Greater Connect
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Great Eastern Highway Bypass Interchanges

Helena River Bridge 1899 – Erosion and Sediment Control Plan

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Abbreviation

Abbreviation	Definition
ACM	Asbestos contain material
BTEXN	Benzene, toluene, ethylbenzene, total xylenes and naphthalene
CoC	Chain of custody
CoPC	Contaminants of potential concern
CSM	Conceptual Site Model
CTSL	Coal Tar Stabilised Limestone
DER	DWER (formerly Department of Environmental Regulation)
DPP	Direct Push Probe Pty Ltd
DWER	Department of Water and Environmental Regulation
ESL	Ecological screening level
GCA	Greater Connect Alliance
GEHB	Great Eastern Highway Bypass
GEHBI	Great Eastern Highway Bypass Interchanges
HIL	Health investigation level
HSL	Health screening level
IFC	Issued for Construction
ML	Management limits
NATA	National Association of Testing Authorities accredited laboratory
NEPM	National Environment Protection Measures
PAH	Polycyclic aromatic hydrocarbons
PID	Photo-ionisation detector
PSP	Principle shared path
QA/QC	Quality assurance/quality control
SWMS	Safe Work Method Statement
TEC	Threatened ecological communities
TRH	Total recoverable hydrocarbons
WP	Work Packages
WP4	Work Package 4
VOC	Volatile organic compounds

1. Project Overview

Roe Highway and Great Eastern Highway Bypass (GEHB) are strategic road corridors in Perth's north-east (Figure 1). They provide critical connections between Great Eastern Highway, Tonkin Highway and the Perth Metropolitan Road network and support access to many key economic zones including Perth Airport precinct, the Kewdale, Hazelmere and Canning Vale industrial areas and freight distribution centres.

The intersections of Roe Highway/GEHB and GEHB/ Abernethy Road experience high congestion and a high number of accidents, directly associated with the volume and diverse mix of traffic. This is expected to worsen with the planned closure of Stirling Crescent, which will divert more vehicles onto Abernethy Road.

In April 2019, the Federal and State Governments initiated a remedy by allocating funds for the planning, development, and construction of two new grade-separated interchanges on GEHB, at the intersections with Roe Highway and Abernethy Road.

The current planning and development for these interchanges considers the proposed realignment of the Midland Freight Rail, development around Airport North, the Kewdale-Hazelmere Regional Integrated Masterplan, reviews of local land use, updated traffic modelling and additional works planned on local government roads.

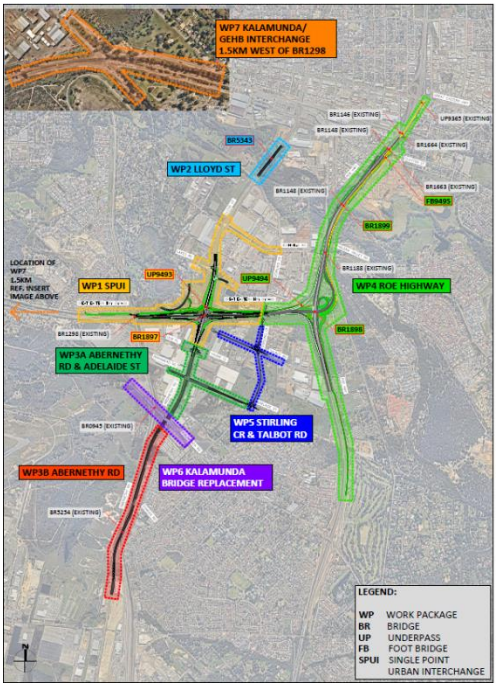


Figure 1 – Project site overview

In April 2020, the Western Australian Government announced the fast-tracking of the tendering process for a number of important projects, including the GEHBI Project, with the intent to commence construction works in 2021.

1.1 Major Elements of the Project

- A new grade separated interchange at Roe Highway and GEHB
- Upgrade works to Roe Highway from GEHB to Clayton Street
- Duplication of the Roe Highway Bridge over the Helena River
- New grade separated interchange at GEHB and Abernethy Road
- Construction of a four-lane bridge over the Helena River providing connection between the northern and southern sections of Lloyd Street
- Connection of Lloyd Street to GEHB
- Connection of Adelaide Street to Abernethy Road
- Duplication of Abernethy Road between GEHB and Avonside Crescent.
- New principle shared path (PSP) sections on Roe Highway and GEHB
- PSP under/overpasses at Roe Highway/GEHBI
- PSP under/overpasses at Abernethy Road/Lloyd Street interchange
- Rehabilitation, landscaping, and revegetation over the disturbed and degraded areas of the site, including hard landscaping
- Production and integration of urban design elements, incorporating public art works and improved amenities.
- Upgrade of the intersection of Abernethy and Kalamunda Road including the bridge replacement over ARC rail on Kalamunda Road. The new Bridge must provide for a dual carriageway and shared path connections on both sides with the formation to tie into the existing Kalamunda Road at grade west of the new structure.
- Planning and development for a new grade separated interchange of GEHB and Kalamunda Road for the Perth Airport Northern Precinct.

The primary objectives of the Project are to provide efficient and safe road access for all road users and to provide road infrastructure that supports economic development. In its delivery, the Project provides opportunity for innovative design and construction approaches to bring superior value for money and minimised risk to Main Roads, and to provide upskilling and employment opportunities for lower-tier contractors and Aboriginal people.

1.2 Scope of Project

Greater Connect Alliance (GCA) will be responsible for completing all the outstanding project development activities, then commence design and construction. The main project development deliverables the Participants must undertake during the project development phase are as below:

- Complete detailed site surveys
- Complete geotechnical and hydrogeological investigations
- Undertake a pavement condition assessment
- Identify the location of potentially contaminated sites
- Prepare a materials sourcing strategy
- Prepare 3D design models to assess design options
- Update land dealing plans
- Identification of complex or costly accommodation works
- Undertake noise assessment and develop a mitigation strategy
- Recommend the extent and type of street lighting
- Prepare conceptual layout of guide signs
- Develop safety barrier strategy
- Identification of major service relocations
- Determination of the extent of visual screening
- Undertake traffic analysis
- Obtain Network Operations sign-off of traffic analysis
- Develop RAV and OSOM network requirements
- Review detailed design criteria
- Establish operational requirements of the intelligent transport systems
- Undertake design optioneering
- Develop an Urban and Landscape Design Strategy
- Develop a sustainability management plan
- Community and stakeholder engagement
- Prepare community and stakeholder engagement plan
- Obtain planning approvals
- Obtain environmental, Aboriginal heritage and other approvals
- Review and refine the Ultimate Concept Design
- Assess design options for the Project Case
- Prepare 15% Concept Design for the preferred Project Case.

The design and construction phases incorporate the detailed design of the scope of the project from 15% through to 'Issued for Construction' (IFC) and delivery of the physical work. This includes:

- Highway incorporating grade separated interchanges and upgrades
- Other roads and bridge over Helena River connecting local government road network to Highway
- PSP and Paths
- Urban and Landscape Design and Public Art
- Design Verification
- Design Process
- Traffic Engineering and Management
- Testing, monitoring, independent quality certifier and Measure of Pavement condition performance
- Community and Stakeholder Engagement
- Road Maintenance
- Handover
- Defect correction

Due to the size and scale of the proposed development, the Site has been divided into seven Work Packages (WP):

WP1 – GEHB

WP2 – Lloyd Street Bridge

WP3A – Abernethy Road and Adelaide Street

WP3B – Abernethy Road

WP4 – Roe Highway

WP5 – Stirling Crescent Upgrade

WP6 – Kalamunda Road bridge over Rail widening

WP7 – Kalamunda Road / GEHB interchange (planning study).

2. Introduction

2.1 Scope

This Helena River Bridge 1899 Erosion and Sediment Control Plan (ESCP) sets out the framework for the management of erosion and sedimentation risks associated with the construction of Bridge 1899 over the Helena River as part of Work Pack 4 of the Project. Bridge 1899 duplicates an existing bridge, part of the existing Roe Highway, immediately to its west. The Plan also addresses management of impacts to the adjacent un-named wetland located to the east of Roe Highway and south of Helena River.

Bridge 1899 and the Helena River are shown below on Figure 2. The *Swan and Canning River - Development Control Area* (DBCA-028), which includes an exclusion area for the Helena River that passes through the Project site, is marked in red.

Figure 2 – Bridge 1899

2.2 Objectives

The objectives of this Plan are adopted from the Water Quality, Erosion and Sediment Control Environmental Risk Action Plan:

- Compliance with contractual and legislative requirements to ensure effective management of erosion and sedimentation are planned and implemented.
- To establish Erosion and Sediment Control (ESC) measures prior to and during excavations and associated construction activities so that negligible environmental, infrastructure and social impact results.
- To implement procedures and drainage designs prior to, and during site activities, so that water quality, stormwater discharge and site drainage is maintained at standards that preserve the natural hydrology and water quality in the Project area.

3. Management Framework

3.1 Acts, Regulations, Guidelines and Standards

The WA Government has published several legislative acts that are relevant to the prevention of soil erosion and for the conservation and reclamation of soil. In severe cases, legislative provisions can be enacted to help protect sensitive areas. The following acts and regulations are applicable to this Plan:

- *Environment Protection and Biodiversity Conservation Act 1999*
- *Environmental Protection Act 1986*
- *Waterways Conservation Act 1976*
- *Soil and Land Conservation Act 1945*
- *Country Areas Water Supply Act 1947*
- *Right in Water and Irrigation Act 1914*
- *Waters and Rivers Commission Act 1995*
- *Environmental Protection Regulations 1987 (WA)*
- *Environmental Protection (Unauthorised Discharges) Regulations 2004*

The following technical guidelines are also applicable:

- WA Development Design Specification D7 – Erosion Control and Storm Water Management
- International Erosion Control Association (IECA) 'Best Practice Erosion and Sediment Control (BPESC)'
- WA Department of Water (DoW) 'Water Quality Protection Note 52: Stormwater management at industrial sites'
- Australian and New Zealand Environment Conservation Council (ANZECC) and Agriculture and Resource Management Council of Australian and New Zealand (ARMCANZ) (2000) Australian Water Quality Guidelines (AWQG) Fresh water aquatic ecosystem.
- Stormwater Management Manual for Western Australia: Best Management Practice.
- The Importance of Western Australia's Waterways.
- Western Australia Development Design Specification D7 – Erosion Control and Storm Water Management.

3.2 GCA Environmental Management Framework

The Great Eastern Highway Bypass Interchanges Environmental Management Plan (EMP) (GEHBI-GCA-PLN-A000-PM-00012) sets out the overall governance of the environmental compliance framework for the construction of the Project.

Currently appended to the EMP are various Environmental Risk Action Plans (ERAPs), including the Water Quality, Erosion and Sedimentation (WQES) ERAP. Objectives of the WQES are included in Section 2.2 and have been adopted as the objectives of this plan. The WQES also includes the following targets:

- Maintain or improve surface and groundwater quality, and prevent deterioration due to erosion and/or sedimentation.

Further controls, resources, responsibilities, monitoring and reporting items are contained within the WQES ERAP and applied within this ESCP.

3.3 Approvals and Permits

The following approvals and permits are required for the construction of Bridge 1899:

- Bed and Banks Permit from DWER PMB206755(1) (if there is disturbance to the bed or banks of a watercourse or wetland).
- Native Vegetation Clearing Permit CPS 9448/1 (pending).
- EPBC Act approval 2020-8784 (pending).
- Development Approval to disturb Bush Forever (pending).
- Section 18 Consent 62-26479 pursuant to the *Aboriginal Heritage Protection Act.*

4. Construction Activities

4.1 Construction Methodology

The general sequence of construction activities will comprise:

- Clearing and grubbing.
- Establishment of access tracks and crane pads.
- Piling at piers and abutment locations.
- Dewatering to underside of footings.
- Formation and construction of footings.
- Formation and construction of columns.
- Formation and construction of abutment walls.
- Craning pre-cast headstock and beams into place.
- Formation and construction of bridge deck.
- Formation and construction of retaining walls.
- Landscaping.
- Demobilisation.

4.2 Schedule

Table 4-1 below sets out the indicative schedule for the construction of Bridge 1899.

Where practicable, high-risk construction activities (with respect to erosion and sedimentation) such as piling, and excavation will occur during summer / lower rainfall months where there is a lower likelihood of rainfall, flooding and overland flows.

Table 4-1 – Indicative schedule (as of 31 May 2022)

Item	Commencement	Completion
Clearing and grubbing		
Establishment of access tracks and crane pads		
Pier 1	5 Sep 23	27 Mar 24
Pier 2	10 Aug 23	29 Jan 24
Southern abutment	25 Aug 23	29 May 24
Northern abutment	1 Aug 23	20 Mar 24
Superstructure	22 Mar 23	31 Jan 25

4.3 Site Layout

4.3.1 Existing conditions

The conditions surrounding the proposed Bridge 1899 were most recently inspected on 26 July 2022. Two photographs of the Helena River and existing Roe Highway bridge are attached below.

With the exception of the area immediately beneath the existing bridge, the embankments of the Helena River are generally gently sloping and grassy. Beneath the existing bridge, the embankments steepen and no vegetation or erosion/sedimentation controls are in place.

Figure 3 – Existing Roe Highway bridge, looking east

Figure 4 – Existing Roe Highway bridge, looking west

Figure 5 – View toward western bank of un-named wetland on east side of Roe Highway

Figure 6 - View north along western bank, showing dense fringing vegetation

4.3.2 Construction staging

The construction methodology details many construction steps, however the site layout with respect to erosion and sedimentation risks and control will be consistent for the duration of the works.

Figure 6, Figure 7 and Figure 8 below shows the proposed site layout for BR1899 and Retaining Wall RW-U3 during construction adjacent to the Helena River and wetlands area. Piling and construction of the piers, as well as craning the central bridge beams into place, will occur from a platform constructed at approximately 7m AHD, consistent with the existing ground level surrounding the existing bridge pier footings (Figure 4). Craning of the northern and southern beams into place will occur from a pad at the approximate level of the existing Roe Highway pavement, approximately 10.5 m AHD.

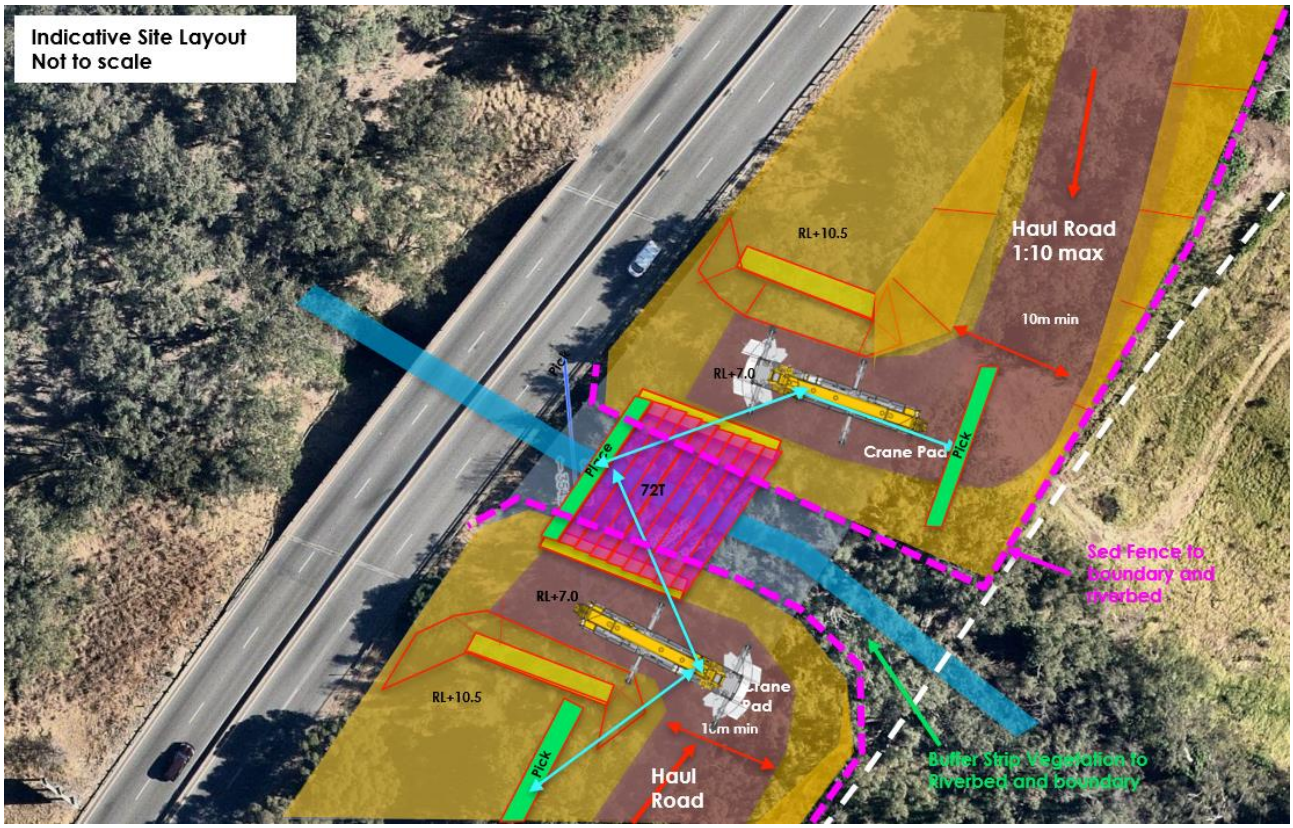


Figure 7 – BR1899 Indicative Site layout during construction

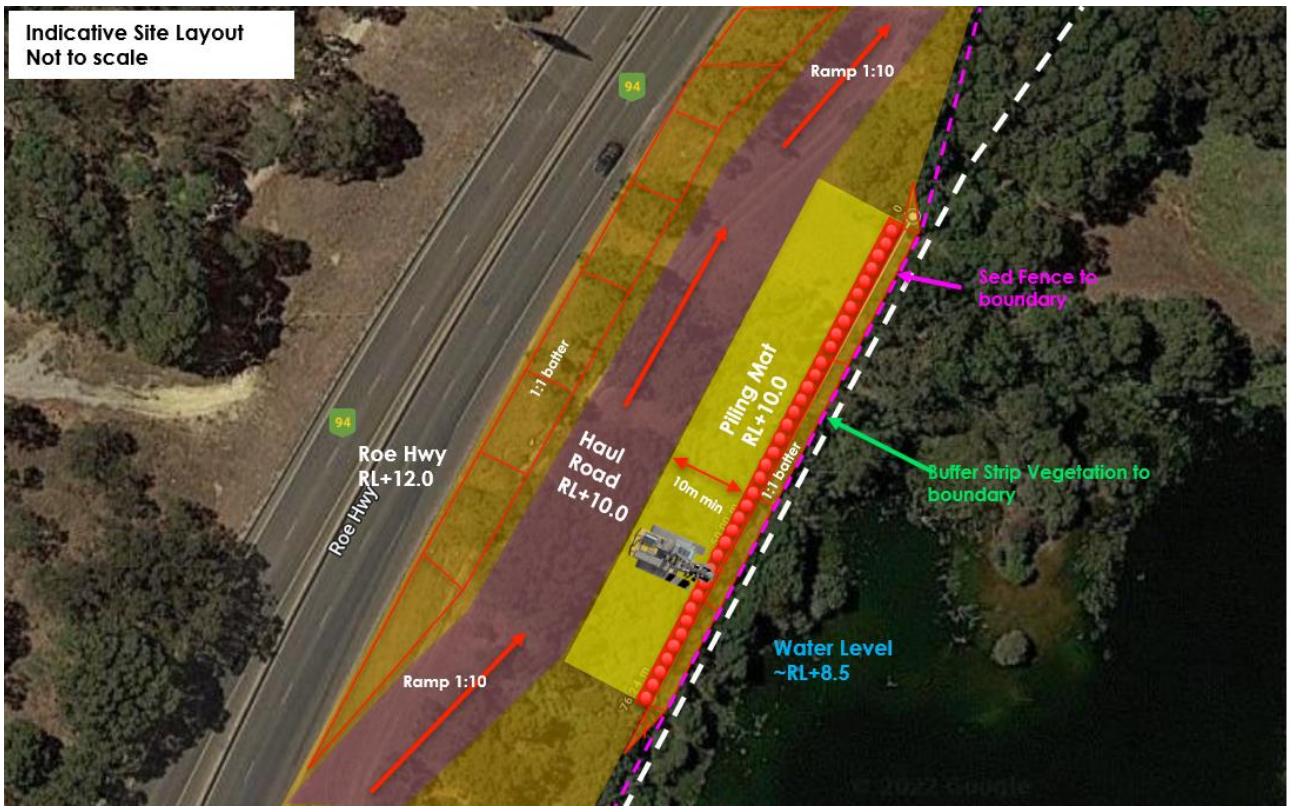


Figure 8 – Retaining Wall (RW-U3) indicative Site Layout during construction

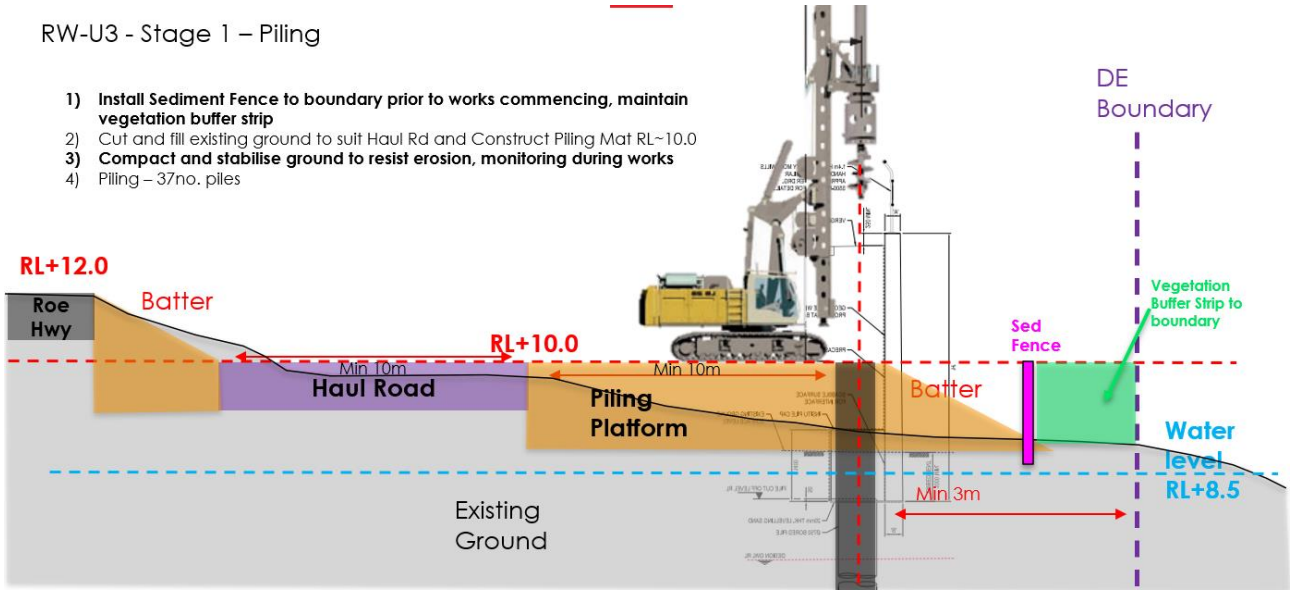


Figure 9 – Retaining Wall (RW-U3) indicative Site Section during construction

4.4 Landscaping

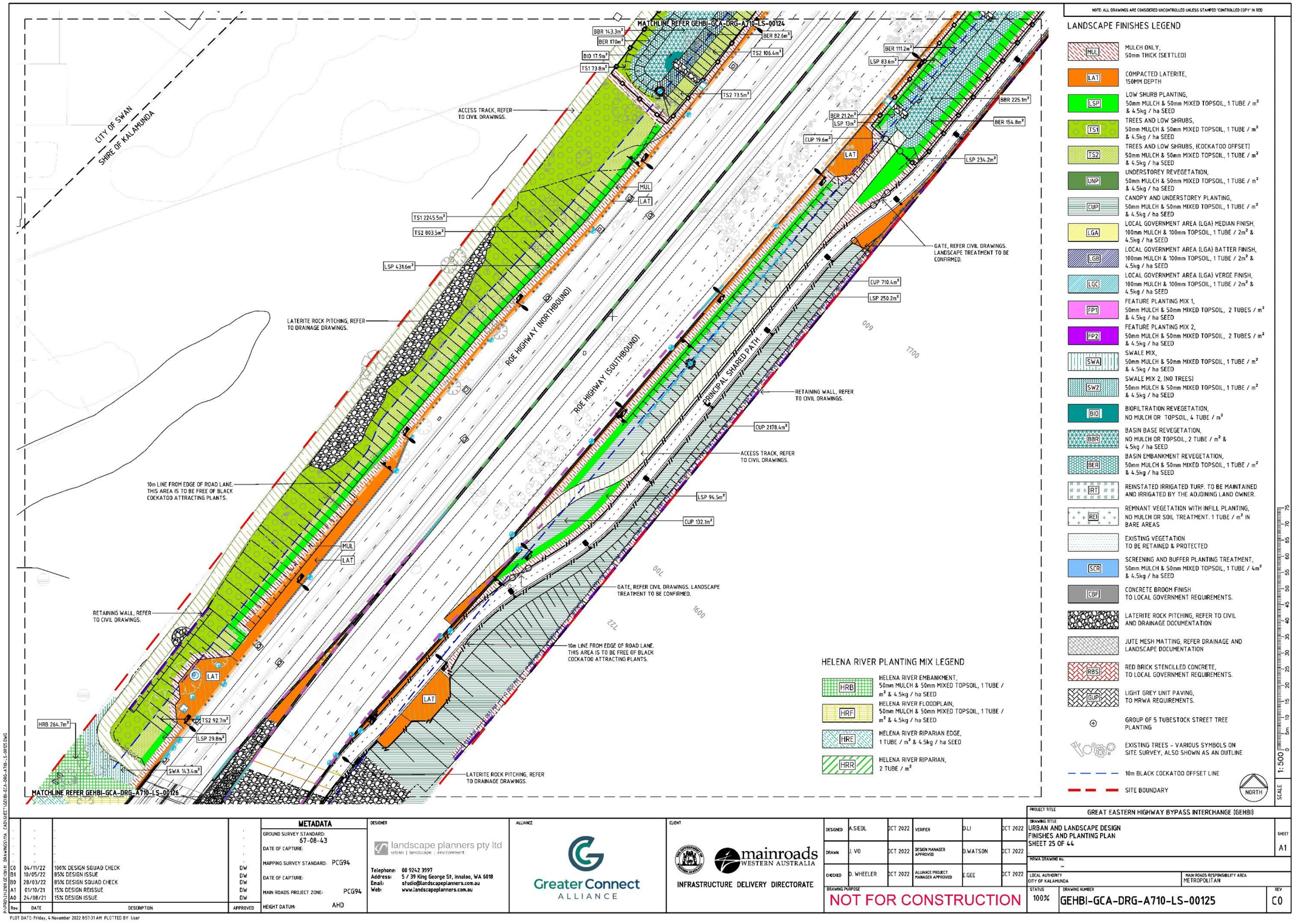
Landscaping will occur following the completion of bridge construction and in accordance with the *Great Eastern Highway Bypass Interchanges Landscape Design 100% Report* (GEHBI-GCA-RPT-A710-LS-00001) and associated drawings. Excerpts from the design drawings, covering the area of the Helena River Bridge 1899, are included overleaf.

Generally, the Project will rehabilitate and revegetate substantial areas along the Helena River. The permanent design (in other Project areas) includes biofiltration basins to receive road reserve runoff for treatment prior to overflow to the Helena River.

The GCA has had extensive consultation with DBCA and the Swan River Trust, which has developed the Helena River Plant Species plant mixes.

Planting adjacent the Helena River will include the following:

- Helena River Embankment Mix, 50mm mulch (native wood chips) and 50mm mixed topsoil (mulch and topsoil mixed 50/50 prior to spreading), 1 tubestock / m² and 4.5kg seed / ha. This is planted between the top and middle retaining wall tier. The planting species palette have been developed in consultation with DBCA.
- Helena River Floodplain Mix, 50mm mulch (native wood chips) and 50mm mixed topsoil (mulch and topsoil mixed 50/50 prior to spreading), 1 tubestock / m² and 4.5kg seed / ha. This is planted in the low areas at the base of the retaining wall tier. The planting species palette have been developed in consultation with DBCA.
- Helena River Riparian Edge, no mulch and no topsoil, 1 tubestock / m² and 4.5kg seed / ha. This is planted along the Helena River Edge, and the planting species have been developed in consultation with DBCA.
- Helena River Riparian, no mulch and no topsoil, 2 tubestock / m². This is planted along the Helena River Edge, and the planting species have been developed in consultation with DBCA. Note: this mix has no seed.



NOTE: ALL DRAWINGS ARE CONSIDERED UNCONTROLLED UNLESS STAMPED 'CONTROLLED COPY' IN RED

LANDSCAPE FINISHES LEGEND

- MUL — MULCH ONLY, 50mm THICK (SETTLED)
- LAT — COMPACTED LATERITE, 150MM DEPTH
- LSP — LOW SHRUB PLANTING, 50mm MULCH & 50mm MIXED TOPSOIL, 1 TUBE / m² & 4.5kg / ha SEED
- TS1 — TREES AND LOW SHRUBS, 50mm MULCH & 50mm MIXED TOPSOIL, 1 TUBE / m² & 4.5kg / ha SEED
- TS2 — TREES AND LOW SHRUBS, (COCKATOO OFFSET) 50mm MULCH & 50mm MIXED TOPSOIL, 1 TUBE / m² & 4.5kg / ha SEED
- UNP — UNDERSTOREY REVEGETATION, 50mm MULCH & 50mm MIXED TOPSOIL, 1 TUBE / m² & 4.5kg / ha SEED
- CUP — CANOPY AND UNDERSTOREY PLANTING, 50mm MULCH & 50mm MIXED TOPSOIL, 1 TUBE / m² & 4.5kg / ha SEED
- LGA — LOCAL GOVERNMENT AREA (LGA) MEDIAN FINISH, 100mm MULCH & 100mm TOPSOIL, 1 TUBE / 2m² & 4.5kg / ha SEED
- LGB — LOCAL GOVERNMENT AREA (LGA) BATTER FINISH, 100mm MULCH & 100mm TOPSOIL, 1 TUBE / 2m² & 4.5kg / ha SEED
- LGC — LOCAL GOVERNMENT AREA (LGA) VERGE FINISH, 100mm MULCH & 100mm TOPSOIL, 1 TUBE / 2m² & 4.5kg / ha SEED
- FP1 — FEATURE PLANTING MIX 1, 50mm MULCH & 50mm MIXED TOPSOIL, 2 TUBES / m² & 4.5kg / ha SEED
- FP2 — FEATURE PLANTING MIX 2, 50mm MULCH & 50mm MIXED TOPSOIL, 2 TUBES / m² & 4.5kg / ha SEED
- SWA — SWALE MIX, 50mm MULCH & 50mm MIXED TOPSOIL, 1 TUBE / m² & 4.5kg / ha SEED
- SW2 — SWALE MIX 2, (NO TREES) 50mm MULCH & 50mm MIXED TOPSOIL, 1 TUBE / m² & 4.5kg / ha SEED
- BIO — BIOFILTRATION REVEGETATION, NO MULCH OR TOPSOIL, 4 TUBE / m²
- BBR — BASIN BASE REVEGETATION, NO MULCH OR TOPSOIL, 2 TUBE / m² & 4.5kg / ha SEED
- BER — BASIN EMBANKMENT REVEGETATION, 50mm MULCH & 50mm MIXED TOPSOIL, 1 TUBE / m² & 4.5kg / ha SEED
- IRT — REINSTATED IRRIGATED TURF. TO BE MAINTAINED AND IRRIGATED BY THE ADJOINING LAND OWNER.
- REI — REMNANT VEGETATION WITH INFILL PLANTING, NO MULCH OR SOIL TREATMENT. 1 TUBE / m² IN BARE AREAS
- EXISTING VEGETATION TO BE RETAINED & PROTECTED
- SCR — SCREENING AND BUFFER PLANTING TREATMENT, 50mm MULCH & 50mm MIXED TOPSOIL, 1 TUBE / 4m² & 4.5kg / ha SEED
- CBF — CONCRETE BROOM FINISH TO LOCAL GOVERNMENT REQUIREMENTS.
- LATERITE ROCK PITCHING, REFER TO CIVIL AND DRAINAGE DOCUMENTATION
- JUTE MESH MATTING, REFER DRAINAGE AND LANDSCAPE DOCUMENTATION
- RBS — RED BRICK STENCILLED CONCRETE, TO LOCAL GOVERNMENT REQUIREMENTS.
- LIGHT GREY UNIT PAVING, TO MRWA REQUIREMENTS.
- GROUP OF 5 TUBESTOCK STREET TREE PLANTING
- EXISTING TREES - VARIOUS SYMBOLS ON SITE SURVEY, ALSO SHOWN AS AN OUTLINE
- 10m BLACK COCKATOO OFFSET LINE
- SITE BOUNDARY

HELENA RIVER PLANTING MIX LEGEND

- HRB — HELENA RIVER EMBANKMENT, 50mm MULCH & 50mm MIXED TOPSOIL, 1 TUBE / m² & 4.5kg / ha SEED
- HRF — HELENA RIVER FLOODPLAIN, 50mm MULCH & 50mm MIXED TOPSOIL, 1 TUBE / m² & 4.5kg / ha SEED
- HRE — HELENA RIVER RIPARIAN EDGE, 1 TUBE / m² & 4.5kg / ha SEED
- HRR — HELENA RIVER RIPARIAN, 2 TUBE / m²

NORTH

SCALE 1:500

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DATE OF CAPTURE:
MAPPING SURVEY STANDARD: PCG94
DATE OF CAPTURE:
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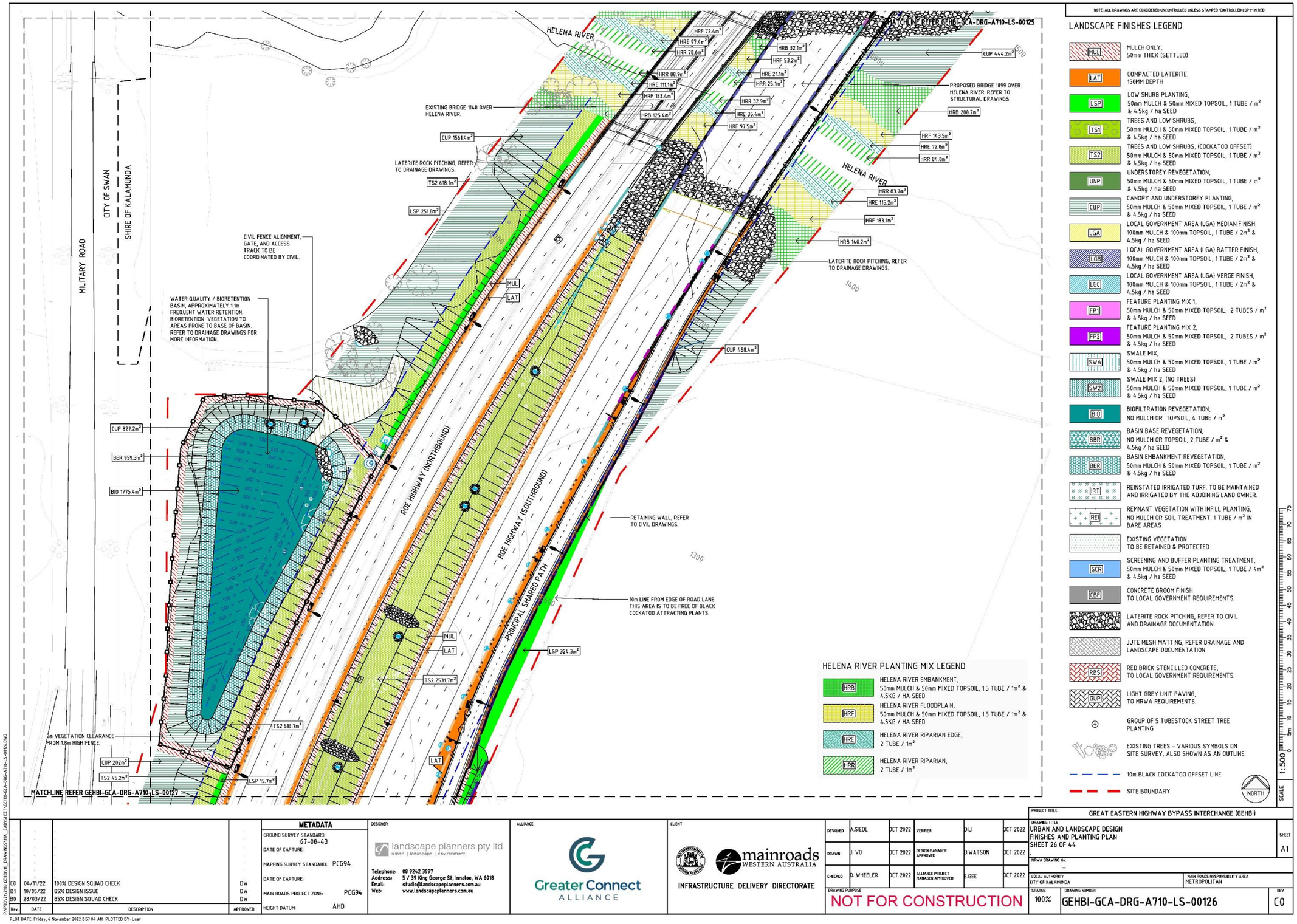

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5. Erosion and Sediment Control

5.1 Risk Assessment

A risk assessment of proposed construction activities with respect to erosion and sedimentation and the Helena River was undertaken in accordance with the methods outlined in Appendix 4 of the EMP.

The key impacts from vegetation disturbance as a result of construction activities will include increased erosive forces on the soil, water quality impacts within the Helena River and adjacent un-named wetland, and potential degradation of habitat in the surrounding areas.

Impacts, consequence levels and likelihoods were assessed on the basis of the temporary works and their relationship to the Helena River and do not relate to the permanent design.

Table 5-1 – Bridge 1899 erosion and sedimentation risk assessment

Activity	Potential impacts	Consequence level	Likelihood	Risk rating
Clearing and grubbing	Elevated erosion and sedimentation potential resulting from direct ground disturbance that then increases exposure to natural and anthropogenic erosive forces.	Minor	Possible	Low
Establishment and use of temporary haul roads and construction pads	Degradation of flora and fauna habitat as a result of sediment loss or accumulation in existing habitats. Impacts to aquatic habitat as a result of sediment-laden runoff. Impacts to surface water quality due to release of sediment-laden run-off.	Minor	Possible	Low
Excavation and piling of piers and abutments	Elevated erosion and sedimentation potential resulting from direct ground disturbance that then increases exposure to natural and anthropogenic erosive forces.	Minor	Possible	Low
Formation of earth embankments	Erosion of earthworks leading to increased sediment loads in Helena River and un-named wetland immediately east of Roe Highway.	Minor	Possible	Low

5.2 Objectives, Indicators and Targets

Objectives, taken from the WSEQ ERAP, and associated activities, performance indicators and targets are detailed within Table 5-2 below.

Table 5-2 – Objectives, performance indicators and targets

Objectives	Activities	Indicators	Performance targets	Ref
Establish erosion and sediment control measures prior to and during excavations and associated construction activities **so that negligible environmental, infrastructure and social impact results**. Implement procedures and drainage designs prior to, and during site activities, **so that water quality, stormwater discharge and site drainage is maintained at standards that preserve the natural hydrology and water quality in the Project area.**	Planning	Properly designed erosion and sedimentation control plans and programmes	Develop plans for erosion and sediment control prior to earthworks to the satisfaction of DBCA	T1
	Clearing, grading and excavation activities	Extents of clearing, grubbing, temporary construction	Implementation of erosion and sedimentation control measures prior to the commencement, and during construction, to minimise potential for erosion and sedimentation. No clearing outside permitted areas. Temporary and permanent design to minimise excavation requirements.	T2
	Soil stockpile management	Stockpile and laydown location	No stockpiling of materials within 50m of the Helena River or un-named wetland.	T3

Objectives	Activities	Indicators	Performance targets	Ref
	Materials stockpiles and laydown areas			
	Formation of temporary haul roads and pads Construction of permanent design	Failures of erosion and sediment control features	Maintain erosion and sediment control devices for proper function	T4
		Water run-off/discharge	Flow within and exiting the Project site will be controlled	T5
		Soil stabilisation of work areas	Exposed temporary work areas will be sufficiently stabilised to prevent erosion	T6
		Undisturbed areas adjacent to Project work areas	No movement of site generated sediment into adjacent, undisturbed vegetation	T7
		Helena River and wetland water quality	No observable sediment load entering river/basin from construction activities No increase in turbidity in river/basin due to construction activities Fill materials to meet 'Clean Fill' specifications within *Landfill Waste Classification and Waste Definitions 1996*	T8

5.3 Management Measures

Table 3.3-1 details the specific strategies, procedures and measures that will be implemented to mitigate identified risks and to achieve the environmental objectives listed above.

Table 5-3 – Management measures

Ref	Management measure	Procedure/plan	Responsibility	Timing
T1	Install and maintain erosion and sediment controls in accordance with manufacturer's specifications and this ESCP	This Plan Figure 10	Site supervisor	Prior to construction activities
T4, T5, T6, T8	Erosion and sediment control devices will be implemented where there are risks of erosion and sediment transport / deposition into local waterways and land areas adjacent to the Project Footprint. Control devices will remain in place until works are complete and stabilisation of cleared/disturbed areas has occurred.	This Plan Figure 10	Site Environmental Representative	Prior to construction activities
T4, T5, T6, T8	Repairing or replacing degraded erosion and sediment control structures and features (including removal of accumulated sediment) based on observations and inspections	Section 5.4 Figure 10	Site supervisor	Continuous during construction
T2, T7	Vegetation clearing should be undertaken progressively and only as area is required, as far as practicable	Ground disturbance permit	Statutory Approvals and Environment Manager	Prior to construction activities
T2, T5, T6, T7, T8	Buffer strips of vegetation will be left intact, wherever possible, between construction works and sensitive features boundaries to help protect water quality (e.g. on the sloping bank of the Helena River or between the unnamed wetland and retaining walls.)	Ground disturbance permit Temporary works specification	Site supervisor	Continuous during construction
T1, T5, T7, T8	Maintenance of natural drainage flow and preservation of sensitive areas (to practical extent)	Temporary works specification	Site Environmental Representative	Continuous during construction
T4, T5, T6, T8	Graded areas will be mechanically compacted and stabilised (either through vegetation, gravel or paving) to minimise the potential for erosion	Temporary works specification	Site supervisor	

Ref	Management measure	Procedure/plan	Responsibility	Timing
T4, T5, T6, T8	Where vegetation establishment is not practical, use of gravel, paving, concrete, soil-binders, mulch, hydromulch, compaction etc., to stabilise areas from erosive forces	N/A	Site Environmental Representative	Continuous during construction
T4, T5, T6, T8	Disturbed areas, stockpile areas and erosion and sediment control features will be inspected on a regular basis, and as soon as practicable following a 12mm or greater rainfall event or cyclone.	Temporary works specification	Site Environmental Representative	Continuous during construction
T5, T8	The implementation, effectiveness and condition of erosion and sediment controls will be monitored	Section 5.4	Site supervisor Statutory Approvals and Environment Manager	Continuous during construction

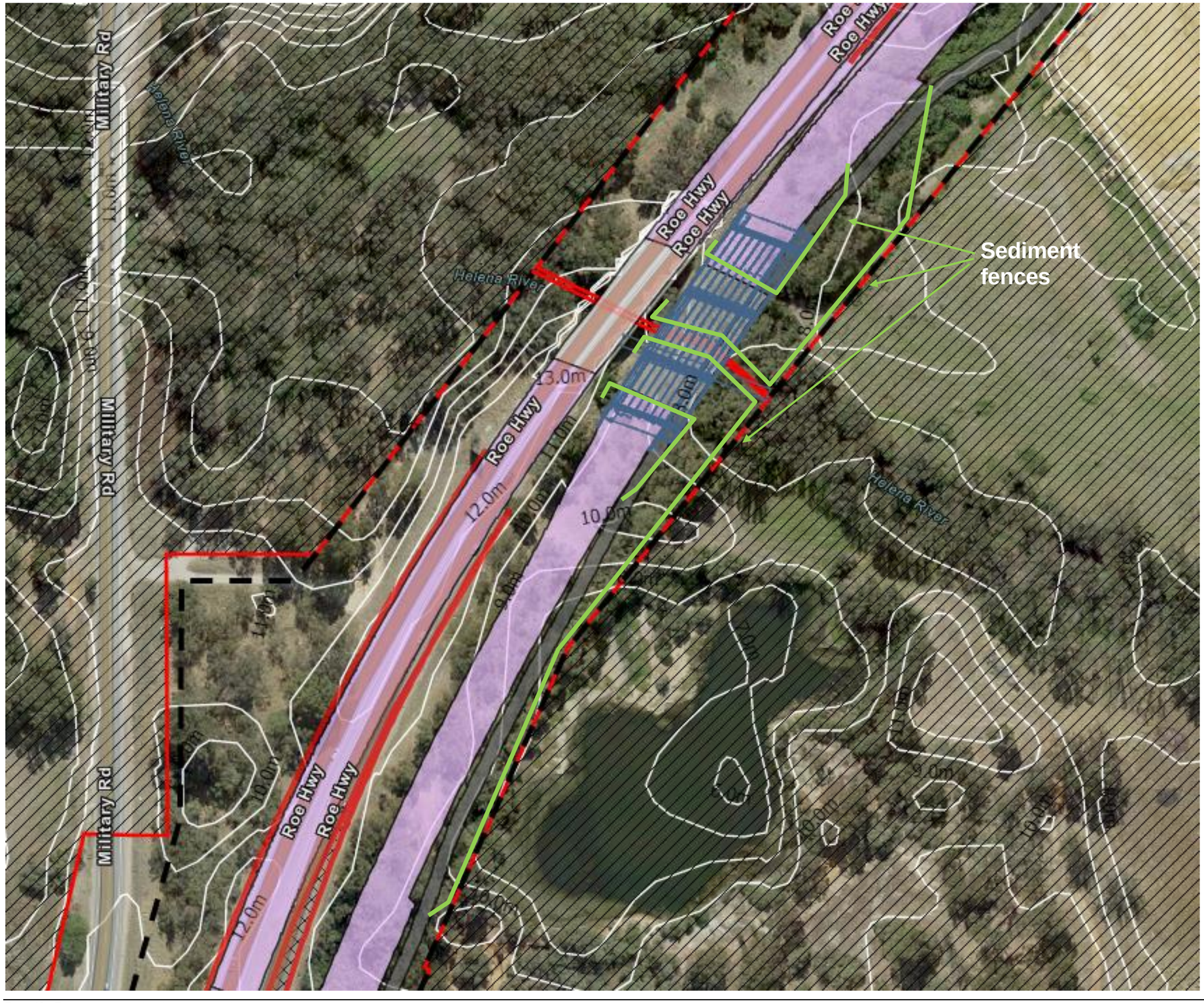
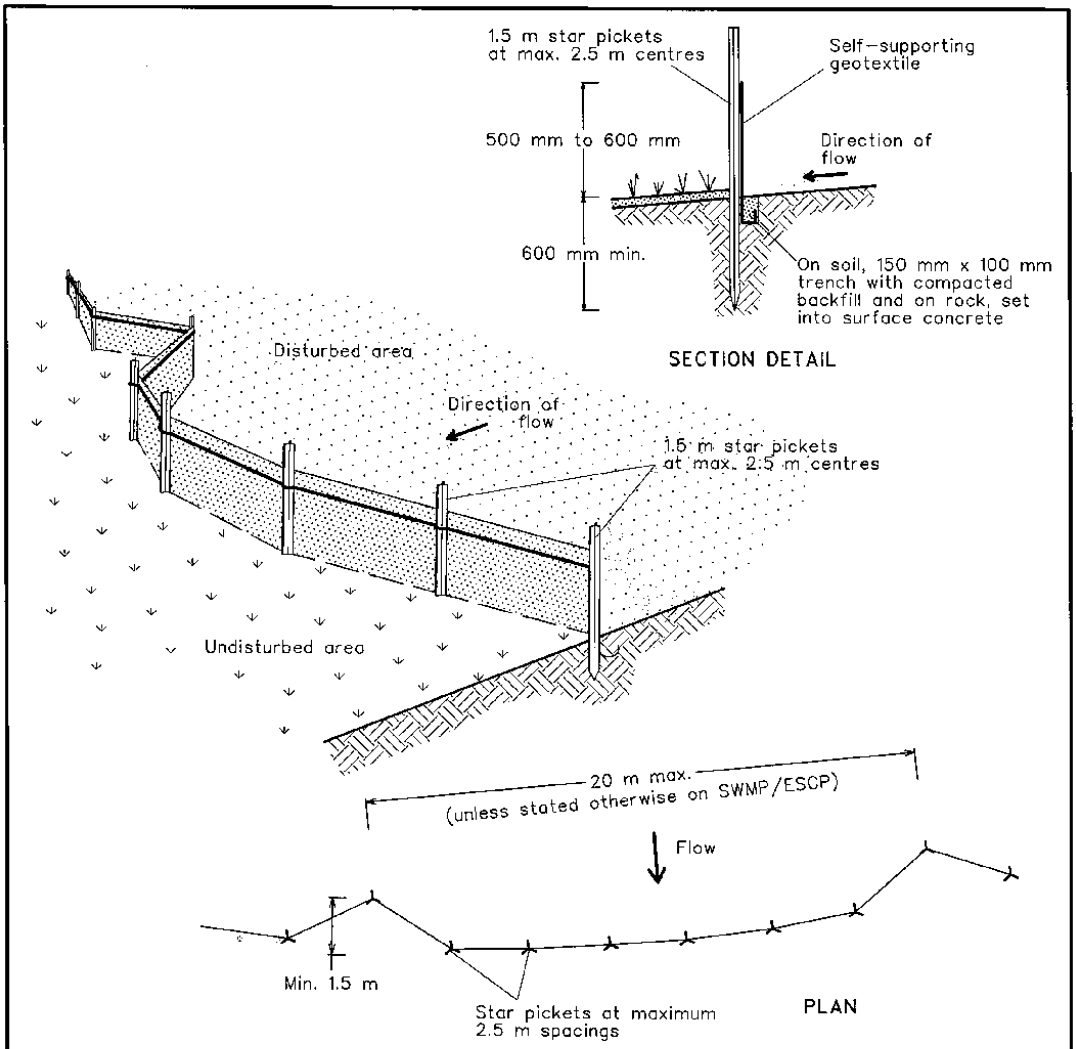


Figure 10 – Erosion and sediment control management measures

5.4 Typical Erosion and Sediment Controls

5.4.1 Sediment fence

A sediment fence is a perimeter control to intercept sediment before it is transported off-site, while maintaining pre-construction stormwater flow regimes. Typical sediment fence design is shown on Figure 11.



Construction Notes

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

SEDIMENT FENCE **SD 6-8**

Figure 11 – Typical sediment fence construction

5.4.2 Stabilised site access

Typical stabilised site access is shown below on Figure 11.

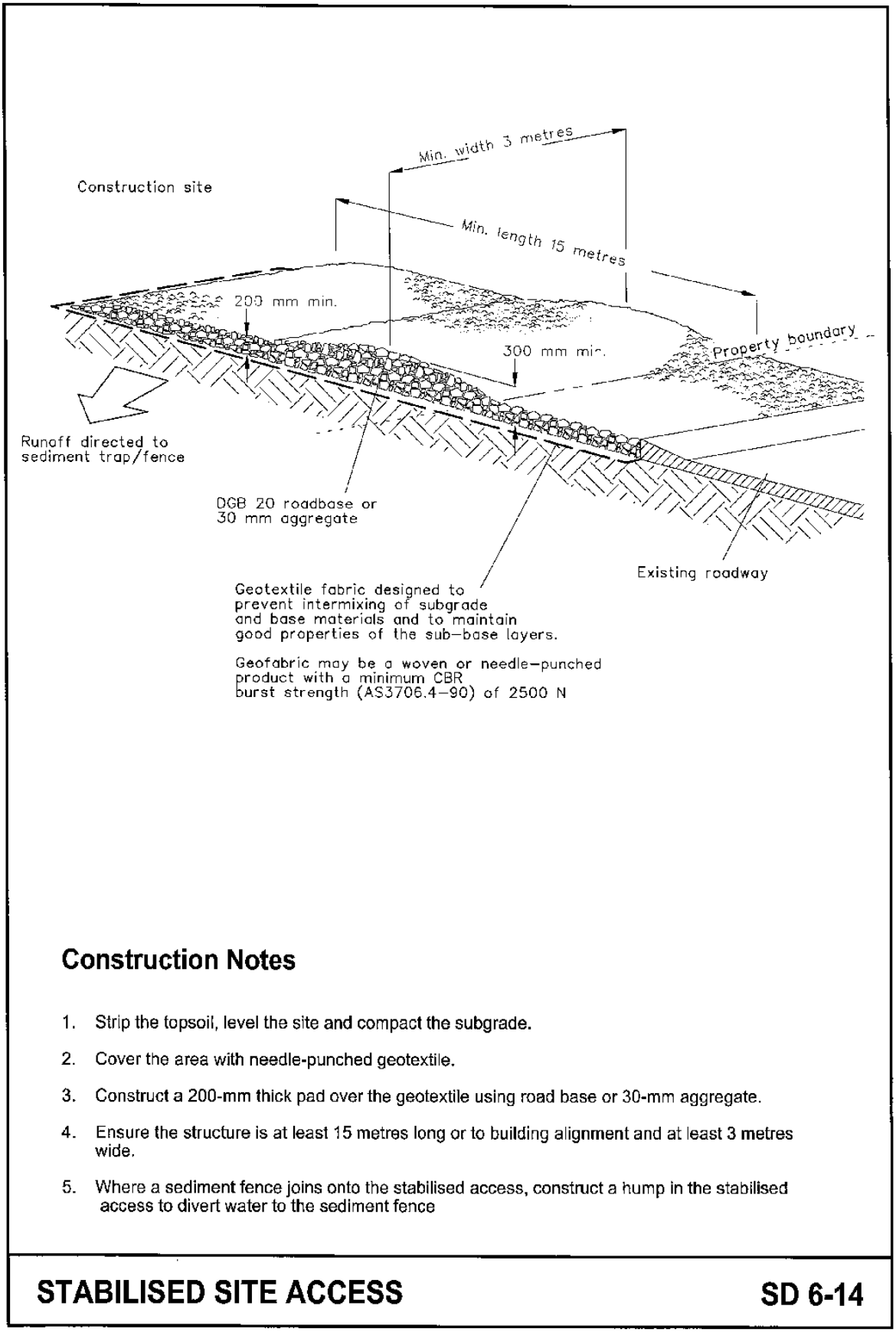


Figure 12 – Typical stabilised site access construction

5.5 Monitoring

Environmental Monitoring programs have been designed and implemented to demonstrate and communicate compliance with regulatory requirements and achievement of performance indicators to on-site management. These initiatives are detailed below:

Table 5-4 – Monitoring program

Ref	Item	Location	Responsibility	Frequency
T2, T3, T4, T6, T7	Disturbed areas and stockpiles will be inspected for appropriate installation of erosion and sediment control features	Workpack 4 extents	Site supervisor	Daily
T1, T4, T5, T6, T8	Erosion and sediment control structures will be checked to verify proper installation and effectiveness, and as far as practicable, including immediately before and following a 12mm or greater rainfall event or cyclone.	Workpack 4 extents	Site supervisor Site environmental representative	Daily Weekly
T2, T7, T8	Vegetation clearing limits will be clearly demarcated and operations remain within limits	Workpack 4 extents	Site environmental representative	Prior to clearing/construction Weekly thereafter
	The Project HSE Management System includes an inspection type *"Severe Environmental Risk – Erosion and Sediment Control."*	Workpack 4 extents	Site environmental representative	Weekly during construction

In addition to the above monitoring program, the GEHBI WP4 Acid Sulfate Soils and Dewatering Management Plan (GEHBI-GCA-PLN-A000-EN-00012) and the GEHBI ISCA Surface Water Sampling and Analysis Quality Plan (GEHBI-GCA-PLN-A000-EN-00024) include surface water monitoring components relating to the Helena River, summarised below.

Table 5-5 – Other related monitoring programs

Document	Location	Parameters	Responsibility	Frequency
GEHBI ISCA Surface Water Sampling and Analysis Quality Plan	SW01-SW30	Total Suspended Solids (TSS), Total Nitrogen (TN), Total Phosphorous (TP). Dissolved Metals: Arsenic (As), Cadmium (Cd), Chromium (Cr), Copper (Cu), Lead (Pb), Nickel (Ni), Zinc (Zn), Mercury (Hg), Aluminium (Al), Iron (Pb), Selenium (Se) and Manganese (Mn). Total Metals: As, Cd, Cr, Cu, Pb, Ni, Zn, Hg, Al, Fe, Se and Mn.	Site environmental representative	Monthly
GEHBI WP4 Acid Sulfate Soils and Dewatering Management Plan	SW07 and SW08	pH, EC, TDS, TSS, Acidity, Alkalinity, Turbidity, SO4-2, S-2, Cl-, Ca, Mg, Na, K Total and Dissolved Al, As, Cd, Cr, Fe, Mn, Ni, Se, Zn, Cr (VI) NH3, NO3, NO2, TKN, TN, TP, FRP	Site environmental representative	Fortnightly

Figure 13 Helena River – surface water monitoring locations

Please note – Work Pack 2 boundary shown above is outdated & not applicable.

5.6 Incidents, Contingencies and Corrective Actions

The Project EMP contains preparation and response actions for the following emergency types:

- Significant adverse dust event due to weather conditions (high winds)
- Damage to temporary erosion and sediment controls during rainfall
- Damage to sediment basin
- Unapproved clearing or damage to protected vegetation, threatened or endangered flora

Further erosion and sediment contingencies and corrective actions are detailed in Table 5-6 below:

Table 5-6 – Contingencies and corrective actions

Ref	Management Trigger/Threshold	Contingency or Corrective Action	Responsibility	Timing
T1, T4, T6, T8	Erosion and sediment control features are deficient or damaged and not functioning properly	Stop earth disturbing activities if imminent threat to ESC features, correct the issue, review inspection guidelines, review repair procedures	Statutory Approvals and Environment Manager	As advised by and discussed with Contractor environmental staff through general observation or written inspection
T1, T6, T8	Evidence of ruts or gully formation	Evaluate erosion and sediment control features in the area; repair, replace or redesign as needed (and where practicable); repair ruts and gullies to grade (where practicable and safe to do so)	Statutory Approvals and Environment Manager	Once evidence is discovered

Ref	Management Trigger/Threshold	Contingency or Corrective Action	Responsibility	Timing
T2, T7	Evidence of clearing outside the demarcated clearing zone	Immediately stop work of clearing activity in the area. Re-enforce in pre task briefing, verify demarcation of roads, rehabilitation of disturbed areas	Statutory Approvals and Environment Manager	Once evidence is discovered
T1, T4, T6, T8	Inadequate stabilisation resulting in loss of sediment due to erosion	Evaluate stabilisation measures; remove, repair, or re-install as needed; or install alternative measures	Statutory Approvals and Environment Manager	Immediately upon identification
T8	Increased turbidity of water downstream of project when assessed against upstream water quality	Evaluate erosion and sediment control features in the area; repair, replace or redesign as needed	Statutory Approvals and Environment Manager	Immediately upon identification

6. Roles and Responsibilities

The roles and responsibilities of personnel working on the site will be determined by the Project Director. It is the Project Director's responsibility to manage all environmental issues and to delegate tasks to Contractor personnel, as appropriate.

Roles and responsibilities for the main parties relevant to this ESCP are set out below:

Table 6-1 – Roles and responsibilities

Role	Responsibilities
Project director	Ensure the EMP and this ESCP are implemented effectively, where required.
Statutory Approvals and Environment Manager	Ensure necessary approvals/permits/site access are obtained. Ensure the appropriate health, safety and environmental procedures are implemented. Ensure compliance with this ESCP and relevant approvals.
Site environmental representative	Monitoring and inspections in accordance with this plan. Oversee implementation of this plan.
Site supervisor	Construction and maintenance of nominated erosion and sediment controls. Monitoring and inspections in accordance with this plan.
Site personnel	Comply with all legal requirements and the requirements of the relevant Main Roads plans and procedures. Report potential CTSL materials if encountered. Attend environmental inductions or any other training on CTSL materials, as required. Participate in health, safety and environment meetings and suggest improvements to the management of CTSL materials where required.

7. Reporting, Review and Audit

7.1 Reporting

During construction of the Project, monthly environmental reporting will be completed and provided to Main Roads, summarising the previous months' environmental-related activities, which may include:

- Summary discussion on Project aspects and impacts, to be read in conjunction with the risk register.
- Environmental performance outcomes, improvement initiatives or corrective measures.
- Client and stakeholders engagement and interface – in particular, client feedback on Project environmental performance.
- Environmental incident and event management, including the outcomes from incident investigations and corrective actions.
- Compliance/Non-compliance with approvals and licence requirements.

7.2 Review

The Plan is not to be considered finite and can be modified as the activities progress during the Project or the scope of the work changes. This document will be modified to reflect any changes in traffic management methods, Project activities or terms and conditions of Project licenses, permits or approvals.

During daily meetings, workers will be encouraged to provide suggestions for improving safety and environmental procedures that are being used at the site.

Additional details, modifications, actions, and notes of meetings conducted with government agencies relative to the Plan will be incorporated into or appended to this document.

This plan should be reviewed when the construction methodology or proposed site layout changes.

Site layout diagrams, when developed, should include erosion and sediment controls as designated within this plan.

7.3 Audit

Auditing of the Project's HSEMS will be carried out in accordance with the Environmental System Requirement: Compliance, Review and Assurance. The audit will evaluate compliance with this ESCP and associated documentation, including legal, contractual and other requirements.

It is expected that the Project will be audited within three months of commencing on site and approximately every six months thereafter, in accordance with the audit schedule appended to the Audit Plan (GEHBI-GCA-PLN-A000-PM-00005).

8. References

Australian and New Zealand Environment Conservation Council (ANZECC) and Agriculture and Resource Management Council of Australian and New Zealand (ARMCANZ) (2000) Australian Water Quality Guidelines (AWQG) Fresh water aquatic ecosystem.

Department of Environment (2004) The Importance of Western Australia's Waterways.

Department of Water (2010) 'Water Quality Protection Note 52: Stormwater management at industrial sites', May 2010

Department of Water and Environmental Regulation (2022) Stormwater Management Manual for Western Australia: Best Management Practice. February 2004, updated May 2022.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