from you.

Thanks

Brian Connellan
Environmental Assessment Advisor
ID – Infrastructure Planning and Approvals

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apa.com.au

From: Connellan, Brian
Sent: Tuesday, 11 January 2022 12:17 PM
To: DPIE Water Assessments Mailbox <water.assessments@dpie.nsw.gov.au>
Subject: RE: APA East Coast Grid Expansion Stage 1 - MW880 Management Plans

Hi Judy,

Happy new year, I trust you had a good break.

I was just hoping to following up on the below and check if you had indicative timing on this? We have received feedback from Planning on the SWMP but I'm unsure if this includes any comments from yourselves.

Thank you

Brian Connellan
Environmental Assessment Advisor
ID – Infrastructure Planning and Approvals

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apa.com.au

From: DPIE Water Assessments Mailbox <water.assessments@dpie.nsw.gov.au>
Sent: Thursday, 9 December 2021 1:52 PM
To: Connellan, Brian <Brian.Connellan@apa.com.au>
Subject: [EXT]: RE: APA East Coast Grid Expansion Stage 1 - MW880 Management Plans

Hi Brian,

Apologies for the delay in responding. I've been advised by my colleague in the water science team that due to a large volume of requests, they won't be able to review the request until the new year.

Sorry for any inconvenience this may cause.

Regards,

Judy Court
Assistant Project Officer
Water Group|Department of Planning, Industry and Environment
T 9842 8126 | **E** judy.court@dpie.nsw.gov.au
4 Parramatta Square, 12 Darcy St, Parramatta
www.dpie.nsw.gov.au
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From: Liz Rogers <liz.rogers@dpie.nsw.gov.au>
Sent: Friday, 3 December 2021 3:37 PM
To: Connellan, Brian <Brian.Connellan@apa.com.au>
Cc: DPIE Water Assessments Mailbox <water.assessments@dpie.nsw.gov.au>
Subject: RE: APA East Coast Grid Expansion Stage 1 - MW880 Management Plans

Hi Brian, I am unable to advise today. Judy Court should be able to advise of likely times next week.

Thanks, Liz

Liz Rogers
Manager Assessments

Water Group | Department of Planning, Industry and Environment
| **M** 0428 600 421 | **E** liz.rogers@dpie.nsw.gov.au
Prince Street, Locked Bag 21, Orange NSW 2800
www.dpie.nsw.gov.au

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I live and work on Wiradjuri Country
The Department of Planning, Industry and Environment acknowledges that it stands on Aboriginal land. We acknowledge the traditional custodians of the land and we show our respect for elders past, present and emerging through thoughtful and collaborative approaches to our work, seeking to demonstrate our ongoing commitment to providing places in which Aboriginal people are included socially, culturally and economically.

From: Connellan, Brian <Brian.Connellan@apa.com.au>
Sent: Friday, 3 December 2021 3:18 PM
To: Liz Rogers <liz.rogers@dpie.nsw.gov.au>
Subject: RE: APA East Coast Grid Expansion Stage 1 - MW880 Management Plans

Thank you Liz,

By any chance are you able to provide an indicative date of when we may receive feedback so I may let Planning know?

Thanks

Brian Connellan
Environmental Assessment Advisor
ID – Infrastructure Planning and Approvals

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apa.com.au

From: Liz Rogers <liz.rogers@dpie.nsw.gov.au>
Sent: Friday, 3 December 2021 8:35 AM
To: Connellan, Brian <Brian.Connellan@apa.com.au>
Cc: DPIE Water Assessments Mailbox <water.assessments@dpie.nsw.gov.au>
Subject: [EXT]: RE: APA East Coast Grid Expansion Stage 1 - MW880 Management Plans

Hi Brian, our review will take some time and we certainly won't have advice back to you by today. I can't speak for DPIE Planning & Assessment as to what you can or cannot lodge but I think you should be able to go ahead and lodge the CEMP noting that you have provide the plans to us for review.

Thanks Liz

Liz Rogers
Manager Assessments

Water Group | Department of Planning, Industry and Environment
| **M** 0428 600 421 | **E** liz.rogers@dpie.nsw.gov.au
Prince Street, Locked Bag 21, Orange NSW 2800
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From: Connellan, Brian <Brian.Connellan@apa.com.au>

Sent: Wednesday, 1 December 2021 3:37 PM
To: Liz Rogers <liz.rogers@dpie.nsw.gov.au>
Subject: RE: APA East Coast Grid Expansion Stage 1 - MW880 Management Plans

Hi Liz,

Thank you for the email and I will make sure to follow those guidelines in the future.

May I ask how long your review may take? I am hoping to lodge the CEMP and associated sub-plans with Planning on Friday or over the weekend. If your review is not yet complete am I still able to lodge?

Thanks

Brian Connellan
Environmental Assessment Advisor
ID – Infrastructure Planning and Approvals

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From: Liz Rogers <liz.rogers@dpie.nsw.gov.au>
Sent: Wednesday, 1 December 2021 2:00 PM
To: Connellan, Brian <Brian.Connellan@apa.com.au>
Cc: water.assessments@dpie.nsw. <water.assessments@dpie.nsw>
Subject: [EXT]: FW: APA East Coast Grid Expansion Stage 1 - MW880 Management Plans

Hi Brian,

Thanks for getting in contact with DPIE Water. I have forwarded your request to our Water assessments mailbox so it can be actioned.

In future can you please submit your requests into the major projects portal? Attached is advice on who to send your post approval requests to.

Thanks, Liz

Liz Rogers
Manager Assessments

Water Group | Department of Planning, Industry and Environment

| **M** 0428 600 421 | **E** liz.rogers@dpie.nsw.gov.au
Prince Street, Locked Bag 21, Orange NSW 2800
www.dpie.nsw.gov.au

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I live and work on Wiradjuri Country
The Department of Planning, Industry and Environment acknowledges that it stands on Aboriginal land. We acknowledge the traditional custodians of the land and we show our respect for elders past, present and emerging through thoughtful and collaborative approaches to our work, seeking to demonstrate our ongoing commitment to providing places in which Aboriginal people are included socially, culturally and economically.

From: Connellan, Brian <Brian.Connellan@apa.com.au>
Sent: Tuesday, 30 November 2021 1:40 PM
To: Mark Harris <mark.harris@dpie.nsw.gov.au>
Subject: APA East Coast Grid Expansion Stage 1 - MW880 Management Plans

Hi Mark,

I am not sure if you have been involved with the APA East Coast Grid Expansion project at all, details can be found on the Major Projects Portal at:
https://www.planningportal.nsw.gov.au/major-projects/project/41546

We have received Planning approval for the Modification with conditions and are currently working through the post-approval management plans. These plans include both a Soil and Water Management Plan as well as an Erosion and Sediment Control Plan. I attached these for your reference / review in accordance with the approval conditions.

Are you able to please let me know when you might be able to provide confirmation that you are satisfied with these plans or any feedback? I am hoping to lodge the Construction EMP with the associated sub-plans (these included) as soon as I can to try and ensure approval prior to construction early next year.

Please feel free to give me a call or an email if you have any queries.

Thank you

Brian Connellan
Environmental Assessment Advisor
ID – Infrastructure Planning and Approvals

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apa.com.au

Moomba to Wilton Pipeline (SSI-15548591)
Soil and Water Management Plan

Post Approval Review

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Document: Soil and Water Management Plan
Revision: V1 Final
Reviewed: Denise Day on 15 December 2021

Soil and Water Management Plan (SWMP)	Sufficient (Yes/No/Partial)	*Document and Reference comment*	Action Required	Proponent Response
Condition A5, Part A				
A5. The Proponent must: (a) rehabilitate the sites progressively, as soon as reasonably practicable following disturbance;	Partial	• Table 2.1 references section 6.2 however there is no mention of progressive rehabilitation. • Section 7.1.4 discusses the prompt use of soil stabilising polymers for temporary erosion control. • Table 7.3 (Summary of commitments) GE-03 states that rehabilitation of disturbed areas will commence progressively as soon as practicable during and after construction and will be carried out in accordance with the SWMP and Landcom (2004).	• Remove reference to section 6.2 in Table 2.1 and include Section 7, Table 7.3.	**Accepted**
(b) minimise the disturbance area at any time; and	Yes	• Section 7.1.2 states that land disturbances will be restricted to areas required for the current stage of works.	No further action required (unless changes to Table 2.1 are required in response to inclusion of the ESCP in the SWMP – refer to General Comments below)	**None required – ESCP to be adjusted consistent with SWMP.**

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(c) employ interim rehabilitation strategies to minimise dust generation, soil erosion and weed incursion on parts of the sites that cannot yet be permanently rehabilitated.	Partial	• Table 2.1 references section 6.2 however this section only lists potential soil covers that may be used on the site and do does not detail the circumstances where each may be used (interim/ permeant). • Section 7.1.4 discusses the use of soil stabilising polymers for temporary erosion control.	• In section 6.2 detail the circumstances where each soil cover may be used (interim/ permeant). Include detail on rehabilitation strategies to minimise weed incursion on parts of the site.	**Accepted, Section 6.2 expanded accordingly and new Section 6.4.**
Condition B11, Part B				

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B11. The Proponent must ensure it has sufficient water supply for all stages of the development.	No	• Section 3.1.1 states that for construction at MW880, water will be purchased under a commercial arrangement with Lachlan Shire Council (LSC) and transported to site by a 25kL water truck, as required. The source of this water is not provided, nor the estimated volume required. • Table 7.3 Summary of Commitments states that stormwater runoff from buildings will be captured in rainwater tanks for use on site (construction and operation). The rainwater tank is not discussed elsewhere in the Plan, in particular section 7 - Management and mitigation measures. • This condition is not included in the compliance table (Table 2.1).	• Provide clarification on the construction and operation water sources and estimated volume required, including details of the rainwater tank (e.g. location, capacity, uses). • Provide details of water use for all stages of the development to ensure supply is sufficient. • Include condition B11 in Table 2.1.	**Condition included in Table 2.1. Water usage, requirements and details added to Section 3.1.1. Clarification on rainwater tanks added in Section 7.1.3.**
Condition B12, Part B				

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B12. Prior to the commencement of construction of Stage 1, the Proponent must provide confirmation to the Department of the water suppliers to provide the necessary water volumes for the construction and operation of the site.	Partial	• Section 3.1.1 notes a commercial arrangement with LSC. • The estimated volume of water required is not specified. • This condition is not included in the compliance table (Table 2.1).	• Provide clarification on the construction and operation water sources and estimated volume to be provided from each source. • Include condition B12 in Table 2.1.	**Condition included in Table 2.1. Water usage, requirements and details added to Section 3.1.1.**
Condition B13, Part B				
B13. The Proponent must not commence construction of Stage 2 until: a) it has received the relevant approvals to construct and extract from a groundwater bore on the site; or		NA – the WMP is for Stage 1 MW880 only.		

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b) it has provided the Department confirmation of the water suppliers to provide the necessary water volumes for the construction and operation of the site. **Note:** Under the *Water Management Act 2000*, the Proponent is required to obtain all necessary water licences if required for the development.		NA – the WMP is for Stage 1 MW880 only.		
Condition B14, Part B				

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B14. The Proponent must: (a) ensure that construction, commissioning and operation of the development does not cause any water pollution, as defined under Section 120 of the POEO Act, including the management of surface water runoff and spray irrigation of treated effluent;	Partial	• Section 2.2.2 identifies the legal requirements under s120 of the POEO Act. • The compliance table (Table 2.1) references section 7.1.5 (Prevention of pollution), however this section includes consideration of mitigation measures for sediment control and spray irrigation effluent only. Chemical management (storage and handling) should also be addressed. (note: Table 7.3 (Summary of commitments) WS-11 includes a brief statement for the management of potential contaminants and Table 8.1 (Maintenance and remedial actions) includes 'bunded areas' and identifies checks, clean up of spills and treatment and removal of accumulated rainwater). • Section 7.1.5ii (Spray irrigation effluent) states that soils in the proposed irrigation area 'may' be sampled and characterised to refine spray effluent application rates. It is recommended that this is	• Address chemical management in section 7.1.5 – Prevention of pollution. • It is recommended that the reference to irrigation area sampling in section 7.1.5ii is changed to 'will' and the sampling details provided, including frequency/ duration, method, and parameters to be tested.	**Section 7.1.5 expanded to reflect APA conducted soil sampling/effluent modelling work (Permeate partners).**

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		changed to 'will' and the sampling details provided.		
(b) minimise any soil erosion associated with the construction of the development in accordance with the relevant requirements in the *Managing Urban Stormwater: Soils and Construction* (Landcom, 2004) manual, or its latest version; and	Yes	• Section 7.1.4 addresses the management of soil erosion in accordance Landcom 2004.	No further action required (unless changes to Table 2.1 are required in response to inclusion of the ESCP in the SWMP – refer to General Comments below).	**None required – ESCP to be adjusted consistent with SWMP.**

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(c) ensure that construction is undertaken to minimise impacts on watercourses by applying management measures generally in accordance with the guidance series for *Controlled Activities on Waterfront Land* (DPIE Water 2012 or latest versions).	No	• Table 2.1 of the SWMP notes this condition as N/A as no waterways within the project area. This is inconsistent with the Erosion and Sediment Control Plan (ESCP) Table 5.2 which references measures and controls to be implemented to address this condition. ESCP Section 7.2 identifies erosion of soils that degrade the water quality of runoff to downstream receivers, dependant flora and fauna, and sensitive areas as a possible impact, while 7.3 references the Modification Report and SWMP and identifies that the attributes of the receiving waters in the vicinity of the Project have been assessed as 'standard' in accordance with Blue Book. • This condition includes impacts on waterways outside the project area. • Neither the SWMP or ESCP reference the *Guidelines for Controlled Activities on Waterfront Land* or justify why consideration of the Guidelines is not required.	• Update the SWMP and Table 2.1 to address this condition. Ensure consistency between the SWMP and ESCP regarding onsite/ offsite impacts on waterways. • Provide details of how *Controlled Activities on Waterfront Land* has been considered, or justify why consideration of the Guidelines is not required. • (also refer to General Comments regarding the recommended structure for the SWMP and ESCP).	**None required – ESCP to be adjusted consistent with SWMP.**

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Condition B15, Part B				
The Proponent must prepare a Soil and Water Management Plan for the development to the satisfaction of the Planning Secretary. This plan must: a) be prepared by a suitably qualified and experienced person/s approved by the Planning Secretary	Yes	• Section 1.6 states that the SWMP was prepared by Michael Frankcombe CPESC 1351 of EMM Consulting who was approved by DPIE on the 10 November 2021 (evidence provided in Attachment A).	• In Section 1.6 (page 4) change the reference to Attachment A, rather than Appendix 1.	**Accepted**
b) be prepared in consultation with Council and DPIE Water;	No	• A consultation section is not included in the report, only copies of the emails provided to Council and DPIE (Attachment B). • Consultation was only conducted following the preparation of the current version of the Plan for review and comment. The DPIE request for review was emailed on the 30/11/2021. There is no evidence of response/ comment from DPIE Water or follow up by the proponent. • The Plan does not provide a response to Council comments	• Include a section with a summary of consultation including details of timing, format, views and responses/ changes (including where changes have been addressed in the SWMP). • Ensure consultation is facilitated prior to Plan preparation so that relevant stakeholder comments can be integrated into the Plan. • Ensure consultation feedback is provided by DPIE, or request confirmation that there are no comments.	**Accepted. Details of consultation are included in Appendix B.**

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		in relation to the water treatment system.		
c) be submitted to the Planning Secretary for approval prior to carrying out construction under this approval;	Yes	Current process	No further action required.	
d) includes: i) details of the sources and security of water supplies for the construction and life of the development (including authorised entitlements and licences);	Partial	• Section 3.1.1 states that for construction at MW880, water will be purchased under a commercial arrangement with LSC and transported to site by a 25kL water truck as required. The source of this water is not described. • Table 7.3 Summary of Commitments states that stormwater runoff from buildings will be captured in rainwater tanks for use on site (construction and operation). The rainwater tank is not discussed elsewhere in the Plan. • The security of water sources is not discussed.	• Provide clarification on construction and operational water sources, including details of the rainwater tank (e.g. location, capacity, uses). • Provide details of the security of water sources. • Update Table 2.1 to reflect any additional information provided.	**Water usage, requirements and details added to Section 3.1.1.**
ii) details of water use and management on the sites;	Partial	• There is no description of the how water will be used onsite during construction and operations, or estimates of volumes required. Combined	• Include details of the construction and operational water uses (e.g. camp facilities, dust suppression) and estimates of the volumes required for each.	**Water usage, requirements and details added to Section 3.1.1.**

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		with insufficient information regarding water sources and volumes (as detailed in i) above) if use and supply is adequate. • Section 6.3.1 notes that wastewater from the construction camp will be treated (refer to (iv) below).		
iii) an Erosion and Sediment Control Plan, consistent with the requirements of the guideline *Managing Urban Stormwater: Soils and Construction* (Landcom 2004) and the *Guidelines for Controlled Activities on Waterfront Land* (NRAR 2018); and	Partial	• A separate Erosion and Sediment Control Plan (ESCP) (29/11/2021) has been prepared as a complete management plan document. • The Progressive Erosion and Sediment Control Plan (i.e. maps, construction notes and plans) is provided In Appendix F of the ESCP and has been prepared in accordance with Landcom 2004. • Neither the SWMP or ESCP reference the *Guidelines for Controlled Activities on Waterfront Land* or justify why consideration of the Guidelines is not required.	• Address the requirements of *Guidelines for Controlled Activities on Waterfront Land,* or justify why consideration of the Guidelines is not required.	**None required – ESCP to be adjusted consistent with SWMP.**
iv) details the wastewater treatment and spray irrigation system, including measures to	Partial	• Section 6.3.1 notes that construction camp wastewater will be treated by a wastewater treatment system that satisfies s68 of the *Local Government*	• Provide further details regarding the wastewater treatment and spray irrigation systems, including system to be used, capacity and confirmation of the spray field site size.	**Referred to relevant APA/Permeate Partners water treatment system report.**

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mitigate downstream and offsite impacts.		*Act 1993* and AS 1547: *On-site domestic wastewater management*. Treated effluent will be pumped for spray irrigation on an application area within the site footprint. A preliminary spray field sizing of 0.9 ha the site has been identified. Spray irrigation effluent quality will comply with AS/NZS 1547. • The onsite wastewater management system is subject to further design development. (Council consultation communication noted there is further work required on the wastewater management system).	• Identify potential downstream and offsite impacts wastewater treatment and spray irrigation system, and measures to mitigate • Detail any inspection, maintenance and monitoring associated with the wastewater treatment and spray irrigation system.	
General Comments				
The following inconsistencies between the SWMP and ESCP have been identified:			• A full review of the ESCP against the SWMP is recommended to identify and address any further inconsistencies, to those presented below, between the documents.	**None required – ESCP to be adjusted consistent with SWMP.**
• Section 1.3 of the SWMP states a two-level document hierarchy to erosion and sediment			• Append the ESCP to the SWMP (Attachment C) and update the text in Section 1.3 of the SWMP and Section 1 of the ESCP to reflect this.	**Accepted**

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control (as per Landcom 2004) comprising the SWMP and Progressive ESCP, and that the SWMP does not include preparation of any PESCPs. However, Section 1 of the ESCP states it was prepared as Appendix 3 in accordance with the SWMP.				
• A compliance table is provided in both the SWMP (Table 2.1) and ESCP (Table 5.2) which makes the review and tracking of compliance with conditions problematic (and has possibly			• Delete the compliance table (Table 5.2) from the ESCP and include references to the ESCP in the SWMP compliance table (Table 2.1).	**Accepted**

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contributed to inconsistences).				
• Part B Condition B13c)			• Refer to the comments under the condition (above).	
The SWMP does not include the following sections as suggested in the *Environmental Management Plan Guideline* (April 2020): • Relationship to an existing environmental management system • Environmental management structure and responsibilities • Environmental risk assessment.			• Review the SWMP against the *Environmental Management Plan Guideline* and ensure that all relevant sections are addressed.	**Accepted**
A number of the sections referenced in the compliance table (Table 2.1) do not address the condition, or only address the condition in part.			• Once changes are completed update Table 2.1, providing direct section reference(s) for all requirements of each condition.	**Accepted**

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Reviewed: Denise Day on 15 December 2021

Appendix C

LSC water commitments

Connellan, Brian

From: Shaula Siregar <Shaula.Siregar@lachlan.nsw.gov.au>
Sent: Monday, 29 November 2021 9:10 AM
To: Connellan, Brian
Cc: Adrian Milne
Subject: [EXT]: RE: APA East Coast Grid Expansion - Request for Water Supply from Lachlan Shire Council

Hi Brian,

Council confirms that Council has the capacity to provide the following:

- Approximately 17ML of raw water for construction
- Approximately 16,000L – 21,000L per day of potable water for your temporary camp (starting from May 2022) for 9-12 months period

Regards,
Shaula

Shaula Siregar | Utilities Manager | Infrastructure Services
Lachlan Shire Council | 58-64 Molong Street | **Condobolin NSW 2877**

Find us on: Facebook Website

From: Connellan, Brian <Brian.Connellan@apa.com.au>
Sent: Friday, 26 November 2021 9:03 AM
To: Shaula Siregar <Shaula.Siregar@lachlan.nsw.gov.au>
Cc: Adrian Milne <Adrian.Milne@lachlan.nsw.gov.au>
Subject: Re: APA East Coast Grid Expansion - Request for Water Supply from Lachlan Shire Council

Thank you Shauna,

Please can you also confirm that Council has capacity to supply the approximate 17ML of raw water for use during construction. I new email confirming both would be much appreciated that I can PDF and use as evidence.

Thanks
Brian

Get Outlook for Android

From: Shaula Siregar <Shaula.Siregar@lachlan.nsw.gov.au>
Sent: Friday, November 26, 2021 7:42:33 AM
To: Connellan, Brian <Brian.Connellan@apa.com.au>
Cc: Adrian Milne <Adrian.Milne@lachlan.nsw.gov.au>
Subject: [EXT]: RE: APA East Coast Grid Expansion - Request for Water Supply from Lachlan Shire Council

Appendix D

PESCP

RUBICON ENVIRO PTY LTD
ABN: 75 616 518 211

EAST COAST GAS EXPANSION – CONSTRUCTION OF COMPRESSOR STATION MW880 AT MILNE (VIA CONDOBOLIN)

EROSION AND SEDIMENT CONTROL PLAN

February 2022 – Version 3

Prepared for:

apa

Prepared by:

ANDREW LITTLEWOOD

CPESC & Senior Soil Conservationist

Rubicon Enviro Pty Ltd | ACN: 616 518 211 | P O Box 7111, Redhead NSW 2290 M. 0429 953 626

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Document Status

Rev No.	Date	Description	Prepared by	Reviewed		Approved	
				Name	Date	Name	Date
0	19/11/2021	Version1	A Littlewood				
1	02/02/2022	Version 2	A Littlewood				
2	11/02/22	Version 3 - Final	A Littlewood				

Document Authorship Information

Project	East Coast Gas Expansion – Construction of Compressor Station MW880 At Milne (Via Condobolin)
Document	Erosion and Sediment Control Plan – ECGE: Construction of Compressor Station MW880
Document Author	Andrew Littlewood – Senior Soil Conservationist
Qualification	Certified Professional in Erosion and Sediment Control (CPESC No. 5988).
Experience – Years	21 years (2000 – 2021)
Current Employment	Director & Principal - Rubicon Enviro Pty Ltd (2016-2021)
Previous Employment	Senior Soil Conservationist & CPESC – TREES Pty Ltd (2008-2016)
Previous Employment	Erosion and Sediment Control Officer - Lake Macquarie City Council (2000 – 2007)
Professional Affiliations	Member of International Erosion Control Association (Australasia)

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Appendices

Appendix A Site Characteristics & Revised Universal Soil Loss Equation Assessment

Appendix B RUSLE Catchment Assessment & Sediment Basin Calculations

Appendix C Site Dewatering Procedure

Appendix D Site Dewatering Discharge Record

Appendix E Wet Weather Contingency Procedure

Appendix F Progressive Erosion & Sediment Control Plans

Appendix G Standard drawings

East Coast Gas Expansion – Construction of Compressor Station MW880 at Milne (via Condobolin) - Primary Erosion and Sediment Control Plan

1 Introduction

This Primary Erosion and Sediment Control Plan (Sub-plan) has been prepared as Attachment 'C' in accordance with the Project Soil and Water Management Plan (SWMP) prepared by EMM Consulting.

The Sub-plan has been prepared to reduce the potential for risk of environmental impacts caused by erosion and sedimentation associated with project activities.

2 Purpose

The purpose of this Sub-plan is to outline the planning, methodologies, techniques and monitoring to minimise the potential environmental impacts of erosion and sedimentation arising from the Project construction activities.

3 Scope

The scope of the Primary ESCP will;

- Provide a strategy and framework for construction to be planned, implemented and maintained to mitigate any adverse environmental impacts,
- Propose control measures and management procedures to be implemented during construction, to avoid or minimise potential adverse impacts to soils, surface water and groundwater,

This Primary ESCP has been prepared in accordance with the requirements of the 'Blue Book' being a collective of;

- Managing Urban Stormwater: Soils and Construction 4th Edition Volume 1 – Landcom, reprinted 2006
- Blue Book Volume 2A: Installation of Services – NSW Department of Environment & Climate Change (DECC), 2007
- Blue Book Vol 2c - Unsealed roads – (DECC), 2007.

4 Objectives

The key objectives of the Primary ESCP is to;

- Identify potential impacts to soil and water quality such as erosion and sedimentation arising from construction activities,
- Outline the soil and water management strategy for the construction phase of the development,
- Promote the adoption of sound principles and criteria for planning and implementation of erosion and sediment controls,
- Ensure the design and construction of controls is undertaken in accordance with the relevant guidelines,
- Minimise the adverse risks to soils and water by detailing mitigation measures and strategies,
- Provide an outline of a monitoring, inspection and reporting framework for the ongoing assessment of adherence to the ESCP.

5 Performance Criteria & SSD Development Approval Condition Compliance

The performance criteria for the ESCP are to:

- Limit potential for adverse environmental impacts on downstream waterways, riparian zones, and other identified sensitive areas,
- Minimise the risk and subsequent occurrence of erosion and sedimentation, to mitigate the impacts on project areas, sensitive areas, and downstream environments,
- Prevent the occurrence of pollution incidents causing environmental harm,
- Maintain existing downstream waterway attributes and water quality parameters,
- Manage erosion and sedimentation with sound management practices of effective planning and formation of relevant controls
- Ensure compliance with legislative & regulatory requirements, and to maintain liaison and communication with statutory authorities and/or delegates.

6. Guidelines, Standards and Procedures

Name of Document/Publication	Author	Published
Acid Sulfate Soil Manual	ASSMAC	1998
Approved Methods for the Sampling and Analysis of Water Pollutants in NSW	NSW EPA	2004
Australian and New Zealand Guidelines for Fresh and Marine Water Quality	ANZECC and ARMCANZ	2000
Bunding & Spill Management	NSW DEC	1997
Environmental Best Management Practice Guideline for Concreting Contractors	NSW DEC	2004
Guidelines for the Management of Acid Sulphate materials: Acid Sulphate Soils, Acid Sulphate Rock and Monosulphidic Black Ooze	NSW RTA	2005
Guideline for Environmental Management - Spraying Bituminous Materials	VIC EPA	2002
Guideline for Handling Liquids	NSW DECCW	2007
Managing Urban Stormwater (‘Blue Book’): Soils and Construction Volume 1, 4th Edition	NSW Landcom	2004
‘Blue Book’ - Volume 2A Installation of Services	NSW DECCW	2008
‘Blue Book’ - Volume 2C - Unsealed roads	NSW DECCW	2008
Noxious and environmental weed control handbook	NSW DPI	2014
Table Drains - Erosion Control Guideline	Brisbane City Council	2001

(Note* The project site does not contain any waterfront land and therefore the requirements of the *‘Guidelines for Controlled Activities on Waterfront Land’ – NSW Department of Primary Industries – Office of Water* are not considered relevant for Project planning purposes)

7. Environmental Planning

Erosion and sediment control planning is based on the principle that preventing erosion where possible provides the best environmental outcomes, is more economical, and effective than controlling the capture of sediment.

7.1 Construction Activities

The scope and anticipated duration of the Project works present risks of environmental impacts. Key aspects of the project that could result in adverse impacts to soils and water include:

- Installation of preliminary erosion and sediment controls.
- Establishment of compounds, exclusion zones, stockpile areas, and soils treatment area/s.
- Minor earthworks, site preparation and site access/temporary access roads.
- Trenching and earthworks for service installation.
- In-situ concrete works and concrete curing.
- Operation of internal haulage and access routes.
- Stormwater construction and drainage stabilisation.
- Dewatering ‘dirty’ water from site areas.
- Importing, handling, stockpiling and transporting materials & resources.
- Compound operation including fuel and chemical storage, refuelling and chemical handling.
- Spills & leaks of fuels & oils from mobile and static machinery.
- Plant maintenance.
- Generation of building and construction waste.
- General putrescible waste from compound/s & works areas.
- Construction camp effluent handling, treatment and irrigation.
- Noxious weed treatment including herbicide spraying.
- Topsoil replacement, revegetation, and stabilisation.
- Landscaping.

7.2 Impacts

The possible impacts on soil and water from the activities described include;

- Unnecessary disturbance of existing areas outside the Project footprint,
- Erosion of soils that degrade the water quality of runoff to downstream receivers, dependant flora and fauna, and sensitive areas,
- Degraded soil or water quality from exposure to contaminated soils or ASS material, or run-off from these soils,
- Contamination of soils, and surface and groundwater from accidental spills or oil leaks
- Disturbance or degradation of groundwater aquifers,
- Litter and gross pollutants from construction activities
- Atmospheric dust pollution affecting air quality of areas surrounding the Project.

7.3 'Blue Book' receiving waters classification

The recommended minimum design criteria for temporary erosion and sediment control measures are based upon an assessment of the sensitivity of receiving environments. Reference to Modification Report 1 (SSI-15548591) describes the surrounding environmental sensitivity and land uses. In accordance with the Modification Report and SWMP assessment (Appendix 2 of the CEMP), the attributes of the receiving waters in the vicinity of the Project have been assessed as 'standard' in accordance with Blue Book Volume 1- Sect. 6.3.4 – (f) & Volume 2A – Table 5.1. The 5-day - 80th percentile rainfall depth for Nyngan of 20.4mm has been adopted. The high confidence for this rainfall depth is confirmed by referencing the 456mm/year average annual rainfall recorded for Condoblin (SWMP Section 4.4) against the plotted trendlines in Figure 6.6 of the 'Blue Book' – Volume 1.

7.4 Key Management Strategies

The following list outlines the Key Management Strategies that will be implemented to mitigate potential erosion and sediment impacts;

- Specialist expertise and advice will be sought from an accredited Project Soil Conservationist (CPESC) in regard to the broad spectrum of erosion and sediment control issues, including but not limited to site establishment, temporary access routes, off-site water diversion, on-site drainage, sediment control construction/operation/decommissioning, soil handling and storage, water management, stabilisation, and rehabilitation/revegetation of Project areas.
- Inclusion of an erosion and sediment control component to be included in the Project induction.
- Minimising the extent and duration of construction disturbance.
- Control and diversion of off-site water flows around or across site.
- Control and diversion of on-site flows to installed sediment controls.
- Conservation of topsoils for site rehabilitation and revegetation.
- Implementation of progressive erosion methods & techniques throughout various work stages.
- Construction and management of suitable sediment controls including sediment filters, traps, sumps and basins.
- A thorough inspection and maintenance program to monitor, record and schedule actions for maintenance and upgrades of controls, rectification works, and sediment removal and handling.
- Establishing a procedure to monitor forecast weather events and implementing response plans for significant wind or rainfall events and flooding.
- Timely and progressive stabilisation of disturbed areas prior to final landscaping.
- Monitoring stabilisation measures and promoting prompt & effective revegetation and permanent stabilisation.

7.5 Preparation of Progressive Erosion and Sediment Control Plans (PESCP's)

This Primary ESCP will be supplemented with Progressive Erosion and Sediment Control Plans (PESCP's) prepared as required for the relevant work areas. The PESCP's illustrate the strategy for erosion and sediment control and provides detail on structures and controls to be implemented in concert with construction activities. The PESCP's will outline structural and non-structural measures to;

- Intercept and divert clean water runoff around worksites
- Prevent erosion
- Limit the movement of sediment
- Remove or filter sediment from runoff
- Detain or control the discharge of runoff from site
- Promote timely rehabilitation or stabilisation of disturbed areas.

There are a number of control measure options available for selection and use. The selection of controls will be in accordance with sound management practices to achieve the desired outcomes.

The PESCP's will be revised as necessary to address changes in the site conditions and nature of works. The PESCP's will be formulated in conjunction with construction personnel prior to the commencement of specific onsite activities. The plans will be prepared to manage the various works or construction stages such as:

- Compound, access, stockpile operations, and construction facilities
- Bulk earthworks for road formation, drainage, services, etc.
- Major off-site and on-site water drainage works or structures such as diversions, drains and treatment/sediment basins
- Construction activities such as paving, kerbing/guttering, stormwater drainage and outlets, etc.
- Stabilisation of disturbed areas, access and works areas, and perimeter areas
- Decommissioning of temporary erosion and sediment controls.

7.6 Erosion and Sediment Control Training for Site Personnel

Prior to the commencement of onsite activities, all site personnel will be instructed to observe site constraints and be made aware of environmental controls, in particular;

- Avoidance of disturbing or damaging 'No-Go' zones
- Effects of erosion and sedimentation and off-site or downstream impacts
- Environmental legislation, responsibilities, and 'due diligence'
- Correct establishment and maintenance of erosion and sediment controls
- 'End-of-day' site maintenance, emergency procedures, and spill response
- Personnel to monitor, review and improve controls as appropriate.

7.7 Inspection and Maintenance

A self-auditing program will be established by the Contractor for erosion and sediment control based on a check sheet developed for the site. A site inspection using the developed check sheet will be undertaken by relevant Project personnel:

- At least weekly
- Immediately before extended site shut down
- At the conclusion of all rainfall events exceeding 10mm and during periods of prolonged rainfall (as soon as practicable).

The self-audit will include:

- Noting the condition of installed erosion and sediment controls onsite
- Detailing maintenance requirements (if any) for installed erosion and sediment controls
- Recording the volumes of sediment removed from sediment controls and sediment traps, where applicable
- Recording the location to where extracted sediments are disposed.

8. Erosion Control Measures and Sediment Control Methods

The formulation of the ESCP is based on the assumption that controls will generally be installed in the following progression;

- Installation of preliminary erosion and sediment controls and exclusion fencing to nominated areas of initial works and establishing exclusion zones
- Establishing any temporary roads and machinery access points in addition to those existing
- Installation of stabilised site access, site compound and facilities
- Forming temporary drains or banks to maximise diversion of off-site flows away from works area to watercourses, existing drainage lines or to temporary drainage diversion structures
- Construction of on-site water diversion drains or banks to direct runoff to the installed sediment controls
- Installation of diversion drains/banks upslope and sediment controls down slope of proposed topsoil and spoil stockpile areas
- Bulk earthworks such as cut excavations, filling, trenching, and engineered formation are controlled with a suite of erosion controls such as exclusion bunding, surface stabilisation treatments, trench stops, batter berms/chutes, contour banks, check dams, etc.
- Drainage and run-off from site areas directed to adequately designed and constructed sediment controls with regular maintenance and repair as required
- Completed areas are progressively stabilised as soon as practical with emphasis on critical areas such as drainage outlets, batters, etc.
- Sediment controls are to be maintained until adequate soil surface protection levels (>70% ground cover) are achieved in the catchment.

The erosion and sediment control measures required for Project areas during the various construction areas will be determined by reference to the guidance and measures detailed in the 'Blue Book' - Volume 2A: 'Installation of Services' – NSW Department of Environment & Climate Change (DECC), 2007. Commonly employed methods and techniques that may be utilised on the Project are detailed in the following table;

Table 8

Erosion Control – Raindrop Impact	
Situation	Control measure or method
Soil surface protection - Vegetation	• Temporary vegetation (cover crop only) • Permanent vegetation – introduced (exotic) pasture species or native (endemic) species
Soil surface protection - Batter protection	• Organic rolled erosion control products (RECP's) such as jute mesh, jute mat, coir fibre blankets • Non-organic RECP's such as non-woven geotextile membrane or heavy grade plastic sheeting.
Soil surface protection - Mulching	• Hydromulch or hydraulic bonded-fibre matrix • Straw mulching with bitumen tack • Rock or gravel mulch
Soil surface protection - geobinders	• Organic tackifiers • Co-polymer emulsions • Bitumen emulsion

Table 8

Erosion control - Concentrated Water Flow	
Situation	Control measure or method
Up-slope diversions	• Excavated channel-type bank • Back push-type bank or windrow • Catch drains
Soft armour channels	• Trapezoidal or parabolic shape design drain cross sections • Organic rolled erosion control products (RECP's) such as jute mesh, jute mat, coir fibre blankets • Non-organic RECP's such as non-woven geotextile membrane or heavy grade plastic sheeting • Organic tackifiers & co-polymer emulsions • Bitumen emulsion • Hydro mulch • Standard or reinforced turf
Hard armour channels	• Loose rock – hard quarry rock • Rock-filled wire mattresses • Grouted rock • Cast in-situ concrete • Underlays utilising heavy grade plastic lining or geotextile lining
Check dams	• Stacked rock • Sandbags and aggregate filter bags • Geotextile covered straw bales • Coir logs
Batter drainage	• Geotextile lined or heavy grade plastic chutes • Pipes and Half pipes • Loose-rock rip rap • Concrete (pre-cast or on-site) • Rock-filled wire mattresses
Grade control structures and flumes	• Geotextile lined or heavy grade plastic chutes • Pipes and Half pipes • Concrete chutes • Loose-rock rip rap • Gully pits and field inlets • Sandbag drop structures •
Outlet dissipation structures	• Loose-rock rip-rap apron diffusers • Rock-filled wire mattresses • Pinned geotextile aprons • Level spreaders

Table 8

Sediment control - Sheet Flows	
Situation	Control measure or method
Vegetative filters	• Turf strips
Sediment barriers/filters	• Sediment fencing • Topsoil berms stabilised with vegetation or geotextile with filter outlets at intervals • Excavated and geotextile lined sediment traps • Geotextile/ shade cloth covered rock or gravel windrows • Coir logs
Site exit points	• Shaker grids with paved or rock aprons and sediment sumps • Wheel wash equipment and designated/controlled areas
Sediment control - Concentrated Flows	
Sediment traps	• Stacked rock with geotextile • Excavated and geotextile lined sediment traps • Straw bale or sand bag structures • Gully pit, field inlet and kerb inlet traps

9 Soil & Water Management Activities & Controls

The following table outlines the environmental management and mitigation measures proposed to be implemented, together with responsibilities and frequency of actions;

Table 9

1. Planning, permits & personnel			
	Environmental Management Controls	**Person Responsible**	**Timing / Frequency**
1.	All necessary licences, permits and approvals required by legislation will be obtained prior to works commencing.	Project Manager / Supervisor / Project HSE Support	Duration
2.	Copies of any relevant licences, permits and approvals will be kept on site for inspection upon request or otherwise, as required.	Construction Manager / Site Supervisor / Contractor HSE Support	Site establishment
3.	All works and site activities will comply with the explicit requirements of any relevant licence, permit or approval.	Construction Manager / Site Supervisor / Contractor HSE Support	Duration
4.	Recordings and data from site inspections, testing, audits, and monitoring will be retained, with associated documentation maintained to demonstrate remedial action/s have occurred.	Construction Manager / Site Supervisor / Contractor HSE Support	Duration
5.	Erosion and sediment control planning is required prior to the commencement of works. The approved CEMP & SWMP is supplemented by concept Progressive Erosion & Sediment Control Plans (PESCP's) which have been developed in accordance with the requirements of '*Soils and Construction: Managing Urban Stormwater' 4th Edition.* - Landcom 2004.	Construction Manager / Site Supervisor / Contractor HSE Support	Site establishment & duration
6.	The CEMP & SWMP & construction PESCP's may be supplemented by site-specific Environmental Management Plans (EMP's) which would be developed in response to a significant environmental issue emerging. The EMP's would outline the relevant environmental risks and issues, mitigation of potential risks, and detail strategies for remediation and/or management.	Construction Manager / Site Supervisor / Contractor HSE Support	Site establishment & duration
7.	The induction of employees and contractors to include a component promoting environmental awareness, legislative requirements & penalties, and basic erosion and sediment control tasks	Construction Manager / Site Supervisor / Contractor HSE Support	Site establishment & duration
8.	Toolbox talks will regularly focus on specific works, associated risks, potential impacts and mitigation measures. Specific erosion and sediment control awareness training and workshops will be undertaken by personnel with direct involvement with erosion and sediment control.	Construction Manager / Site Supervisor / Contractor HSE Support	Site establishment & duration

Environmental Management Controls	Person Responsible	Timing / Frequency
9. Promote planning for seasonal restrictions for high-risk areas and/or activities ((i.e., late summer/autumn rainfall events for culvert works or cold winter temperatures affecting revegetation)	Construction Manager / Site Supervisor / Contractor HSE Support	Site establishment & duration
2. Clearing, site establishment, topsoil stripping, stockpiling and bulk earthworks		
1. Exclusion areas ('No Go' zones) to be identified, delineated where practical, and personnel instructed to avoid disturbance in these areas.	Greenfields Project Manager / Project HSE Support	Site establishment
2. Temporary fencing or barricading such as parawebbing or perimeter tape is to be utilised on the perimeter with accompanying signage as required.	Greenfields Project Manager / Project HSE Support	Site establishment
3. Areas of proposed works with identified noxious weed infestations to be treated with appropriate herbicide, in accordance with product directions. The weed treatment will occur in sufficient time prior to disturbance to ensure complete 'die back' prior to topsoil handling.	Greenfields Project Manager / Project HSE Support	Site establishment
4. In areas requiring weed control, spray drift will be mitigated by conducting spraying activities in calm weather and application by hand sprayer unit where practical.	Greenfields Project Manager / Project HSE Support	Site establishment
5. The extent of earthworks and formation stripping will be demarcated to the footprint necessary for the proposed works. Disturbance outside the earthworks footprint will be limited to necessary operations such as stockpiling, lay downs, etc.	Greenfields Project Manager / Project HSE Support	Site establishment & duration
6. Early establishment of suitable stockpiling and processing areas to reduce unnecessary soil disturbance from double handling of soil by machinery in the early works phase.	Greenfield Project Manager / Construction Manager / Site Supervisor / Contractor HSE Support	Site establishment & duration
7. The installation of preliminary sediment controls such as perimeter sediment fencing, excavated sediment traps, check dams, coir log/straw bale filters, etc, will be implemented prior to disturbance within the catchment.	Greenfield Project Manager / Construction Manager / Site Supervisor / Contractor HSE Support	Site establishment
8. Construct erosion resistant access routes, site access/egress points, and compound roads to be formed and stabilised as early works. Car parking areas and frequently utilised areas should be stabilised (e.g. geotextile with asphaltic millings, rock aggregate overlay, bitumen chip seal or similar) to prevent soil churning, where required. Any rock or aggregate required for vehicle access should be clean and free from soil or other contaminants.	Greenfield Project Manager / Construction Manager / Site Supervisor / Contractor HSE Support	Site establishment & duration

Environmental Management Controls	Person Responsible	Timing / Frequency
9. Design and construction of haul roads and temporary watercourse crossings as per Blue Book 2C as a minimum requirement.	Greenfield Project Manager / Construction Manager / Site Supervisor / Contractor HSE Support	Site establishment & duration
10. Vegetation will be progressively cleared to minimise disturbance by area and duration. Cleared vegetation to be windrowed parallel to the contour until mulching/removal to control flows across cleared areas	Greenfield Project Manager / Construction Manager / Site Supervisor / Contractor HSE Support	Site establishment
11. Temporary drains, banks or diversions are to be formed and stabilised to divert concentrated 'clean' flows around disturbed works areas.	Greenfield Project Manager / Construction Manager / Site Supervisor / Contractor HSE Support	Site establishment & duration
12. During the process of topsoil stripping, the soils should be handled when it is not wet or dry, but sufficiently moist to avoid damage to the soil structure.	Greenfield Project Manager / Construction Manager / Site Supervisor / Contractor HSE Support	Site establishment
13. During grubbing and topsoil stripping provide short term, temporary topsoil windrows as upper and mid-slope controls to control 'clean' flows until stabilised 'clean' water drains/berms are installed	Greenfield Project Manager / Construction Manager / Site Supervisor / Contractor HSE Support	Site establishment & duration
14. Strip any viable topsoil in the required locations and stockpile locally where possible. The topsoil will be handled and stored in the correct manner necessary for successful rehabilitation.	Greenfield Project Manager / Construction Manager / Site Supervisor / Contractor HSE Support	Site establishment & duration
15. Any viable stripped topsoil to be stored in stockpiles less than two metres in height where possible. The stockpile locations are to avoid concentrated surface flows or areas subject to inundation during wet weather. The height of stockpiles of other soil materials to be minimised where practical and to mitigate wind-blown erosion risks.	Greenfield Project Manager / Construction Manager / Site Supervisor / Contractor HSE Support	Site establishment & duration

Environmental Management Controls	Person Responsible	Timing / Frequency
16. The stockpile locations are to avoid concentrated surface flows or areas subject to inundation during wet weather.	Greenfield Project Manager / Construction Manager / Site Supervisor / Contractor HSE Support	Site establishment & duration
17. Temporary stockpiles are to be covered for the duration of high winds, rainfall and/or storm conditions. Long term stockpiles to be cover crop seeded as appropriate to the season.	Greenfield Project Manager / Construction Manager / Site Supervisor / Contractor HSE Support	Site establishment & duration
18. The long-term soil stockpile locations are to be located away from major drainage lines, and 5 metres from any waterway. The stockpiles will not be established in areas subject to concentrated surface flows, waterlogging or prolonged inundation during wet weather.	Greenfield Project Manager / Construction Manager / Site Supervisor / Contractor HSE Support	Site establishment & duration
19. Stockpiles should be stabilised if they are to remain in place for more than 20 days. Rolled Erosion Control Products (RECP's such as geotextile, jute mesh, coco fibre mat, etc) or soil binders can be used on smaller stockpiles, however, larger stockpiles should be formed into crowned structures to minimise erosion and be subsequently stabilised with cover crop seeding or applied geobinders. Plastic covers should only be utilised for short term cover for wind or storm protection.	Greenfield Project Manager / Construction Manager / Site Supervisor / Contractor HSE Support	Site establishment & duration
20. The use of existing, available materials on-site (i.e. soils, rock, mulch etc) to be salvaged and stored where it can be utilised for temporary or permanent works (where practical) to reduce import requirements.	Greenfield Project Manager / Construction Manager / Site Supervisor / Contractor HSE Support	Site establishment & duration
21. Prioritise planning for early and rapid cut-to-fill earthworks in periods of seasonal risk and/or other high-risk areas.	Greenfield Project Manager / Construction Manager / Site Supervisor / Contractor HSE Support	Site establishment & duration
22. Where practical, cut earthworks should be staged from the upslope approaches to control dirty water within the excavation (i.e. the excavation proceeds downslope whilst maintaining unexcavated remnant earth as a control bund)	Greenfield Project Manager / Construction Manager / Site Supervisor / Contractor HSE Support	Site establishment & duration

Environmental Management Controls	Person Responsible	Timing / Frequency
23. Subgrade excavations and engineered fill formations at risk of temporary inundation during flood events may be stabilised with moisture-repelling soil binders.	Greenfield Project Manager / Construction Manager / Site Supervisor / Contractor HSE Support	Duration
24. As the earthworks progress, areas of fill should generally be graded to shed flows away from the edges of fill batters to sediment controls where possible	Greenfield Project Manager / Construction Manager / Site Supervisor / Contractor HSE Support	Duration
25. Progressively form and maintain lip berms and batter chutes with velocity dams on fill formations	Greenfield Project Manager / Construction Manager / Site Supervisor / Contractor HSE Support	Duration
26. Maintain minor benches or contour berms on long or steep fill batter formations until profiling for topsoiling is imminent	Greenfield Project Manager / Construction Manager / Site Supervisor / Contractor HSE Support	Duration
27. Access to the works area, and movements on the site during construction will be limited to the defined access and project areas, where possible. Minimise vehicle movements & speed on unsealed areas and access tracks.	Greenfield Project Manager / Construction Manager / Site Supervisor / Contractor HSE Support	Duration
28. Earthworks and hauling, and vehicular movements to be limited in wet conditions.	Greenfield Project Manager / Construction Manager / Site Supervisor / Contractor HSE Support	Duration
29. Appropriate sediment tracking controls such as an aggregate/geotextile apron, shaker grid, etc may be installed at exit point/s from the site, where required.	Greenfield Project Manager / Construction Manager / Site Supervisor / Contractor HSE Support	Duration

Environmental Management Controls	Person Responsible	Timing / Frequency
30. The adjoining local road network to be regularly monitored for tracked sediments with affected areas cleaned as soon as possible in a safe manner.	Greenfield Project Manager / Construction Manager / Site Supervisor / Contractor HSE Support	Duration
31. Vehicles transporting bulk materials such as soils and fill are to correctly cover loads to prevent loss of load and/or dust generation on public roads.	Greenfield Project Manager / Construction Manager / Site Supervisor / Contractor HSE Support	Duration
32. Imported quarry product and fill materials required for construction are to be clean, and free of contaminants (ie. weeds, waste, liquids, etc).	Greenfield Project Manager / Construction Manager / Site Supervisor / Contractor HSE Support	Duration
33. Bunded or controlled areas for re-fueling, material stockpiling, (and contaminated soil treatment area if required) are to be formed prior to commencement of those works in the relevant risk areas.	Greenfield Project Manager / Construction Manager / Site Supervisor / Contractor HSE Support	Site establishment & duration
34. Water carts are to regularly spray access tracks, works areas, & temporary stockpiles, during dry weather conditions.	Greenfield Project Manager / Construction Manager / Site Supervisor / Contractor HSE Support	Duration
35. The progress of earthworks will minimise slope lengths and gradients where practical utilising contour berms, batter berms, diversion banks, etc.	Greenfield Project Manager / Construction Manager / Site Supervisor / Contractor HSE Support	Duration
36. Personnel to ensure visual dust monitoring is maintained during works, and dust suppression is undertaken regularly.	Greenfield Project Manager / Construction Manager / Site Supervisor / Contractor HSE Support	Duration

Environmental Management Controls	Person Responsible	Timing / Frequency
37. Minimise earthworks, soil handling and general disturbance during periods of strong and/or gusty winds.	Greenfield Project Manager / Construction Manager / Site Supervisor / Contractor HSE Support	Duration
38. Apply water sprays for dust suppression where earthworks, soil handling, rock saw cutting and/or potentially contaminated soils are generating dust.	Greenfield Project Manager / Construction Manager / Site Supervisor / Contractor HSE Support	Duration
3. Drainage and water management		
1. Construct diversion drains or banks upslope of proposed works to direct off-site water flows to existing drainage or adequately stable vegetated areas.	Greenfield Project Manager / Construction Manager / Site Supervisor / Contractor HSE Support	Duration
2. Immediately line any constructed off-site water diversions with appropriate RECP's (i.e. geotextile, plastic, etc.), OFM's (coir matting, jute mesh, etc.) and/or geobinders. Temporary spillways and associated structures to be suitably stabilised for the volume and turbulence of flows.	Greenfield Project Manager / Construction Manager / Site Supervisor / Contractor HSE Support	Duration
3. Sheet flows in work areas have erosion measures such as surface roughening, scribed drains and/or contour banks to reduce slope lengths. Flows from diversions to have velocities controlled and directed to sediment controls.	Greenfield Project Manager / Construction Manager / Site Supervisor / Contractor HSE Support	Duration
4. Temporary 'dirty' water drainage will be adjusted progressively to maximise flows to sediment filters and traps.	Greenfield Project Manager / Construction Manager / Site Supervisor / Contractor HSE Support	Duration
5. Permanent storm water drains, and outlet structures will be stabilised as soon as possible following completion.	Greenfield Project Manager / Construction Manager / Site Supervisor / Contractor HSE Support	Duration

Environmental Management Controls	Person Responsible	Timing / Frequency
6. Check dams are to be constructed from geotextile/aggregate bags, sandbags, staked coir logs/straw bales or geotextile/rock formations to reduce flow velocities in unlined drains and other areas of concentrated flow (i.e. against diversion banks). Check dams are to be installed at the required intervals in drains with the frequency of the dams increasing as the grade increases	Greenfield Project Manager / Construction Manager / Site Supervisor / Contractor HSE Support	Duration
7. Trenching works on grade will be controlled with methods detailed in the 'Blue Book' – Volume 2A' - Section 6	Greenfield Project Manager / Construction Manager / Site Supervisor / Contractor HSE Support	Duration
8. Flooded excavations, ponded water, etc will be extracted as required and utilised for site purposes or treated to achieve acceptable water quality prior to discharge.	Greenfield Project Manager / Construction Manager / Site Supervisor / Contractor HSE Support	Duration
9. Flooded excavations and groundwater encountered in ASS areas or potentially contaminated areas will be tested and assessed prior to being extracted for treatment & subsequent discharge or conveyed to a licensed liquid waste facility.	Greenfield Project Manager / Construction Manager / Site Supervisor / Contractor HSE Support	Duration
10. Site water that is to be discharged directly to a flow line, drain, watercourse, etc, will be tested, treated, and recorded prior to discharge.	Greenfield Project Manager / Construction Manager / Site Supervisor / Contractor HSE Support	Duration
11. Water quality should meet the following proposed minimum criteria prior to discharge to any waterway or drainage line: • Total suspended solids (TSS) – less than 50 mg/L • pH – 6.5 to 8.5 • oil and grease – not visible and less than 10 mg/L	Greenfield Project Manager / Construction Manager / Site Supervisor / Contractor HSE Support	Duration
12. Dewatering devices or transfer pumps will be positioned to ensure that settled sediments are not disturbed or extracted. Discharge of concentrated, treated flows to lands will occur in well vegetated areas with diffusers or level spreaders to prevent erosion. Flows transferred from in-stream works to downstream areas be released in a diffused manner.	Greenfield Project Manager / Construction Manager / Site Supervisor / Contractor HSE Support	Duration

Environmental Management Controls	Person Responsible	Timing / Frequency
13. The appearance of water quality at the discharge outlet will be regularly monitored for any increase in turbidity, and dewatering suspended until acceptable water quality levels are regained	Greenfield Project Manager / Construction Manager / Site Supervisor / Contractor HSE Support	Duration
14. Adequately designed and constructed concrete washout facilities will be constructed in a suitable location away from drainage lines and 40m from waterways. Concrete wash down to occur directly into lined receptacles or formed washouts.	Greenfield Project Manager / Construction Manager / Site Supervisor / Contractor HSE Support	Duration
4. Sediment Controls		
1. Commonly used sediment control devices are outlined in Section 8 – Table 8, and some construction details are shown in the Standard Drawings shown in this ESCP at Appendix F. Alternative controls or methods may be employed in certain circumstances for practicality or efficiency purposes. Alternative controls or methods must demonstrate efficacy and be in accordance with the intent and objectives of the 'Blue Book'.	Greenfield Project Manager / Construction Manager / Site Supervisor / Contractor HSE Support	Duration
2. Substitute materials may be utilised in the construction of erosion or sediment controls where functionality is not affected.	Greenfield Project Manager / Construction Manager / Site Supervisor / Contractor HSE Support	Duration
3. Sediment fencing, non-woven geotextile, mulch/topsoil berms, etc, will be installed on down slope work boundaries, down slope of stockpiles, cut/fill batters, access tracks, etc, to filter sheet flows.	Greenfield Project Manager / Construction Manager / Site Supervisor / Contractor HSE Support	Duration
4. Sediment filters will be formed from rock & shade cloth/geotextile structures, aggregate & geotextile filter bags, coir logs, compacted mulch formations, etc, to control concentrated on-site water flows as required	Greenfield Project Manager / Construction Manager / Site Supervisor / Contractor HSE Support	Duration
5. Excavated sediment traps may be utilised at critical locations at the toe of the contributing catchment. They will be desilted at 60% capacity and are to be dewatered prior to the onset of further rainfall.	Greenfield Project Manager / Construction Manager / Site Supervisor / Contractor HSE Support	Duration

Environmental Management Controls	Person Responsible	Timing / Frequency
6. The excavated sediment traps should be regarded as a secondary control, relying on retention of coarse sediment in upslope controls within the construction area.	Greenfield Project Manager / Construction Manager / Site Supervisor / Contractor HSE Support	Duration
7. Aggregate filter bags or sandbag inlet traps are to be deployed on roadside pit inlets or other inlets to the drainage system.	Greenfield Project Manager / Construction Manager / Site Supervisor / Contractor HSE Support	Duration
8. Gully pit inlets will be protected with filter inlet controls formed from sediment fence, filter bags, straw bales & geotextile, coir logs, etc.	Greenfield Project Manager / Construction Manager / Site Supervisor / Contractor HSE Support	Duration
9. The sediment captured by control devices is to be removed when 60% of capacity is reached. Regular desilting is also to maintain catchment and settling capacity, and to reduce re-entrainment of settled materials in subsequent rain events.	Greenfield Project Manager / Construction Manager / Site Supervisor / Contractor HSE Support	Duration
5. Soil Contamination & Acid Sulphate Soils (ASS)		
1. Excavation of sub-soils to be inspected and monitored as works proceeds, to identify potential contamination. Any potentially contaminated soils to be stripped or excavated separately and transported directly to the designated stockpile, treatment area or licensed waste facility.	Greenfield Project Manager / Construction Manager / Site Supervisor / Contractor HSE Support	Duration
2. Potentially contaminated soils or ASS are to be stored within an appropriately bunded area and covered with heavy grade plastic or other impermeable covers for the duration of rainfall.	Greenfield Project Manager / Construction Manager / Site Supervisor / Contractor HSE Support	Duration
3. Potentially contaminated excavated material that are required to be removed from site are to be assessed and classified in accordance with the Protection of the Environment Operations Act 1997 and '*Waste Classification Guidelines: Parts 1 and 2* (DECC 2008)'.	Greenfield Project Manager / Construction Manager / Site Supervisor / Contractor HSE Support	Duration

Environmental Management Controls	Person Responsible	Timing / Frequency
4. Excavated soils and materials (that have been assessed, classified, treated, and re-assessed on site) will be re-used as fill material on site where appropriate.	Greenfield Project Manager / Construction Manager / Site Supervisor / Contractor HSE Support	Duration
5. Vehicles transporting potentially contaminated soils or ASS both on internal access tracks and public roads will correctly cover loads to mitigate dust generation or spillage.	Greenfield Project Manager / Construction Manager / Site Supervisor / Contractor HSE Support	Duration
6. The ground disturbance and machinery/vehicle movements in potentially contaminated areas will be minimised to essential works.	Greenfield Project Manager / Construction Manager / Site Supervisor / Contractor HSE Support	Duration
7. Earthworks, soil handling and general disturbance in potentially contaminated areas are to be avoided during periods of strong and/or gusty winds.	Greenfield Project Manager / Construction Manager / Site Supervisor / Contractor HSE Support	Duration
8. Water sprays are to be utilised to mitigate dust from contaminated soils in works areas, contaminated soil handling or temporary stockpile areas.	Greenfield Project Manager / Construction Manager / Site Supervisor / Contractor HSE Support	Duration
6. Soil & Water pollution control		
1. All waste will be handled, stored and disposed of in accordance with the '*Waste Classification Guidelines: Parts 1 and 2* (DECC 2008)'.	Site Supervisor / Contractor HSE Support	Duration
2. Waste construction materials such as steel, concrete, etc will be removed to an appropriate recycling facility, to a suitable location for appropriate re-use, or to a licensed waste disposal facility.	Site Supervisor / Contractor HSE Support	Duration
3. All putrescible, construction, and food wastes are to be immediately captured and stored correctly, prior to removal to a licensed waste facility. Putrescibles and food wastes will be removed from site on a least a weekly basis.	Greenfield Project Manager / Construction Manager / Site Supervisor / Contractor HSE Support	Duration

Environmental Management Controls	Person Responsible	Timing / Frequency
4. Large amounts of concrete, excess to construction requirements, should not be discharged on site. Residual concrete from hoppers and discharge lines is to be blown into a concrete washout and the remainder in the concrete delivery vehicle returned to the supplier's batch plant for recycling.	Greenfield Project Manager / Construction Manager / Site Supervisor / Contractor HSE Support	Duration
5. The effluent from concrete wash down is to be captured by an excavated wash out pit lined with an impervious membrane at least 5 metres away from any waterway or major drainage lines. The pit is to be protected by a diversion bund to prevent entry of site run-off that may subsequently displace alkaline water/slurry. Concrete washouts to be covered for the duration of significant or prolonged rainfall.	Greenfield Project Manager / Construction Manager / Site Supervisor / Contractor HSE Support	Duration
6. The water levels in concrete washout pits will be monitored and dewatered regularly. The water pH will be tested and treated where it is outside the parameters of pH 6.5-8.5. Where suitable pH is attained, the water can then be used site purposes.	Greenfield Project Manager / Construction Manager / Site Supervisor / Contractor HSE Support	Duration
7. The site machinery 'lay-up' area, re-fuelling areas and chemical storage areas are to be located at least 5 meters away from major drainage lines.	Greenfield Project Manager / Construction Manager / Site Supervisor / Contractor HSE Support	Duration
8. The re-fuelling and servicing of machinery is to be undertaken at approved premises off-site where possible. Onsite refuelling and servicing only to occur with appropriate spill control measures at hand, or where established or temporary bunded areas are available.	Greenfield Project Manager / Construction Manager / Site Supervisor / Contractor HSE Support	Duration
9. Mobile plant, machinery and vehicles are to be regularly inspected and maintained to manufacturer's specifications.	Greenfield Project Manager / Construction Manager / Site Supervisor / Contractor HSE Support	Duration
10. Appropriate spill kits are to be always kept on site and any spillage is to be immediately cleaned up. In the event of a large or hazardous spill, contact will be made with emergency and relevant authorities, where required.	Greenfield Project Manager / Construction Manager / Site Supervisor / Contractor HSE Support	Duration

Environmental Management Controls	Person Responsible	Timing / Frequency
11. All site personnel will be instructed about emergency spill procedures, spill kit locations and requirements. The location of spill response kits will be established close to works or operations areas.	Greenfield Project Manager / Construction Manager / Site Supervisor / Contractor HSE Support	Duration
12. Storage of liquid construction materials (chemicals, fuels, oils, etc) will be provided in appropriately bunded areas on site to prevent leaching into soils, leaking or other transfer of material into waterways.	Greenfield Project Manager / Construction Manager / Site Supervisor / Contractor HSE Support	Duration
13. Containment bunds are to be monitored regularly and captured materials removed as required to ensure bund capacity is maintained.	Greenfield Project Manager / Construction Manager / Site Supervisor / Contractor HSE Support	Duration
14. Bunded areas will satisfy requirements of the relevant Australian Standards and 'Bunding and Spill Management (DEC, 1997)'	Greenfield Project Manager / Construction Manager / Site Supervisor / Contractor HSE Support	Duration
15. The requirements of the Australian Dangerous Goods Code will be observed for storage and transport of any hazardous materials. The compatibility of all chemicals, pesticides and fuels transported and stored will be assessed to avoid potential risk from reactions, explosion, etc.	Greenfield Project Manager / Construction Manager / Site Supervisor / Contractor HSE Support	Duration
16. All chemicals, pesticides and fuel will be stored and transported in approved containers. Chemicals, pesticides, and fuels are to be labelled correctly and clearly, including using approved warning symbols etc.	Greenfield Project Manager / Construction Manager / Site Supervisor / Contractor HSE Support	Duration
17. A MSDS register and will be maintained and be readily accessible on site for all hazardous chemicals transported, handled, or applied.	Greenfield Project Manager / Construction Manager / Site Supervisor / Contractor HSE Support	Duration

Environmental Management Controls	Person Responsible	Timing / Frequency
18. An adequate record or log of all environmentally hazardous chemicals received, used and/or disposed of will be maintained.	Greenfield Project Manager / Construction Manager / Site Supervisor / Contractor HSE Support	Duration
19. Substitution of less hazardous materials or chemicals or modifying methods of use/storage etc. will be implemented where possible.	Greenfield Project Manager / Construction Manager / Site Supervisor / Contractor HSE Support	Duration
20. The quantities of hazardous materials and chemicals stored or used will be minimised as far as practical.	Greenfield Project Manager / Construction Manager / Site Supervisor / Contractor HSE Support	Duration
21. Sensitive areas (ie. drainage lines) will be identified before utilising or applying chemicals. Where sensitive areas are identified, appropriate guidance and relevant restrictions will be formulated for chemical use or applications.	Greenfield Project Manager / Construction Manager / Site Supervisor / Contractor HSE Support	Duration
22. The application methods and dilution ratios specified in manufacturer's directions and/or associated MSDS will be observed by personnel.	Greenfield Project Manager / Construction Manager / Site Supervisor / Contractor HSE Support	Duration
7 Stabilisation		
1. Promote efficient staging planning for early stabilisation of perimeter or completed areas. (i.e. stabilisation of permanent drains, batters, sealing & paving, and decommissioning of temporary controls)	Greenfield Project Manager / Construction Manager / Site Supervisor / Contractor HSE Support	Duration
2. Stabilisation of areas is to occur progressively in conjunction with the completion of earthworks.	Greenfield Project Manager / Construction Manager / Site Supervisor / Contractor HSE Support	Duration

Environmental Management Controls	Person Responsible	Timing / Frequency
3. Suitable design and construction techniques are to be selected for stabilisation of relevant areas such as drain linings, batter treatments, etc.	Greenfield Project Manager / Construction Manager / Site Supervisor / Contractor HSE Support	Duration
4. Completed earthworks areas will be backfilled and compacted in a staged manner as soon as possible. Adjacent disturbed areas will be suitably trimmed and stabilised as required.	Greenfield Project Manager / Construction Manager / Site Supervisor / Contractor HSE Support	Duration
5. Erosion and sediment controls are to be maintained until the relevant catchments are stabilised, re-vegetated, or sealed adequately to achieve soil surface protection factors as per the 'Blue Book', SWMP & ESCP requirements.	Greenfield Project Manager / Construction Manager / Site Supervisor / Contractor HSE Support	Duration
6. Compounds, lay down areas and other areas of heavy construction impact to be restored to an acceptable condition. Destocking, waste removal & cleaning to be followed by scarification, topsoiling and stabilisation.	Greenfield Project Manager / Construction Manager / Site Supervisor / Contractor HSE Support	Duration
7. Any aggregate placed for vehicle access or as a work platform should be removed to a suitable location for recycling, appropriate re-use, or to a licensed waste disposal facility.	Greenfield Project Manager / Construction Manager / Site Supervisor / Contractor HSE Support	Duration
8. Any areas subject to heavy compaction and disturbance from vehicle movements and machinery will be subject to surface roughening and scarification (up to 300mm) to reduce compaction of the upper layer of soil.	Greenfield Project Manager / Construction Manager / Site Supervisor / Contractor HSE Support	Duration
9. Topsoil to be re-used locally within the precincts, with batters prioritised for topsoil application and timely application of soil stabilisers where applicable.	Greenfield Project Manager / Construction Manager / Site Supervisor / Contractor HSE Support	Duration

Environmental Management Controls	Person Responsible	Timing / Frequency
10. The remaining stored topsoil should be utilised to topsoil disturbed areas, rehabilitate compounds, and haul roads, or be spread to a uniform depth over the disturbed non-structural areas that are of low gradients.	Greenfield Project Manager / Construction Manager / Site Supervisor / Contractor HSE Support	Duration
11. Determine the cover crop mix seed blend suitable to the site & seasonal conditions to provide adequate protection until final landscaping commences.	Greenfield Project Manager / Construction Manager / Site Supervisor / Contractor HSE Support	Duration
12. Lands recently stabilised with cover crops will not be regularly watered except for initial germination or during prolonged hot & dry conditions. During milder seasons the cover crop will be monitored as received precipitation should be adequate.	Greenfield Project Manager / Construction Manager / Site Supervisor / Contractor HSE Support	Duration
13. Further application of seed may be necessary in latter stages in areas of inadequate vegetation establishment. Pedestrian and vehicular traffic will be restricted from all recently stabilised areas.	Greenfield Project Manager / Construction Manager / Site Supervisor / Contractor HSE Support	Duration

Appendix A

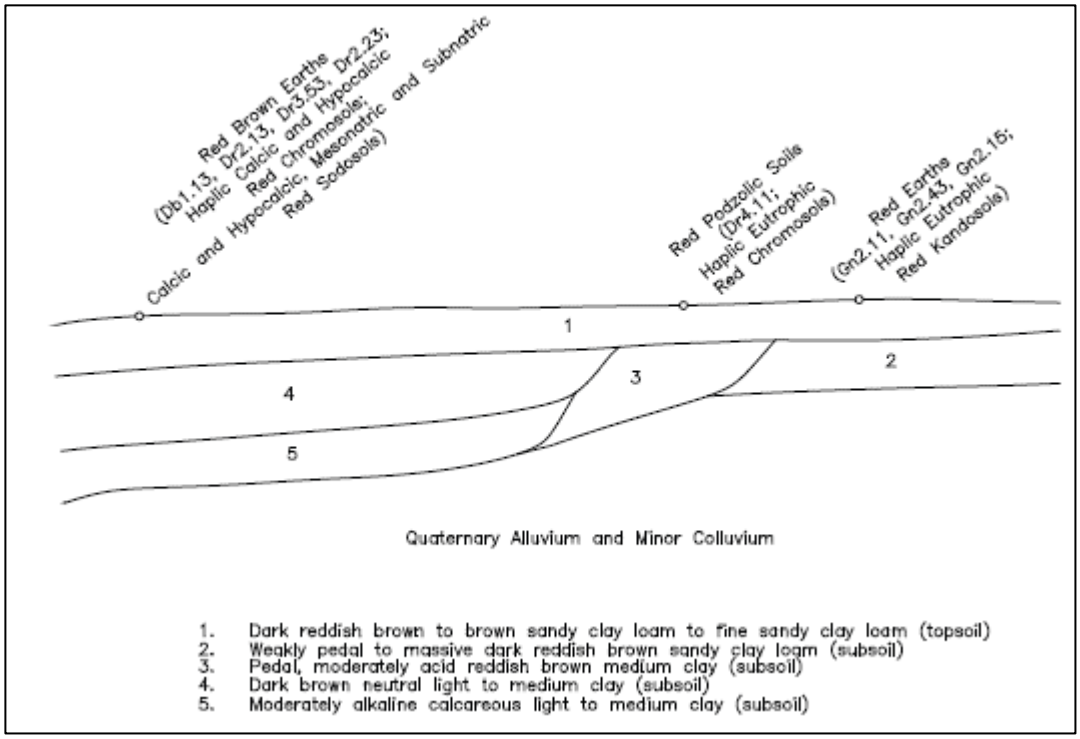
Site Characteristics & Revised Universal Soil Loss Equation Assessment

Site Characteristics Table & Revised Universal Soil Loss Equation (Rusle) Data

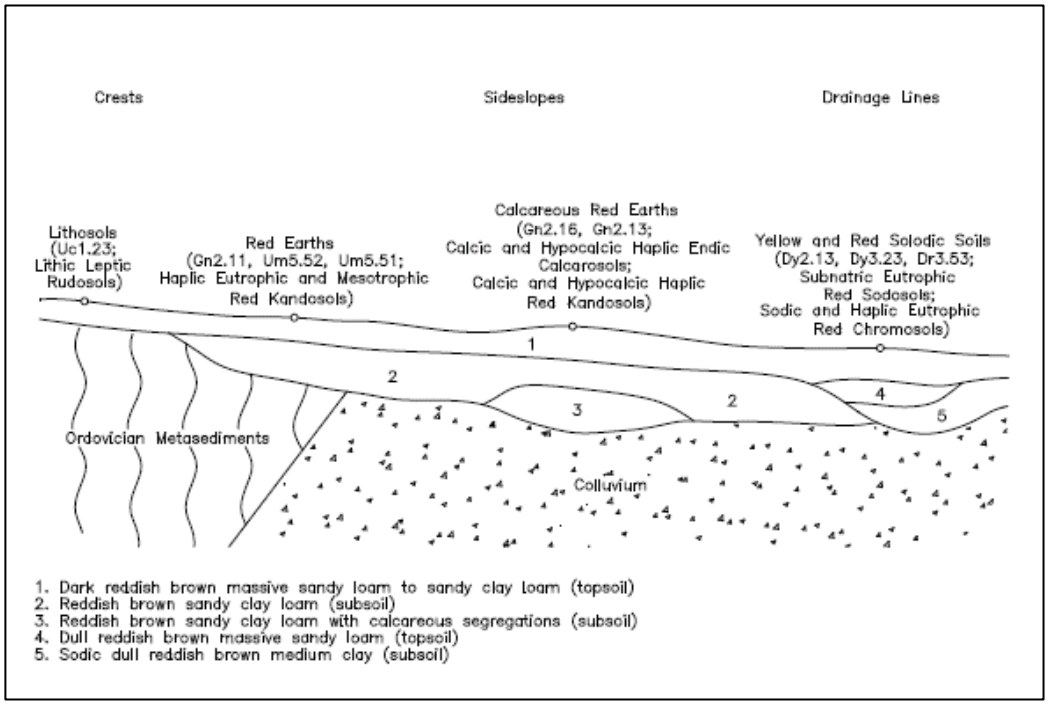
Location	Compressor Station MW880 at Milne (via Condobolin)
Construction duration	<12 months earthworks – 80th%ile adopted (Sect. 6.3.4 – (f). Blue Book)
Erosion Hazard	Low (Sect 4.4.1 & Figure 4.6 – Blue Book)
Soil Loss Class	Class 1 (Sect 4.4.2. & Table 4.2 – Blue Book)
Batter Restrictions	No restrictions under 20m batter slope length Generally, >25m batter length @ 2H:1V ranging to >30m @ 2.5H:1V (Sect 4.4.2 – (a) & Figure 4.7 – Blue Book)
Seasonal erosion hazard	No (Sect 4.4.2 – (c), Figure 4.9 & Table 4.3 – Blue Book)
Soil texture group – Please refer to the Project SWMP Section 4.2.5	
Euglo (eg) Soil Landscape:	Please refer to the Project SWMP Section 4.2.5
Weelah (wl) Soil Landscape:	Please refer to the Project SWMP Section 4.2.5
USCS Class	Please refer to the Project SWMP Section 4.2.5
Soil erodibility factor – K factor	0.071- Adopted. Please refer to the Project SWMP Table 4.5
Sediment Type	Type D Adopted - Please refer to the Project SWMP Section 5.1
Soil hydrologic group	Group D Adopted - Please refer to the Project SWMP Table 4.5
80th %ile, 5-day rainfall event	20.4mm – Nyngan (Sect 6.3.4 – Table 6.3a - Blue Book)
Rainfall Intensity - millimetres per hour	5.87mm/hour - Please refer to the Project SWMP Section 4.4.1
Rainfall Erosivity – R factor	990.3 - Please refer to the Project SWMP Section 4.4.1
Volumetric runoff coefficient - Cv	0.50 (Blue Book – Appendix F: Table F2
Grade	Euglo (eg) Soil Landscape: 0-1% (commonly 0%) Weelah (wl) Soil Landscape: 1-3%
Slope Length	80 metres adopted
LS Factor	0.19 -0.41
Erosion control practice factor – P factor	1.3
Ground cover – C Factor	1.0

Typical Soil Profile diagrams

Euglo (eg) Soil Landscape



Weelah (wl) Soil Landscape



Appendix B

RUSLE Catchment Assessment & Sediment Basin Calculations

SWMP Commentary, Detailed Calculations

Note: These "Detailed Calculation" spreadsheets relate only to high erosion hazard lands as identified in figure 4.6 or where the designer chooses to use the RUSLE to size sediment basins. The "Standard Calculation" spreadsheets should be used on low erosion hazard lands as identified by figure 4.6 and where the designer chooses not to run the RUSLE in calculations.

1. Site Data Sheet

Site Name: Oakdale West Estate - Building 2A

Site Location:

Precinct:

Description of Site: Building 2A Construction Area

Site area	Sub-catchments						Remarks
	1%/80	2%/80	1%/85	2%/85			
Total catchment area (ha)	8.05	8.05	8.05	8.05			
Disturbed catchment area (ha)	8.05	8.05	8.05	8.05			

Soil analysis (enter sediment type if known, or laboratory particle size data)

Sediment Type (C, F or D) if known:	D	D	D	D			From Appendix C
% sand (fraction 0.02 to 2.00 mm)							Soil texture should be assessed through mechanical dispersion only. Dispersing agents (e.g. Calgon) should not be used
% silt (fraction 0.002 to 0.02 mm)							
% clay (fraction finer than 0.002 mm)							
Dispersion percentage							E.g. enter 10 for dispersion of 10%
% of whole soil dispersible							See Section 6.3.3(e). Auto-calculated
Soil Texture Group	D	D	D	D			Automatic calculation from above

Rainfall data

Design rainfall depth (days)	5	5	5	5			See Sections 6.3.4 (d) and (e)
Design rainfall depth (percentile)	80	80	85	85			See Sections 6.3.4 (f) and (g)
x-day, y-percentile rainfall event	24.6	24.6	32.2	32.2			See Section 6.3.4 (h)
Rainfall R-factor (if known)	1920	1920	1920	1920			See Appendix B
IFD: 2-year, 6-hour storm (if known)	9.2	9.2	9.2	9.2			See IFD chart for the site

RUSLE Factors

Rainfall erosivity (*R*-factor)	1920	1920	1920	1920			Auto-filled from above
Soil erodibility (*K*-factor)	0.05	0.05	0.05	0.05			RUSLE LS factor calculated for a high rill/interrill ratio.
Slope length (m)	80	80	80	80			
Slope gradient (%)	1	2	1	2			
Length/gradient (*LS*-factor)	0.19	0.41	0.19	0.41			
Erosion control practice (*P*-factor)	1.3	1.3	1.3	1.3	1.3	1.3	
Ground cover (*C*-factor)	1	1	1	1	1	1	

Calculations

Soil loss (t/ha/yr)	24	51	24	51			
Soil Loss Class	1	1	1	1			See Section 4.4.2(b)
Soil loss (m^3/ha/yr)	19	39	19	39			
Sediment basin storage volume, m^3	25	53	25	53			See Sections 6.3.4(i) and 6.3.5 (e)

4. Volume of Sediment Basins, *Type D* and *Type F* Soils

Basin volume = settling zone volume + sediment storage zone volume

Settling Zone Volume

The settling zone volume for *Type F* and *Type D* soils is calculated to provide capacity to contain all runoff expected from up to the y-percentile rainfall event. The volume of the basin's settling zone (V) can be determined as a function of the basin's surface area and depth to allow for particles to settle and can be determined by the following equation:

$$V = 10 \times C_v \times A \times R_{x\text{-day, y-\%ile}} \ (m^3)$$

where:

10 = a unit conversion factor

C_v = the volumetric runoff coefficient defined as that portion of rainfall that runs off as stormwater over the x-day period

$R_{x\text{-day, y-\%ile}}$ = is the x-day total rainfall depth (mm) that is not exceeded in y percent of rainfall events. (See Sections 6.3.4(d), (e), (f), (g) and (h)).

A = total catchment area (ha)

Sediment Storage Zone Volume

In the detailed calculation on Soil Loss Classes 1 to 4 lands, the sediment storage zone can be taken as 50 percent of the settling zone capacity. Alternately designers can design the zone to store the 2-month soil loss as calculated by the RUSLE (Section 6.3.4(i)(ii)). However, on Soil Loss Classes 5, 6 and 7 lands, the zone must contain the 2-month soil loss as calculated by the RUSLE (Section 6.3.4(i)(iii).

Place an "X" in the box below to show the sediment storage zone design parameters used here:

	50% of settling zone capacity,
X	2 months soil loss calculated by RUSLE

Total Basin Volume

Site	C_v	$R_{x\text{-day, y-\%ile}}$	Total catchment area (ha)	Settling zone volume (m^3)	Sediment storage volume (m^3)	Total basin volume (m^3)
1%/80	0.50	20.4	1	102	2	104
2%/80	0.50	20.4	1	102	5	107
Site	0.50	20.4	3.5	357	8	365
Site	0.50	20.4	3.5	357	17	374

Note that designers should achieve a minimum 3:1 length:width ratio in Type D or F basins

Appendix C

Site Dewatering Procedure

1.1 Purpose

The purpose of the Site Dewatering Procedure (the Procedure) is to detail the actions to be taken regarding site dewatering in general and specific measures for the construction and maintenance of sediment basins including steps to be taken prior to any discharge.

Adherence to the methodology outlined in procedure will ensure that works are carried out in accordance with industry standard and environmental conditions.

1.2. Scope

The Procedure applies to the following works:

- Dewatering of excavations and construction water generally, and
- Acid sulfate leachate ponds in the event that acid sulfate soils or rock is encountered.

1.3. Objectives

The objectives of this Procedure are to:

- Ensure all Project personnel are aware of the requirements of this procedure
- Detail personnel responsible for undertaking actions relating to sediment basin, construction dewatering and acid sulfate leachate management on the site;
- Providing a uniform, controlled methodology and clear criteria for water releases from the site;
- Implement industry standard methods for managing sediment basins and dewatering in accordance with best practice guidelines such as Managing Urban Stormwater Soils and Construction (Landcom 2004) and Acid Sulfate Soil Manual (ASSMAC 1998);
- Ensure water discharges from site are compliant with:
    - the NSW EPA Water Quality Criteria;
    - Managing Urban Stormwater Soils and Construction (Landcom 2004)
    - Approved Erosion and Control Plan; and
- Comply with environmental requirements of the Project, including all legal requirements and contractual obligations.

The procedure shall ensure appropriate environmental protection measures are in place relating to construction water management (dewatering of excavations, culverts, etc) and management of leachate collected in ponds from acid sulfate material stockpiles.

2. Site Dewatering Procedure

Environmental Management Controls	Person Responsible	Timing / Frequency
Planning		
A copy of this Site Dewatering Procedure will be kept on site and be made available to all relevant project personnel	Supervisor / Environmental Site Representative	Site Establishment / Duration
All relevant project personnel will be made aware of this document during the site induction and again in Toolbox Talks and targeted training sessions.	Supervisor / Environmental Site Representative	Site Establishment / Duration
Training and Awareness		
Training, instruction and equipment familiarisation for environmental personnel undertaking water quality monitoring, equipment calibration and maintenance will be the responsibility of the Environmental Site Representative. This will be completed prior to the initial use of equipment or as new equipment arrives on site.	Environmental Site Representative	Site Establishment / Duration
Training sessions will be conducted with Supervisors, Foreman, and Environmental Work Crew and relevant personnel. The training will address • Preliminary post-rainfall inspections • Testing and recording • Treatment methods and recording • Details of the Water Discharge Permit • Dewatering requirements, methods and recording • Maintenance requirements, methods and recording • Storage, Handling and Application of Flocculants	Supervisor / Environmental Site Representative	Site Establishment / Duration
Any personnel that are responsible for monitoring pumps during dewatering activities, and that have not undertaken training described above, will undertake a specific toolbox talk to ensure awareness of requirements.	Supervisor / Environmental Site Representative	Site Establishment / Duration
Water Quality Testing, Treatment & Criteria for Discharge		
Captured water to be discharged from site must meet the following criteria: • pH between 6.5 – 8.5 • TSS < 50mg/L and • Oil and grease - no visible trace.	Supervisor / Environmental Site Representative	Duration
Potential contamination of any ponded waters will be considered prior to discharge. Where the main source is from storm water, TSS and oil and grease are considered to be the likely pollutants. Where groundwater is a significant contributing source, influence from contaminants will be considered as potential pollutants and additional testing in the form of pH and metals may be undertaken.	Supervisor / Environmental Site Representative	Duration
Water Treatment		
Onsite reuse of ponded stormwater or infiltrated groundwater should always be the first dewatering option considered. Onsite reuse may include application for dust suppression, earthworks compaction and vegetation establishment.	Supervisor / Environmental Site Representative	Duration
If water is to be used for construction purposes (e.g. compaction, dust control) no treatment is required.	Supervisor / Environmental Site Representative	Duration

Environmental Management Controls	Person Responsible	Timing / Frequency
Before any de-watering to off-site areas, excavations, etc, the parameters of pH, T.S.S. and oil and grease are to be tested and meet the following criteria: • pH between 6.5 – 8.5 • TSS < 50mg/L; and • Oil and grease < 10mg/L (and no visible trace). Treatment should commence as soon as practical following cessation of a rain to allow enough time for settlement of suspended solids.	Supervisor / Environmental Site Representative	Duration
Records of water quality management must be maintained and the required records include: • The date(s) on which the sample was taken; • The time(s) at which the sample was collected; • The name of the person who collected the sample.	Supervisor / Environmental Site Representative	Duration
pH Treatment should be undertaken as follows: • Test water with a suitable pH meter. No action is required if the pH reading is between 6.5 and 8.5 • Lime to be added if pH below 6.5 or Hydrochloric Acid (32% Muriatic) or Sulfuric Acid to be added if pH above 8.5 • Determine volume of water to be treated. • Determine the percentage of lime or acid required by taking a 10-litre sample of basin water and adding a known amount of lime or acid (initially 0.004%). If the pH is still not acceptable, vary the amount of lime or acid until within the limits. • Once the required percentage has been determined, calculate the actual amount of lime or acid to be added by multiplying the volume of water in the basin by the determined percentage. • Add the required amount of lime or acid to the basin and mix the water well • Treat for pH prior to T.S.S.	Supervisor / Environmental Site Representative	Duration
Total Suspended Solids • Test the water initially for NTU using a turbidity tube, nephelometer (Turbidity tester) or by comparing with water samples contained in jars with representative readings up to 100mg/l. • When the comparative NTU readings indicate T.S.S. levels are <50mg/l obtain a grab sample in accordance with approved sampling methods promptly analysed by a laboratory. • No further treatment action is required if T.S.S. results are <50mg/l.	Supervisor / Environmental Site Representative	Duration

Environmental Management Controls	Person Responsible	Timing / Frequency
<u>Total Suspended Solids</u> • If waters require flocculation (e.g. T.S.S. >50mg/l), a flocculant/coagulant is to be utilised at the determined dosage initially, then treated with incremental doses should more flocculant be required. • The water should be monitored daily after flocculation until desired TSS is achieved and to assist in determination of optimal dosage levels. Methods of application to include: • broadcast by shovels on small sumps and excavations is acceptable. This method requires spreading powdered coagulants (i.e. gypsum, calcium chloride, etc) evenly and thinly (i.e. "dusting") over as much of the water surface as possible. • For areas with a large water surface area. The powdered or flake style coagulants should be pre-mixed thoroughly in a drum with clean water and sprayed over the maximum surface area of water as possible. • When spraying coagulant mixtures, the mixture should hit the water at between 10 to 20 degrees to increase surface areas exposure to the water column. • Alternative water treatment utilising liquid flocculants/coagulants will require the assessed dosage to be pre-mixed and discharged into the basin. Following dosing, the basin water is to be gently re-circulated for a suitable period (2-4 hours) to allow chemical reaction time, and to keep precipitated flocculant/coagulant in suspension a sufficient time to collect the maximum quantity of fine suspended particles into floc clusters. • The process outlined may need to be repeated if acceptable water quality is not achieved initially. **<u>Oil and Grease</u>** • Examine surface of water for evidence (e.g. sheen, discoloration). • No action if no visual contamination. • Oil absorbent material to be spread if there is contamination (e.g. cell-u-sorb). Leave basins to compensate for 24 to 48 hours.	Supervisor / Environmental Site Representative	Duration
After retesting, and once the above field tests indicate, the water quality is acceptable, pumping or siphoning can commence with the water extraction inlet protected to prevent extraction of sediment.	Supervisor / Environmental Site Representative	Duration
Discharging Water		
Where possible, ponded water will be reused on site for compaction, dust suppression, and irrigation.	Supervisor / Environmental Site Representative	Duration
The whole process of water quality management will be completed within 5 days of cessation of a rain period.	Supervisor / Environmental Site Representative	Duration

Environmental Management Controls	Person Responsible	Timing / Frequency
Water may be discharged from site where the tested water quality meets NSW EPA criteria and the Site Representative gives approval. The discharge outlet will be constructed to prevent erosion and scour.	Supervisor / Environmental Site Representative	Duration
The Supervisor is to ensure that treated water has been re-tested for pH and turbidity (NTU) in-situ immediately prior to discharge.	Supervisor / Environmental Site Representative	Duration
The preferred method for dewatering is by the use of a static siphon system with sufficient flow capacity to discharge the volume of supernatant water within a reasonable timeframe (i.e. 12 to 24 hours). The siphon inlet is to be positioned so that settled sediments are not extracted during dewatering.	Supervisor / Environmental Site Representative	Duration
Where ponded waters are to be dewatered by pump, suitable inlet protection devices (i.e. float & housing or extraction tube) will be provided to prevent the extraction of settled sediments. The flows from the pump outlet and basin are to be constantly monitored during discharge.	Supervisor / Environmental Site Representative	Duration
Only personnel who have undertaken the relevant training and been approved by the Supervisor may operate pumps and discharge sediment basins. During dewatering pumps must be monitored at all times to ensure that settled sediment is not disturbed or extracted, and that water is discharged in a diffused manner to prevent erosion.	Supervisor / Environmental Site Representative	Duration
Assessment and use of Coagulants & Flocculants		
Coagulation is the neutralisation and/or destabilisation of electrical charge on suspended soil colloids, whereas flocculation utilises bridging type interactions involving polyelectrolyte chains adsorbing to multiple colloid particles and aggregates through electrostatic charge interactions. The following procedure will be implemented to determine the suitability and effectiveness of the various water treatment products. • The product will be sourced from a reputable and traceable supplier together with MSDS and any other supporting documentation. • Controlled 'jar testing' will be undertaken using site sourced water. The jar testing will establish the site-specific dosing rates for any given products. • Initial dosing will be undertaken incrementally up to the site specific/determined dosing rate in the event that the water responds to a lower dose in the 'real world' application. • Settling rates will be assessed to determine the efficiency of each product. • On site water sampling and testing will progressively assess the water's pH and turbidity in NTU's prior to lab testing. • Lab testing for TSS, NTU & pH will be completed prior to any dry weather/controlled discharge to downstream waterways.	Supervisor / Environmental Site Representative	Duration
The range and type of suitable flocculants/coagulants (including typical dosing rates described as product required to water volume)) that may be utilised include; • Calcium Sulphate (Gypsum - powder) – 300ppm (30kg/100m3) • Anionic Polyacrylamide (gel blocks) – 200ppm (20kg/100m3) • Calcium Chloride (solid - flakes), – 200ppm (20kg/100m3) • Aluminium Chlorohydrate (liquid) – 40ppm (4L/100m3) • PAC23 (poly aluminium chloride 23% - solution) - 50ppm (12.5L/100m3) • Aluminium Sulphate (crystals) – 200ppm (20kg/100m3)	Supervisor / Environmental Site Representative	Duration

Storage and Handling of Flocculants		
Environmental Management Controls	**Person Responsible**	**Timing / Frequency**
Gypsum and agricultural lime will be stored on site as either bagged or bulk product. Storage of bulk gypsum and agricultural lime will be covered, within erosion and sediment controls in a position where run on water will not erode the stockpiles.	Supervisor / Environmental Site Representative	Duration
All treatment chemicals particularly acids and basics will be stored in appropriately bunded and covered locations that are locked to prevent unauthorised access.	Supervisor / Environmental Site Representative	Duration
All chemicals on site will be stored with MSDSs for ease of reference in the event of a spill or irritation/injury to handlers.	Supervisor / Environmental Site Representative	Duration
Requirements of the Material Safety Data Sheets (MSDSs) will be met to ensure compatible storage with other chemicals to ensure safety.	Supervisor / Environmental Site Representative	Duration

Monitoring and Record Keeping		
Records to be kept of the rainfall events, inspections undertaken, field tests undertaken, dosage rates and when water is released etc.	Supervisor / Environmental Site Representative	Duration
The results of all inspections, including inspection reports will be retained in the site environmental inspection register	Supervisor / Environmental Site Representative	Duration
All discharges will be recorded on a discharge permit which will include: • Volume to be discharged • Treatment details (e.g. Coagulant/ flocculant used, dosage, duration and treatment date) • Water quality monitoring results (including date and time of testing) • Discharge water quality results • Date and time of discharge	Supervisor / Environmental Site Representative	Duration
Pumped discharge of any water off site will be monitored regularly to ensure that tested water quality meets all applicable criteria.	Supervisor / Environmental Site Representative	Duration

3. Procedure Review

The procedure will be regularly reviewed as part of the CEMP audit requirements. This document will be updated when needed in response to audit findings or changes to site conditions. The Environmental Site Representative will modify the procedure where improvements are identified.

Appendix D

Site Dewatering Discharge Record

Site Dewatering Discharge Record

Date Inspected		Discharge point ID:	
Date of last rainfall event:		Amount of rainfall received:	
Estimated basin level in %?		Approximate volume of water prior to treatment:	
Initial turbidity reading of NTU's		Initial pH of the water? (range of 6.5 -8.5 required)	
The initial amount of acid/lime used if pH correction is required.		Date & time of acid/lime dosing	/ / am/pm
Subsequent amount of acid/lime used if pH correction is required.		Date & time of acid/lime dosing	/ / am/pm

Type of flocculant or coagulant product used (and typical dosing volume)	Yes	No	Flocculant or coagulant product used	Date & time of flocculant or coagulant dosing
Calcium Sulphate (Gypsum - powder) 300ppm (30kg/100m3)				/ / am/pm
Anionic Polyacrylamide (gel blocks) 200ppm (20kg/100m3)				/ / am/pm
Calcium Chloride (solid - flakes) 200ppm (20kg/100m3)				/ / am/pm
Aluminium Chlorohydrate (liquid) 40ppm (4L/100m3)				/ / am/pm
PAC23 (poly aluminium chloride 23% - solution) 50ppm (12.5L/100m3)				/ / am/pm
Aluminium Sulphate (crystals) 200ppm (20kg/100m3)				/ / am/pm

Turbidity reading of the NTU's		Laboratory TSS Result: (if applicable)	
Time and Date of dewatering (i.e. siphon valve opened for discharge or commencement of pump operation)			/ / am/pm
Supervisor responsible for discharge:	Name:		
Date:	Signed:		
Comments? (E.g. next rainfall predicted – slight, moderate, severe?) Was rainfall received during treatment period affecting basin (start a new sheet)			

Appendix E

Wet weather contingency procedure

1.1 Purpose

The purpose of the Wet Weather Contingency Procedure (the Procedure) is to detail the actions to be taken by construction personnel in response to an imminent severe rainfall event as forecast by the Australian Government - Bureau of Meteorology (BOM). The procedure provides guidance for monitoring BOM rainfall & storm event forecasts and other resources, to assist with Project preparations to minimise adverse site impacts where practical.

Adherence to the methodology outlined in procedure will ensure that works for wet weather contingency planning & implementation will be carried out in accordance with contract specifications and to maximise adherence to environmental obligations.

The purpose of the Wet Weather Contingency Procedure is to;

- Identify rainfall events which may cause significant precipitation over the site areas which would result in flash flooding and/or exacerbate erosion and sediment impacts;
- Include monitoring procedures of the Bureau of Meteorology (BOM) weather forecasts to predict severe rainfall events;
- Ensure emergency procedures are developed for the management of work areas, facilities and materials in a severe rainfall event that has the potential to impact areas of the Site;
- Ensure hazardous chemical & fuel/oil storage and stockpile areas are positioned in locations to limit the potential for adverse impacts from major runoff flows and/or flash flooding;
- Outline control measures for the protection of water quality in the event of a flood over the site;
- Ensure progressive stabilising methods for areas that may be potentially affected by flash flooding and/or significant scouring & erosion are implemented.

1.2. Scope

The Procedure applies to the following:

- Weather forecast monitoring and works planning,
- Implementation, monitoring and maintenance of erosion and sediment controls,
- Stockpile and hazardous materials storage,
- Sediment basin management, dewatering and maintenance.

1.3. Objectives

The objectives of this Procedure are to:

- Ensure all Project personnel are aware of the requirements of this procedure
- Detail personnel responsible for undertaking actions relating to works planning, erosion and sediment control management, sediment basin management & construction dewatering on the site;
- Comply with environmental requirements of the Project, including all legal requirements and contractual obligations.

2. Wet Weather Contingency & Management

Environmental Management Controls	Person Responsible	Timing / Frequency
Planning		
A copy of this Wet Weather Contingency Procedure will be kept on site and be made available to all relevant project personnel	Supervisor / Environmental Site Representative	Site Establishment / Duration
All relevant project personnel will be made aware of this document during the site induction and again in Toolbox Talks and targeted training sessions.	Supervisor / Environmental Site Representative	Site Establishment / Duration
Training and Awareness		
Training & instruction of site personnel will be the responsibility of the Environment Manager/ Environmental Site Representative.	Environmental Site Representative	Site Establishment / Duration
Training sessions will be conducted with Supervisors, Foreman, Environmental Work Crew and relevant personnel. The training will address • Weather forecast monitoring procedures and interpretation of forecasting by BOM and other sources • Site erosion and sediment control status and high-risk areas • Roles and responsibilities for wet weather preparation • Temporary measure selection for augmentation or additional ERSED measures • Pre & post-rainfall inspections and recording • Dewatering requirements, methods and recording • Identification of stabilisation and rectification works required.	Supervisor / Environmental Site Representative	Site Establishment / Duration
Identification of significant rainfall events		
The daily BOM forecasts for the Condobolin area are issued each morning and late afternoon. The forecasts will be monitored daily, at the start of the shift and prior to shut down. The BOM three-day forecast outlook will be reviewed daily.	Supervisor / Environmental Site Representative	Duration
BOM forecasts indicating a high likelihood of storm fronts or rainfall events of >10mm with an occurrence probability of more than 50% will be regarded as a potential rainfall event.	Supervisor / Environmental Site Representative	Duration
In periods of forecast storm weather or likely rainfall events, the tracking and intensity of approaching weather fronts is to be monitored regularly (where possible) to anticipate the time of the onset of wet weather.	Supervisor / Environmental Site Representative	Duration
Wet Weather Management Procedures		
Where a potential rainfall event is deemed likely in the BOM three-day outlook, Project personnel are to review the scope and progress of existing and imminent site works to determine high risk areas and prioritise works to stabilise the nominated areas. High risk works include culvert works, scour protection installation, permanent drainage installation, trenching on grade, and sediment basin construction or maintenance.	Project Manager / Senior Engineer / Supervisors / Environmental Site Representative	Duration

Environmental Management Controls	Person Responsible	Timing / Frequency
Wet Weather Management Procedures		
The high-risk work areas that are identified will be managed by; • Completion and temporary/permanent stabilisation of the high-risk work areas where time & resource constraints allow, prior to the onset of the potential rainfall event. • Re-allocating resources from low risk activities to assist with completion of high risk works prior to the onset of a rainfall event. • Implementation of erosion controls in high risk areas to minimise sediment control requirements. Erosion controls will be employed such as; o temporary geotextile linings or soil binders will be installed around culverts, scour protection works and drain junctions, o sandbag check dams, rock baffles, trench stops, etc will be utilised in open trenching on grade, temporary diversion drains, or concentrated flow paths over unstabilised areas.	Project Manager / Senior Engineer / Supervisors / Environmental Site Representative	Duration
The site sediment controls and sediment basins are to be inspected and any necessary rectification works undertaken such as; • Sediment basins are to be managed in accordance with Sediment Basin Management Procedure to regain the maximum runoff capacity parameters, where possible, • Sediment traps and filters to be desilted where more than 60% storage capacity is exceeded, • Spillways and discharge points from sediment traps to be inspected and reinstated as required. • Sediment fences, mulch bunds, earth berms to be inspected and repairs or reinstatement implemented as required.	Supervisor / Environmental Site Representative	Duration
The chemical, fuel and other hazardous material storage areas to be inspected to ensure their location is protected from the ingress of rainfall or concentrated overland flows. Bund controls to be inspected and accumulated liquids or other residues removed to a controlled waste location on site or for offsite disposal at licensed premises.	Supervisor / Environmental Site Representative	Duration
Following the onset of a significant storm event or rainfall event, the site controls to be inspected as soon as site conditions and safety requirements allow. The inspection to focus on high risk areas to review the function and status of the installed erosion and sediment controls.	Supervisor / Environmental Site Representative	Duration
Post-Rainfall/Storm Procedure		
The Post Rainfall Inspection will be conducted in accordance with Section 7.7 of this ESCP. The identified high-risk areas will be prioritised for any rectification or maintenance works, followed by areas with lower risk.	Supervisor / Environmental Site Representative	Duration
Records detailing the necessary works to reinstate the controls will be conducted in accordance with Section 7.7 of this ESCP.	Supervisor / Environmental Site Representative	Duration
Sediment basins are to be managed in accordance with Sediment Basin Management Procedure. Flocculation of the sediment basins may occur soon after the cessation of a rainfall event to improve the water quality parameters in circumstances where further significant rainfall is anticipated.	Supervisor / Environmental Site Representative	Duration

Environmental Management Controls	Person Responsible	Timing / Frequency
High risk work areas that are inundated will be prioritised for dewatering by; • Dewatering to a sediment basin where sufficient capacity is available, • Flocculated in-situ and discharged at a licensed discharge point when EPL water quality parameters are attained, • Dewatered by water cart and utilised for construction purposes.	Supervisor / Environmental Site Representative	Duration
Repair and reinstatement of erosion and sediment controls to be implemented as site conditions allow, proceeding from high risk areas to lower risk areas on site.	Supervisor / Environmental Site Representative	Duration

3. Procedure Review

The procedure will be regularly reviewed as part of the CEMP audit requirements. This document will be updated when needed in response to audit findings or changes to site conditions. The Project Environmental Representative in consultation with the Client will modify the procedure where improvements are identified.

Appendix F

Progressive Erosion and Sediment Control Plan

NOTES - Administration & General

1. This progressive plan is to be read in conjunction with the, PMP, relevant specifications, and procedures.
2. Works programming to maximise the mitigation of erosion by the early implementation of permanent drainage measures, temporary and permanent soil surface stabilisation measures, and minimising the area and duration of soil disturbance.
3. Bureau of Meteorology weather forecasting to be monitored daily for the local 7-Day weather outlook. Site management measures to be planned for imminent storm/rainfall/flood/wind events include, but are not limited to;
   - avoiding additional soil disturbance immediately prior to an event,
   - provision of additional erosion and sediment controls in critical locations,
   - installing, repairing, and/or adjusting 'clean' (off site water) and 'dirty' (on site) water drainage measures,
   - desilting and re-instating sediment controls as required,
   - implementing stockpile protection measures,
   - stabilising and sealing disturbed soil surfaces,
   - minimising dry soil handling in windy conditions,
   - evacuating or protecting erodible materials in lower lying area.
4. The plan is to be revised as necessary (i.e. progression of works, altered site conditions or weather). The controls depicted are subject to staging and the controls may be progressively implemented or removed according to progression of works.
5. All erosion and sediment controls generally to be constructed in accordance with `Blue Book' specifications and standard drawings being
   - MANAGING URBAN STORM WATER: SOILS AND CONSTRUCTION - 4th EDITION, LANDCOM, MARCH 2004;
   - MANAGING URBAN STORM WATER: SOILS AND CONSTRUCTION – VOLUME 2D MAIN ROAD CONSTRUCTION, DEC, 2008;
   - RMS QA SPECIFICATION G36 - ENVIRONMENTAL MANAGEMENT (SOIL AND WATER MANAGEMENT PLAN)
6. Substitute materials may be utilised in the construction of erosion or sediment controls where functionality is not affected, i.e. compacted mulch bunds in place of sediment fences, stabilised earth Berms in place of excavated drains near underground services or timber pegs in place of star pickets where electrical or gas.
7. Personnel constructing controls to have demonstrated competence and experience. Specific awareness training and workshops to be undertaken by personnel with direct involvement with erosion and sediment control. Toolbox talks to regularly focus on erosion and sediment control for specific works, associated risks, potential impacts and mitigation measures.
8. All existing vegetated or undisturbed areas outside of the works area to be regarded as "No Go" zones and to be delineated with fencing, tape or other markers, as required. All site personnel to be instructed to avoid "No Go" zones or damaging installed controls.

Erosion Control

9. During the process of clearing, maintain a control bund of cleared vegetation to control run-off as works progress. Boundary sediment controls to be installed as soon as practical as the clearing front advances. Maintain clearing slash and minimise disturbance of ground vegetation, where possible.
10. Prior to commencement of significant works, install surface drains, sediment traps, sumps & filters, and other surface runoff control measures to control runoff onto, across, and from the works zones to prevent the loss of sediment from the site.
11. Construction zones in constrained areas to be managed in smaller, defined sub-catchments to reduce slope lengths and minimise sediment loads to boundary controls.
12. Stripped topsoil to be stripped and stockpiled generally as per SD 4-1. Any viable stripped topsoil to be stored in stockpiles, preferably less than two metres in height.
13. Short term on-site stockpiles to be located away from drains and flow lines and be controlled with sediment fence or storm covers.
14. Any significant (long & steep) cut/fill batters should be progressively overlaid with Rolled Erosion Control Products (RECP's such as jute mesh, coir fibre mesh, etc), mulching, Organic Fibre Mulches (OFM's) or geobinders to reduce erosion and rilling, prior to permanent stabilisation with cover crops, mulching or other long-term surface protection
15. Vehicles transporting bulk materials on public roads are to correctly cover loads to prevent loss of load and/or dust generation.
16. Temporary controls in addition to those shown may be required at strategic locations as required by the progression of works or weather conditions

Water Management (Cont'd)

17. Maximise the interception and diversion of 'clean' (off site water) away from works areas. The 'clean' flows to be conveyed in stabilised drainage lines to suitable discharge points. The flows to be discharged to off-site areas at non-erosive velocities with adequate diffusers, level spreaders, etc. Ensure drainage paths and controls are adjusted as required to maximise the separation of 'clean' (off site) and 'dirty' (on site) water flows through/off site.
18. Flows paths with high velocity flows over unstabilised areas to be controlled with
    - applied soil surface stabilisers i.e. geotextile lining, applied soil binders, coarse rock lining, etc
    - suitably constructed check dams placed at intervals to maximise flow suppression and settling of coarse sediment.
19. Where possible, provide sand bag or other bunding controls at on-site collection points & pit inlets to prevent flows bypassing controls to downslope areas.
20. Protect all existing and constructed inlets to pits & culverts from sediment ingress.
21. Where practical, maintain and/or improve existing stabilised drains to assist in the diversion of 'clean' (off site) flows.
22. Flooded excavations, ponded water, etc. to be extracted where required and utilised for site purposes, or treated to achieve acceptable water quality prior to discharge.

Sediment Control

23. Vegetation to be progressively cleared to minimise disturbance by area and duration. Cleared vegetation to be windrowed parallel to the contour until mulching/removal to control flows across cleared areas
24. The installation of preliminary sediment controls such as perimeter sediment fencing, windrowed vegetation/mulch, excavated sediment traps, check dams, straw bale filters, etc, will be implemented prior to soil disturbance within the catchment.
25. Accumulated water in sediment traps/sumps cannot be pumped, discharged or released from site without completing a dewatering checklist.
26. Appropriate sediment tracking controls such as an aggregate/geotextile apron, shaker grid, etc. will be installed at exit points from the site. Personnel to monitor roadways & tracked sediments to be removed as required.
27. Personnel to ensure visual dust monitoring is maintained during works, and dust suppression is undertaken regularly. Dust control to be regularly conducted with water carts and soil stockpiles to suitably covered. Additional dust suppression measures to be utilised to minimise dust pollution during periods of high winds.
28. Temporary 'dirty' water drainage will be adjusted progressively to maximise flows to sediment control devices.

Contamination

29. Excavation of sub-soils to be inspected and monitored as works proceeds, to identify potential contamination. Any potentially contaminated soils to be stripped or excavated separately and transported directly to the designated stockpile, treatment area or licensed waste facility.
30. Potentially contaminated soils are to be stored within an appropriately bunded area and covered with heavy grade plastic or other impermeable covers for the duration of rainfall.
31. Ground disturbance and machinery/vehicle movements in potentially contaminated areas will be minimised to essential works.

Monitoring & Reporting and Inspection & Maintenance

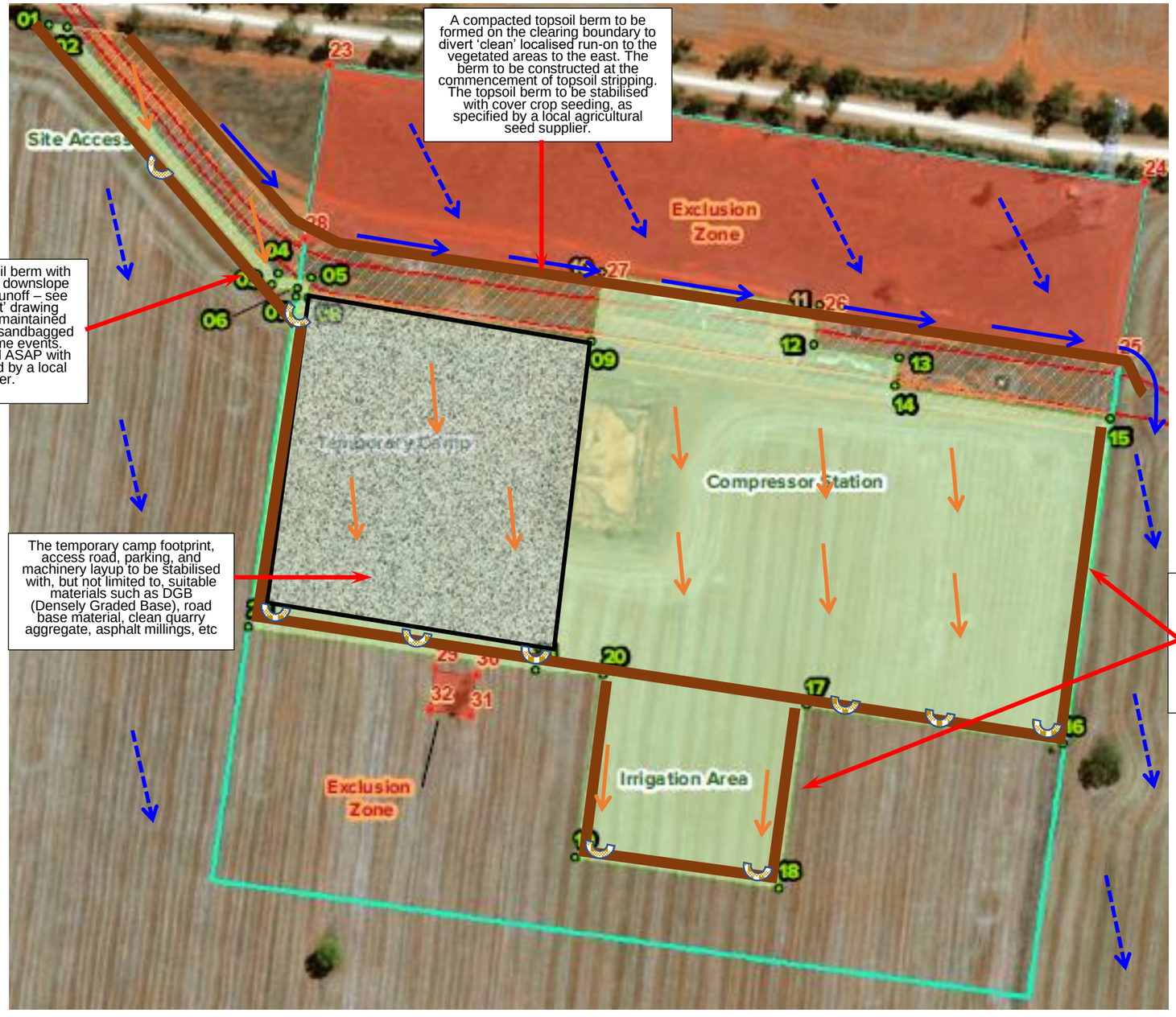
32. Inspections of erosion and sediment controls will occur following rainfall events >10mm (daily on work days or as soon as practical during site shutdown periods), with any necessary repairs implemented as soon as possible.
33. Relevant checklists and records to be maintained noting details such as rainfall received, repairs to controls and amounts of sediments cleaned from controls.
34. Sediment traps, sumps and filters are to be desilted when 60% of storage capacity is reached.
35. All site personnel to report any spill, leaks, or other failure to relevant response staff as soon as possible.

Stabilisation

36. Erosion and sediment controls are to be maintained until the relevant catchments are stabilised, re-vegetated, or sealed adequately to achieve soil surface protection factors as per the 'Blue Book' and SWMP requirements.
37. Completed earthworks areas will be backfilled and compacted in a staged manner as soon as possible. Adjacent disturbed areas will be suitably trimmed and stabilised as required.
38. Stabilisation of areas is to occur progressively in conjunction with the completion of earthworks.
39. Areas subject to heavy compaction and disturbance from vehicle movements and machinery to be scarified to a depth >100mm prior to topsoiling and seeding.

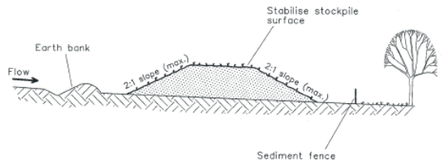
Version	Drawn by	Date	Signed	Reviewed by	Date
01	A. Littlewood	19/11/2021			
02	A. Littlewood	08/02/2022			
03	A. Littlewood	11/02/2022			

Progressive Erosion & Sediment Control Plan



Legend											
Off Site Water – Sheet Flows		Piped Drainage		Stabilised Topsoil Berm (geo/jute/seed)		Sediment basin / large sump		Sediment Fence Geotextile Apron		Vegetated filter	
Off Site Water – Concentrated Flow/Drain		Off-site & onsite water cross-over		Stabilised or lined drain		Filter bag / rock & shade cloth sediment filter		Bucket compacted mulch bund		Controlled site access	
On Site Water - Concentrated Flow/Drain		'Off site' water exclusion bank		Rock lined drain or lined spillway		Compacted Mulch / Rock & Geotextile / topsoil sediment trap		Coir Log / Straw bale filter		Stabilised Haul Road/Access Track/ Piling pad/Piped crossing	
On Site Water – Sheet Flows		Level Spreader / Diffuser		Coarse rock / sandbag check dam		Excavated sediment trap with spill weir		Filter bag or sediment fence inlet filter		Temporary Traffic Barriers	

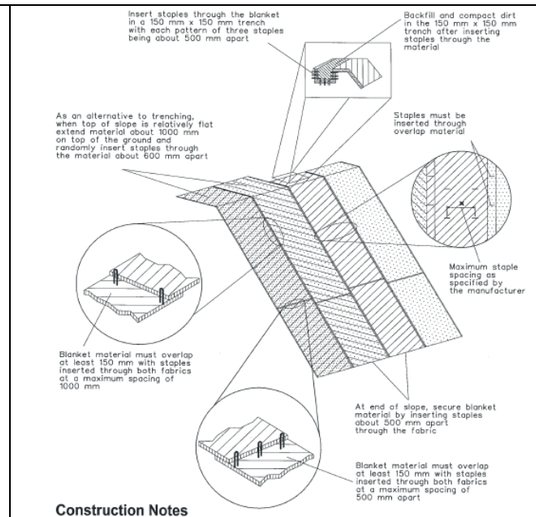
Standard Drawings



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.

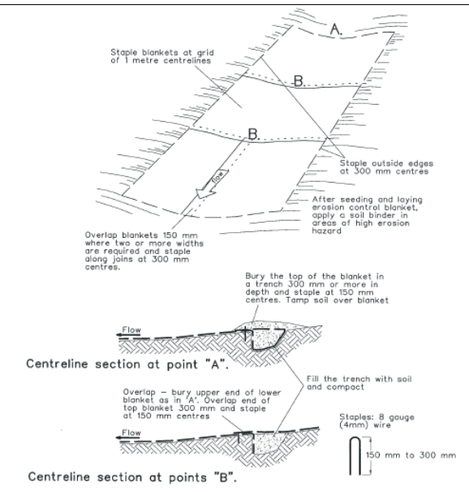
STOCKPILES **SD 4-1**



Construction Notes

1. Remove any rocks, clods, sticks or grass from the ground surface before laying the matting.
2. Spread topsoil to at least 75 mm depth.
3. Where appropriate, complete fertilising and seeding on a properly prepared seedbed (Standard Drawing 7-1) before laying the matting.
4. Ensure the fabric can be continuously in contact with the soil by grading the surface carefully first.
5. Lay the matting in "shingle-fashion" with the ends of each upstream roll overlapping the next roll downslope.
6. Ensure sufficient staples are used to maintain a good contact between the soil and the matting.

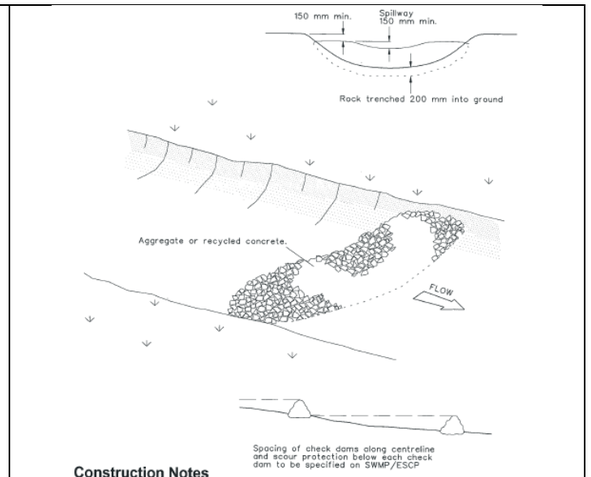
RECP : SHEET FLOW **SD 5-2**



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.

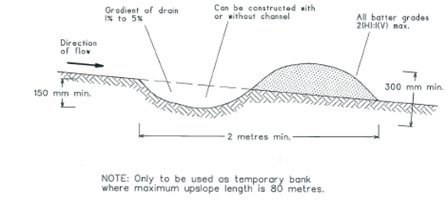
RECP : CONCENTRATED FLOW **SD 5-7**



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**

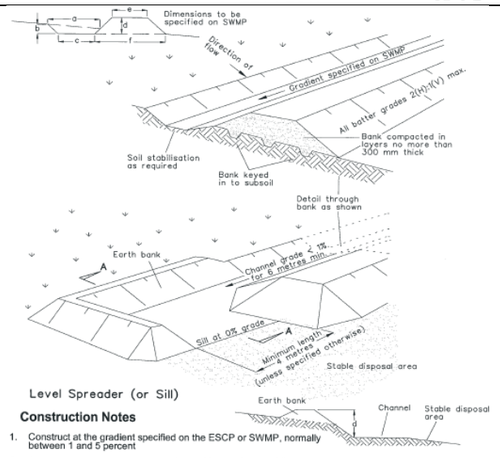


NOTE: Only to be used as temporary bank where maximum upslope length is 80 metres.

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**

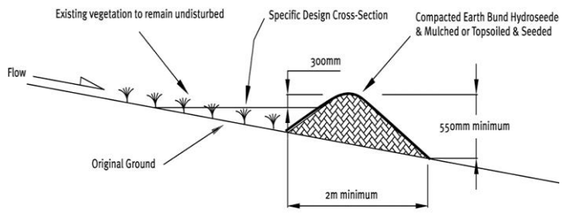


Construction Notes

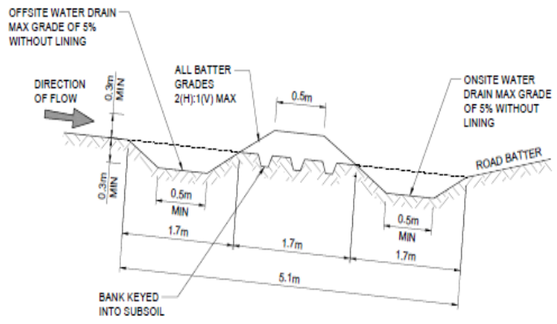
1. Construct at the gradient specified on the ESCP or SWMP, normally between 1 and 5 percent
2. Avoid removing trees and shrubs if possible - work around them.
3. Ensure the structures are free of projections or other irregularities that could impede water flow.
4. Build the drains with circular, parabolic 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 spreador.
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**

Stabilised topsoil diversion bank



Cross Section

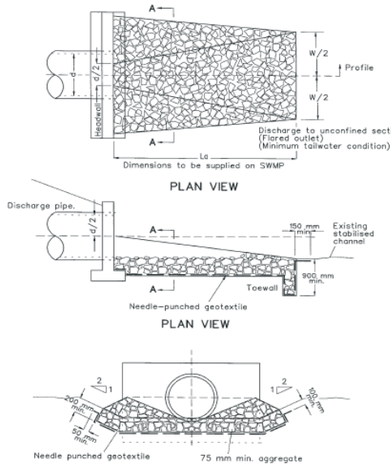


EARTH BANK (ONSITE & OFFSITE COMBINED)
N.T.S.

GENERAL CONSTRUCTION NOTES

1. CONSTRUCT WITH GRADIENT OF 1% TO 5%.
2. AVOID REMOVING TREES AND SHRUBS IF POSSIBLE - WORK AROUND THEM
3. DRAINS TO BE CIRCULAR, PARABOLIC OR TRAPEZOIDAL CROSS SECTION NOT V-SHAPED.
4. EARTH BANK TO BE ADEQUATELY COMPACTED IN ORDER TO PREVENT FAILURE.
5. PERMANENT OR TEMPORARY STABILISATION OF THE EARTH BANK TO BE COMPLETED WITHIN 10 DAYS OF CONSTRUCTION.
6. ALL OUTLETS FROM DISTURBED LANDS ARE TO BE FED INTO A SEDIMENT BASIN OR SIMILAR.
7. DISCHARGE RUNOFF COLLECTION FROM UNDISTURBED LANDS ONTO EITHER A STABILISED OR AN UNDISTURBED DISPOSAL SITE WITHIN THE SAME SUBCATCHMENT AREA FROM WHICH THE WATER ORIGINATED.
8. COMPACT BANK WITH A SUITABLE IMPLEMENT IN SITUATIONS WHERE THEY ARE REQUIRED TO FUNCTION FOR MORE THAN FIVE DAYS,
9. EARTH BANK TO BE FREE OF PROJECTIONS OR OTHER IRREGULARITIES THAT WILL IMPEDE NORMAL FLOW.

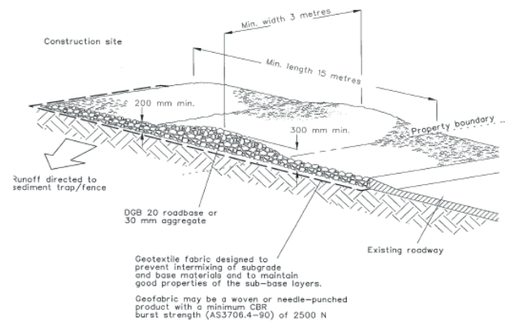
Standard Drawings



Construction Notes

1. Compact the subgrade fill to the density of the surrounding undisturbed material.
2. Prepare a smooth, even foundation for the structure that will ensure that the needle-punched geotextile does not sustain serious damage when covered with rock.
3. Should any minor damage to the geotextile occur, repair it before spreading any aggregate. For repairs, patch one piece of fabric over the damage, making sure that all joints and patches overlap more than 300 mm.
4. Lay rock following the drawing, according to Table 5.2 of Landcom (2004) and with a minimum diameter of 75 mm.
5. Ensure that any concrete or riprap used for the energy dissipater or the outlet protection conforms to the grading limits specified on the SWMP.

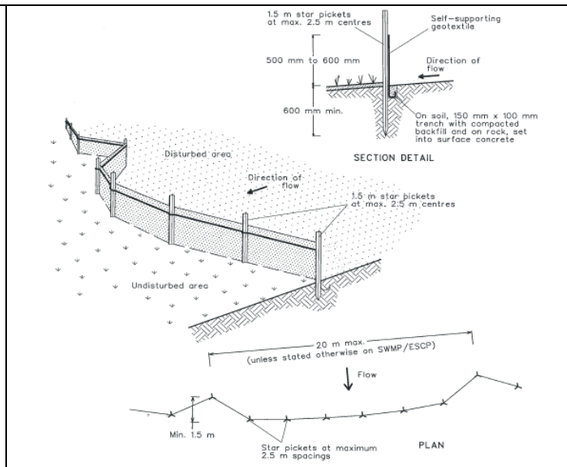
ENERGY DISSIPATER **SD 5-8**



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

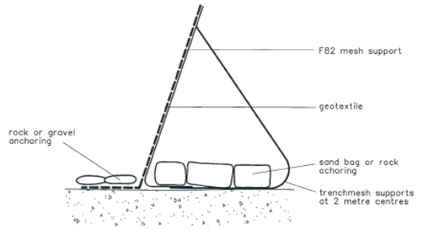
STABILISED SITE ACCESS **SD 6-14**



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.

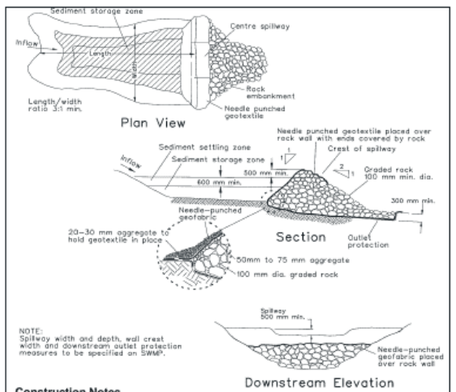
SEDIMENT FENCE **SD 6-8**



Construction Notes

1. Install this type of sediment fence when use of support posts is not desirable or not possible. Such conditions might apply, for example, where approval is granted from the appropriate authorities to place these fences in highly sensitive estuarine areas.
2. Use bent trench mesh to support the F82 welded mesh facing as shown on the drawing above. Attach the geotextile to the welded mesh facing using UV resistant cable ties.
3. Stabilise the whole structure with sandbag or rock anchoring over the trench mesh and the leading edge of the geotextile. The anchoring should be sufficiently large to ensure stability of the structure in the design storm event, usually the 10 year event.

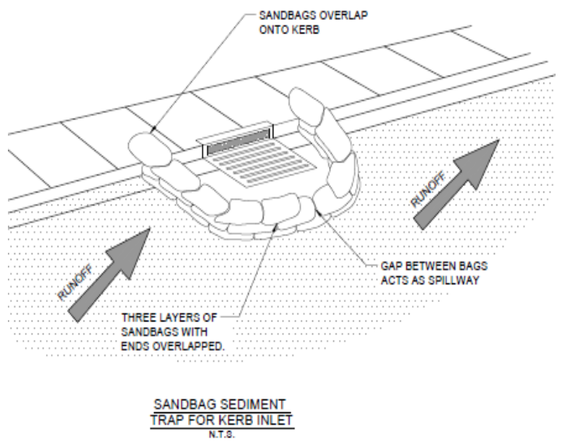
ALTERNATIVE SEDIMENT FENCE **SD 6-9**



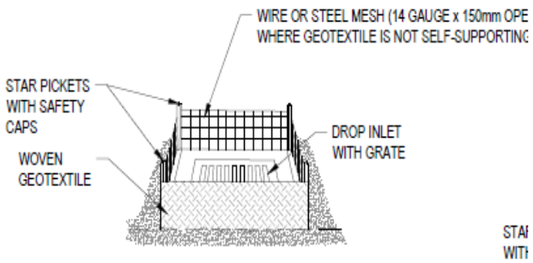
Construction Notes

1. Remove all vegetation and topsoil from under the dam wall and from within the storage area.
2. Excavate to 300 mm depth for base of the dam wall.
3. Line the excavation with a needle-punched geotextile allowing sufficient to line below the wall, and over the upstream rock and the spillway to 500 mm below the spillway exit on the downstream face.
4. Make up the wall profile and outlet protection with100 mm (min.) diameter graded rock. Spread a layer of 50 mm to 75 mm diameter aggregate over the upstream batter for a more even surface, and add 100 mm to 150 mm of 20 mm to 30 mm gravel over the 50 mm to 75 mm diameter aggregate.
5. Lay geotextile over the upstream batter and through the spillway, fixing in place with 100 mm rock.
6. Place a "Full of Sediment" marker to show when less than design capacity occurs and sediment removal is required.
7. Replace the upstream geotextile layer each time sediment is removed

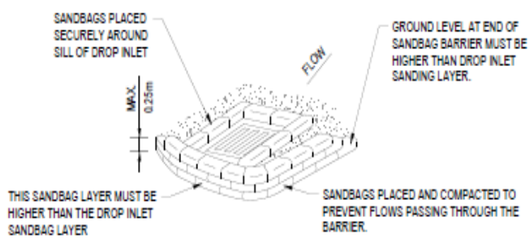
ROCK SEDIMENT BASIN **SD 6-1**
(APPLIES TO 'TYPE C' SOILS ONLY)



SANDBAG SEDIMENT TRAP FOR KERB INLET
N.T.S.



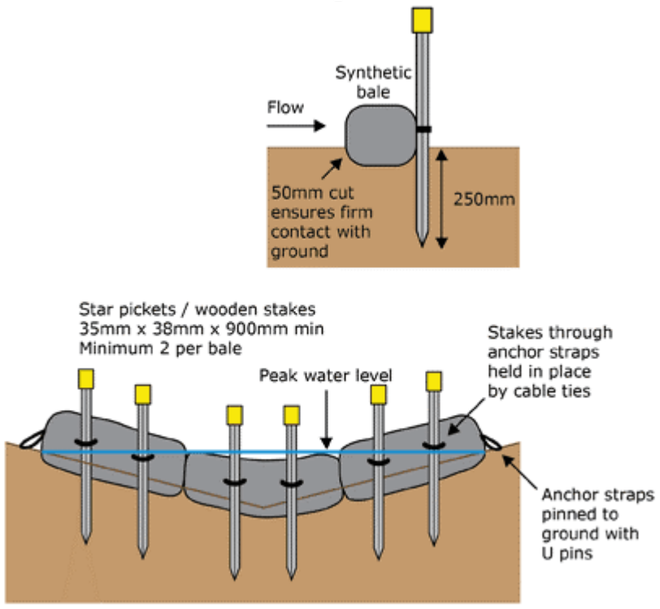
GEOTEXTILE INLET FILTER (SD 6-12) - PERSPECTIVE
NTS

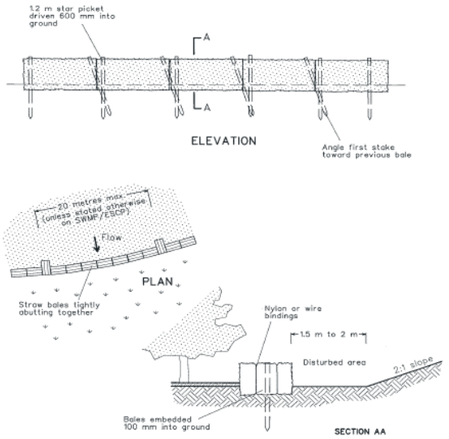


SEDIMENT BARRIER (SD 5-4) DETAIL

Standard Drawings

Coir Log Filter

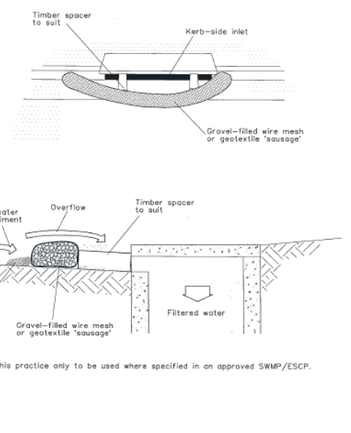




Construction Notes

1. Construct the straw bale filter as close as possible to being parallel to the contours of the site.
2. Place bales lengthwise in a row with ends tightly abutting. Use straw to fill any gaps between bales. Straws are to be placed parallel to ground.
3. Ensure that the maximum height of the filter is one bale.
4. Embed each bale in the ground 75 mm to 100 mm and anchor with two 1.2 metre star pickets or stakes. Angle the first star picket or stake in each bale towards the previously laid bale. Drive them 600 mm into the ground and, if possible, flush with the top of the bales. Where star pickets are used and they protrude above the bales, ensure they are fitted with safety caps.
5. Where a straw bale filter is constructed downslope from a disturbed batter, ensure the bales are placed 1 to 2 metres downslope from the toe.
6. Establish a maintenance program that ensures the integrity of the bales is retained - they could require replacement each two to four months.

STRAW BALE FILTER **SD 6-7**

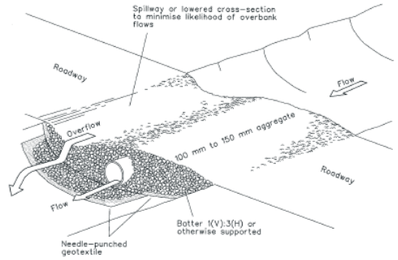


NOTE: This practice only to be used where specified in on approved SWMP/ESCP.

Construction Notes

1. Install filters to kerb inlets only at sag points.
2. Fabricate a sleeve made from geotextile or wire mesh longer than the length of the inlet pit and fill it with 25 mm to 50 mm gravel.
3. Form an elliptical cross-section about 150 mm high x 400 mm wide.
4. Place the filter at the opening leaving at least a 100-mm space between it and the kerb inlet. Maintain the opening with spacer blocks.
5. Form a seal with the kerb to prevent sediment bypassing the filter.
6. Sandbags filled with gravel can substitute for the mesh or geotextile providing they are placed so that they firmly abut each other and sediment-laden waters cannot pass between.

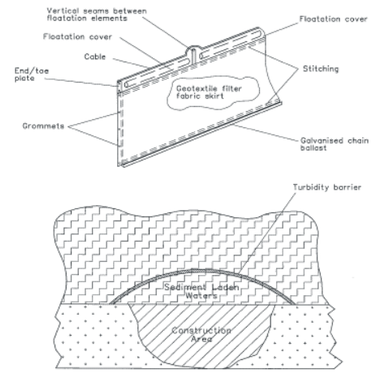
MESH AND GRAVEL INLET FILTER **SD 6-11**



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.

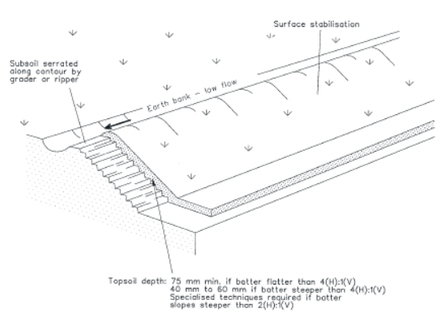
TEMPORARY WATERWAY CROSSING **SD 5-1**



Construction Notes

1. Use turbidity barriers only where high flows are unlikely to remove accumulated sediment and/or move the curtain significantly.
2. Where the barrier is to remain in place for more than one month, ensure the floatation cover is a UV-resistant, durable material.
3. Use only closed cell foam or foam-filled PVC piping as floatation elements. Do not use unfilled pipes.
4. Use only woven or heat-set non woven geotextiles. Needle-punched, non woven geotextiles can become fouled with debris that fray and delaminate them as they move with the waves or currents.
5. Remove captured sediment before the barrier is decommissioned.
6. In tidal areas, ensure the barrier can rise and fall without being moved from its position.

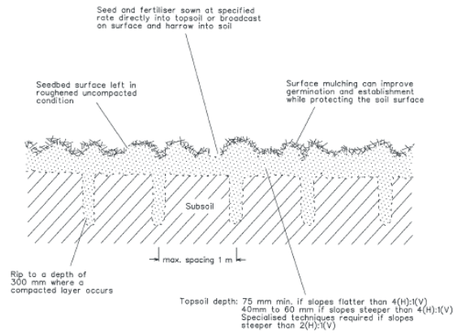
TURBIDITY BARRIER **SD 6-10**



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 handsetting 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.

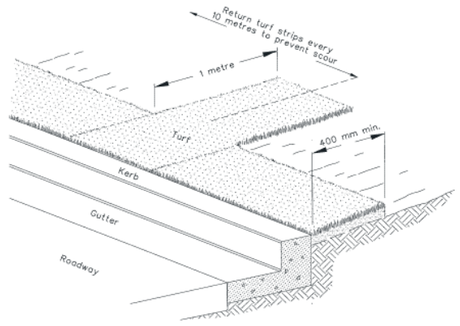
REPLACING TOPSOIL **SD 4-2**



Construction Notes

1. Loosen compacted soil before sowing any seed. If necessary, rip the soil to a depth of 300 mm. Avoid rotary hoe cultivation.
2. Work the ground only as much as necessary to achieve the desired tilth and prepare a good seedbed.
3. Avoid cultivation in very wet or very dry conditions.
4. Cultivate on or close to the contour where possible, not up and down the slope.

SEEDBED PREPARATION **SD 7-1**

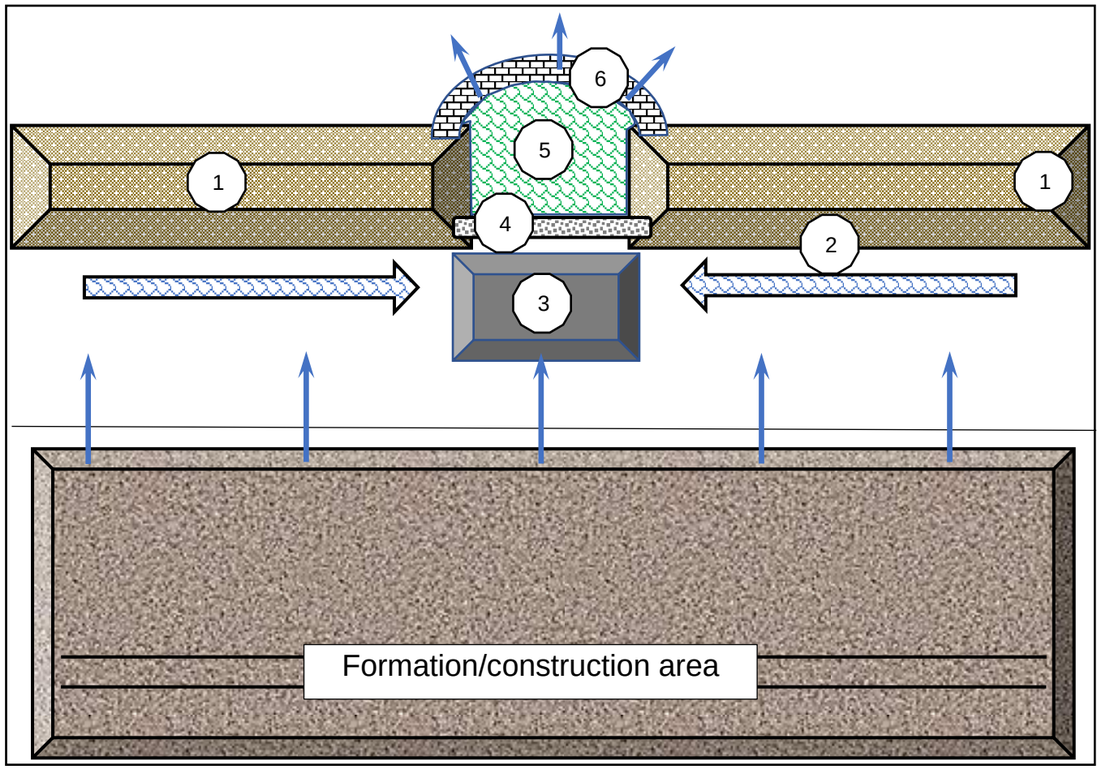


Construction Notes

1. Install a 400-mm minimum wide roll of turf on the footpath next to the kerb and at the same level as the top of the kerb.
2. Lay 1.4 metre long turf strips normal to the kerb every 10 metres.
3. Rehabilitate disturbed soil behind the

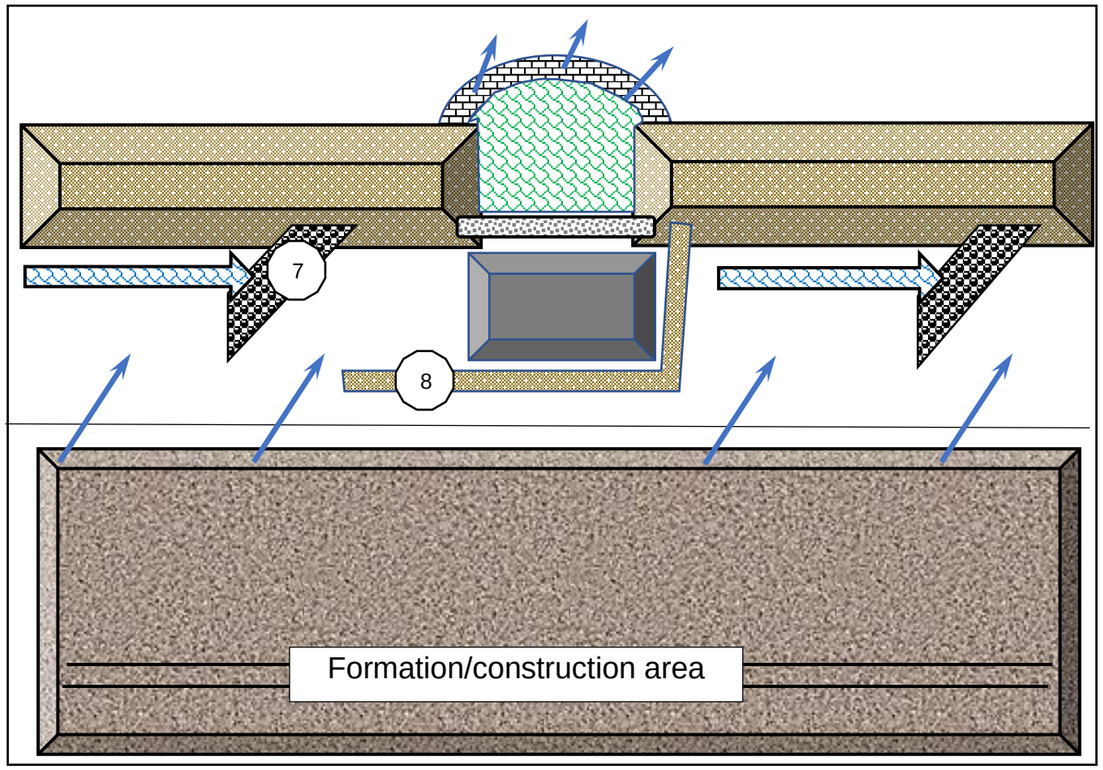
KERBSIDE TURF STRIP **SD 6-13**

PLAN VIEW OF TOPSOIL BERM WITH FILTER OUTLETS ON GRADES 0-1% (Not to Scale)



1. A compacted, trapezoidal topsoil berm –1000mm base width, 500mm high, 400mm top width (nom.) The filter outlets to be constructed at localised sag points, or 50m intervals (in areas with grades up to 1%.)
2. The topsoil berm and adjacent area to be stabilised with locally suitable, cover crop seeding.
3. An excavated sediment sump be excavated - 1500mm long, 1000mm wide, 400-500mm depth (nom.) (See example photo)
4. A spillway inlet sediment filter control to be installed – i.e. Shade cloth and aggregate filter bag weir (see example photo)., staked coir log filter, shade cloth and rock filter sock
5. Stabilised outlet spillway – The spillway formed with level grade across invert, 1000mm wide stabilised with pinned close weave, coir fibre mat lining (Tec Mat 9 or similar) followed by seeding, or broadcast seeding over pinned jute mesh.
6. Install a staked coir log filter using 3m x 200mm diameter (nom.) coir logs.

PLAN VIEW OF TOPSOIL BERM WITH FILTER OUTLETS ON GRADES 1+% (Not to Scale)



7. In areas with increased longitudinal grade, check dam formations to be formed at intervals to slow runoff flow velocities, reduce erosion & scouring, and capture coarse sediment. The check dams could be formed from coarse aggregate ballast in areas with grades from 1+%. In areas with grades 3% & above, check dams could be formed as compacted topsoil groynes formed upslope, with in-line geotextile/coir mat lined spillways (See example photo). The intervals of the check dam formations to be increased with an increase of longitudinal grades. Recommended intervals are 30m for grades 1-2%, 20m for grades 2%-3% and 10-15m intervals for grades 3% and above.
8. A flow control berm to be formed from compacted topsoil, extending upslope to prevent flows outflanking the filter-controlled spillway formations. The upslope extent of the berm to achieve a height exceeding that of the spillway inlet sediment filter control to prevent out-flanking of runoff.