green light elecnor	**Goyder South Wind Farm Project**	**CODE:**	GSWF-ELECNOR-EHS-PLN-0008
		REVISION:	9
		DATE:	09-09-2022
		STAGE:	**1A / 1B**

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Title of the Report

SOIL EROSION AND DRAINAGE MANAGEMENT PLAN

Goyder Renewables Zone Project
Soil Erosion and Drainage Management Plan

Construction Activities

Green Light Contractors Elecnor Group

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DOCUMENT TRACKING

Project Name	Goyder Renewables Zone Project – Sediment, Erosion and Drainage Management Plan: Construction Activities
Project Number	**21SYD**20126 / 21ADL20126
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Reviewed by	Andrew Herron
Approved by	Richard Cresswell
Status	**Final**
Version Number	**9**
Last saved on	**9 September 2022**

This report should be cited as 'Eco Logical Australia 2022. *Goyder Renewables Zone Project – Sediment, Erosion and Drainage Management Plan*. Prepared for Green Light Contractors Elecnor Group.'

Template 2.8.1

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Abbreviations, acronyms and initialisms

Abbreviation	Description
CEMP	Construction Environmental Management Plan
DIT	Department for Infrastructure and Transport
DWLBC	Department of Water, Land and Biodiversity Conservation
EPA	South Australian Environment Protection Authority
EPP	Environment Protection Policy
ESC	Erosion and Sediment Control
GRZ	Goyder Renewables Zone
MDB	Murray Darling Basin
MW	Mega-Watt (1,000,000 watts)
NEPM	National Environment Protection Measure
NRM	Natural Resource Management
OMP	Operational Management Plan
PV	Photo-voltaic
SA	South Australia
SEDMP	Soil Erosion and Drainage Management Plan
SMP	Stormwater management plan
WAA	Water Affecting Activity
WTG	Wind Turbine Generator

1. Introduction

1.1. Overview

The Goyder South Hybrid Renewable Energy Facility, to be developed south of Burra (Figure 1-1), is a hybrid power station comprising up to 1,200MW of wind generation, up to 600MW of solar PV generation and up to 900MW/1,800MWh of battery storage. The development area covers approximately 30,000 hectares (ha), with the area extending from its most northern point located 5 km south of Burra, to approximately 27 km south and terminating approximately 5 km north of Robertstown, SA (Figure 1-1).

The Goyder South Hybrid Renewable Energy Facility proposal comprises:

- A wind farm of up to 163 turbines with a capacity of up to 1200MW, a maximum hub height of 160m, a maximum blade length of 80m and an overall maximum height (tip height) of 240m
- A solar farm (across two sites) of up to 3000 ha of solar panels with a capacity of up to 600MW
- An energy storage facility (lithium-ion battery) with a capacity of up to 900MW/1,800MWh (2 hours)
- Associated infrastructure for connection to the electricity grid including three substations, access tracks, underground connection cabling and transmission lines
- Permanent operations and maintenance compounds
- Temporary construction compounds for both wind and solar components, including concrete batching plant
- A number of meteorological masts (in addition to those already on the site) to record wind speed and other meteorological data, both pre- and post- construction.

Neoen Australia Pty Ltd sought Development Authorisation for the Goyder South Hybrid Renewable Energy Facility (Goyder South) pursuant to section 49 of the Development Act 1993 (SA). Approval was issued by the South Australian Minister for Planning and Local Government and Planning, dated 3 March 2021 (updated: 7th June 2021), with 41 conditions. Neoen is also submitting additional applications under the relevant legislation as a concurrent process with the Development Application to address all regulatory requirements for the project.

The project has been divided into three separate stages, each comprising 400MW wind, 200MW solar and 300MW/600MWh storage. The size and composition of each stage depends on the size and type of the demand from electricity customers. This will be communicated through approved engineering plans prior to site works commencing for each stage. Given the scale of the project stages, the development timeframes will be structured on a 'rolling' basis with construction of the entire project be completed within 12 years from the date of the approval. Within each stage construction will be undertaken as sub-stages focused on the key components of the project:

- Sub-Stage A – Wind farm and ancillary infrastructure
- Sub-Stage B – Solar farm and ancillary infrastructure
- Sub-Stage C – Battery energy storage facility and ancillary infrastructure
- Sub-Stage D – Transmission lines
- Sub-Stage E – Balance of works.

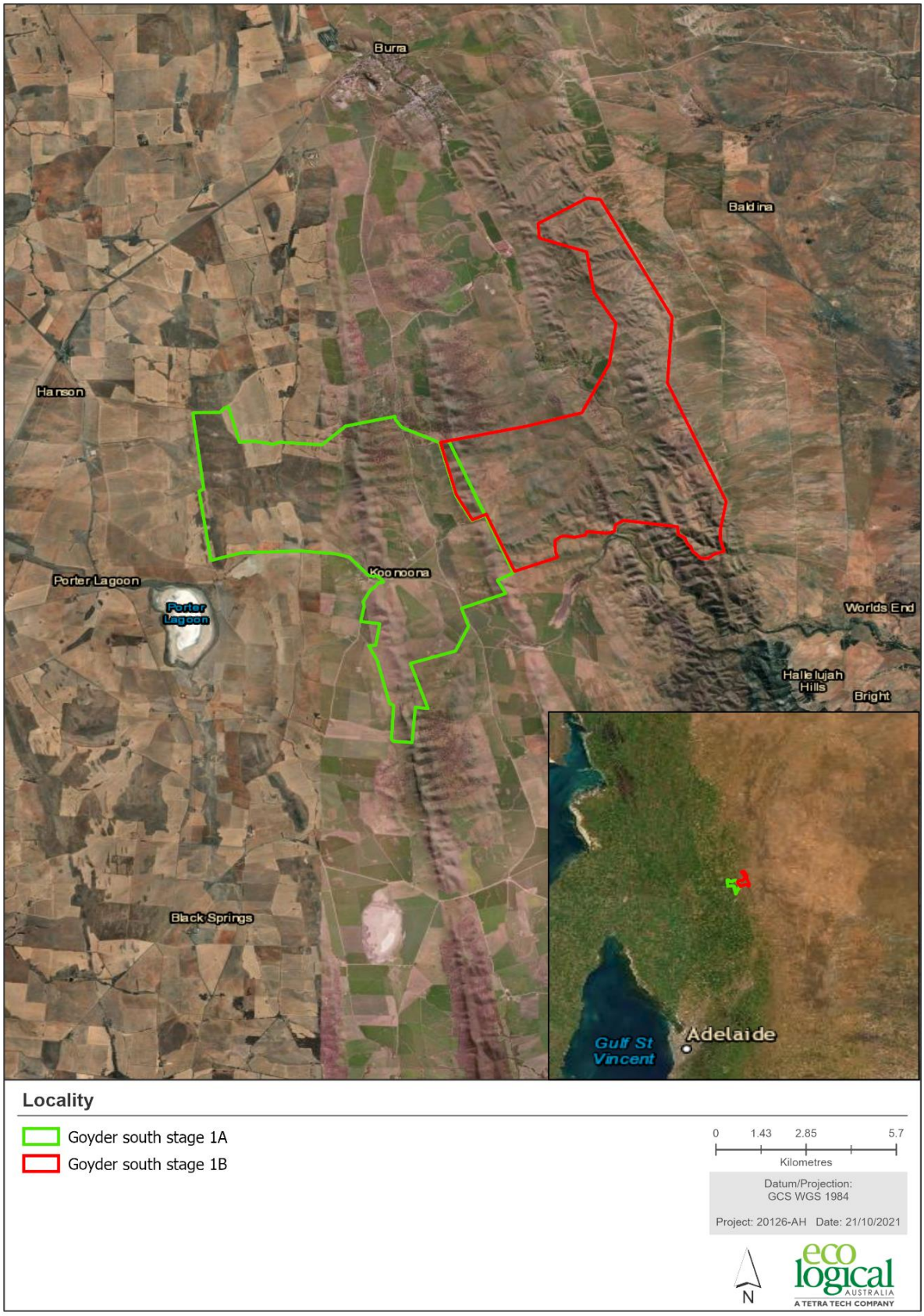

Figure 1-1: Locality map for the Goyder South Hybrid Renewables Energy Facility Wind Farm Stage 1

Green Light Contractors (The Contractor) have been engaged as the Contractor to carry out the Goyder Wind Farm aspect of this development, specifically Sub-Stage A (wind farm and ancillary activities) and Sub-Stage D (transmission lines) of Stage 1. To facilitate timely and co-ordinated construction activities, the wind farm construction works will be further divided into two stages (1A and 1B), comprising 38 and 37 turbines, respectively (Figure 1-2). These stages, in turn, have been sequenced into 6 phases of construction over 2 years.

Construction activities disturb soil and once disturbed this may be easily eroded and transported outside of the Project Area into stormwater drains or natural waterways, potentially becoming a significant source of sediment pollution in waterways. Water quality management on a construction site must therefore be incorporated at all stages of infrastructure development, including through planning, design and construction phases. A 'best management practice' approach should be adopted, utilising the best available methods, technologies and designs to achieve the goal of pollution minimisation in a practical and cost-effective manner.

A Soil Erosion and Drainage Management Plan (SEDMP) is the document used to manage erosion, sedimentation and water quality on the construction sites. It shall identify the drainage flows on the site and the treatment measures required to manage them. It needs to be a living document and able to be modified as construction progresses and able to predict and respond to changes on the site. The Environment Protection Authority's Stormwater Pollution Prevention Code of Practice for Local, State and Federal Government provides a guide to the preparation of a SEDMP (EPA, 1999). The Department for Infrastructure and Transport endorses this code and provides further guidelines for the preparation of the SEDMP (DIT, 2021; *appended to this document at* Appendix I).

This revision of the SEDMP has been prepared to support the development of Sub-Stage A construction activities for the Goyder Renewables Zone (GRZ) Project and includes appendices that detail site-specific erosion and sediment control measures for the scheduled phases of construction of the Stage 1(A and B) Wind Farm (Figure 1-2). This SEDMP shall form a sub-plan to the project's CEMP.

1.2. Construction activities and timeframe

The key intent of a SEDMP is to ensure that appropriate consideration is given to erosion and sediment control requirements before works commence. Sections 3.2 to 3.7 of this document provide checklists of issues considered when preparing this SEDMP.

This SEDMP will be up-dated as necessary and additional SEDMPs will be developed for other phases of the Project as required. A staged development approach has been adopted, with parallel works occurring in Stage 1A and 1B and each phase having staggered starts roughly monthly apart.

The Goyder South Project extends across the Worlds End Valley and will comprise construction of the following to form part of the larger Goyder South Hybrid Renewable Energy Project:

- Wind turbine generators (WTGs) – a total of 75 WTGs will be constructed over two stages (1A and 1B)
- Substations – two sub-stations (1A and 1B) will be constructed during Stage 1
- Overhead transmission line – the proposed transmission line is covered by the SEDMP for Pre-construction and temporary facilities.

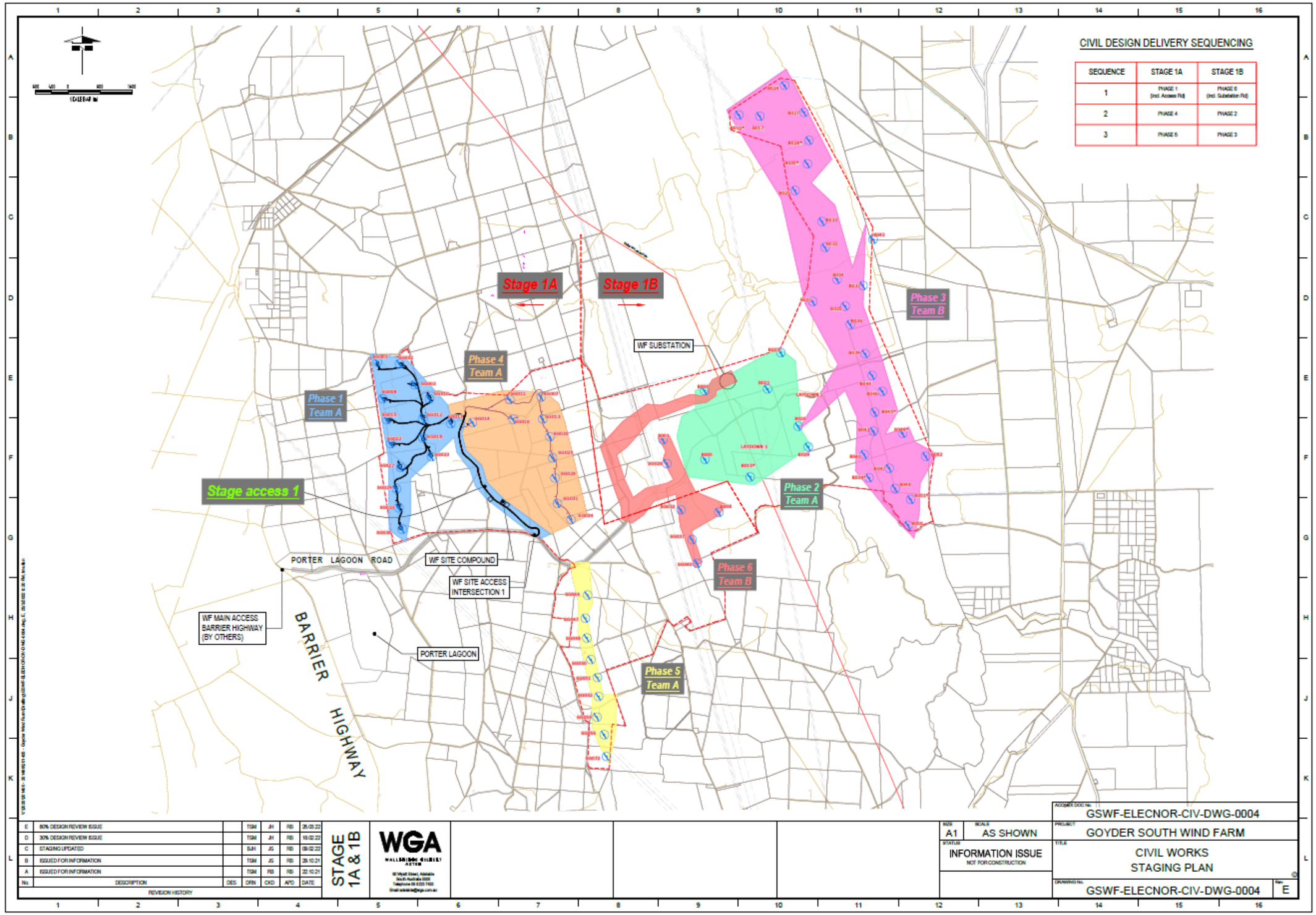

Figure 1-2: Civil Works Staging Plan for the Goyder South Wind Farm Stage 1

In addition to the power generation infrastructure, a number of ancillary facilities are needed to support the construction phases of the Project, including:

- Two wind construction compounds co-located with the western and eastern substations (Stages 1 and 2 of the Project)
- Construction compounds including an office, staff amenities and carparking facilities as well as storage and laydown areas – up to 300 people are expected to be working on site at peak times through to mid-2024
- Wind construction compounds which would include an option for a temporary batching plant facility
- Laydown areas required at the base of each turbine
- One temporary concrete batching plant (located at the western end of the wind construction compounds) on the southern side of Springbank Road.

These pre-construction and temporary facilities have been covered in the separate SEDMP for Pre-construction and Temporary Facilities (ELA, 2022a).

1.3. Environmental Objectives

There is a risk of erosion generating sediment pollution during construction. Mitigation measures are needed to be planned to minimise:

- soil disturbance and erosion,
- soil (over) compaction and loss of soil quality.
- impacts to surface water (including existing and receiving water bodies), and
- wind erosion.

The location of project components has avoided creek-lines and drainage lines as much as possible. Where this has not been possible, setback of 100m from creek-lines and 15m from drainage lines has been applied (NEOEN, 2020). The concrete batch plant has also been sited to avoid sensitive locations.

In addition, the substations and the battery and grid connection facilities are designed to include appropriate stormwater and wastewater management systems.

The construction phase is when there is the greatest risk of impact on water quality and natural resources. As is standard practice, the construction phase is controlled and managed by a range of legislative and permit requirements. Crucial to this is the preparation of a Construction Environment Management Plan (CEMP) and supporting management plans. These plans set out the manner in which construction activities are to occur in order to protect water quality and minimise impacts associated with earth moving, erosion, dust, traffic and the spread of weeds. This soil, erosion and drainage management plan (SEDMP) forms a sub-plan to the CEMP.

Separate SEDMPs will be prepared for any infrastructure that requires a site-specific CEMP, such as the temporary concrete batching plant.

1.4. Legislation and Other Guidance

The following legislation and regulatory guidelines have been reviewed and assessed as relevant to the Project SEDMP:

- Landscape South Australia Act 2019
- Environment Protection Act 1993
- Environment Protection (Water Quality) Policy 2015 (Water Quality EPP)
- The Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC/ARMCANZ (2000) and revision ANZG (2018))
- The National Environment Protection (Assessment of Site Contamination) Measure 1999 (as amended 2013) (NEPM)
- Australian Standard AS 1940 The storage and handling of flammable combustible liquids
- SA EPA Guidelines including:
    - Stormwater Pollution Prevention Code of Practice for the Building and Construction Industry (1999)
    - EPA 080/16 Bunding and spill management
    - EPA 517/16 Stormwater management for wash bays
    - EPA 1093/18 Environmental management of dewatering during construction activities
    - EPA 1095/19 Construction Environmental Management Plan (CEMP).
- SA DIT Guidelines, including:
    - Protecting Waterways Manual. Attachment 6A to the Environment and Heritage Technical Manual (Effective 1 November 2021)
    - Water Affecting Activities Best Operating Procedure. Attachment 6B to the Environment and Heritage Technical Manual (Effective 1 November 2021)
    - Roads. Master Specification. RD-DK-C1 Installation of Stormwater Drainage. Version 2 16/09/2019.

Site management specifically needs to be in compliance with the EPA (1999) *Stormwater Pollution Prevention Code of Practice for the Building and Construction Industry*. This code informs organisations of their 'general environmental duty' with respect to stormwater and water quality under the EP Act, and the best management practice approach to stormwater pollution prevention. It provides general guidance on the preparation and supporting documentation for a SEDMP.

The DIT (2021) Protecting Waterways Manual provides a detailed guide to the preparation of a SEDMP, commensurate with the determined risk to waterways. In addition, the Water Quality EPP 2015 specifies a set of pollutants that must not be discharged to the stormwater system or onto land where they may enter waters. This SEDMP is designed to ensure that such pollutants do not reach the stormwater system or waterways.

The SEDMP's objectives are therefore:

- to control surface runoff and prevent the export of sediment from sites before it reaches external stormwater systems or waterways
- to ensure land is exposed for the shortest period of time
- to rehabilitate the site as soon as practical
- to maintain and monitor the controls for the duration of works.

The level of detail required in each SEDMP should be determined by the scale and risk of the project works. A simple SEDMP may be prepared for components with a low risk of soil erosion drainage impacts

whilst a more comprehensive SEDMP will be required for activities with medium and high risks of soil erosion drainage impacts. Major projects would require a comprehensive or detailed SEDMP to be prepared and implemented.

1.5. Construction Site Risk Assessment

A construction site erosion risk assessment (DIT, 2021) has been carried out for Stage 1 of the Project (Table 1-1).

Table 1-1 Construction site erosion risk assessment for Stage 1 of the Goyder Renewables Zone Project

Parameter	Parameter Ranges	Range Score	Stage 1 score
Location (for determining erosivity)	Areas over 500 mm rainfall	2	
	Other areas	1	1
Average slope before construction works (from topographical maps of the site)	Not greater than 2 percent	1	
	Greater than 2 to 5 percent	2	
	Greater than 5 to 10 percent	4	4
	Greater than 10%	8	
Soil type by Universal Soil Classification (where there is more than one type, select the highest score)	Sandy soil or gravel	0	
	Sandy loam	1	
	Clay loam	2	
	Clay soil	3	3
Expected duration of risk undertaken at any one time	3 months or less	1	
	3 to less than 6 months	2	2
	6 to less than 12 months	4	
	Longer than 12 months	8	
Expected area disturbed at any one time	Less than 500m^2	1	
	More than 500m^2 but not exceeding 1,000m^2	2	
	More than 1,000m^2 but not exceeding 2,500m^2	4	
	More than 2,500m^2	8	8
Sensitivity of receiving environment	Highly disturbed system	0	
	Slightly to moderately disturbed system	2	2
	High conservation value system	4	
	Stage 1 total		**20**

The score of 20 for this construction risk assessment implies a high level of risk for Stage 1 activities and this requires a Detailed SEDMP according to recommendations in DIT (2021). Site assessment requirements include a high level of site management and self-auditing with regular inspections and reporting to demonstrate compliance. site. This may include situations where off-site conditions may either affect the management of the site. Details are presented in Table 1-2.

Table 1-2: Requirements for a Detailed SEDMP

Requirement	Where described in this SEDMP
Figures (or series of figures) detailing: ○ North point and plan scale ○ Site and easement boundaries and adjoining roadways ○ Construction access points ○ Site office, car park and location of stockpiles ○ Proposed construction activities and limits of disturbance ○ Retained vegetation including protected trees ○ General soil information and location of problem soils ○ Location of critical environmental values (where appropriate) ○ Existing site contours (unless the provision of these contours adversely impacts the clarity of the SEDMP) ○ Final site contours including locations of cut and fill ○ General layout and staging of proposed works ○ Higher risk areas of the site ○ Location of all drainage, erosion and sediment control management and water quality protection measures that will be utilised, if required, for example silt fences, hay bales, water diversion systems (i.e. to divert clean water away from disturbed areas), stockpile protection measures and sediment traps ○ Site revegetation requirements (if not contained within separate plans) ○ Any other relevant information that may be required by a regulating body or to satisfy any conditions of environmental authorisations	Throughout, where applicable
Contractors shall indicate responsibilities for and frequency of site monitoring to ensure environmental protection	Section 4.11
Construction drainage plans for each stage of earthworks, including land contours for that stage of construction, sub-catchment boundaries and location of watercourses	Appendices III through X
Details of the construction treatment measures to be deployed (and associated durations), including the location, size and type of all construction-phase water quality treatment measures	Section 4.8 and Appendices III through X
For the construction treatment measures that will not be deployed throughout the full period of construction, the stages at which various measures will be deployed	Section 1.2
Calculation sheets for the sizing of any water quality treatment measures	To be undertaken for each site ESC Plan
Responsibilities for site environmental management	Section 4.11
Emergency response measures	Section 4.12
The nature and frequency of site inspection and monitoring (including any water quality monitoring)	Section 4.10 (Water Quality Monitoring) and Section 4.12 (other matters)
The nature and frequency of site reporting	Section 4.10 (Water Quality Monitoring) and Section 4.12 (other matters)
How issues identified within the EHIA, WQRA and contract documents will be managed on site. This may include situations where off-site conditions may either affect the management of the site during construction or be adversely affected by soil loss from the site.	

Requirement	Where described in this SEDMP
Appropriate operations-phase treatment measures will need to be incorporated into the site design	
Full design and construction details (e.g. cross-sections, minimum channel grades, channel linings) for all drainage and sediment control devices and measures, including diversion channels and sediment basins	Appendices III through X
The location of proposed stormwater discharge point(s) from the site, both during and following completion of construction	Appendices III through X
Limits of site disturbance including areas of cut and fill volumes at each disturbance location and proposed stockpile areas	Detailed Erosion Sediment Control Plans will be generated for each WTG site
Site plans (e.g. Site Environmental Plans /Project Control Plans) that identify types of sediment and erosion control measures and their locations for all stages of construction works	Appendices III through X
Water Quality Monitoring Plan	Section 4.10

2. Current environmental conditions

The Project area is located in the Northern Ranges portion of the South Australian area of the Murray Darling Basin (MDB) within the Eastern Mount Lofty Ranges. The region mainly comprises hills and slopes with grades of over 5% and watercourses with longitudinal gradients of up to 2% slope (Southfront, 2021), that form a transitional zone between cropping land to the west and pastoral land to the east and supports extensive natural grasslands and open grassy woodlands that host mallee and riparian woodlands within the drainages and plains between the rises (SA MDB NRM Board, 2015; NEOEN, 2020).

The Project area largely straddles the Central Catchment of Burra Creek, which rises north of Mount Bryan and flows south to Worlds End where it swings east towards Morgan and the Murray River. The lower reaches, below Worlds End, are essentially flood plains and lack a defined drainage (Deane, et al., 2008), with flows generally disappearing underground in the lower reaches of the creek though have occasionally extended to the river during exceptional flooding periods in the past.

2.1. Soils and landscape

The central Burra Catchment is characterised by a series of three parallel, north-south trending ridge lines that form part of the Mount Lofty Ranges. The Burra Creek extends from the north-west to the south-east, bisecting the eastern side of the Goyder South Stage 1B area, and aligns with a major north-south trending fault to the east of the ranges. The creek is largely fault controlled in the region and is incised into fine grained rocks of the Saddleworth Formation with ridgelines comprised of Gilbert Range Quartzite and Auburn/ Nackara Dolomite. The ridges create sub-catchment areas that contribute surface water flow to Burra Creek.

The region contains extensive areas of locally formed outwash sediments and gravel layers that are present within outwash fans and creek flats and are generally clayey in composition, with interbedded layers of clay and gravel materials.

The Project area comprises hills and slopes containing shallow soils that have been formed on basement rock, grading to plains and gentle slopes containing soils that have been formed from outwash of sediments that have also been derived from basement rock (SA MDB NRM Board; 2015; NEOEN, 2020).

The Project area comprises the following four main soil groups (Table 2-1, Figure 2-1):

- Calcareous loams on rock (A),
- Loam over clay on rock (D),
- Cracking clay soils (E), and
- Shallow soils on rock (L).

The deeper soils are highly erodible and significant erosion is evident in the region. Due to the nature of the soils, the relatively high slopes, significant soil erodibility and low rainfall conditions in the region, there is limited potential for the land in this region to be utilised for cropping activities.

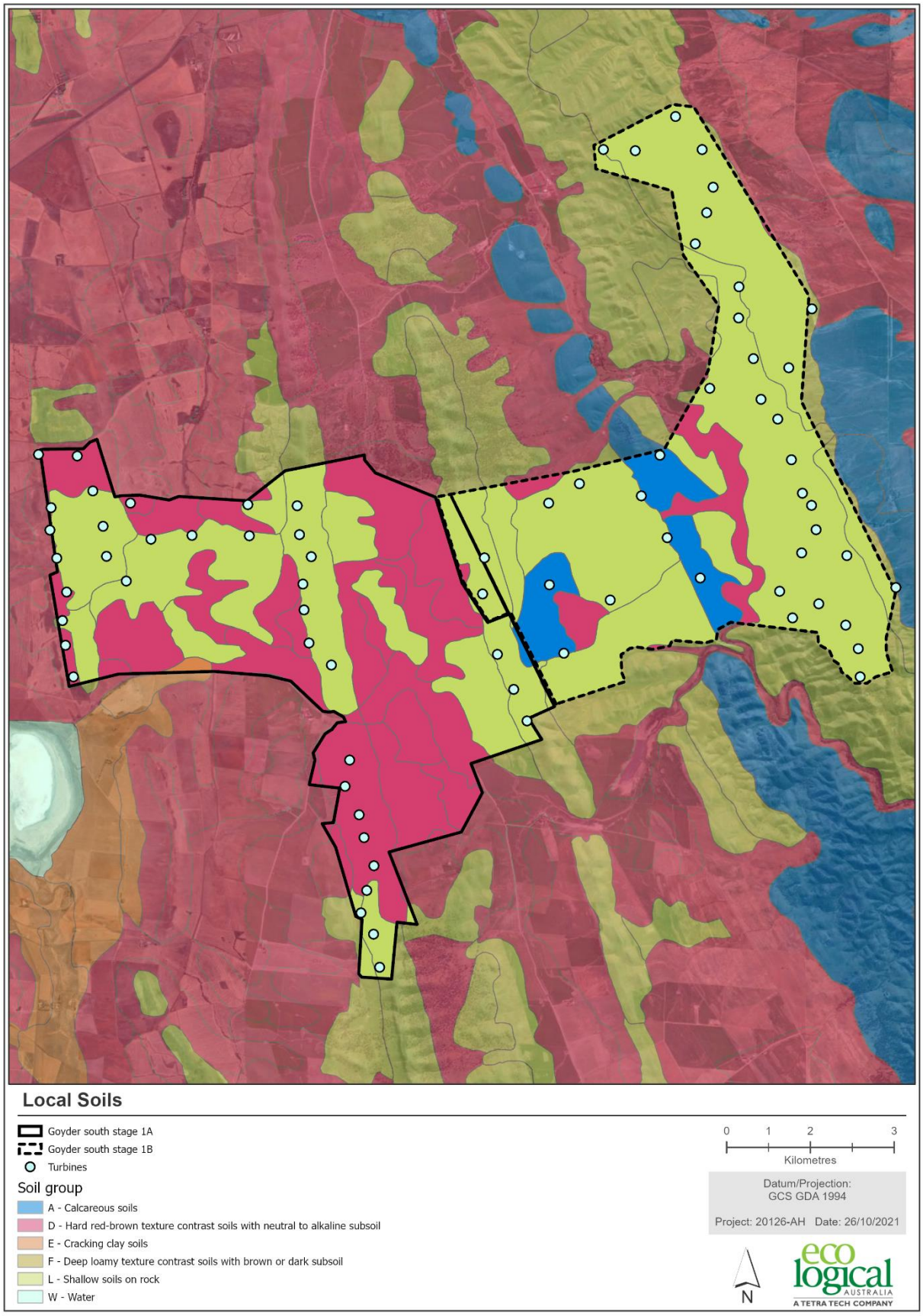

Figure 2-1: Regional soil types within the Goyder South project area

Table 2-1 presents key characteristics of the four main soil groups listed above, based on the South Australian classification system presented in DWLBC (2008) *The Soils of Southern South Australia*.

Table 2-1: Soil group descriptions (sourced from DWLBC, 2009)

Soil group	Description
A	Calcareous loams on rock: Very common in low rainfall districts (annual average rainfall is 400 mm). Soil profiles are gradational to uniform and calcareous throughout.
D	Loam over clay on rock: Texture-contrast and characterised by red-brown subsoil that is alkaline and generally calcareous. Topsoil is typically 10 to 40 cm thick and hard setting or firm, ranging from loamy sand to clay loam. Increased potential for erosion.
E	Cracking clay soils: Soil profiles are clayey and exhibit shrink-swell behaviour upon drying and wetting. Large cracks form within the soils when dry. Soils contain shear planes (slickensides) and/ or lenticular peds. Resistant to wind and sheet water erosion.
L	Shallow soils on rock: Variable thickness stony sandy loam to clay loam grading to hard or weathered basement rock, usually within 50 cm.

2.1.1. Site soil conditions

The proposed wind turbine sites are located on rolling hills cut by heavily gullied ephemeral creeks (Figure 2-2) at elevations between approximately 540 to 670m AHD. The natural slopes across the site range from flat to approximately 40 degrees from the horizontal.

Figure 2-2 Rolling hills and gullied creeks typical of the Stage 1 area

Detailed site investigations were carried out by CMW Geosciences (2022), who observed transient creeks and water-incised gullies (Figure 2-3) running in a predominantly east-west and north-south direction throughout the proposed project area. Some creeks drain into the Burra Creek which runs from north to south on the western side of the project area.

Figure 2-3 Sheet-wash and gully erosion (left) and ephemeral incised creek-lines (right) near Worlds End

For most of the year the creeks are dry, including no flow in the Strahler 5th order Burra Creek located to the east of the Stage 1 area except during winter months, though perennial flow is observed to the south-east of the project area at the Worlds End streamflow gauge (DWLBC, 2018).

The existing ground surface is covered by low-lying grass and is dominated by boulders and rock outcrops (Figure 2-4). The presence of rock outcrops and steep slopes make access difficult, and the wind turbine locations are typically inaccessible even by 4WD vehicle without constructed access tracks (CMW, 2022).

Figure 2-6, Figure 2-7 and Figure 2-4 present typical surface conditions across the project site.

Of note, no groundwater has been encountered during any site investigations (CMW, 2022). Only three registered (stock and domestic use) and active bores occur within the Project area (SA WaterConnect). All have groundwater levels greater than 15 m below ground surface and salinities greater than 2,000 ppm (slightly brackish).

Figure 2-4 Typical surface conditions at WTG sites (site SG033. looking south, Porter Lagoon to the top right)

Figure 2-5 Detail of outcrop observed near SG033 (looking north-west)

Figure 2-6 Typical surface condition at proposed WTG sites (Site SG023, looking east)

Figure 2-7 Typical site conditions along the proposed WTG corridors (site SG025, looking south)

2.2. Subsurface conditions

At fifty-one (51) of the proposed seventy-five (75) WTG sites for Stage 1, up to 4m deep test pits were excavated and Pocket Penetrometer Tests were undertaken on cohesive soils. Pits were also excavated at two representative access track locations. Fifty-one (51) boreholes were also drilled up to depths of 20m below the ground surface. Standard Penetrometer Tests were undertaken at 1.5m intervals on samples retrieved via diamond coring.

Surface observations and geological mapping was carried out at all sites and bulk samples collected for moisture, size-distribution, shrinkage and compaction tests. The locations of the test pits and boreholes are shown in Figure 2-8. Details and references to specific sites described in CMW Geosciences (2022) are shown in Figure 2-9 and Figure 2-10, for sites in Stage 1A and 1B, respectively.

CMW Geosciences (2022) confirmed that ground conditions were generally consistent with published geology and soils of the region and followed the subsurface sequence listed in Table 2-2. The depth and thickness of these units is highly variable across the Project area and topsoil and/or residual soil was not encountered at some locations. Of note, BH-B021 penetrated the Skillogalee Dolomite and encountered an inferred 2m void at 17.25 m depth.

Details of all site conditions and geotechnical results are provided in CMW Geosciences (2022).

Table 2-2: Generalised subsurface sequence across the Project area

Layer	Condition
Topsoil	Typically comprising a medium dense sand to silty sand to clayey sand or stiff to very stiff sandy clay with some rootlets and root fibres. Trace quantities of fine to medium sub-rounded to sub-angular gravel were encountered.
Residual Soil	Typically comprising hard or very dense silty and clayey sands with variable gravel, cobbles and boulder-sized material. This material is derived from the *in situ* weathering of the parent bedrock.
Parent Rock	Bedrock associated with various geological units which include shales, tillites, siltstones, sandstones and dolomites. Rock strength, weathering condition and fracture density varied across the Project area.

Twenty-two proposed WTG sites still require detailed field investigation.

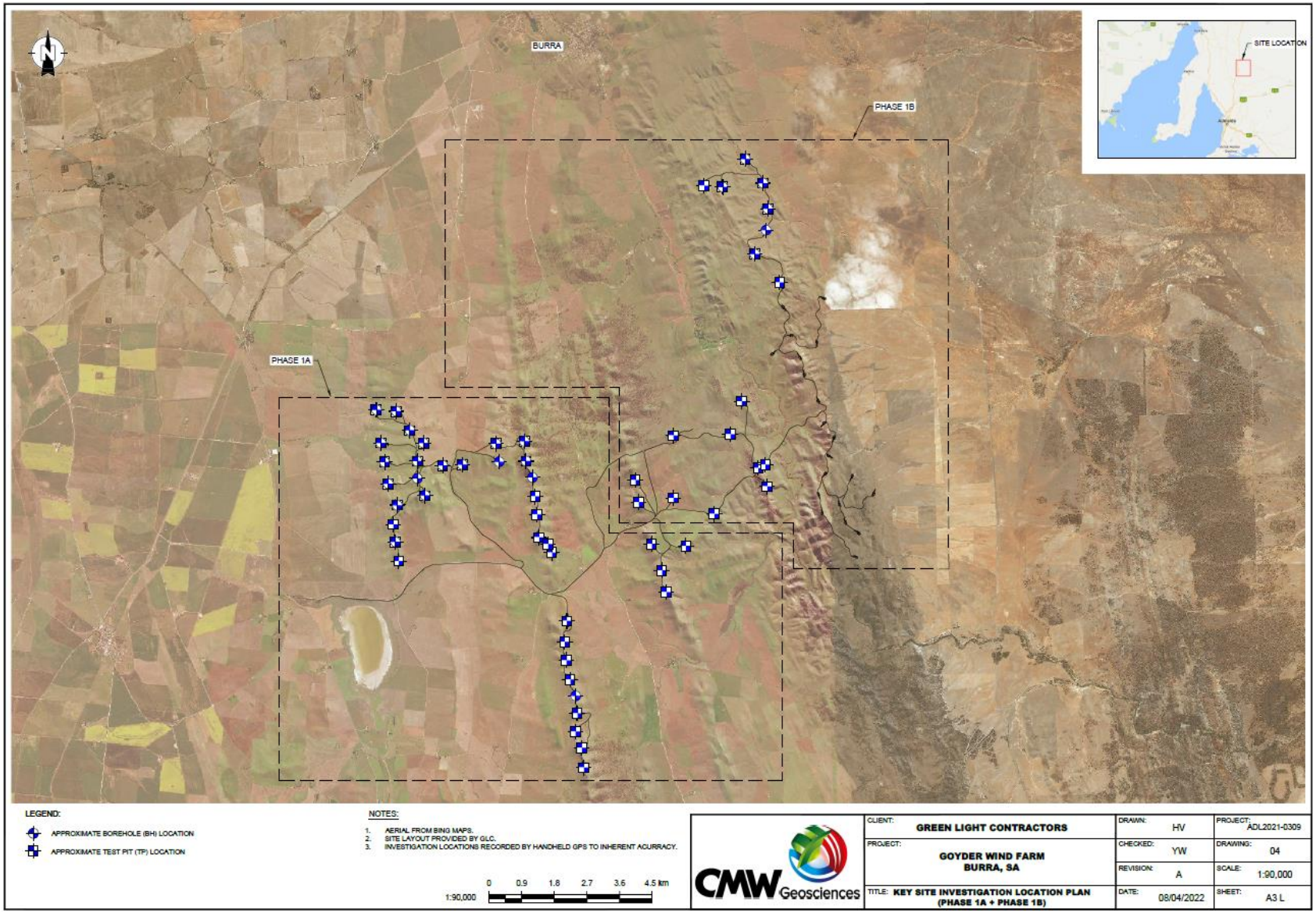

Figure 2-8: Key site investigation locations for the geotechnical assessment (Stage 1)

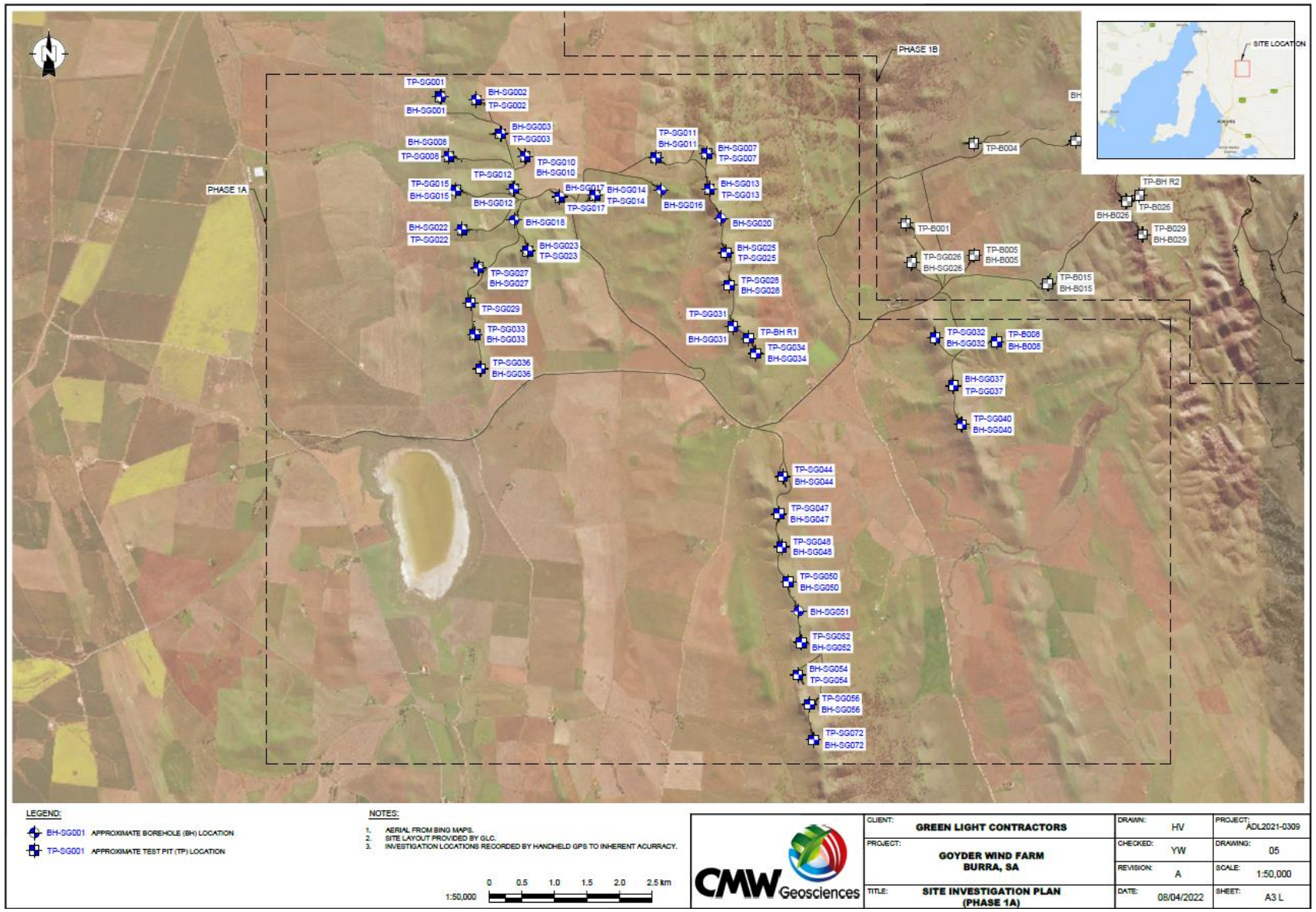

Figure 2-9: Geotechnical Assessment Site Identification Plan (Stage 1A)

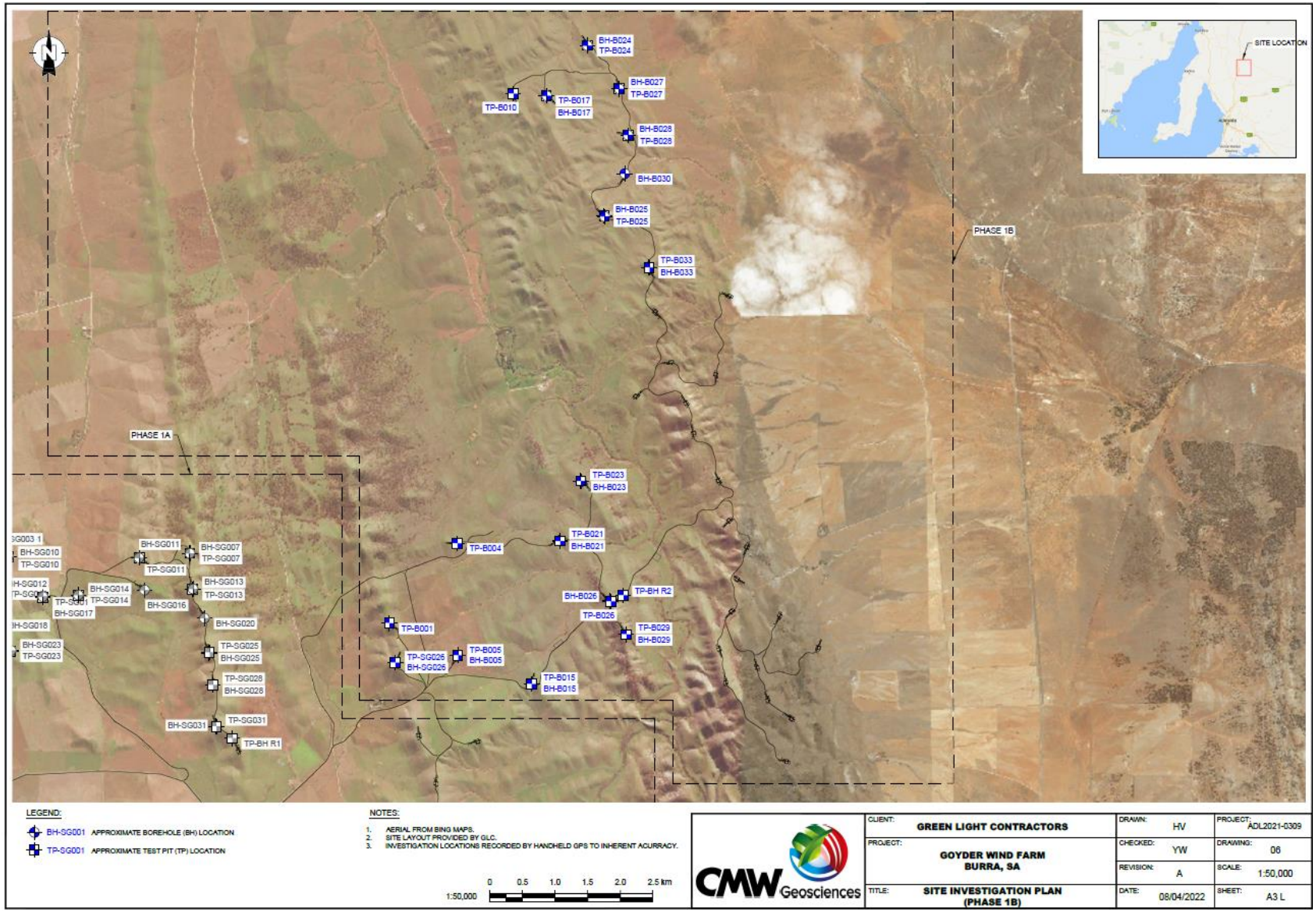

Figure 2-10: Geotechnical Assessment Site Identification Plan (Stage 1B)

2.3. Surface Water Conditions

The proposed road infrastructure for the Project will cross a number of drainage lines (Southfront, 2020). The majority are minor in nature, consisting of small streams from hillside slopes. The exception is Burra Creek which is approximately 30 to 40 metres wide in most sections with capacity to convey significant flows in large rainfall events. The proposed access road crosses Burra Creek at one location, as indicated on Figure 2-11.

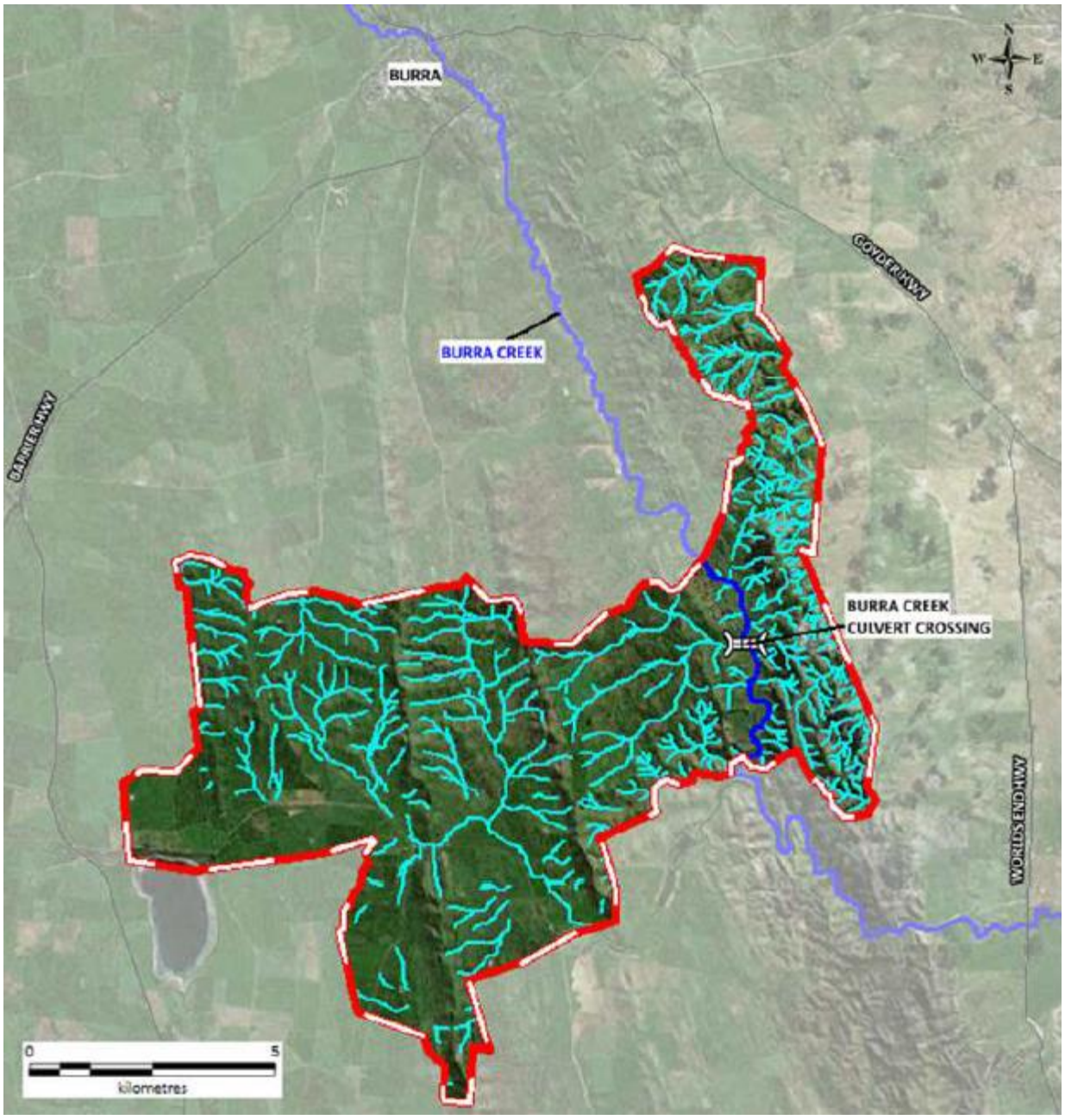

Figure 2-11 Stage 1 area and modelled natural drainage network (Southfront, 2020)

Burra Creek is a large stream that rises north of Burra and flows in a south-easterly direction towards the Murray River, which it meets to the east of Morgan. Flows generally disappear underground before joining the Murray, but occasionally surface flows extend to the confluence during exceptional flooding events.

Burra Creek is perennial in some reaches and forms one of the most significant water courses in the Project area (NEOEN, 2020). The creek line is fault controlled and follows a major north-south trending fault line that is present to the east of the central range (DWLBC, 2008). The parallel ridgelines creating a number of sub-catchments that contribute to flow at Burra Creek. Logan Creek exists within this area and forms a tributary to Burra Creek upstream of Burra Gorge, through a gap in the ranges (DWLBC, 2008).

Burra Creek predominantly receives flow during winter-spring rainfall events, however large volumes of water may be received during summer storms when rainfall events are of short duration and can be quite destructive (Deane et al. 2006; NEOEN, 2020). The Burra Creek system also receives permanent baseflow from the underlying groundwater system in the Skillogalee Dolomite, which results in perennial flow in these reaches.

The Burra Creek catchment is predominantly used for sheep grazing and cereal cropping in the upper catchment with minor areas of lucerne, irrigated cropping, rural residential, orchards and recreation. Naïve vegetation occurs mostly along the hills, gorges and gullies in the catchment with moderate changes in ecosystem structure and some changes to the way the ecosystem functions with considerable human disturbance, including nutrient enrichment and fine sediment deposition, resulting in an overall condition considered to be “fair” by SA EPA in 2010 (Burra Creek, near Worlds End 2010 Aquatic Ecosystem Condition Report).

The sampled water was moderately fresh (salinity of 2,506 mg/L in autumn and 2,884 mg/L in spring), well oxygenated (72-103% saturation) and clear, with moderate to high concentrations of nutrients such as nitrogen (0.62-0.64 mg/L) and phosphorus (0.02 mg/L). The sediments were dominated by bedrock, boulders and algae in the riffles and detritus, silt, gravel and pebble in the still and slow-flowing pool habitats. Samples taken from below the surface were black, sulphidic and anaerobic indicating that too much organic matter had entered the creek in the past. A deposit of 5-10 cm of silt covered the creek bed in spring and no erosion was noted during either sampling period.

EPA (2010) noted livestock pressures on the creek, causing sediment erosion and generating excessive nutrients, both leading to habitat disturbance. Further, limited riparian vegetation was noted, hence only minimal buffer protection from catchment land uses.

A stormwater management plan (SMP) was developed by Water Technology (2021) for the township of Burra and used to investigate ways to alleviate existing stormwater and flooding problems to provide protection for public and private assets. Whilst the Burra SMP focusses on a plan for the township, the purpose of the SMP as outlined by the Stormwater Management Authority (SMA) is to manage stormwater on a total catchment basis and hence this study provides significant information on the Burra Catchment in the region of this development and hence provides relevant contextual information for this SEDMP.

The Burra SMP also highlights the environmental values agreed between the Regional Council of Goyder Steering Committee and the local community and consistent with the National Water Quality Management Strategy (Agriculture and Resource Management Council of Australia and New Zealand, 1994). These values are illustrated in Table 2-3 (Water Technology, 2021).

Table 2-3 Surface watercourses environmental values for Burra Creek

Environmental Values	Supporting Details
Aquatic Ecosystems	Supporting pristine or modified **Aquatic Ecosystems – HD (see below)**
	Highly disturbed systems (**HD**). These are degraded systems likely to have lower levels of naturalness. These systems may still retain some ecological or conservation values that require protecting. Targets for these systems are likely to be less stringent and may be aimed at remediation and recovery or retaining a functional but highly modified ecosystem that supports other environmental values also assigned to it (e.g. primary industries).
Primary Industries	**Irrigating** crops such as vines, lucerne, etc
	Water for **farm use** such as in fruit packing or milking sheds, etc
	Stock watering
Recreation & Aesthetics	**Secondary recreation** with indirect contact with water such as boating, canoeing or sailing
	Visual appreciation with no contact with water such as picnicking, bushwalking, sightseeing
Cultural & Spiritual	**Cultural and spiritual** values including the cultural values of traditional owners

2.3.1. Farm dams

The over-development of farm dams at unsustainable levels presents a significant threat to surface water resources and downstream users in the region. Overuse of dams can cause hydrological impacts, including delays in the onset of streamflow and reductions in the natural volume and duration of streamflow patterns (DWLBC, 2008).

A desktop study of the number of farm dams in the Burra Creek catchment was undertaken by DWLBC (2008). A total of 609 dams were identified, representing 985 ML storage capacity and approximately one dam per square kilometre. The identified dams primarily provide stock water supply, with an

average storage capacity of 1.6 ML per dam and more than 95% of the dams at < 5 megalitres (ML) in size and holding 77% of the total potential storage volume. No irrigation dams were identified.

Surface water modelling undertaken by Deane, et al. (2008) indicated that farm dams had a major impact on streamflow, except during extreme (high rainfall) years. A total of 70% of surface runoff was estimated to be intercepted by dams in the region during low rainfall years and this increases to 95%, based on the quick flow gauged data. The model findings provided evidence that dams may delay the onset of streamflow and while total dam storage remained within the SA MDB NRM Board's criteria for dam storage (i.e. 30% of average winter runoff; estimated at 1,289 ML/year at the time of the study), at least two sub-catchments showed exceedances of this runoff criteria (Deane, et al., 2008).

2.3.2. Surface Water Quality

Surface water quality in the Burra Creek catchment is also highly variable and very dependent on flow (Deane, et al., 2008; Water Technology, 2021). As part of a preliminary assessment of the impacts of water resource development on Burra Creek Catchment (Deane, e al., 2008), a daily time step surface water model was constructed using the WaterCress modelling platform to evaluate changes to catchment hydrology (i.e. resulting from farm dam development), and any resulting impacts on flow regime. During the assessment, salinity was opportunistically measured at the Worlds End gauging site.

Statistics summarising the salinity data, and a subset of these recorded during steady baseflow conditions, are presented in Table 2-4. Whilst opportunistic, the data does, however, indicate the highly variable baseline levels of salinity within the system.

Table 2-4 Summary statistics of Burra Creek salinity data from 1974 to 2004 (DWLBC, 2018)

Statistic	EC (µS/cm) all samples	EC (µS/cm) samples taken at steady baseflows
Number of samples	167	63
Mean	4,871	4,993
Median	5,000	5,100
Maximum	9,000	5,800
Minimum	956	3,571

Observed streamflow salinity concentrations are closely related to discharge volumes, in particular the relative contributions to the total flow from direct surface runoff and groundwater baseflow. Due to this fact, it is not possible to use data based purely on observation date to determine any trend, as the reading may be artificially reduced due to a major streamflow event occurring immediately prior to the reading.

A continuous salinity logger was installed at Worlds End gauge (site: A4261149) between 2009 and 2012 (Figure 2-11Figure 2-12). Observations confirmed the general salinity level averaging around 3,000-4,000 ppm and highlighted more extreme salinisation and freshening of the Creek corresponding to drying and storm events, respectively.

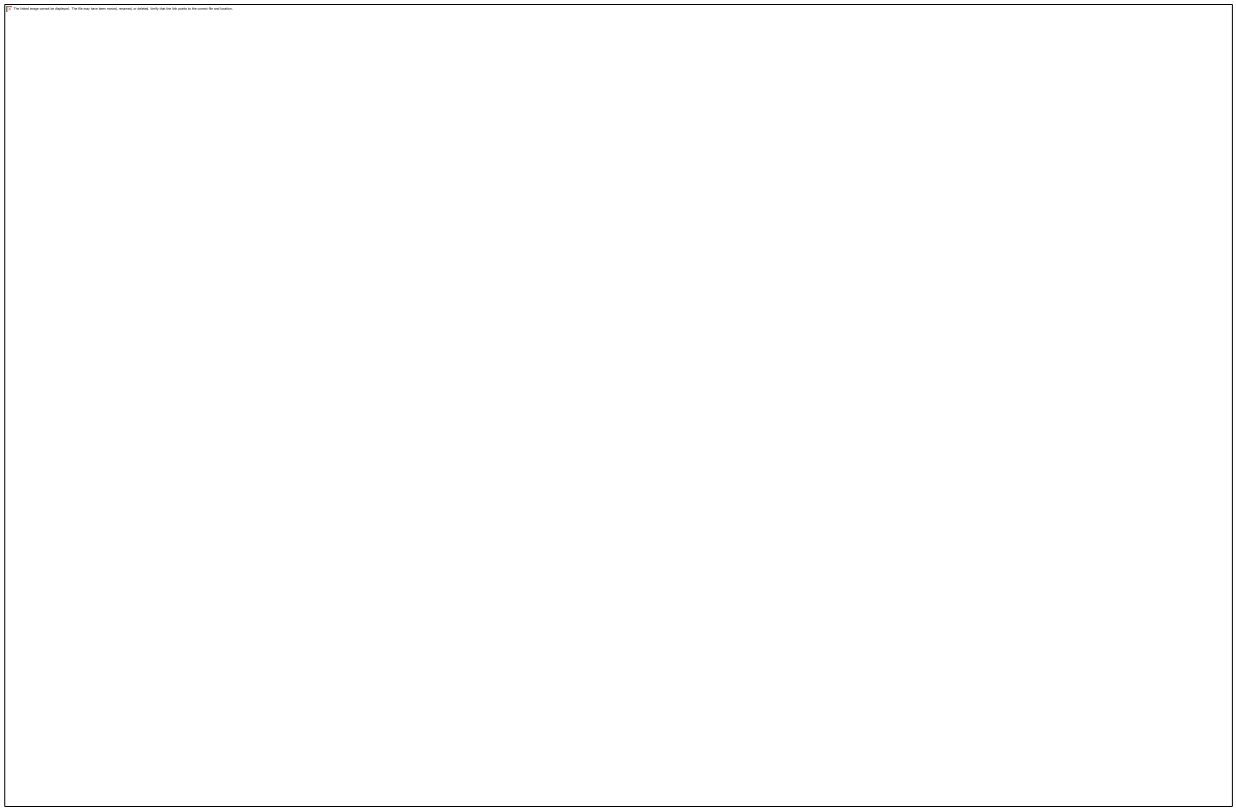

Figure 2-12 Surface water salinity (ppm) at Worlds End gauge on Burra Creek (Site A4261149).

2.3.2.1. Base flow

Baseflow is theoretically defined as that part of the surface streamflow attributed to groundwater discharge to streams. The Burra Creek catchment supports extensive areas of continuous permanent surface water, which extends for 17 km along the creek from south of Burra township to Burra Gorge and consists of numerous deep pools connected by year-round flow. Perennial flow through these reaches is maintained by continuous groundwater discharge from the Skillogalee Dolomite.

This groundwater contribution is of particular interest as annual baseflow volumes are seemingly not closely linked to climatic conditions. For example, during the period 1984–90 mean annual flow was 1490 ML, but this corresponds to a period of below average rainfall and limited surface runoff. Baseflow discharge during this six-year period showed no sign of decreasing and contributed on average 1200 ML/y (87%) of streamflow (Figure 2-13).

The mean monthly flows in Burra Creek (Figure 2-14) deviate considerably from this pattern, indicating the significant influence of large storm events on the generally low volumes of runoff within the catchment. Median monthly flows demonstrate a more typical pattern but are almost entirely due to the perennial baseflow. Although the mean monthly streamflow indicates a highly variable surface flow system, in contrast the median monthly flow volumes indicate that the baseflow conditions provide a relatively constant and stable year-round environment compared to other streams in the Mount Lofty Ranges. The relatively high median flows across all months (Figure 2-14) are evidence of the importance of the baseflow contribution to the annual catchment surface water budget (Deane, et al., 2008).

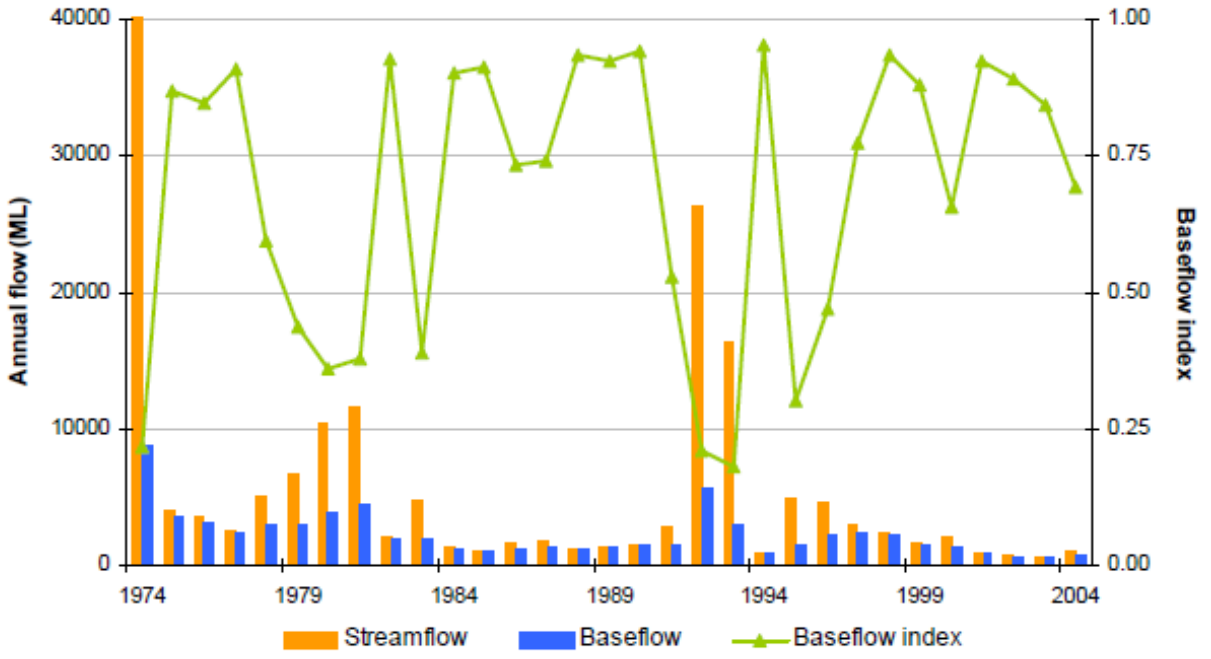

Figure 2-13 Annual streamflow, baseflow and baseflow indices at World End (Deane, et al., 2008)

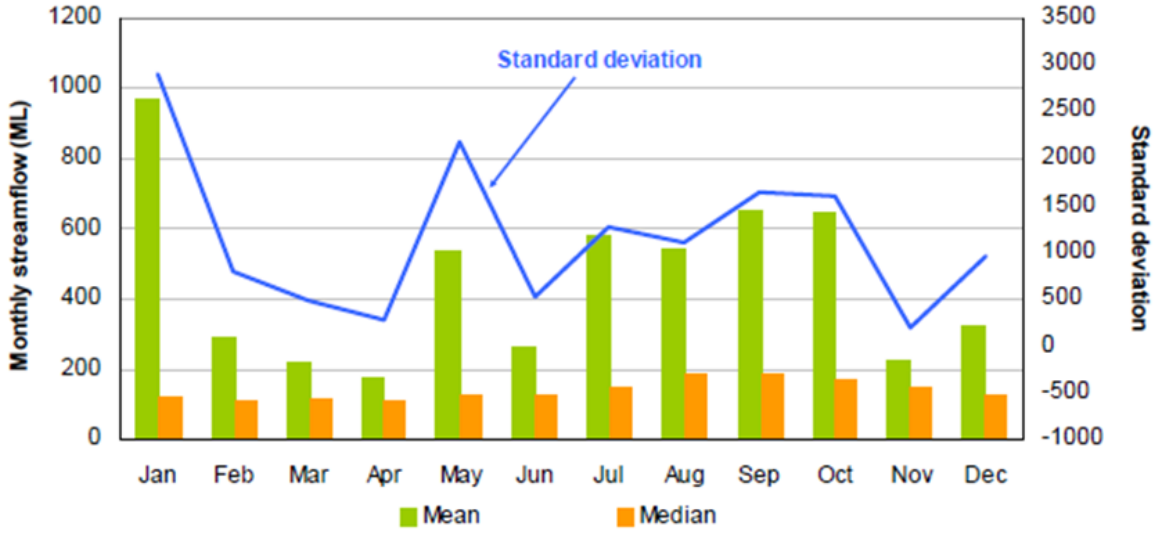

Figure 2-14 Median, mean and standard deviation of the mean monthly flow (1974-2004) for Burra Creek Catchment (Deane, et al., 2008).

Deane, et al. (2008) analysed the annual streamflow and estimated baseflow volumes, deriving a baseflow index (the percentage of total streamflow attributed to baseflow) for the Burra Catchment from data from the Worlds End stream gauge. Baseflow indices range from ~20% in extreme rainfall (and discharge) years such as 1974 and 1992–93 to over 90% during low annual discharge years such as 1994 and 2001–02. When total streamflow and baseflow for the entire period are summed together as single volumes, the baseflow index is 40%, but the average annual baseflow index is 70%, highlighting the reliance of the creek on baseflow to persist in the great majority of years. Highest monthly baseflows

broadly reflect the highest streamflow months, with August, September and October dominating. This reflects increasing recharge of the source aquifer during these months, which has implications for the management of water resources in the catchment, as care must be taken to determine an appropriate level of streamflow upon which to base a permissible surface water yield to allow adequate recharge to "top-up" the dolomite aquifer to maintain discharge during dry months.

If most of the streamflow from November through April is effectively groundwater, then the potential for double allocation of the same volume of water must be addressed. Seasonal variations in baseflow can therefore be attributed to increases in the watertable following the high rainfall winter season and the seasonal changes in evapotranspiration rate. Deane, et al. (2008) showed that in many, if not most, years the baseflow contribution is a very significant proportion of total streamflow and the magnitude of groundwater discharge, and hence baseflow, is a function of the relative water level within the aquifer (and hence the volumes of both precipitation and streamflow received in the preceding period).

By filtering the readings through inspection of streamflow data to include only those collected during apparent steady baseflow conditions, Deane, et al. (2008) analysed trends in baseflow salinity over the data collection period, and a slightly increasing trend is apparent in Figure 2-15. The saw-tooth pattern reflects the influence of recharge on the dolomite aquifer, which is the source for the groundwater base-flow and the freshening due to high streamflow events. Over the same period, daily streamflow reduced, particularly during drier months, in large part due to the increasing prevalence of farm dams (Deane, et al., 2008) and this reduction in runoff reaching the creeks likely contributes to the rising salinity trend over the same period.

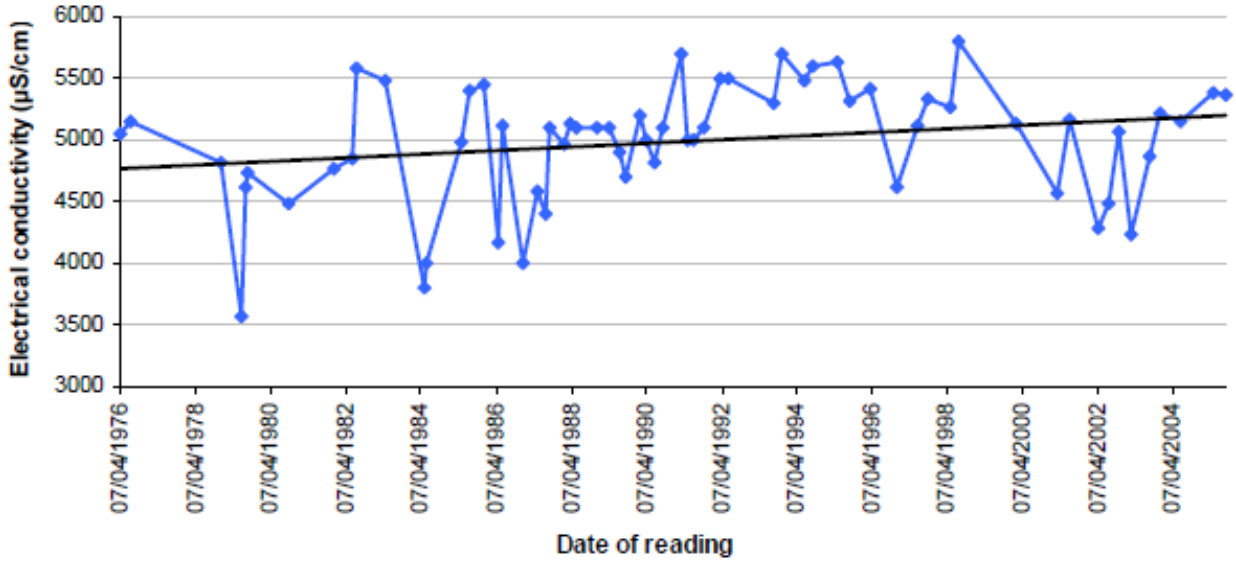

Figure 2-15 Salinity concentrations and trends in baseflow on Burra Creek between 1974 and 2004.

3. Mitigation and Control Measures

There are a range of treatment measures for managing soil erosion and drainage on construction sites (DIT, 2021). Potential environmental impacts considered by this SEDMP include:

- Soil erosion or sedimentation due to changed surface water flow.
- Soil compaction (potentially resulting in a reduced water infiltration capacity, increased potential for runoff and erosion and reduced vegetation growth).
- Stockpiling of topsoil (which may result in a reduction in soil viability and quantity).
- Alteration of drainage patterns (and possible changes to flood regimes).
- Soil or water contamination.

Hence, mitigation and control measures considered during detailed design and prior to any on-site activity, should involve the following (DIT, 2021):

- Planning and scheduling construction activities to manage erosion risk. Where feasible, site measures should be designed to protect the site from 1 in 5-year ARI storm events. If temporary drainage works last greater than 12 months, consideration should be made for 1 in 10-year ARI in accordance with IECA 'Best Practice ESC'.
- Installing appropriate erosion and sediment control structures and strategies using a treatment train approach.
- Stabilising and rehabilitating all disturbed areas.
- Identifying responsibilities for erosion management and implementation of the SEDMP on site. This includes the availability of suitably qualified expertise.
- Implementing a regular inspection and monitoring program.
- Ensuring site workers, subcontractors and delivery drivers are made aware of their responsibilities in relation to erosion and water quality protection. Installation of information signs at key places should be considered throughout the site.
- Staging of works to minimise disturbance.
- Stabilisation and Rehabilitation as soon as safe and practicable.
- Complete, maintain and monitor the CEMP for each stage/sequence of works.

3.1. Implementation of Mitigation Options

This SEDMP selects appropriate mitigation and control measures from a variety of options that can be tailored to the project specifications as determined in detailed design. Options will be selected for each site during planning and refined prior to implementation and post-micro-siting surveys and assessment. Thus, the timeframe for implementation will incorporate three distinct phases of activity: planning (or pre-development); detailed assessment and construction (implementation).

Mitigation options can be classified into 5 categories which are expanded in Sections 3.2 to 3.7, below and have been taken from DIT (2021). Options for specific erosion mitigation solutions can be found in EPA (1999) and include sediment traps, earth banks, catch drains, settling basins and ponds.

Mitigation and control measures apply across the entire Project area. These measures are specifically described where a Strahler third order or higher creek line is to be traversed for access or construction purposes. In these cases, a Water Affecting Activity (WAA) is defined and a WAA Permit is required to be granted by the Northern and Yorke Landscape Board. Appropriate design and management strategies are sanctioned by the Goyder Regional Council prior to permit approval.

WAA Permits have been approved for all current proposed crossings and these are summarised in Section 3.8 and described in the Stormwater Management Plan (ELA, 2022)

Table 3-1 Soil erosion and drainage management options

Phase	Mitigation Options
Planning	Incorporate existing tracks into the design as far as possible
	Locate and construct infrastructure to minimise the potential for erosion and avoid alteration of surface water flows
	Ensure turbines are not placed in watercourses, or in areas of high erosion potential
	Locate camps and temporary facilities away from watercourses and lakes
	Restrict the area and duration of soil disturbance
	Retain groundcover where possible
	Limit planning construction activities to minimise the time that soils are exposed
	Install sediment and erosion controls as required
	Implement measures to minimise wind erosion
	Locate soil stockpiles to minimise the potential for off-site impacts
	Develop protocols for dealing with potential acid sulfate soils and potentially contaminated material
	Obtain water affecting activity (WAA) permits for watercourse crossings
	Develop plan to manage dispersive or troublesome soils (Dispersive)
Implementation	Stockpile topsoil and cleared vegetation
	Ensuring importation of clean fill
	Limit vehicle movements to defined tracks and work areas
	Manage any disturbed acid sulfate soil in accordance with industry standards (avoidance, minimisation of disturbance, treatment)
	Undertake hydrocarbon and chemical storage in accordance with Australian Standards and EPA bunding guidelines
	Undertake in-field refuelling
	Avoid refuelling activities in close proximity to surface water features
	Maintain equipment to prevent spills or leaks
	Implement spill and emergency response procedures including containment, reporting and clean up
	Any dewatering will need to be treated prior to discharge off site
	Any dewatering would be undertaken with landholder consent and sediment and erosion controls would be in place
	Implement appropriate measures for any dewatering
	Manage camp wastewater in accordance with health regulations and Environment Protection (Water Quality) Policy 2015
	Ensuring camp ablutions facilities are installed in accordance with the On-site Wastewater Systems Code and the South Australian Public Health (Wastewater) Regulations 2013
	Use licensed chemical and waste transporters
	Implement progressive rehabilitation of temporary construction areas
	Rehabilitate areas of temporary disturbance by scarifying or ripping to alleviate compaction and replacing any previously stripped stockpiled topsoil and vegetation
	Undertake monitoring during and after construction to ensure that sediment and erosion control measures are effective and undertake remediation

3.2. Earthworks

Physical modification to the landscape should be undertaken to prevent or reduce potential erosion impacts. The following best practice principles should be followed:

- Undertake earthworks in a manner that conserves topsoil and minimizes disturbance. Separate topsoil and store for use in rehabilitation.
- Minimise the amount of soil disturbance beyond the limit of approved development.
- Where possible, avoid disturbance to areas of high or extreme erosion risk.
- Use appropriate treatment measures to treat runoff.
- When necessary, install erosion and sediment control structures before commencement of site disturbance and construction works.
- Schedule earthworks to retain as much protective ground cover as possible at all times.
- Program site stabilisation and revegetation as soon as possible after completion of earthworks.

3.3. Drainage

Managed control of surface water drainage is critical to preserve landscape capabilities and reduce potential for erosion and flooding. The following would be considered at each construction area:

- Divert off site and “clean” drainage around disturbed areas.
- Intercept and redirect runoff on the site to protect exposed areas.
- Where appropriate, install sediment detention basins early so that site drainage can be directed to them as soon as possible.
- Consider the impact of all works including minor works such as service trenches, pavement cutting etc.

3.4. Treatment Train Approach

The treatment train approach incorporates the sequential use of multiple technologies or actions that progressively increase the mitigation of a potential impact. Thus, a treatment train approach can be used to minimise erosion and velocity of runoff to reduce the need, size and cost of sediment collection basins. For example:

1. Locate catch (diversion) drains above proposed cuttings where upslope drainage is into the cutting area.
2. Construct diversion drains to protect slopes by directing intercepted drainage to a stable outlet.
3. Construct batter toe or catch drains to collect runoff from batter slopes. Direct to drainage system or watercourse.
4. Protect minor drainage lines to slow water velocities and filter sediment with measures such as sand-bags, hay bales, silt fences, gabions or local materials. Typically, these are suitable for drainage areas of less than 0.5 ha.
5. Construct level spreaders to convert concentrated flows to sheet flow at non-erosive velocities. Direct sheet flow across stabilised, vegetated areas. Where conditions permit, use grass filter strips as a simple sediment trapping measure. These are more effective on low gradient slopes.

Where possible the Project should retain or convert site treatment measures for operations phase water quality treatment. Sediment detention basins, for example, may be either temporary, or can be integrated into the operations-phase treatment system; a sediment basin used in construction may be converted at a later stage into a sediment trap upstream of a wetland system.

3.5. Site Facilities

Care and consideration should be paid to siting of all facilities across the Project area. In particular:

- Ensure site facilities such as depots, access tracks, stockpile sites, etc. are identified and established in appropriate locations.
- Ensure sediment controls around these areas where an erosion risk exists.
- Erosion and sediment controls and stabilisation of access tracks, compounds, camps.
- Ensure sediment controls at site exits such as shaker ramps, washdown bays or street sweeping to minimise off site sediment from vehicles.

3.6. Landscaping and Rehabilitation

Begin rehabilitation of all disturbed areas as soon as possible after final land formation for each area. Options available include installation of the permanent landscape or a temporary cover of a sterile or non-seeding grass species (e.g. sterile rye grass); chipped or mulched vegetation; biodegradable mats or soil binders.

3.7. Site Waste Management

At all times, the Project should minimise the risk of pollution from construction activities by:

- Appropriate disposal of wastes
- Undercover storage and suitable bunding of materials such as paints, chemicals, fuel etc. if used
- Suitable disposal of washdown waters from cleaning vehicles where required
- Discharge of wastewater and wash water in an approved manner to an approved disposal site.

For Stages 1A and 1B of the development, no fuel is planned to be stored on site.

A workers' accommodation area will be erected that will include a portable ablutions block that will be self-contained and pumped on an as-needs basis. No waste will be discharged to local waterways or to the landscape.

Water supply will be obtained via the SA Water hydrant located 130 m east of the intersection of Porter Lagoon Road and Koonoona Road and transported via water truck to construction sites. Small water tanks (up to 30,000 L capacity) will be deployed strategically to support individual site construction and the concrete batch plant.

3.8. Water Affecting Activities

Water Affecting Activity (WAA) Permits have been granted for all relevant proposed crossings within the Stage 1 area and along the Overhead Transmission Line (OHTL) corridor. WAAs are required at all locations where a Strahler third order or higher creek line is to be traversed for access or construction purposes. WAAs are granted for activities on a landholder's property and hence are applied for on behalf of consenting landholders.

A total of twelve (12) WAA applications were required to cover the land parcels containing the wind farm, all access tracks and the OHTL corridor. As of July, 2022, eleven (11) have been granted, with the twelfth pending decision on a parcel of Crown Land along the proposed OHTL corridor. The permits allow for construction activities across twenty-six (26) 3rd order or higher crossings that are not already maintained by Council. An additional eight (8) crossings along public roads will also be utilised and may

be up-graded where required. WAAs are not required for public roads where no substantive changes are planned (e.g. only grading and maintenance works planned).

WAAs are not required for road improvements across creeks that are less than 3rd order. The Stage 1 works require a total of fifty-five (55) crossings (39 1st and 2nd order and 16 3rd order and above).

Four WAA permits were required to support activities within the Stage 1 Wind Farm areas. The granted permit applications included 100% design for all WTGs, permanent access tracks, temporary construction facilities and associated infrastructure (including culverts, drainage diversion channels, bunding and storage ponds (for temporary facilities only). The site and construction information provides constraints on the permitted activities. Any activities not detailed in the application require further assessment and permitting.

Permits were granted for the erection, construction or placement of any building or structure in a watercourse or lake or on the floodplain of a water course (Clause 104(4)(b) of the *Landscape South Australia Act 2019* concerning: buildings or structures, pump house, culvert, crossing point or fencing).

A summary of granted WAA Permits for Stage 1 is provided at Table 3-2. Locations of Land Parcels are shown in Figure 3-1, Figure 3-2 and Figure 3-3 for Stage 1A, Stage 1B and the OHTL corridor, respectively.

Table 3-2 Summary of Water Affecting Activities' Permits for Stage 1 activities

WAA Permit #	Permit date	Land Parcels affected			
N21033	02/06/2022	H200100 S389			
N21034	02/06/2022	D12300 A2	F101459 A14	F101457 A12	F17596 A3
N21035	03/06/2022	D42727 Q1			
N21038	21/06/2022	H200800 S186	D46215 A344	H200800 S40	D46215 A344

The following general conditions of consent apply to all granted WAA Permits:

1. This water affecting activity must be completed in accordance with the permit application (including all documents submitted with the application), unless varied by the following conditions.
2. The proposed works must be undertaken in a manner that prevents silt or sediment leaving the site including, but not limited to, the use of erosion and sediment control measures, such as catch/diversion drains, re-vegetation, hay bale barriers, filter fences, sediment traps and basins.
3. All excavated material must be removed from the watercourse and securely stored away from the watercourse to ensure that it does not return to the watercourse.
4. Soil excavated for the purpose of this proposal shall be replaced and compacted to prevent accelerated erosion.
5. Destruction of vegetation shall only occur where it will not cause destruction to significant habitat for wildlife. The removal of introduced and exotic vegetation can be undertaken but it shall only be undertaken in a manner that will not cause exacerbated erosion of the bed and banks.
6. There must be a minimum distance of 20 metres between a watercourse and the fuelling site for machinery used to undertake construction.

7. The proposed works shall be kept free at all times of debris to minimise the risk of flooding.
8. Any work must not increase the risk of flooding.
9. After completion of this proposed activity all temporary structures must be removed from the watercourse and the watercourse must be restored to its original character.
10. Any work undertaken in the watercourse must be undertaken during a period of no flow.
11. The culvert must not have a detrimental impact on the bed and bank stability of the watercourse, result in an increase in erosion upstream or downstream of the structure or have detrimental off-site impacts. In addition to the design outlined, a rip rap must be installed downstream of the culvert site to prevent erosion downstream of the site.
12. Any imported material used in the works, including fill, sand, soil etc. must be clean and free of weed infestation.
13. This permit approval is for works which must be carried out in accordance with the application submitted for and if there are any alterations to the proposed construction or location, the Board must be notified, and permission obtained prior to commencing construction.
14. All building and residual construction material must be removed on completion of the proposed works.

In addition:

1. The works must be completed by 31 December 2023.
2. This permit is not transferable.
3. In South Australia, native vegetation is protected by the Native Vegetation Act 7991. In most cases, the clearance of native vegetation requires the consent of the Native Vegetation Council.

All 100% Design Drawings have taken these principles into consideration during drafting.

Further information on the Water Affecting Activities and the permits is provided in the Stormwater Management Plan (ELA, 2022).

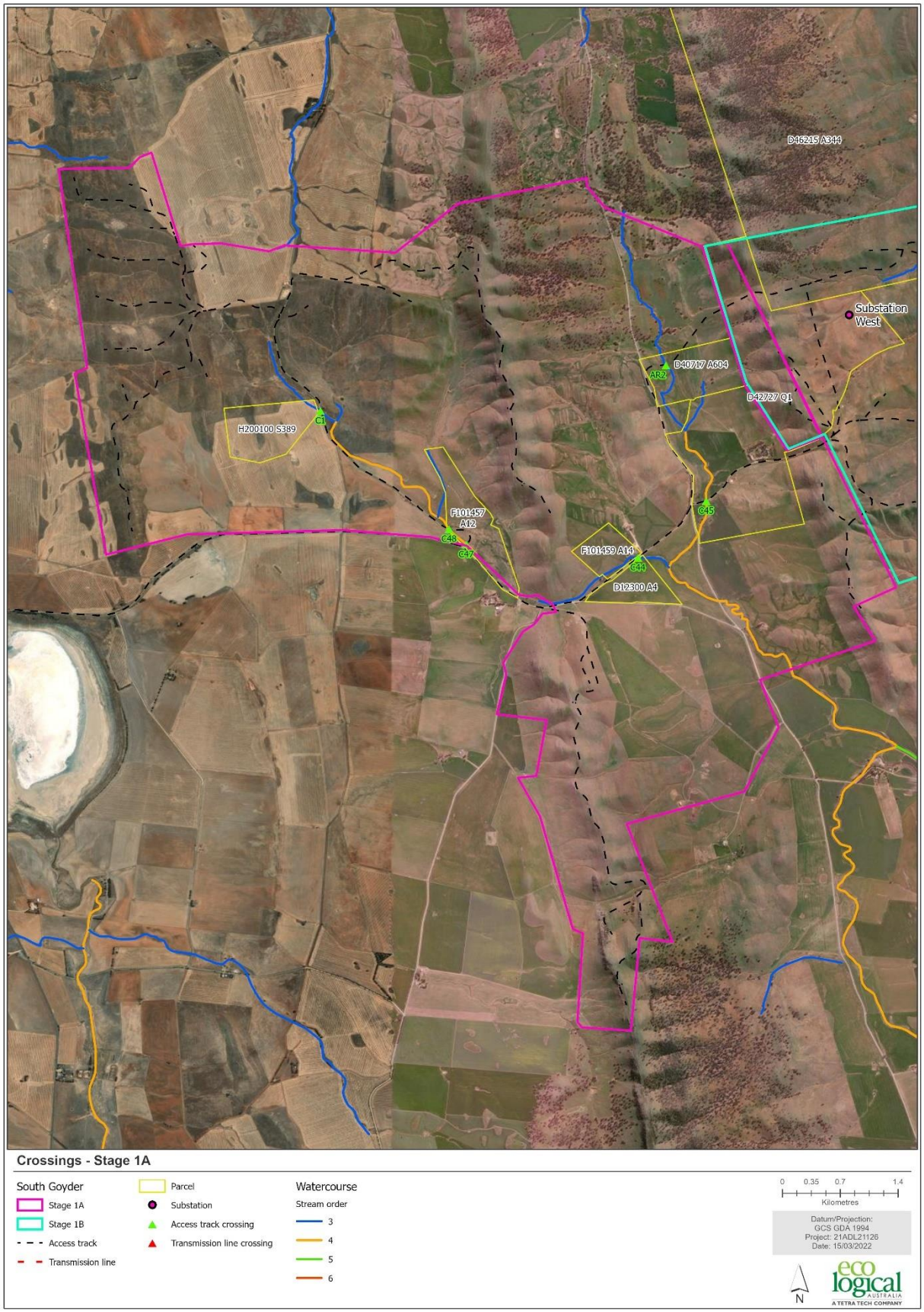

Figure 3-1 Land Parcels that have received approval for Water Affecting Activities across Stage 1A

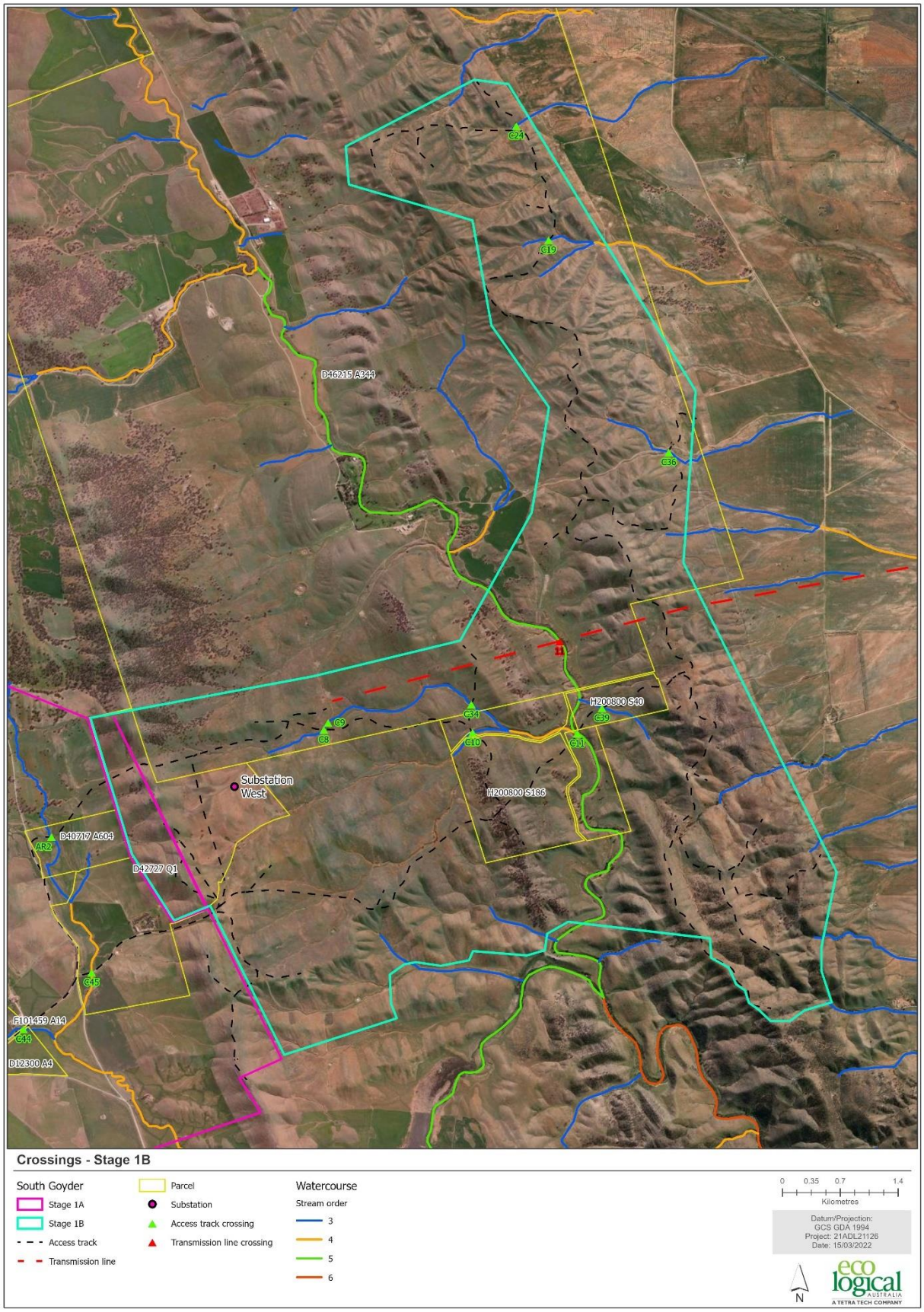

Figure 3-2 Land Parcels that have received approval for Water Affecting Activities across Stage 1B

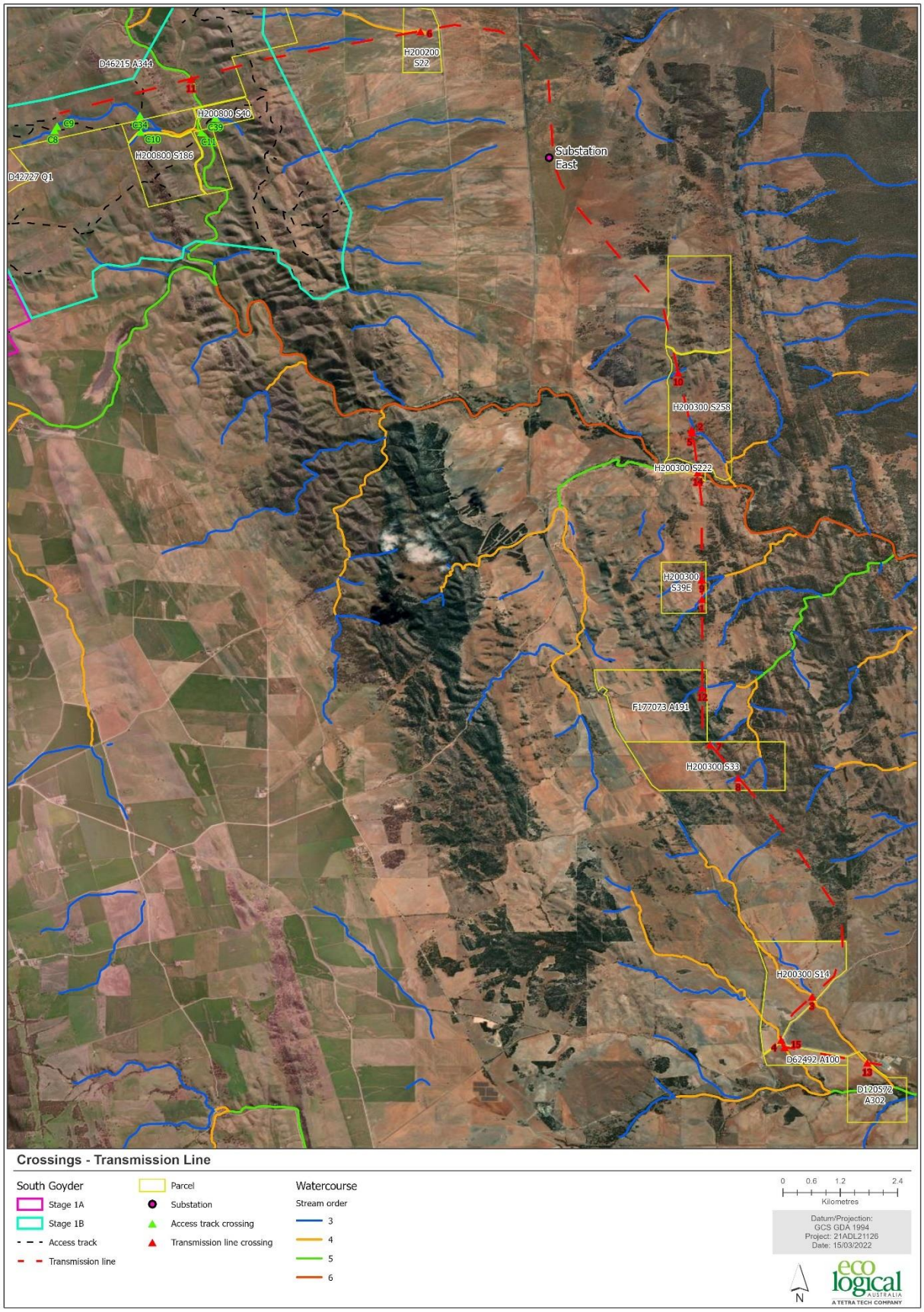

Figure 3-3 Land Parcels that have received approval for Water Affecting Activities along the Overhead Transmission Line route

4. Construction Soil Erosion Management

This section provides a summary of the construction soil and erosion management approaches considered for this project. Further details can be found in the Construction and Erosion Management Plan (CEMP) and on design drawings provided in the appendices. Each distinct construction site will require a detailed ESC Plan that is site-specific and developed immediately prior to implementation of any construction activities. The ESC Plan will include detailed calculations for sizing of any sedimentation ponds and make reference to stormwater control as stipulated in the approved Stormwater Management Plan (SMP).

4.1. Erosion and sediment control

Figure 4-1 shows an indicative concept design of erosion and sediment control to be used for site construction activities. Contractor, maintenance and erosion control notes are to apply to all construction activities and are detailed on the Construction Design Drawings presented in Appendix III, or as amended.

4.2. Soil Management

The general strategy of soil resource management will be to strip suitable soil resources from the proposed disturbance areas within the project area and directly replace on existing rehabilitation areas or store in dedicated stockpiles for re-use during progressive rehabilitation works. The strategies/objectives for management of the soil resources include:

- Characterisation – asses the suitability of the material for rehabilitation purposes prior to stripping.
- Storage and Management – soil resources are stored selectively and managed according to their characterisation and in such a manner that their long-term viability is maintained.
- Availability – is sufficient sub soil and stable topsoil are available for rehabilitation purposes.
- Progressive Rehabilitation - rehabilitation of final landforms is conducted as soon as practical after completion of the landforms or when areas are no longer required.

4.3. Soil Stripping

Prior to soil stripping, testing of soil profiles will be undertaken where necessary to confirm the precise depths of suitable soil and any requirements for amelioration at the time of soil stockpiling. Stakes may be used to delineate soil boundaries and to identify suitable stripping depths for equipment operators. Disturbance areas will be stripped progressively, to reduce potential erosion and sediment generation, and to minimise the extent of topsoil stockpiles and the period of soil storage.

4.4. Soil Stripping Quantities/Depths

Typical topsoil stripping depths will usually be to 100-150mm. This may vary from 50mm to 300mm depending on local conditions.

4.5. Soil Stripping Practices

4.5.1. Prior to Stripping

There are two steps to the process:

- A surface cultural heritage clearance survey, which is designed to inspect the relevant land and identify surface objects from which a representative sample would be collected.
- A sub-surface cultural heritage clearance survey, which allows for inspection once the topsoil has been removed. Typically, this is accomplished by grading several centimetres of topsoil to enable identification of objects and other items (kept with the soil) for collection and storage.

4.5.2. Stripping Activities

Through all stages of soil stripping earthworks, soil stockpiling and re-application for rehabilitation, operations will be closely supervised to maintain correct recovery depths of suitable soils based on results of soil testing or typical stripping depths (Section 3.8.3). The site supervisor will direct and control the recovery, handling and management of site soils. Supervisor responsibilities will include:

- delineation of areas to be stripped
- delineation of suitable stockpile areas
- direction of soil collection/haulage equipment to designated stockpile locations according to soil type
- recording of volumes stored (including date, location, soil type, volume and descriptions of any ameliorants added to stockpiled materials for recording in the soils database)
- installation of signposts for all soil stockpiles with the date of construction and type of soil

4.6. Soil Stockpile Management

The general protocol for the management of soil stockpiles is presented below and includes soil handling measures that optimise the retention of soil characteristics (in terms of nutrients and micro-organisms) favourable to plant growth:

- leave the surface of the completed soil stockpiles in a “rough” condition to help promote water infiltration and minimise erosion prior to vegetation establishment
- deep-rip soil stockpiles and seed (if necessary) to maintain soil organic matter levels, soil structure and microbial activity
- treat soil stockpiles with gypsum to reduce dispersiveness during stockpiling
- install signposts for all soil stockpiles with the date of construction and type of soil
- record details of all soil stockpiles on a site database which includes the location and volume of each stockpile, and the stockpile maintenance records (e.g. ameliorative treatment, weed control, seeding) where practicable, soil will be stripped from one area and immediately transferred to an active rehabilitation area for direct placement. This will reduce the size of soil stockpiles and optimise soil fertility for rehabilitation.

4.6.1. Long-term Soil Stockpile Management

Where required to improve structural and fertility characteristics prior to application, soil stockpiles will be deep-ripped to establish aerobic conditions (Resource Strategies, 1997). All soil stockpiles will have sediment control measures installed in accordance with the requirements of the ESCMP. The control measures used will depend on the size and location of each stockpile.

Long-term topsoil stockpiles will be constructed up to 2m in height with slopes at a maximum acceptable angle to resist erosion, where sufficient area exists. Where area is limited, stockpiles that exceed 2m in height will be stabilised as per the Dust Management Plan.

A general-purpose starter fertiliser may be applied to all soil stockpiles following construction. Fertiliser use and mix will depend on soil tests on stockpiled soil and proposed use of the soil. The soil stockpiles will be inspected on an annual basis, with regard to vegetation cover, weed and erosion and sedimentation issues. The following soil stockpile maintenance procedures will be conducted where on-going monitoring indicates the need:

- fertiliser application
- deep-ripping to improve aerobic conditions
- additional erosion control and stabilisation
- supplementary seeding with a select cover species
- weed control as necessary

4.7. Soil Amelioration

Soil amelioration will only be required if topsoil is absent.

Soil amelioration would be in the form of a topsoil cap if topsoil is not already present.

4.8. Stormwater management infrastructure arrangements

Figure 4-2 shows design details of typical stormwater management infrastructure arrangements that may be employed during construction and for long-term drainage requirements as detailed on the design drawings. The possible arrangements comprise:

- typical table drain,
- typical rock check installation,
- silt fence,
- hay bale barrier,
- retention swale,
- sedimentation pond,
- stormwater berm, and
- stormwater drainage level spreader.

Dust suppression measures shall be maintained to the satisfaction of the superintendent. All disturbed and unsealed areas shall be dampened and rolled to seal the surface to minimise dust.

All erosion and sediment control devices and silt traps are to be installed prior to the commencement of construction activities. Top-soil stripped from construction areas to be stockpiled at a nominated site away from flow paths.

All sediment control fences are to be constructed along contour where possible. Where sediment control fences are not constructed along contour return panels are to be incorporated at regular intervals not exceeding 20m.

.

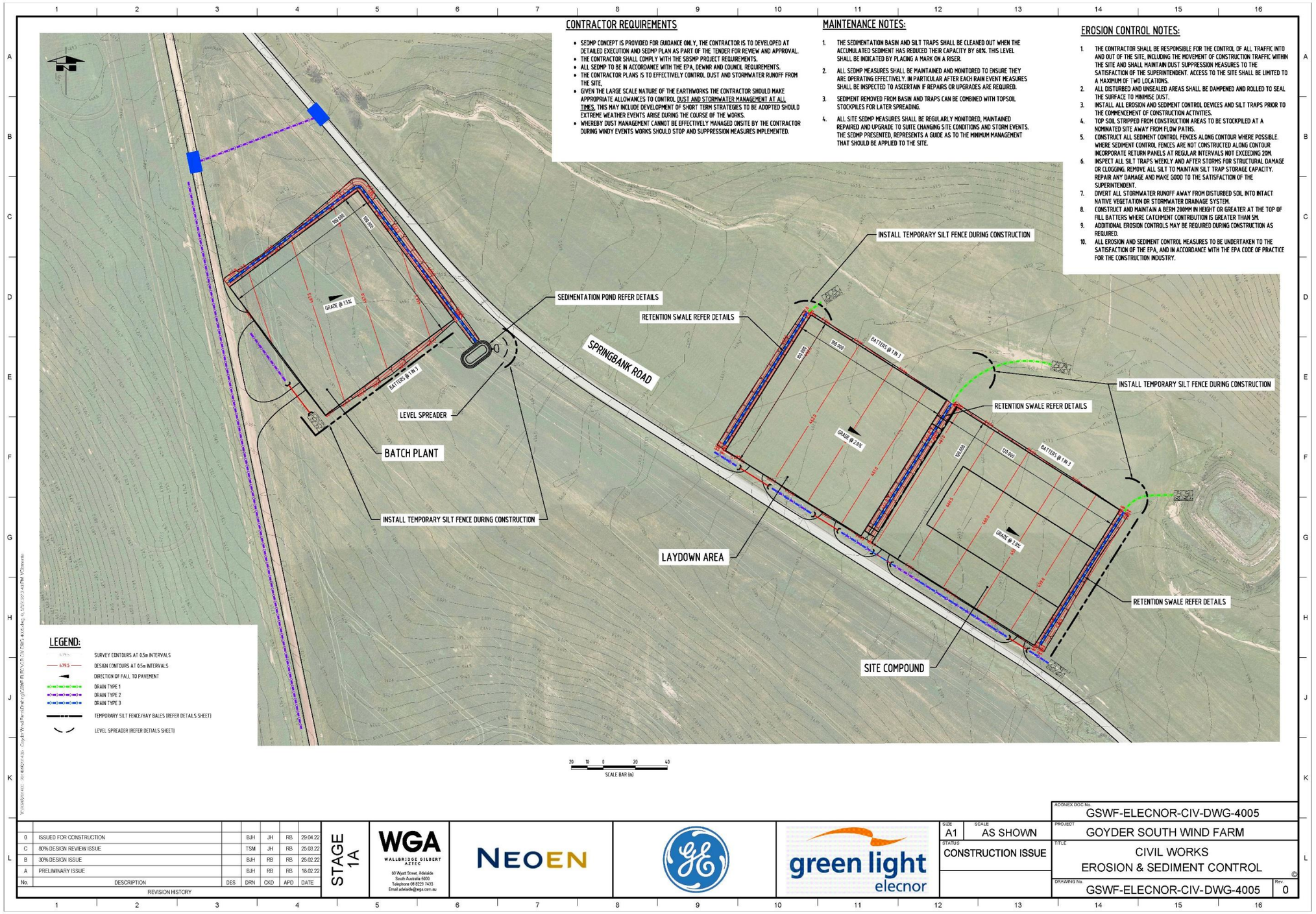

Figure 4-1: Indicative erosion and sediment control plan

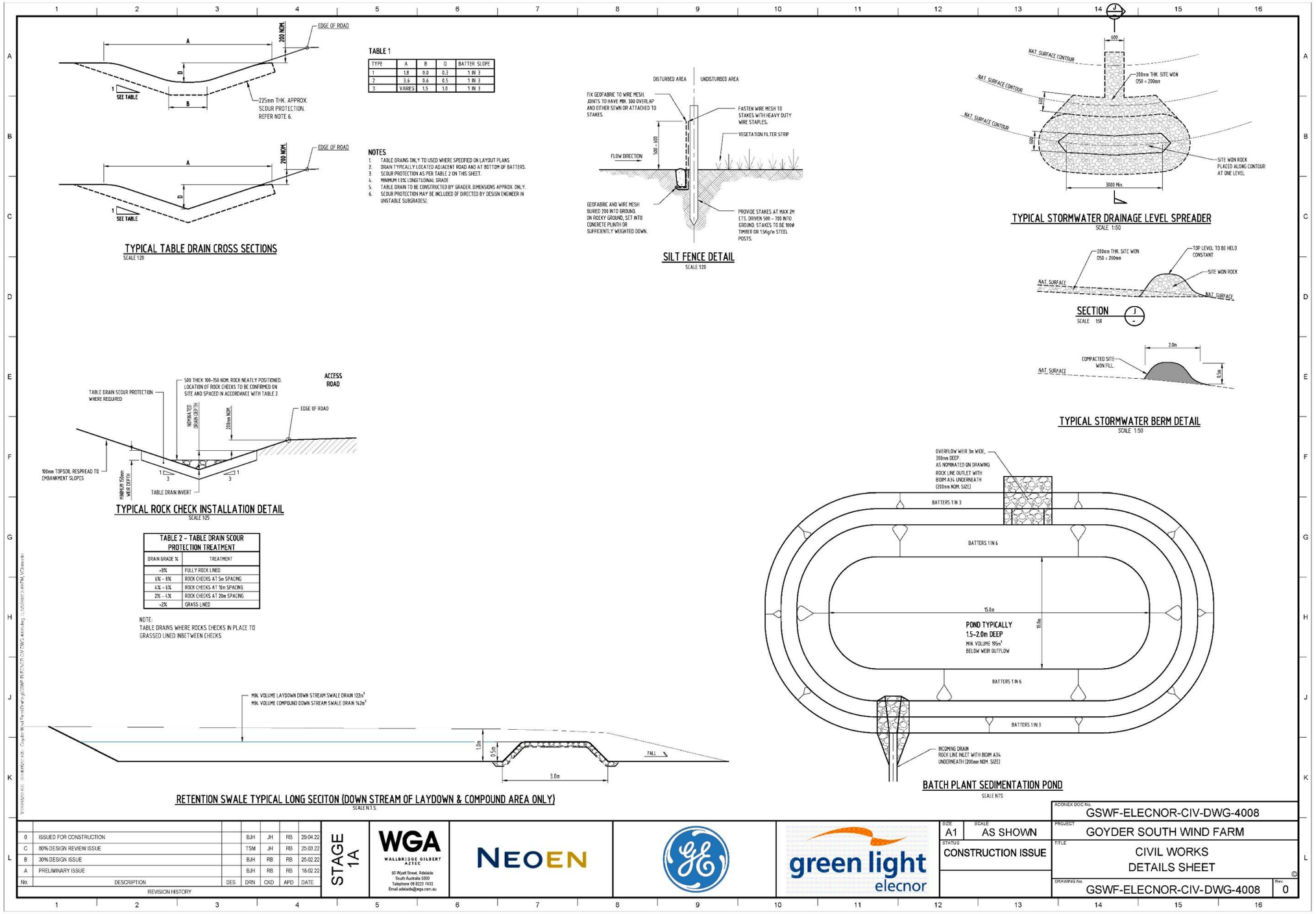

Figure 4-2 Design details of stormwater management arrangements for the temporary facilities

All silt traps are to be inspected weekly and after storms for structural damage or clogging. All silt will be removed to maintain silt trap storage capacity. Any damage will be repaired to the satisfaction of the superintendent. All stormwater run-offs will be diverted away from disturbed soil into intact native vegetation or stormwater drainage system.

The sedimentation basin and silt traps shall be cleaned out when the accumulated sediment has reduced their capacity by 60%. This level shall be indicated by placing a mark on a riser.

All SEDMP measures shall be maintained and monitored to ensure they are operating effectively. In particular, after each rain event measures shall be inspected to ascertain if repairs or upgrades are required. Sediment removed from basin and traps can be combined with topsoil stockpiles for later spreading. All site SEDMP measures shall be regularly monitored, maintained all site SEDMP measures shall be regularly monitored, maintained repaired and upgraded to suite changing site conditions and storm events.

Additional erosion controls may be required during construction as determined by the superintendent in consultation with the EPA. All erosion and sediment control measures to be undertaken to the satisfaction of the EPA, and in accordance with the EPA code of practice for the construction industry. The site will be managed such that not all surface vegetation is cleared in one operation.

The site shall be progressively managed, and areas of vegetation shall remain to act as buffer strips to trap and reduce the risk of the risk of sediment laden runoff. Any clearing work or any type of disturbance outside the limits of work shall not be undertaken unless approved by the construction supervisor.

All materials and workmanship shall be in accordance with the latest edition of the relevant Australian standards and other relevant codes as referenced in the technical specification.

All final erosion prevention measures will be completed prior to the final handover inspection. Any changes to the erosion and sediment control plan shall be submitted and approved by the superintendent.

On completion of the works all unwanted materials, plant, equipment and temporary construction facilities shall be removed from the site, areas used during the course of the work is to be remediated, and the site is to be restored to a neat and tidy condition. All work areas should be smoothed and graded in a manner to conform to the appearance of the surrounding land

4.9. Inspection and Monitoring

Inspection and management measures should be documented as part of the records of implementation of the SEDMP and Fortnightly Site Reports and be made available to the contract manager. Reports should include details of rainfall; water quality testing (if required); the effectiveness of site management measures and any modifications proposed; and other matters which contribute to the level of performance of work practices.
Monitoring measures should include:

- Regular inspections and maintenance of all treatment and drainage protection devices on site.
- Checks that suitable site measures are in place prior to rain events.

- After each significant runoff event, inspection for damage or clogging by silt or debris and replacement or clean out as necessary.
- Ensure temporary drainage measures such as diversion channels are in place on site at the end of each day, particularly if rain is forecast.
- Ensure all EPA site licence conditions are complied with.
- On sensitive sites, where appropriate, or where required by contract or licence conditions, undertake water quality monitoring to effectively manage the site. Such monitoring should be undertaken simultaneously up-stream and down-stream of the site and include stream flow. Frequency of monitoring should be guided by the Transport SA (2002) Water Quality Monitoring Manual for Construction Sites.

4.10. Water Quality Monitoring Plan

The region can be considered as moderately disturbed (see Section 2.3). Therefore, monitoring activities and criteria should be undertaken as detailed in Table 4-1.

Table 4-1: Water Quality Monitoring Requirements

Activity	Criteria
Scenario	Low risk construction activities (within the Project area) or activities where discharges may only enter highly disturbed systems or moderately disturbed systems.
Monitoring Method	• Visual inspection of site erosion and drainage management measures • Visual inspection of drainage discharge points • Photo points • Temperature and rainfall from nearest Bureau of Meteorology station
Frequency	Weekly and during rainfall events
Status	• Sediment traps clear and available for trapping sediment • No visible sediment discharge in receiving waters
Equipment	Camera
Expertise	Monitoring may be undertaken by Contractor's Environmental Management Representative, or staff with supervisory responsibilities, good observational skills and ability to reliably assess and record site condition.

Where potential soil erosion and drainage discharge points may enter high conservation/ecological value systems or slightly to moderately disturbed systems, and for all other scenarios (other than that represented in Table 2-6), the water quality monitoring plan must be prepared by a suitably qualified person to ensure that the monitoring plan meets legislative requirements, conditions of any approvals sought as well as meeting the Contractor's general environmental duty. During the preparation of the WQMP, the following should also be considered:

- Monitoring frequency and criteria must be sufficient to address the WQ EPP 2015 or any other policies/guidelines relevant to the receiving water body/water course/aquatic ecosystem
- Continuous or automated monitoring of adjacent watercourses, up and down stream, during flow events with manual sampling at minor discharge points may be required to demonstrate the effectiveness of implemented control measures
- Field testing results may require validation via supplemental laboratory analysis

- Where undertaken, all laboratory analysis is to be undertaken by National Association of Testing Authorities, Australia Accredited laboratories only
- Sample collection should be undertaken by appropriately trained persons only. Biological samples must be collected and analysed by a skilled ecologist
- For extreme risk work activities or works undertaking in high conservation/ecological value areas, baseline and follow-up monitoring may be required
- The plan must include contingency measures detailing actions to be adopted where there are exceedances of adopted guidelines/screening criteria.

For all water quality monitoring, the associated reporting should demonstrate performance of the water quality protection measures, compliance against the adopted screening/ guideline criteria and provide details of corrective measures implemented.

4.11. Staff Roles and Responsibilities

It is the responsibility of all head contractors to:

- Ensure that responsibilities for implementation of the SEDMP are clearly identified.
- Ensure appropriate environmental expertise is available.
- Ensure staff and subcontractors are aware of their responsibilities through appropriate induction and training programs.
- Ensure the SEDMP is implemented and maintained as specified.

Specifically, the following responsibilities are identified:

4.11.1. Project Manager and/or Construction Manager

- Ensure that this Sediment, Erosion and Drainage Management Plan (SEDMP) is communicated to relevant Project personnel daily and undertake site specific inductions.
- Ensure that all relevant aspects of this SEDMP are implemented by GLC personnel and Subcontractor personnel
- Ensure adequate resources are provided to ensure this SEDMP can be effectively implemented and maintained

4.11.2. HSE Manager

- Assist the Project Manager, Supervisors and Contractor representatives to implement this SEDMP
- Modify this SEDMP to meet any project specific contractual and legislative requirements
- Where modifications are made to this SEDMP an equivalent or higher level of health and safety MUST be achieved (e.g. in the event a client requires their system to be implemented and used)
- Monitor compliance with the SEDMP and report non-compliance to the Project Manager.

4.11.3. Supervisors

- Implement all relevant aspects of this SEDMP
- Identify and assess high risk construction areas when erosion or flood risk is identified.

4.11.4. Workers

- Comply with all relevant aspects of this SEDMP
- Do not put themselves or others at risk
- Report any erosion or drainage impacts immediately.

4.12. Incidents, Auditing and Reporting

If inspection and monitoring indicate a notable failure in the Sediment, Erosion and Drainage Control Program, the source of the failure should be investigated and remediation measures undertaken and procedures modified, as appropriate.

An environmental audit should be conducted, following an initial three-month assessment, every six months to ensure that the plan is operating according to its environmental objectives and within legislative requirements. Implementing environmental complaint procedures and training staff to recognise and minimise environmental hazards are also good ways of achieving high standards of environmental compliance through continuous improvement. There may be benefits in providing integrated quality, safety and environmental management systems for the site, plant operation and delivery process.

5. References

International Erosion Control Association (IECS), 2021. Best Practice Erosion and Sediment Control (BPESC)

CMW Geosciences 2022. Goyder Wind Farm, Burra, South Australia: Geotechnical Factual Report. Report No. ADL2021-0309AI Rev 1. Dated 29 April 2022

Deane, D, Graves, C, Magarey, PD & Phipps, L, 2008. Preliminary assessment of the impacts of water resource development on Burra Creek catchment, DWLBC Report 2008/01, Department of Water, Land and Biodiversity Conservation, Adelaide

Department for Infrastructure and Transport (DIT), 2021. Protecting Waterways manual. Attachment 6A to the Environment and Heritage Technical Manual, available at: EHTM - Department for Infrastructure and Transport - South Australia (dit.sa.gov.au) (downloaded: 21/10/2021)

Department of Water, Land and Biodiversity Conservation (DWLBC), 2008. Improving Biodiversity Outcomes of Restoration Works: Habitat Restoration Workshop Proceedings

Department of Water, Land and Biodiversity Conservation (DWLBC), 2018.

ELA 2022. Goyder South Stormwater Management Plan

Environment Protection Agency (EPA), 1999. Code of practice for the building and construction industry. v + 55pp. ISBN 0 7308 6011 6

Resource Strategies, 1997. Agricultural Suitability/Rural Land Capability and Soil Resources. Report prepared for North Limited

SARIG, 2021. https://map.sarig.sa.gov.au

Transport SA, 2002. Water Quality Monitoring Manual for Construction Sites

Appendix I

DIT (2021) PROTECTING WATERWAYS GUIDELINE

Protecting Waterways Guideline

EHTM Attachment 6A

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Document Amendment Record

Rev	Change Description	Date	Author	Approved
01	Original Version	October 2021	DIT	Director Technical Services

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http://www.DIT.sa.gov.au/standards/environment

Contents

Abbreviations

Term /Acronym	Meaning
ADS Act	Adelaide Dolphin Sanctuary Act 2005
CEMP	Contractor's Environmental Management Plan
DEW	Department for Environment and Water (SA)
DIT or the Department	Department for Infrastructure and Transport
EHIA	Environment and Heritage Impact Assessment
EPA	South Australian Environment Protection Authority
EP Act	Environment Protection Act 1993
EP Regulations	Environment Protection Regulations 2009
EPBC Act	Environment Protection and Biodiversity Conservation Act 1999
EHTM	Environment and Heritage Technical Manual
FM Act	Fisheries Management Act 2007
LG Act	Local Government Act 1999
LSA Act	Landscape South Australia Act 2019
NV Act	Native Vegetation Act 1991
NV Regulations	Native Vegetation Regulations 2017
PDI Act	Planning, Development and Infrastructure Act 2016
PPMF	The Department's Program and Project Management Framework
SEDMP	Soil Erosion Drainage Management Plan
WAA	Water Affecting Activities
WQMP	Water Quality Monitoring Plan
WQRA	Water Quality Risk Assessment
WQ EPP 2015	EPA Environment Protection (Water Quality) Policy 2015
WSUD	Water Sensitive Urban Design
WSRD	Water Sensitive Road Design

Glossary

Term	Meaning
Contract Documentation	Contract Scope and Technical Requirements; Functional and Operational Requirements; Contract or Project Scope
Contractors	Contractor engaged by the Department to undertake the planning, design or construction of a project (including maintenance projects)
Project Area	Area in which a project can have an effect on environmental and heritage aspects. Includes the construction, operational and maintenance footprints

1 Introduction

The Protecting Waterways Guideline forms Attachment 6A of the Department's Environment and Heritage Technical Manual (EHTM). This document applies to a range of Department programs and projects including road, rail, marine and other infrastructure, as required. The document applies to employees of the Department (direct or contracted) and others operating under the direction of the Department.

Transport infrastructure can affect our waterways through changes to landform, drainage, flow patterns, sedimentation and pollution. The purpose of this document is to detail the processes to be followed and criteria to be applied when assessing and mitigating potential impacts to the quality of receiving waters and the aquatic environment.

It is expected that, unless otherwise approved by the Department, Contractors undertaking the works described in this Guideline are suitably qualified professionals, listed on, or that can demonstrate their eligibility to be listed on, the Department's Professional and Technical Services Prequalification for Environmental Services.

1.1 Supporting Documentation

The following supporting DIT documentation applies to assessments undertaken under these guidelines and is available for download via the EHTM Toolkit:

- DIT Sustainability Manual
- DIT Acid Sulphate Soils Assessment and Management Plan
- DIT Water Affecting Activities Permit – Best Practice Operating Procedure
- DIT Fauna Impact Guideline

1.2 Performance Outcome

In order to meet the performance requirements under this document, unless specified otherwise in the Contract Documentation, the following shall be achieved:

- Undertake the appropriate level of risk assessment to determine the level of management and monitoring required to ensure that, to the extent reasonably practicable, the construction and operation of a project results in no change or results in an improvement of the quality of receiving waters and/or aquatic environments.
- Identify the required level of management and monitoring for project works and ensure that relevant plans are prepared in accordance with this guideline.

1.3 Legislative Context

Users of this document are responsible for complying with relevant legislation and obtaining relevant approvals, permits or authorisations (where required by the Contract Documentation).

The following legislation may apply to departmental construction, demolition, operation and maintenance activities associated with transport and building (including property) related infrastructure:

- *Environment Protection Act 1993* and Environment Protection Regulations 2009 (EP Act and EP Regulations) and subordinate guidelines and policies. A key policy is the Environment Protection (Water Quality) Policy 2015 (WQ EPP 2015)
- *Landscape South Australia Act 2019* (LSA Act)
- *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act)
- *Fisheries Management Act 2007* (FM Act)
- *Local Government Act 1999* (LG Act) and the *Local Government (Stormwater Management) Amendment Act 2007*
- *Fisheries Management Act 2007* (FM Act)

- *Planning, Development and Infrastructure Act 2016* (PDI Act) and Planning, Development and Infrastructure (General) Regulations 2017
- *Native Vegetation Act 1991* (NV Act) and Native Vegetation Regulations 2017
- *Adelaide Dolphin Sanctuary Act 2005* (ADS Act)
- South Australia's Water Sensitive Urban Design (WSUD) Policy 2013

Note that this list is non-exhaustive and other legislation may be relevant for consideration.

1.4 Green Infrastructure Commitment

In response to the Government's objective to accelerate urban greening (as detailed in the South Australian Government Climate Change Action Plan 2021-2025), the Department has committed to expanding Green Infrastructure (including waster sensitive urban design) on public land, focusing on priority areas identified by Green Adelaide, corridors which provide for active travel, and new infrastructure projects. In order to deliver this commitment, Green Infrastructure needs to form part of planning and design thinking from the outset of a project. For projects in the Adelaide metropolitan area and townships, a Green Infrastructure assessment is undertaken during the proving phase to assess the opportunity to incorporate Green Infrastructure into the asset and identify the priority objectives and desired characteristics for Green Infrastructure across the project area.

Outputs are captured in a Green Infrastructure concept plan, showing the types and approximate extent of Green Infrastructure envisaged across the project (taking into account anticipated land acquisition/boundary realignment and having regard to the likely location of services and approximate space required to achieve Water Sensitive Urban Design policy targets). The outcomes of the water quality risk assessment, including any project specific objectives and/or mitigation treatments, should be fed into the Green Infrastructure assessment.

2 Processes for Assessing and Managing Impacts

The process outlined in this section is intended as a guide. Actual requirements will differ depending on the Project Area, water bodies/ landscape present, interface with construction activities and; nature of potential impacts and the project phase.

As detailed in Part 1 of the EHTM, assessment of environmental impacts (including impacts to water) is integrated in the Department's Program and Project Management Framework (PPMF). The PPMF describes how the Department should manage the development of programs and projects. It provides guidance on the key activities, minimum deliverables, decisions, and approvals within each phase of the Project lifecycle. These stages are outlined in The process followed in the Proving phase, where the scope of a project is undefined or there may be a range of alignment/location options to be assessed, will differ to the Pre-delivery or Delivery phase where the scope is defined and/or a preferred design and construction methodology is known.

Table 2-1 along with the expected level of impact assessment and/ or obtainment of approvals for each phase.

The process followed in the Proving phase, where the scope of a project is undefined or there may be a range of alignment/location options to be assessed, will differ to the Pre-delivery or Delivery phase where the scope is defined and/or a preferred design and construction methodology is known.

Table 2-1 Summary of PPMF Stages and Associated Level of Assessment Regarding the Protection of Waterways

PPMF Stage	Description	Level of Assessment
Initialisation	Building the foundation for the program or project through establishing the need, engaging the team, and identifying and assessing options.	N/A
Proving	Proving the option identified in the initialisation phase is suitable and ensuring the way forward is achievable.	Preliminary Impact Assessment - refer to Section 2.1.1
Pre-Delivery	Firming up the scope and approach for delivery, identifying and addressing any remaining information gaps and ambiguities, and ensuring commitment to delivery of a project or program prior to going to market.	Detailed Impact Assessment – refer to Section 2.1.2 Water Quality Risk Assessment - refer to Section 2.2 Permits, Licences and Authorisations – refer to Section 2.3
Procurement	Delivery strategy is implemented and the delivery is put to the market for tender. Final preparation to ensure readiness for delivery	N/A
Delivery	Asset is constructed by the delivery contractor, handed over and put into operation	Detailed Impact Assessment – refer to Section 2.1.2 Water Quality Risk Assessment - refer to Section 2.2 Permits, Licences and Authorisations – refer to Section 2.3 Sediment Erosion Drainage Management Plan – refer to Section 2.4 Water Quality Monitoring Plan – refer to Section 2.5

2.1 Key Considerations during Project Planning and EHIA

A preliminary water quality impact assessment should be undertaken during the project Proving phase. A more detailed impact assessment shall be undertaken during the Pre-Delivery/ Procurement/ Delivery phase when the project has a preferred design and is at a level that is generally representative of the final design. Once a preferred design has been selected, the detailed impact assessment should be undertaken to determine if further investigation is required and to determine the mitigation measures to be adopted.

2.1.1 Proving Phase

The preliminary impact assessment should identify potential impact minimisation options influencing planning and design decisions (e.g. via informing the Multi-Criteria Analysis process). The preliminary impact assessment shall identify physical features and project specifics including:

- The location of any water bodies (including surface, ground and marine) and receiving stormwater systems within and adjacent to the Project Area;
- Ecologically sensitive areas;
- Environmental areas of special significance (e.g. seasonal habitats, wetlands) including areas that are protected under Commonwealth or State legislation;
- Physical disturbances including the alteration of landforms, realigning or altering creek lines, lining of channels etc;
- Hydrologic disturbances including changes to surface and sub-surface flows, alteration of the volume or timing of water flows either on a temporary or long term basis;
- Interaction with groundwater (with reference to the proposed extent of ground disturbing activities) including the need for dewatering;
- Interaction with waterways, potentially requiring a water affecting activity permit;
- Potential contribution to dryland salinization;
- Any built structures within/across water bodies that may pose potential barriers to fauna (e.g. fish) passage that should be remediated (existing structures) or optimised (new structures) - refer to the Department's Fauna Impact Assessment Guideline;
- The need to take water or other interaction with a groundwater well, potentially requiring a water affecting activity permit/licence.
- The location of prescribed water resources and any interactions with such waters that could be minimised;
- Pollutants generated during the construction or operation of transport infrastructure;
- Landscaping;
- Disturbance of Acid Sulphate Soils;
- Mobilisation of contaminants from contaminated land.

The preliminary impact assessment will also:

- Identify if and what other information may be required in this or subsequent phases;
- Identify management and mitigation measures required to be adopted during delivery (including design);
- Determine if any permits or authorisations may be required and the recommended approval pathway with reference to timing implications;
- Present impacts/opportunities that are to be considered when evaluating alternatives and selecting the preferred project options (if relevant);
- Identify any water quality requirements specific for the project site.

The outcome of the preliminary impact assessment may be summarised in the Environment and Heritage Impact Assessment (EHIA) report, planning report and/or the design report. If outcomes are likely to

influence the objectives and desired characteristics for Green Infrastructure (including WSUD) on the project, they should be fed into the Green Infrastructure assessment and used to inform the Green Infrastructure concept plan (if applicable).

2.1.2 Pre-Delivery/ Delivery Phase

Once the detailed project scope and/or the preferred design is known, if there is a need for further investigation, the preliminary impact assessment should be reviewed and updated to become the detailed impact assessment. In addition to the outcomes in Section 2.1.1, the detailed impact assessment shall address the following:

- Identify mitigation measures and legislative requirements for each of the identified potential impacts during the delivery and operation of a project.
- Identify the need for a Water Quality Risk Assessment and subsequent completion of such assessment. Note that this would usually be required where project works include works over water or potential discharges to water.
- Obtainment of permits or authorisations (if required in Contract Documentation) including the need for a Water Affecting Activity Permit (as required by the LSA Act).

The outcome of the detailed impact assessment shall be summarised in the EHIA report, planning report and/or the design report etc.

2.2 Water Quality Risk Assessment

Where required in accordance with Contract Documentation (including Master Specification adopted for the project) or where a project poses a significant risk to the water quality of a waterbody/watercourse (i.e. works over water, potential discharges to water, changes in flow regime), a Water Quality Risk Assessment (WQRA) must be undertaken.

The WQRA shall be undertaken to determine the potential nature, scale and likelihood of any impacts during the design, construction and the operational use of the infrastructure and to ensure that the mitigation proposed through the design and construction methodology works to reduce the risk. Consideration must also be given to WSUD performance objectives for the project (refer Master Specification Part RD-DK-D1 “Road Drainage Design”).

The process to be adopted for the WQRA should follow the generic framework in AS/NZS ISO 31000-2009 as well as that developed by AustRoads (2001) in Environmental Risk Management Guidelines and Tools for Road Projects.

The phase and scale of the project should be considered when determining the stakeholders involved throughout the WQRA process and any associated workshops. Generally, stakeholders should include the project manager, a stormwater engineer/designer for the project, the construction manager for the project, an environmental consultant/advisor and (where the scale or likely level of impact warrants) external stakeholders such as representatives from Local Council, Landscape Boards, the South Australian Environment Protection Authority (EPA). Where Water Quality criteria/targets are unable to be achieved, it will need to be demonstrated that all reasonable and practicable measures have been investigated and assessed and that the activity will not result in environmental harm (as defined under the *Environment Protection Act 1993*).

Throughout the risk assessment, the following should be considered:

- The purpose and nature of the project;
- Legislative compliance requirements;
- The water quality objectives or strategic directions for the catchment;
- Particular environmental concerns raised by the local community;
- The cost of the treatment/opportunity should be proportional to the risk and scale of the project works;
- The risk acceptance criteria for the project. Note that the overarching criteria should include no change or an improvement in water quality and/or the quality of aquatic environments.

The main steps in the risk management process are:

1. Establishing the context;
2. Identifying the risks;
3. Analysing and evaluating the risks; and
4. Identifying treatments for the risks.

The following sub-sections provide further details for each of the main steps.

2.2.1 Establishing the Context

Noting that the nature of the Department's projects can vary, the following should be considered when defining the scope of the WQRA:

- The purpose and nature of the project;
- Legislative compliance requirements noting that some activities are prescribed in legislation and are subject to approvals and licence conditions;
- The water quality objectives or strategic directions for the catchment/project area including:
  - where available, documented in the Regional Landscape Plans (including Water Allocation Plans), Council Water Management Plans and Stormwater Management Plans (where available);
  - consideration of Water Sensitive Road Design (WSRD) measures (for road projects) and WSUD performance targets;
  - consideration of any project specific objectives that have been developed.
- The Green Infrastructure assessment and concept plan (if this has been prepared at the time of undertaking the WQRA);
- Particular environmental concerns raised by the local community.

2.2.2 Identifying the Risks

Every conceivable environmental risk arising from the project should be recorded, as prompted by answers given to the key questions:

- What can happen?
- How and why can it happen?

To carry out this step, a thorough understanding of the local environment in and surrounding the Project Area is required. Knowledge of the methods to be used during construction and the ongoing operational characteristics will also be needed. Information gathered shall be documented to a level of detail appropriate to the likely scale of potential environmental impact of the project.

Risk identification may require input from many areas and other agencies or stakeholders. Various tools are available to obtain input to the process, ranging from individual consultation to a WQRA workshop. An appropriate tool for risk identification and management during the remainder of the process shall be selected to suit the scale and potential environmental impact associated with the project. The WQRA must document who 'owns' the risk and who is accountable for its effective management.

The aspects listed below shall be considered in identifying risks (this list is non-exhaustive and project specific considerations should also be made):

<u>Site Characteristics</u>

- The topography of the site.
- The nature and erodibility of the soils (including potential acid sulfate soils).
- Climate and rainfall patterns.
- The drainage pattern and size of catchments. Where indicated in RD-DK-D1 hydrological modelling shall be undertaken.
- The quality and nature of receiving waters e.g. a water supply reservoir, recreational water body, or protected marine area;
- The quality and depth to groundwater and any pollution transport mechanisms;

- The vegetation and ecology of the site and surrounding area, including the downstream aquatic environment for example important wetlands, aquatic habitat, rare or endangered flora or fauna, or other significant area;
- The land use of the adjacent and downstream areas. Any sensitive land and water uses that may be affected by soil erosion or water quality impacts from the project including downstream water users must be identified, as well as any existing stormwater management treatment measures or reuse of the water resource in place, or planned, downstream of the project;
- The nature and capabilities of any water quality treatment measures already in place downstream of the project area;
- Presence of contaminated soil/groundwater/surface water within and surrounding the Project Area;
- Presence of potential acid sulphate soil material.

Project Characteristics

- The timing and scale of the project;
- Any proposed staging of the project (extent of area under construction at any one time), particularly the area exposed to erosion during high rainfall or potential storm event periods;
- The extent of cut and fill;
- The volume and nature of traffic, extent of commercial vehicles or hazardous loads;
- Potential traffic accident characteristics;
- Concentration or dispersion of stormwater, changing the nature, timing and location and quality of flows or altering flood patterns;
- The extent to which risks can be avoided by management measures;
- The effect of the project on any water quality treatment measures already in place downstream of the project area;
- Impediments to achieving any water quality objectives for the catchment and WSUD objectives for the project;
- Impacts on water quality from scouring and erosion of the project site, with consequent siltation of downstream watercourses, will need to be addressed. Other risks, such as harm to biota and downstream users through changes in flow regime, volumes and peak flows, spilling or leakage of toxic substances used on site, or operational pollutants (for example, sediments and nutrients) shall also be considered.

2.2.3 Analysing and Evaluating the Risks

Risk analysis is accomplished through the examination of all identified risks in relation to two questions:

- How likely is it to occur?
- What is the potential consequence, if it does occur?

The information about the site and the project is examined again to answer these questions.

Once the likelihood and potential consequences have been assigned levels, a qualitative risk analysis matrix provides a simple way to evaluate the level of risk.

Appendix E of AS/NZS 4360:1999 gives examples of qualitative descriptive scales that can be used to assign levels of consequence or impact. Qualitative levels of likelihood are similarly assigned. Refer to Table 2-2 for an example WQRA matrix.

Where the project area crosses multiple waterbodies/water courses/aquatic ecosystems and catchment areas, the specific hazards for each should be identified followed by the analysis and evaluation of risks.

Table 2-2 Example Water Quality Risk Assessment Matrix

Likelihood	Consequence		
	Low Minor adverse social or environmental impact.	**Medium** Measurable adverse environmental or social impact. Will result in annoyance or nuisance to community	**High** Significant damage or impact on environmental systems and local community.
Low The event could occur only rarely, or is unlikely to occur.	Low Risk	Low Risk	Medium Risk (or High if in a sensitive area)
Medium The event will occur occasionally or could occur	Low Risk	Medium Risk	High Risk
High The event will occur often or is most likely to occur	Medium Risk	High Risk	High Risk (or Critical if in a sensitive area)

2.2.4 Treating the Identified Risks

The risk assessment process indicates which risks to water quality require priority attention, during both the operational and construction phases. Table 2-3 provides a general indication of the efforts in treatment and mitigation that would typically be warranted for the risk levels indicated by the process.

Table 2-3 Levels of Risk and Associated Levels of Treatment

Level of Risk	Proposed Level of Treatment
Critical	• Ensure appropriate treatment methods adopted and/or consider alternative project options or alignments to reduce the level of risk • Cost of treatment shall not be the primary consideration • Development and implementation of a detailed Soil, Erosion and Drainage Management Plan (and other water quality plans as required) for construction
High	• Ensure an integrated stakeholder approach and risk management plan in place • Cost of treatment shall not be the primary consideration • A range of treatments shall be applied to the site (i.e. adopt the treatment train approach) • Design of treatments shall be based on a judicious, conservative application of design procedures • Development and implementation of a detailed Soil, Erosion and Drainage Management Plan (and other water quality plans as required) for construction
Medium	• Cost of treatments may be considered. Select in conjunction with the most suitable measures for the site constraints • A range of treatments shall be applied to the site (i.e. adopt the treatment train approach) • Design sizing of treatments, may be at a lower standard than those under the “high” risk descriptor if substantial cost reduction will result for a small increase in potential risk. For example, if reducing the capacity of a detention basin results in significant cost savings for a small increased sediment or pollution risk • Use standard construction site management practices and comply with Master Specification Part PC-ENV2

Level of Risk	Proposed Level of Treatment
Low	• Only low cost operational treatments to be applied • Use standard construction site management practices and comply with Master Specification Part PC-ENV2

Detailed consideration of specific treatment measures to address risks requires answers to the following questions:

- How effective are any existing mitigation measures?
- If not effective, what additional treatments are available and how effective would they be in reducing the risk to an acceptable level?
- Are the additional measures reasonable and practicable?

Where identified targets cannot be met, demonstration of having undertaken all reasonable and practicable measures to meet the general environmental duty, including that the activity will not result in environmental harm is required. For example, where all WSUD targets for a project cannot be met, evidence of communication with stakeholders as well as offset measures must be demonstrated.

Noting that the outcomes of the WQRA will directly influence the design and operation of the project, the following must be considered when making recommendations/prescribing specific treatment measures:

- Incorporation of measures to improve water quality where reasonable and practicable and when they are identified as a requirement from the planning phase. These may include measures such as swale drains, detention basins, gross pollutant traps;
- In developing water quality protection measures liaison should be undertaken with the stormwater authority (e.g. local council) and Landscape Boards;
- Investigation of opportunities for optimising, with appropriate temporary amendments, the joint use of any treatment measures during both construction and operation. Consider the potential for incorporating concepts such as:
  - sediment basins that can be employed in post construction as a gross pollutant trap and sediment basin upstream of a constructed wetland;
  - runoff diversion drains on shallow grades may be converted to grass swales with or without infiltration trenches or check dams, after construction.
- Drainage features shall be designed to maintain or enhance, where possible, the aesthetics and aquatic ecology of the aquatic environment;
- Water quality treatment measures incorporated as an aesthetic or urban design feature in an urban area;
- The on-going maintenance requirements shall be considered as part of the recommendation, selection and design of any water quality management measures;
- Where water quality targets have been set for the project, modelling is required to demonstrate that such targets will/will not be met;
- Where ongoing monitoring has been recommended to determine the effectiveness of the treatment measures, specific details regarding the level and intensity of monitoring must be identified. Where monitoring needs to be undertaken by persons with specific qualifications, this must also be detailed. Further details regarding considerations for a Water Quality Monitoring Plan are presented in Section 2.5.

The South Australian Government Water Sensitive Urban Design Technical Manual should be referred to for further information on design of treatment measures.

2.3 Permits, Licences and Authorisations

As an outcome of the EHIA and WQRA, it shall be determined if any approvals, permits or licenses will be required for the project, for example, under the LSA Act or the EP Act. These may include:

- A Water Affecting Activities (WAA) Permit or a water licence under the LSA Act for water affecting activities and/ or the taking of water.

  Refer to the relevant Landscape Board website for further information as well as the Department's Water Affecting Activities Best Practice Operating Procedure.

- An EPA Environmental Authorisation for prescribed activities under the EP Act.

With respect to the taking of water, the following is noted:

- Applications for the taking of water are assessed by the Department for Environment and Water (DEW) Water Licencing Branch in accordance with the provisions of a Water Allocation Plan specific to the water resource affected.
- Provision of a flood diversion channel or the construction of a wetland as part of a construction project may be considered to constitute the "taking of water" and advice should be obtained from the relevant Landscape Board. Construction of a wetland is likely considered the construction of a water body (dam) and a WAA permit will be required.
- Taking of water for certain uses (such as use of water for road making) from a prescribed watercourse, lake or well or from a prescribed area may be authorised by the responsible Minister. Notwithstanding such authorisation, all reasonable measures must be undertaken by the Department and its contractors to investigate and utilise alternative sources of water such as reclaimed water, treated stormwater etc. to avoid the use of prescribed water, particularly in drought years.
- If there is uncertainty as to whether a project will constitute the 'taking of water' that requires a permit, clarification must be sought from the Water Resource Officer at the relevant Landscape Board.

2.4 Soil Erosion Drainage Management Plan

Construction activities disturb soil and once disturbed it may be easily eroded and move outside of the Project Area into stormwater drains/waterways, becoming a significant source of sediment pollution in waterways. Water quality management on a construction site must be incorporated at all stages of infrastructure development including planning, design and construction. A 'best management practice' approach shall be adopted, utilising the best available methods, technologies and designs to achieve the goal of pollution minimisation in a practical and cost-effective manner.

Site management needs to be in compliance with the EPA Stormwater Pollution Prevention Code of Practice for Local, State and Federal Government and the EPA Code of Practice for the Building and Construction Industry. These codes inform organisations of their 'general environmental duty' with respect to stormwater under the EP Act, and the best management practice approach to stormwater pollution prevention.

A Soil Erosion and Drainage Management Plan (SEDMP) is the document used to manage erosion, sedimentation and water quality on the construction site. The SEDMP must identify the drainage flows within the Project Area and the treatment measures required to manage them. It needs to be a living document and able to be modified as construction progresses and flexible to predict and respond to changes on the construction site.

The EPA Stormwater Pollution Prevention Code of Practice for Local, State and Federal Government provides a guide to the preparation of a SEDMP. The WQ EPP 2015 specifies that a number of pollutants cannot be discharged to the stormwater system or onto land where they may enter waters. The SEDMP must be designed to ensure that such pollutants do not reach the stormwater system and/ or waterways.

The key intent of a SEDMP is to ensure that appropriate consideration is given to erosion and sediment control requirements **before** works commence. Appendix A of this document provides a checklist of issues that a Contractor shall take into consideration when preparing a SEDMP. The SEDMP should be informed by the WQRA undertaken during the Proving/Pre-Delivery/Delivery phase of a project.

The level of detail required in the SEDMP should be determined by the scale and risk of the project works. A simple SEDMP may be prepared for projects with a low risk of soil erosion drainage impacts whilst a more comprehensive SEDMP will be required for projects with medium and high risks of soil erosion drainage impacts. Major projects would require a comprehensive or detailed SEDMP to be prepared and implemented.

The following guide may be utilised to determine the level of SEDMP to be adopted for the project. It should be undertaken in the Pre-delivery or early in the Delivery phase and documented in the EHIA Report and subsequent SEDMP:

- Refer to Table 2-4 to conduct an initial site erosion risk assessment for a project.
- Refer to Table 2-5 to determine the nature of documentation and management of the site required during the construction phase based on the score obtained by adding the individual factors from Table 2-4.

Table 2-4 Initial Site Erosion Risk Assessment

Parameter	Ranges	Score
Location (for determining erosivity)	Areas over 500mm rainfall	2
	Other areas	1
Average slope before construction works (from topographical maps of the site)	Not greater than 2 percent	1
	Greater than 2 to 5 percent	2
	Greater than 5 to 10 percent	4
	Greater than 10 percent	8
Soil type by Universal Soil Classification (where there is more than one type, select the highest score)	Sandy soil or gravel	0
	Sandy loam	1
	Clay loam	2
	Clay soil	3
Expected duration of risk undertaken at any one time	3 months or less	1
	3 to less than 6 months	2
	6 to less than 12 months	4
	Longer than 12 months	8
Expected area disturbed at any one time	Less than 500 m^2	1
	More than 500 m^2 but not exceeding 1000 m^2	2
	More than 1000 m^2 but not exceeding 2500 m^2	4
	More than 2500 m^2	8
Sensitivity of receiving environment	Highly disturbed system	0
	Slightly to moderately disturbed system	2
	High conservation or ecological value system	4
	Total	**To be calculated**

Table 2-5 Detail Required for SEDMP

Score	Level of Risk	Site Assessment Requirements
Over 20	Extreme	Detailed SEDMP High level of site management Third party auditing with regular (e.g. fortnightly or monthly) reporting to demonstrate compliance
16 to 20	High	Detailed SEDMP High level of site management Self-auditing with regular (e.g. fortnightly or monthly) inspections/reporting to demonstrate compliance
10 to 15	Moderate	Medium level SEDMP Self-auditing with regular (e.g. fortnightly or monthly) inspections/reporting to demonstrate compliance
0 to 9	Low	Simple SEDMP Self-auditing with regular (e.g. fortnightly or monthly) inspections/reporting to demonstrate compliance

The SEDMP shall form part of the Contractor's Environmental Management Plan (CEMP). The SEDMP shall describe the range of measures proposed for managing the site and responses to the issues raised

during the Proving/Pre-Delivery/Delivery project planning phases, the EHIA process and/or the WQRA process (as well as any Contract Documentation). For example, the SEDMP shall include a plan of the high risk areas within the Project Area and identify the proposed management measures such as use of silt fences, temporary stabilisation, straw bales, sand bags, cut off drains, sedimentation basins.

2.4.1 SEDMP for Sites of Low Erosion Risk – Simple SEDMP

A simple SEDMP should include a figure/series of figures detailing the following:

- North point and plan scale;
- Site and easement boundaries and adjoining roadways;
- Construction access points;
- Site office, car park and location of stockpiles;
- Proposed construction activities and limits of disturbance;
- Retained vegetation including protected trees;
- General soil information and location of problem soils;
- Location of critical environmental values (where appropriate);
- Existing site contours (unless the provision of these contours adversely impacts the clarity of the SEDMP);
- Final site contours including locations of cut and fill;
- General layout and staging of proposed works;
- Higher risk areas of the site;
- Location of all drainage, erosion and sediment control management and water quality protection measures that will be utilised, if required, for example silt fences, hay bales, water diversion systems (i.e. to divert clean water away from disturbed areas), stockpile protection measures and sediment traps;
- Site revegetation requirements (if not contained within separate plans);
- Any other relevant information that may be required by a regulating body or to satisfy any conditions of environmental authorisations; and
- Contractors shall indicate responsibilities for and frequency of site monitoring to ensure environmental protection.

A simple SEDMP and Water Quality Monitoring Plan (if required) shall be included within the project's CEMP.

2.4.2 SEDMP for Sites of Moderate Erosion Risk – Medium SEDMP

In addition to the requirements listed for the Simple SEDMP, a medium SEDMP should include the following:

- Construction drainage plans for each stage of earthworks, including land contours for that stage of construction, sub-catchment boundaries and location of watercourses;
- Details of the construction treatment measures to be deployed (and associated durations), including the location, size and type of all construction-phase water quality treatment measures;
- For the construction treatment measures that will not be deployed throughout the full period of construction, the stages at which various measures will be deployed;
- Calculation sheets for the sizing of any water quality treatment measures;
- Responsibilities for site environmental management;
- Emergency response measures;
- The nature and frequency of site inspection and monitoring (including any water quality monitoring); and
- The nature and frequency of site reporting.

A medium SEDMP and Water Quality Monitoring Plan (if required) may be included within the project's CEMP or be standalone documents.

2.4.3 SEDMP for Sites of High Erosion Risk – Detailed SEDMP

In addition to the requirements listed for the Simple and Medium SEDMP, a detailed SEDMP should include the following:

- How the issues identified within the EHIA, WQRA and contract documents will be managed on site. This may include situations where off-site conditions may either affect the management of the site during construction, or be adversely affected by soil loss from the site. Appropriate operations-phase treatment measures will need to be incorporated into the site design;
- Full design and construction details (e.g. cross-sections, minimum channel grades, channel linings) for all drainage and sediment control devices and measures, including diversion channels and sediment basins;
- The location of proposed stormwater discharge point(s) from the site, both during and following completion of construction;
- Limits of site disturbance including areas of cut and fill volumes at each disturbance location and proposed stockpile areas;
- Site plans (e.g. Site Environmental Plans /Project Control Plans) that identify types of sediment and erosion control measures and their locations for all stages of construction works; and
- Water Quality Monitoring Plan (refer Section 2.5)

The Detailed SEDMP shall form a sub-plan to the project's CEMP.

2.5 Water Quality Monitoring Plan for Construction

Where identified to be required (during Proving/Pre-Delivery/Delivery phase project panning, EHIA, WQRA and/or Contract Documentation), water quality monitoring of the Project Area shall be undertaken to detect pollution discharges and to assess the potential impact of such discharge on the aquatic environment.

During the delivery of a project (construction phase), monitoring must be undertaken to determine if site management practices and mitigation measures are successful in preventing sediment, waste waters or pollution from entering drainage lines/waterways or impacting water quality to an unacceptable level. The level and duration of monitoring required is determined by a number of factors, including an evaluation of the nature of a threat from a discharge and the level of protection required for the environment. Generally the greater the potential environmental risk posed by a project, the more rigorous and complex the monitoring requirements become.

The type and frequency of water quality monitoring should be based on previous risk assessment and recommendations made by suitably qualified persons. The level of monitoring required should be determined with consideration of the following criteria:

- The nature of the threat from a discharge;
- The level of protection for the environment as determined with reference to the Australian and New Zealand (2018) Guidelines for Fresh and Marine Water Quality categories of ecosystem conditions (i.e. high conservation/ecological value systems, slightly to moderately disturbed systems, highly disturbed systems); and
- The environmental value of the waters, as prescribed in the WQ EPP 2015.

A Water Quality Monitoring Plan (WQMP) must be prepared to ensure that monitoring will be undertaken in accordance with legislative requirements and relevant guidelines, achieve the required objectives and that collected data will be of good quality. The plan must include details of the following:

- The monitoring objective;
- A description of the receiving environment;
- Details of the legislative framework relevant to the monitoring plan;
- The approach and methodology of the monitoring works including sampling frequency;

- Parameters to be measured and analysed, including analytical method (where relevant). Standard parameters include salinity, turbidity, pH and dissolved oxygen;
- The criteria against which monitoring results will be assessed;
- A map showing the sampling locations, major infrastructure and sensitive environmental receptors. Generally, sampling locations include within the Project Area, downstream of construction activities/ discharge points and a background/control location;
- Data quality control and assessment processes;
- The method and frequency of reporting;
- A monitoring plan review process to allow for corrective actions; and
- Work health and safety requirements.

Where there is a risk that project works will mobilise known contamination (for example, heavy metals or other leachable contaminants and/or potential acid sulphate soils or present a biological risk), a site contamination professional as well as other technical experts shall be consulted when designing the water quality monitoring plan.

For lower risk construction activities (within the Project Area) where discharges can only enter highly disturbed systems or moderately disturbed systems, the monitoring activities and criteria as detailed in Table 2-6 may be sufficient.

Table 2-6 Water Quality Monitoring Requirements - Low Risk Activities in Disturbed Systems

Scenario	• Low risk construction activities (within the Project Area) or activities where discharges may only enter highly disturbed systems or moderately disturbed systems
Monitoring Method	• Visual inspection of site erosion and drainage management measures • Visual inspection of drainage discharge points • Photo Points • Temperature and rainfall from nearest Bureau of Meteorology station
Frequency	• Weekly and during rainfall events
Criteria	• Sediment traps clear and available for trapping sediment • No visible sediment discharge in receiving waters
Equipment	• Camera
Expertise	• Monitoring may be undertaken by Contractor's Environmental Management Representative or staff with supervisory responsibilities, good observational skills and ability to reliably assess, record site condition.

Where potential soil erosion and drainage discharge points may enter high conservation/ ecological value systems or slightly to moderately disturbed systems, and for all other scenarios (other than that represented in Table 2-6), the water quality monitoring plan must be prepared by a suitably qualified person to ensure that the monitoring plan meets legislative requirements, conditions of any approvals sought as well as meeting the Contractor's general environmental duty. During the preparation of the WQMP, the following should also be considered:

- Monitoring frequency and criteria must be sufficient to address the WQ EPP 2015 or any other policies/guidelines relevant to the receiving water body/water course/aquatic ecosystem;
- Continuous or automated monitoring of adjacent watercourses, up and down stream, during flow events with manual sampling at minor discharge points may be required to demonstrate the effectiveness of implemented control measures;
- Field testing results may require validation via supplemental laboratory analysis;
- Where undertaken, all laboratory analysis is to be undertaken by National Association of Testing Authorities, Australia Accredited laboratories only;
- Sample collection should be undertaken by appropriately trained persons only. Biological samples must be collected and analysed by a skilled ecologist;

- For extreme risk work activities or works undertaking in high conservation/ecological value areas, baseline and follow-up monitoring may be required; and
- The plan must include contingency measures detailing actions to be adopted where there are exceedances of adopted guidelines/screening criteria.

For all water quality monitoring, the associated reporting should demonstrate performance of the water quality protection measures, compliance against the adopted screening/ guideline criteria and provide details of corrective measures implemented.

3 Reporting

Unless specified otherwise in Contract Documentation the following reporting applies to each phase of a project. Completed reporting shall be provided to the Principal for review and acceptance by Department's Technical Services Environment Unit and Independent Design Certifier (where specified in Contract Documentation).

3.1 Proving

During the Proving phase of a project, water quality impact assessment information may be required for input into an options assessment, the EHIA Report and to inform the cost estimation of the project.

Preliminary Impact Assessment information

The outcomes of a preliminary impact assessment (refer to the assessment outcomes detailed in Section 2.1.1) and supporting documentation are to be incorporated into the preliminary EHIA. The impact assessment should also be summarised in the planning and/or design reports. Where multiple project options are being assessed and compared, the preliminary impact assessment outcomes are to be reported in a suitable location to inform such option comparisons.

3.2 Pre-Delivery/Delivery

During the Pre-Delivery/Delivery phase of the project, water quality impact assessment may be required for input into the EHIA Report, to inform project design and the approvals pathway for the project.

Detailed Impact Assessment information

The outcomes of a detailed impact assessment (refer to the assessment outcomes detailed in Section 2.1.2) and supporting documentation are to be incorporated into the EHIA report and/or Detailed Design Report(s). The impact assessment should also be summarised in the planning and/or design reports.

AND

Water Quality Risk Assessment

The WQRA report shall contain the following information as a minimum:

- General site and project information;
- A summary of relevant legislation;
- Details of the participants involved in the WQRA;
- Summary of the approach and methodology of the WQRA in accordance with the process detailed in this guideline;
- Clear and concise WQRA in accordance with the process detailed in this document; and
- Details of the required level of SEDMP and Water Quality Monitoring for specific project activities.

The WQRA is to be incorporated into the EHIA report and/or Detailed Design Report(s)

The following information is to be provided during the Delivery phase of a project once the construction methodology has been established:

Soil Erosion Drainage Management Plan

SEDMPs are required to address the requirements for the different level SEDMPs as detailed in Section 2.4.

AND

Water Quality Monitoring Plan

The WQMP is required to address the requirements as detailed in Section 2.5.

Water quality monitoring results (in comparison to guideline criteria) must be readily available to be provided to the Department upon request and as per the specified frequency in contract documents.

AND

Stormwater treatment devices are installed throughout the Department's infrastructure network. The Department maintains a Stormwater Treatment Infrastructure Manual (STIM) to ensure that such infrastructure is maintained in a manner that meets the initial design objectives.

Handover Documentation

The following information is to be recorded and submitted for the installed stormwater treatment infrastructure:

- Location and identification details;
- Physical details;
- Water treatment design objectives; and
- Maintenance requirements to achieve initial design objectives.

This information is to be provided in the project handover documentation and, where relevant, in accordance with the specifications detailed in MS DK-DK-D1.

3.3 Realisation

During the Realisation phase, ongoing maintenance of water quality treatment measures will be required in accordance with handover documentation.

Appendix A – SEDMP Checklist

The following sub-sections detail some key factors to be considered when developing a SEDMP:

Earthworks

- Undertake earthworks in a manner that conserves topsoil and minimises disturbance. Separate topsoil and store for use in rehabilitation.
- Avoid any soil disturbance beyond the limit of approved development.
- Where possible, avoid disturbance to areas of high or extreme erosion risk.
- Use appropriate treatment measures to treat runoff.
- When necessary, install erosion and sediment control structures before the commencement of site disturbance and construction works.
- Schedule earthworks to retain as much protective ground cover as possible at all times.
- Program site stabilisation and revegetation as soon as possible after completion of earthworks.

Drainage

- Divert off site and “clean” drainage around disturbed areas.
- Intercept and redirect runoff on the site to protect exposed areas.
- Where appropriate, install sediment detention basins early so that site drainage can be directed to them as soon as possible.
- Consider the impact of all works including minor works such as service trenches, pavement cutting.

Treatment Train Approach

- Use a treatment train approach to minimise erosion and velocity of runoff to reduce the need, size and cost of sediment collection basins. For example:
- Locate catch (diversion) drains above proposed cuttings where upslope drainage is into the cutting area;
- Construct diversion drains to protect slopes by directing intercepted drainage to a stable outlet;
- Construct batter toe or catch drains to collect runoff from batter slopes. Direct to drainage system or watercourse;
- Protect minor drainage lines to slow water velocities and filter sediment with measures such as sand bags, hay bales, silt fences, gabions or local materials. Typically, these are suitable for drainage areas of less than 0.5 hectares. Construct level spreaders to convert concentrated flows to sheet flow at non-erosive velocities. Direct sheet flow across stabilised, vegetated areas; and
- Where conditions permit, use grass filter strips as a simple sediment trapping measure. These are more effective on low gradient slopes.
- Where possible retain or convert site treatment measures for operations phase water quality treatment. Sediment detention basins may be either temporary, or can be integrated into the operations-phase treatment system. For example, a sediment basin used in construction may be converted at a later stage into a sediment trap upstream of a wetland system.

Site Facilities

- Ensure site facilities such as depots, access tracks and stockpile sites are identified and established in appropriate locations.
- Ensure sediment controls around these areas where there is an erosion risk exists.
- Ensure sediment controls at site exits such as shaker ramps, washdown bays or street sweeping to minimise off site sediment from vehicles.

Landscaping and Rehabilitation

- Begin rehabilitation of disturbed areas as soon as possible after final land formation for each area. Options available include installation of the permanent landscape or a temporary cover of

a sterile or non-seeding grass species (e.g. sterile rye grass), chipped or mulched vegetation, biodegradable mats or soil binders.

Inspection and Monitoring

- Regularly inspect and maintain all treatment devices on site. Check that suitable site measures are in place prior to rain events. After each significant runoff event, inspect treatment devices for damage or clogging by silt or debris and replace or clean out as necessary.
- Ensure temporary drainage measures such as diversion channels are in place on site at the end of each day, particularly if rain is forecast.
- Ensure all environmental authorisation conditions are complied with.
- On sensitive sites, where appropriate, or where required by contract or licence conditions, undertake water quality monitoring to effectively manage the site. Such monitoring should be undertaken simultaneously up stream and down stream of the site and include stream flow.
- Inspection and management measures should be documented as part of the records of implementation of the SEDMP and Weekly Site Reports and be made available to the contract manager. Records should include details of rainfall; water quality testing (if required); the effectiveness of site management measures and any modifications proposed; and other matters which contribute to the level of performance of work practices.
- If inspection and monitoring indicates a notable failure in the SEDMP, the source of the failure should be investigated and remediation measures undertaken and procedures modified, as appropriate.

Site Waste Management

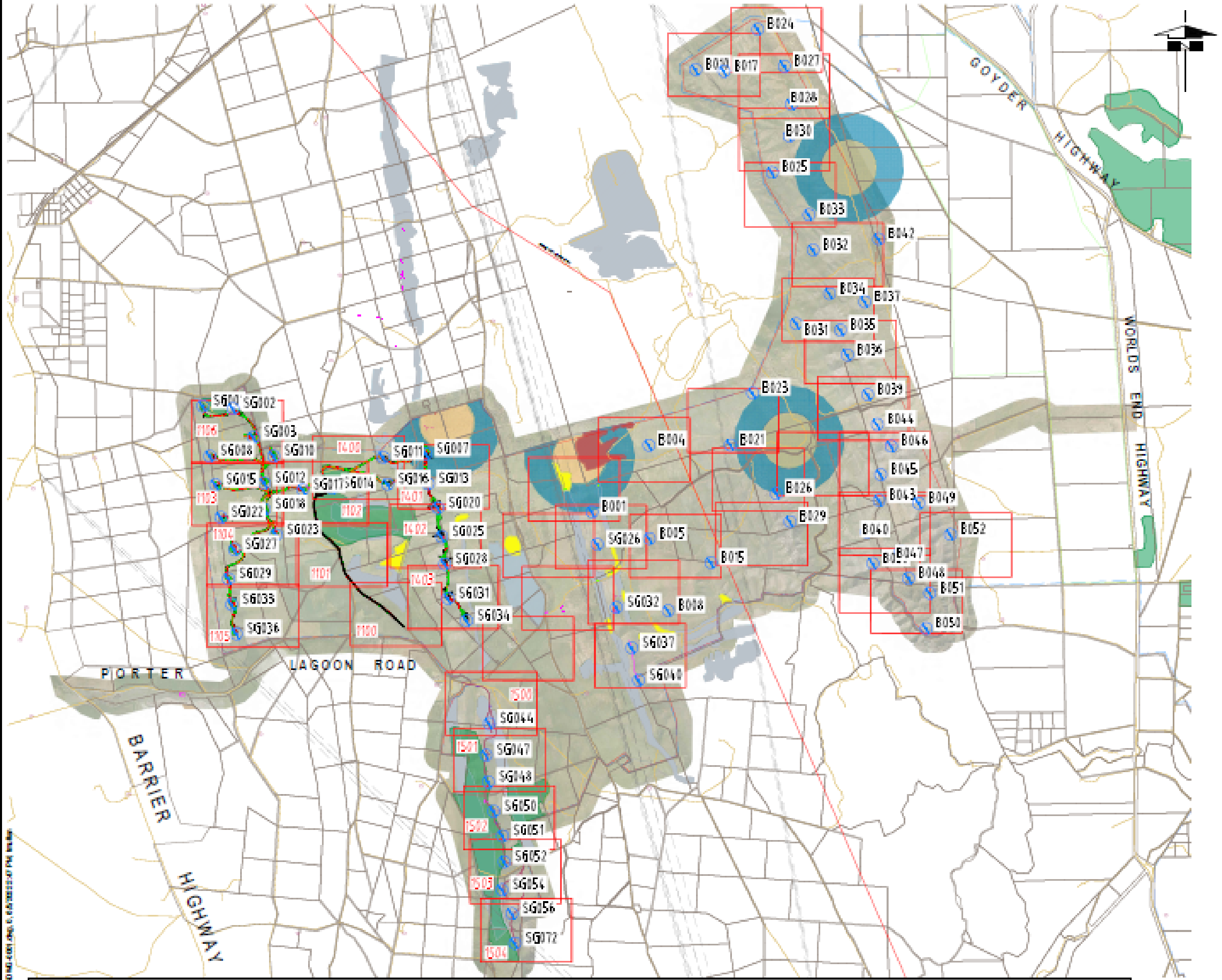
- Minimise the risk of pollution from other construction activities by adopting the following:
  - Appropriate collection and disposal of wastes;
  - Undercover storage and suitable bunding of materials such as paints, chemicals, fuel etc;
  - Suitable disposal of washdown waters from cleaning vehicles;
  - Discharge of wastewater and wash water in an approved manner to a sewer (if applicable), or approved disposal site.

Further waste management and chemical storage requirements are detailed in the Department's Master Specification.

Appendix II

GOYDER SOUTH WIND FARM OVERALL SITE PLAN DRAWINGS INDEX

GOYDER SOUTH WIND FARM



DRAWING INDEX

DRAWING NUMBER	DRAWING TITLE
GSWF-ELECNOR-CIV-DWG-0001	OVERALL SITE PLAN
GSWF-ELECNOR-CIV-DWG-0002	TURBINE COORDINATES
GSWF-ELECNOR-CIV-DWG-0003	EXTERNAL LAYOUT PLAN
GSWF-ELECNOR-CIV-DWG-0004	STAGING PLAN
GSWF-ELECNOR-CIV-DWG-0005	SITE CONSTRAINTS PLAN - SHEET 1
GSWF-ELECNOR-CIV-DWG-0006	SITE CONSTRAINTS PLAN - SHEET 2
GSWF-ELECNOR-CIV-DWG-0007	ROAD HIERARCHY PLAN
GSWF-ELECNOR-CIV-DWG-0008	EXTERNAL LAYOUT PLAN - SHEET 2
GSWF-ELECNOR-CIV-DWG-0010	REFERENCE DESIGN PLAN 1
GSWF-ELECNOR-CIV-DWG-0011	REFERENCE DESIGN PLAN 2

GENERAL NOTES:

1. SURVEY BY CLIENTS
   - AUSTRALIAN HEIGHT DATUM (AHD)
   - MGA 2020 ZONE 54
2. THE CONTRACTOR SHALL VERIFY THE LOCATION AND DEPTH OF ALL EXISTING SERVICES BEFORE COMMENCING WORKS.
3. CONTRACTOR TO VERIFY ALL LEVELS AND SETTING OUT DIMENSIONS WITH THE SURVEY DOCUMENTATION, AND OTHER RELEVANT PARTIES ON SITE PRIOR TO COMMENCEMENT OF ANY WORK.
4. ALL DESIGN LEVELS SHOWN ON THE DRAWINGS ARE FINISHED SURFACE LEVELS, UNLESS NOTED OTHERWISE.
5. CONTRACTOR SHALL EXAMINE AND COMPLY WITH THE RECOMMENDATIONS OUTLINED IN THE GEOTECHNICAL INTERPRETIVE REPORT.
6. THESE DRAWINGS BE READ IN CONJUNCTION WITH ALL ENGINEERING AND OTHER CONSULTANTS DRAWINGS AND SPECIFICATIONS.
7. ALL CONSTRUCTION WORKS TO BE IN ACCORDANCE WITH THE CIVIL SPECIFICATION.
8. GEOTECHNICAL SUPERVISION SHALL BE PROVIDED FOR ALL HARDSTAND PADS, ROADS AND LAYDOWNS LOCATED IN FILL. REFER SPECIFICATION.
9. ROAD AND HARDSTAND PAVEMENTS DESIGNS HAVE BEEN BASED UPON THE NOMINATED CBR'S. SHOULD SUBGRADE CONDITIONS NOT ACHIEVE THIS REQUIREMENT THICKER PAVEMENT DESIGNS MAY BE REQUIRED.
   - ROAD AND HARDSTAND PADS IN ACCORDANCE WITH THE PROJECT SPECIFICATION REQUIREMENTS.
   - MAX HARDSTAND CROSS FALL 1% (CRANE LIFTING AREA).
   - MAX ROAD CROSSFALL 3%.
   - MAX LONGITUDINAL ROAD GRADE 15%.
   - MIN VERTICAL RADIUS 400m.
   - MIN HORIZONTAL RADIUS 100m WITH ROAD WIDENING (DESIRABLE 150m).
10. GUIDE POSTS TO BE PROVIDED AT THE FOLLOWING LOCATIONS:
    - SITE ENTRANCE.
    - CULVERTS AND FLOODWAYS.
    - OVERTAKING BAYS.
    - VEHICLE TURNAROUNDS.
    - FILL AREAS WITH LARGE DROP OFFS (REFER DETAILS FOR PLACEMENT LOCATIONS).
    - THE SPACING OF GUIDE POSTS SHALL BE IN ACCORDANCE WITH AS 1742.2-2009.
    - GUIDE POST SELECTION TO BE PRE-AGREED WITH GE PRIOR TO INSTALLATION.
11. DESIGN VEHICLES:
    - WIND FARM ROADS AND TURBINE ENTRANCES CATER FOR WIND FARM BLADE TRUCKS CARRYING THE LARGEST BLADE SIZE.

No.	DESCRIPTION	DES	DRN	CKD	APD	DATE
0	ISSUED FOR CONSTRUCTION		TSM	JH	RB	05.05.22
C	80% DESIGN REVIEW ISSUE		TSM	JH	RB	25.03.22
B	30% DESIGN REVIEW ISSUE		TSM	JH	RB	18.02.22
A	ISSUED FOR INFORMATION		TSM	JS	RB	29.10.21

REVISION HISTORY

STAGE 1A & 1B

WGA
WALLBRIDGE GILBERT AZTEC

ACONEX DOC No. GSWF-ELECNOR-CIV-DWG-0001

SIZE: A1 | SCALE: AS SHOWN

STATUS: CONSTRUCTION ISSUE

PROJECT: GOYDER SOUTH WIND FARM

TITLE: CIVIL WORKS
OVERALL SITE PLAN

DRAWING No. GSWF-ELECNOR-CIV-DWG-0001 | Rev. 0

Appendix III

PHASE 1 DESIGN DRAWINGS

ecological AUSTRALIA
A TETRA TECH COMPANY

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www.ecoaus.com.au