South Batemans Bay Link Road
Erosion and sediment management report
Transport for NSW | April 2020
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Prepared by Strategic Environmental and Engineering Consulting (SEEC) Pty Ltd and Transport for NSW

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South Batemans Bay Link Road erosion and sediment management report

Erika Garbayo
Senior Project Development Officer

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<td>Ver A</td>
<td>29 Nov 2019</td>
<td>A Macleod, SEEC</td>
<td>Cassy Baxter, Michael Stojanoski</td>
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<td>EPA</td>
<td>NSW Environment Protection Authority</td>
</tr>
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<td>EP&amp;A Act</td>
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<td>ESMR</td>
<td>Erosion and sediment management report (this document)</td>
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<td>POEO Act</td>
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<td>South Batemans Bay Link Road</td>
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<tr>
<td>REF</td>
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<td>RUSLE</td>
<td>Revised Universal Soil Loss Equation</td>
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<td>TfNSW</td>
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1. Introduction

1.1 Proposal identification

Transport for NSW is proposing to connect the Princes Highway with the existing South Batemans Bay Link Road at Glenella Road (the proposal). The proposal would include a new roundabout on the Princes Highway south of Batemans Bay and a new two-lane road (one lane in each direction) between the roundabout and Heron Road. The proposal would generally follow the current alignment of Glenella Road (formally known as The Ridge Road) between the Heron Road and the Princes Highway to complete the South Batemans Bay Link Road project.

This report supports the environmental assessment for the proposal. The proposal is subject to assessment by a review of environmental factors (REF) under Division 5.1 of Environmental Planning and Assessment Act 1979 (EP&A Act).

1.1.1 Proposal location

The proposal is located within the Eurobodalla Local Government Area (LGA) about 2.5 kilometres south of Batemans Bay, adjacent to the Princes Highway, about 300 kilometres south of Sydney and 150 kilometres east of Canberra (Figure 1-1). Batemans Bay is the main commercial centre of the Eurobodalla Shire. The town centre has a mix of commercial, tourist, recreational and residential land uses. There are further urban residential and future employment lands located along the coastal villages south of Batemans Bay. The area is a popular tourist destination, particularly for Australian Capital Territory (ACT) residents and the Batemans Bay population increases substantially during holiday periods.

1.1.2 Key features of the proposal

Key features of the proposal include:

- A new roundabout on the Princes Highway, including:
  - two southbound lanes through the roundabout
  - a single northbound right turn lane through the roundabout to Glenella Road
  - a northbound bypass lane on the Princes Highway
  - single lane entry and exit to and from the Glenella Road
- A new two-lane road (one lane in each direction), about one kilometre in length, between the new roundabout on the Princes Highway and Heron Road
- A new T-intersection at the junction of The Ridge Road and Glenella Road
- Utility adjustments including for telecommunications, electrical and water infrastructure
- Earthworks including cuttings, embankments and retaining walls
- Establishment and use of temporary ancillary facilities during construction, including site offices, plant laydown areas, access tracks, stockpile sites, water quality controls and vehicle turning bays
- Drainage and stormwater management infrastructure along the road corridor
- Site rehabilitation and landscaping work.
The proposal would allow for land use development and increase freight access and productivity in the Batemans Bay CBD, southern coastal villages and proposed Surf Beach employment lands. The proposal would also provide a safe and efficient alternative access to the southern coastal villages that would help ease current and future congestion in the Batemans Bay CBD, particularly along Beach Road.

The proposal is shown in Figure 1-2.

### 1.1.3 Proposal background

The Princes Highway is an important connection for regional motorists and is a key route for heavy vehicle, commuter and tourist traffic movements. The traffic volume on the Princes Highway just south of Batemans Bay is around 8,800 vehicles per day with 8.3 per cent heavy vehicles and a growth rate of around 1.2 per cent per year. Beach Road is a regional road and a major sub-arterial road through the Batemans Bay CBD linking the Princes Highway, just south of the Batemans Bay Bridge, to the various residential areas and beaches south of the CBD, from Catalina to Surf Beach and further south along George Bass Drive.

In June 2014, the NSW Government announced $10 million for the South Batemans Bay Link Road project to improve traffic flow through Batemans Bay and support future growth in the region. In early 2019, Eurobodalla Shire Council completed construction of the first stage of the South Batemans Bay Link Road between George Bass Drive and Heron Road, east of the Princes Highway. The completed section of the South Batemans Bay Link Road is known as Glenella Road. As part of these works, the section of The Ridge Road from the Princes Highway to Glenella Road was renamed to Glenella Road. This was undertaken by Council to define the connection of the sub arterial road (Glenella Road) through to the Princes Highway.

In January 2019, the NSW Government announced funding of $30 million for Transport for NSW to finalise planning and build the connection of the South Batemans Bay Link Road to the Princes Highway.

Transport for NSW proposes to build a road connection between the Princes Highway and the South Batemans Bay Link Road along the existing alignment of Glenella Road. The proposal would reduce pressure on the existing Beach Road/Princes Highway, ease congestion in the Batemans Bay CBD and accommodate for future traffic growth.

The main objective of the proposal is to provide a safe and efficient connection between the Princes Highway and Glenella Road.

Other objectives of the proposal are to:

- Facilitate land use development in the Batemans Bay CBD and southern coastal villages to support residential property and employment growth
- Increase freight productivity for heavy vehicles accessing the southern coastal villages and the proposed Surf Beach employment lands
- Improve traffic and pedestrian amenity in the Batemans Bay CBD by relieving congestion in the town centre and providing an alternative route to South Batemans Bay.
FIGURE 1-1
1:12,500 Scale at A4

Legend
- Construction boundary
- Watercourse (LPI)
- Road (LPI)
- Proposed road design
- State Forest (LPI, 2017)
- NPWS Reserve (LPI, 2017)
- Council completed alignment SBBLR Stage 1

SOUTH BATEMANS BAY LINK ROAD PROJECT

Location of the proposal

Map Produced by Cardno NSW/ACT Pty Ltd (WOL)
Date: 2020-02-25 | Project: 8202006301
Coordinate System: GDA 1994 MGA Zone 56
Map: 8202006301-GS-011-LocalityContext_A4.mxd  05
Aerial imagery supplied by Nearmap (September, 2019)
The proposal
SOUTH BATEMANS BAY LINK ROAD PROJECT
1.2 Purpose of this report

This erosion and sediment management report (ESMR) has been prepared by Strategic Environmental and Engineering Consulting (SEEC) Pty Ltd on behalf of Transport for NSW. For the purposes of these works, Transport for NSW is the proponent and the determining authority under Division 5.1 of the EP&A Act.

The purpose of the ESMR is to:

- Identify the construction boundary and surrounding catchments
- Identify the erosion hazard in each sub-catchment within the construction boundary
- Determine site constraints that might limit the feasibility to implement erosion and sediment control measures as defined by Volumes 1 and 2D of the NSW Blue Book (Landcom, 2004 and DECC, 2008)
- Identify sensitive receiving environments that would receive stormwater discharge from the proposal during construction such as lands protected under environmental planning instruments such as the Coastal Management SEPP, or lands protected under national parks legislation
- Identify proposed measures for major erosion and sediment control devices such as up-gradient stormwater diversions, cross-drainage and sediment basins
- Calculate the potential soil loss for each road catchment as detailed in Volumes 1 and 2D of the NSW Blue Book (Landcom, 2004 and DECC, 2008) to determine appropriate sediment basin design requirements
- Assess the feasibility for installing, operating and maintaining major erosion and sediment controls such as sediment basins during construction
- Propose methods to eliminate, substitute or manage potential erosion and sediment control hazards during construction.

1.3 Structure of this report

This ESMR includes the following sections:

- Section 2 provides background regarding document preparation against Transport for NSW procedural guidelines
- Section 3 provides an assessment of the potential constraints and opportunities that might impact on construction-phase erosion and sediment control
- Section 4 identifies design considerations for erosion and sediment control measures
- Section 5 summarises a series of recommendations to manage or mitigate potential impacts relating to construction-phase erosion and sediment control.

Section 5 is accompanied by a series of Concept Erosion and Sediment Control Plans (ESCPs) which are included as Appendix 2. These ESCPs show conceptually the setup of key erosion and sediment control measures.
2. Background

2.1 Concept ESCPs
A series of Concept ESCPs prepared by SEEC accompany this ESMR and are included in Appendix 2. They show the setup of key erosion and sediment control measures, and have been developed iteratively as the road design was progressed.

2.2 Site inspection
A site inspection was conducted by Andrew Macleod from SEEC in October 2019 to identify and confirm soil and topographical conditions and how they might influence erosion and sediment control during construction.

2.3 Documentation and site review
As part of preparing this ESMR, SEEC conducted a review of:
- The strategic design prepared by Transport for NSW (2019), to determine how construction-phase erosion and sediment control issues might impact on the design process as it progresses
- The assumed work methodology and construction activities as described in Section 3 of the REF (Cardno, 2019) to determine how these aspects might influence the constructability of structures such as sediment basins, and the management of clean offsite water and dirty onsite water at each stage
- The land available during construction to determine if space constraints might impact on the effective implementation and establishment of erosion and sediment controls; and
- The site topography and setting, to determine if these aspects would limit the effective implementation of erosion and sediment controls.

Constraints identified in this process have been taken into account in preparing the concept ESCPs (Appendix 2) and comments regarding this are included in Section 5 of this ESMR.

2.4 Environmental design and compliance checklist
Table 2-1 details the requirements for this ESMR as described in Section 2.3.2 of Roads and Maritime Services (Roads and Maritime) PS311 Specification (Environmental Design and Compliance) and where each is addressed.

<table>
<thead>
<tr>
<th>Item reference</th>
<th>ESMR requirement</th>
<th>Location in this ESMR</th>
</tr>
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<tbody>
<tr>
<td>2.3.2 (i)</td>
<td>Identify road corridor and surrounding catchments.</td>
<td>Section 3.5 and ESCPs (Appendix 2)</td>
</tr>
<tr>
<td>2.3.2 (ii)</td>
<td>Identify road construction boundary catchments and their associated erosion hazard.</td>
<td>ESCPs (Appendix 2)</td>
</tr>
<tr>
<td>2.3.2 (iii)</td>
<td>Identification of site constraints that limit the implementation of appropriate erosion and sediment control measures.</td>
<td>Section 3, Section 5 and</td>
</tr>
<tr>
<td>Item reference</td>
<td>ESMR requirement</td>
<td>Location in this ESMR</td>
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</tr>
<tr>
<td>2.3.2 (iv)</td>
<td>Identification of any sensitive receiving environments that would receive stormwater discharge from the construction proposal, including but not limited to: (a) lands protected under environmental planning instruments such as the Coastal Management SEPP [now superseded by the Coastal Management SEPP] or SEPP 26 (Littoral Rainforest); and (b) land reserved or protected under national parks legislation such as Marine Parks, National Park estates or State Forests.</td>
<td>Section 3.5</td>
</tr>
<tr>
<td>2.3.2 (v)</td>
<td>Major erosion and sediment control measures, including but not limited to: (a) Up-gradient stormwater diversion to ensure clean water does not enter the construction site (b) Temporary cross drainage to transfer clean water through and/or around the site through all construction phases (c) Sedimentation basins, as required, designed in accordance with the sizing criteria in Blue Book Vol 2D.</td>
<td>Section 3.12, Section 4, Section 5, Appendix 1, ESCPs (Appendix 2).</td>
</tr>
<tr>
<td>2.3.2 (vi)</td>
<td>Water flow paths and direction for the construction area and adjacent property i.e. off site and on site water flow.</td>
<td>ESCPs (Appendix 2)</td>
</tr>
<tr>
<td>2.3.2 (vii)</td>
<td>Calculation of work area and soil loss for each road catchment (Refer Department of Housing’s Publication Managing Urban Stormwater - Soils and Construction).</td>
<td>ESCPs (Appendix 2) and Section 3.13</td>
</tr>
<tr>
<td>2.3.2 (viii)</td>
<td>Basin calculation for each road catchment that exceeds the soil loss equation in accordance with the Department of Housing’s Publication Managing Urban Stormwater - Soils and Construction.</td>
<td>Section 3.13, Appendix 1 and ESCPs (Appendix 2)</td>
</tr>
<tr>
<td>2.3.2 (ix)</td>
<td>Construction basin location and measures to direct on site runoff into the basin.</td>
<td>ESCPs (Appendix 2)</td>
</tr>
<tr>
<td>2.3.2 (x)</td>
<td>A risk assessment of the effective installation, operation or maintenance of major controls, including but not limited to: (a) Timing of installation of the major controls, with reference to the construction staging of the proposal, including traffic and earthworks staging; (b) Availability of land to install major controls, with reference to any property acquisition requirements or environmental restrictions on environmentally sensitive area.</td>
<td>Section 5 and ESCPs (Appendix 2)</td>
</tr>
<tr>
<td>2.3.2 (xi)</td>
<td>Measures to mitigate or eliminate identified risks, through design changes, construction methodology and additional land acquisition and/or leasing. Where risks cannot be eliminated, mitigation measures for managing the specific sub-catchment must be designed and documented in a summary table.</td>
<td>Section 5, specifically Table 5-3.</td>
</tr>
</tbody>
</table>
3. Existing environment

3.1 Climate

Bureau of Meteorology (BoM) rainfall statistics for Batemans Bay (station 069134 Catalina Country Club) are contained in Table 3-1.

Table 3-1: Monthly rainfall for Batemans Bay (BoM station 069134)

<table>
<thead>
<tr>
<th>Month</th>
<th>Jan</th>
<th>Feb</th>
<th>Mar</th>
<th>Apr</th>
<th>May</th>
<th>Jun</th>
<th>Jul</th>
<th>Aug</th>
<th>Sep</th>
<th>Oct</th>
<th>Nov</th>
<th>Dec</th>
<th>Annual</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rainfall (mm)</td>
<td>87.1</td>
<td>96.2</td>
<td>78.0</td>
<td>63.5</td>
<td>55.6</td>
<td>79.0</td>
<td>41.2</td>
<td>65.3</td>
<td>57.0</td>
<td>88.1</td>
<td>95.1</td>
<td>74.4</td>
<td>916.8</td>
</tr>
<tr>
<td>Mean no of days with rain &gt;1mm</td>
<td>8.7</td>
<td>8.7</td>
<td>7.7</td>
<td>6.4</td>
<td>5.1</td>
<td>5.7</td>
<td>4.7</td>
<td>4.8</td>
<td>6.9</td>
<td>7.9</td>
<td>9.1</td>
<td>9.0</td>
<td>84.7</td>
</tr>
</tbody>
</table>

The Bureau of Meteorology reports the 2-year, 6-hour rainfall event as 13.1 mm/hr (using the 1987 IFD values) or 11.2 mm/hr (using the 2016 IFD values) for Batemans Bay. This translates to a Revised Universal Soil Loss Equation (RUSLE) R-Factor of 3710 or 2720. R-factor mapping in Appendix B of Landcom (2004) notes the R-factor for Batemans Bay is between 3500 and 4000, so the higher value (3710) is adopted for erosion hazard calculations (refer to Section 3.13).

The risk of rainfall at any time of year is considered to be a significant constraint for construction-phase erosion and sediment control on this proposal.

3.2 Topography

Site topography is mostly steep and complex, with slope gradients around 20 to 30 per cent. Steep slopes (i.e. greater than 20 per cent) significantly increase the risk of erosion on disturbed ground.

Topography is considered to be a significant constraint for this proposal and would impact on the feasibility of constructing structures such as sediment basins, which are difficult to construct on steep hillsides.

The recommendations in Section 5 include proposed management and mitigation measures for topography-related constraints. Also refer to the accompanying ESCP (Appendix 2).

3.3 Soils - general

Soil landscape mapping is not available for the construction boundary. To determine soil conditions, two representative soil samples were collected along Glenella Road as part of the site inspection in October 2019. These were bulked, and were then subjected to in-house soil testing. Table 3-2 contains a summary of the soil characteristics based on soil sampling and testing by SEEC.
Table 3-2: Soil characteristics (interpretations based on Hazelton and Murphy, 2016).

<table>
<thead>
<tr>
<th>Soil characteristic</th>
<th>Conditions at the construction boundary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soil profile description</td>
<td>Light brown sandy loam topsoil (to 100 mm depth) and light yellowish brown sandy clay loam subsoil (to 500 mm depth – varies according to rock)</td>
</tr>
<tr>
<td>Soil field texture</td>
<td>Sandy loam to sandy clay loam</td>
</tr>
<tr>
<td>Soil pH</td>
<td>5.24 (strongly acidic)</td>
</tr>
<tr>
<td>Salinity (ECe)</td>
<td>1.632 (non-saline)</td>
</tr>
<tr>
<td>Emerson Aggregate Test</td>
<td>Class 5 (non-dispersive)</td>
</tr>
</tbody>
</table>

A conservative K-factor of 0.043 is recommended for erosion hazard calculations based on typical soil data presented in IECA (2008).

Key soils constraints include:

- Soils are strongly acidic across the entire construction boundary, which can be a significant constraint for revegetation following construction without effective amelioration with lime
- Soils are generally shallow, with limited topsoil resources
- Soils have extensive rock outcrop and shallow bedrock
- Soils have low fertility and low water holding capacity.

The recommendations in Section 5 include proposed management and mitigation measures for soils-related constraints.

### 3.4 Acid sulfate soils

Acid Sulfate Soil Risk Mapping (DLWC, 1997) did not identify the construction boundary as having a risk of acid sulfate soils (confirmed via the NSW Government eSpade portal, 2019). The closest mapped occurrence of Potential Acid Sulfate Soils (PASS) is about 1km north of the construction boundary. Site observations did not identify any landscape indicators that suggest acid sulfate soils might be present within the construction boundary.

### 3.5 Surface water

#### 3.5.1 Catchments and receiving waters

The proposal generally resides on or near ridgelines, and no named watercourses are intercepted within the construction boundary.

The proposal crosses a single first-order drainage depression and lies in close proximity to the headwaters of several other first-order depressions. The entire proposal lies in the headwaters of Hanging Rock Creek, which ultimately flows into the Tasman Sea at Batemans Bay about 2 km to the north-east from the construction boundary.
There are no areas within the construction boundary that are noted as lands protected under the Coastal Management State Environmental Planning Policy (SEPP).

In addition, there are no lands within the construction boundary that are reserved or protected under national parks legislation such as Marine Parks or National Park estates, although runoff from the proposal drains into the Batemans Marine Park (located about 500m north west of the proposal). Within the construction boundary are lands mapped as part of Mogo State Forest, including Special Management (Zone 2), Special Prescription (Zone 3), General Management (Zone 4) and non-Forestry use. As such, minimising the extent of clearing is essential and is a constraint for erosion and sediment control.

### 3.5.2 Existing drainage

Table drains exist along the edge of the Princes Highway around the location for the proposed roundabout with the South Batemans Bay Link Road. There is a kerb and gutter along the southbound side of the Princes Highway upslope of that location.

There are four pipe culverts of 375 mm diameter spaced approximately evenly along the existing Glenella Road within the proposed construction boundary.

### 3.5.3 Run-on of offsite water

A significant portion within the construction boundary is affected by the potential for offsite run-on from surrounding upslope lands. This would necessitate temporary cross-alignment drainage during construction until permanent cross-alignment drainage is installed.

Wherever possible, permanent drainage structures should be installed as early as possible to facilitate effective separation of offsite and onsite water. The locations where this occurs are noted on the Concept ESCPs in Appendix 2.

The recommendations in Section 5 include management and mitigation options for drainage-related constraints.

### 3.6 Flooding

Flooding can impact on the ability to install and/or operate erosion and sediment controls. The Blue Book (Landcom, 2004) suggests that special erosion and sediment control measures should apply to any works below the 2-year average recurrence interval (ARI) flood level. This includes:

- Sediment controls should be placed above the 2-year ARI flood level (e.g. basins, sediment fences etc)
- Requirements to stabilise lands using temporary ground cover whenever rain is falling or imminent
- Scheduling works for lower-risk times of year, based on historical rainfall figures.

Based on the assessment of flooding in the REF (Cardno, 2020), construction works associated with the proposal are unlikely to be affected by flooding that might impact on the effective installation and management of erosion and sediment controls.
3.7 Groundwater

Given the steep slopes and upland position of the construction boundary, elevated groundwater tables are not expected to occur, so are unlikely to impact on the effective installation and management of erosion and sediment controls during construction. No springs were observed within the construction boundary.

Given that the detectable presence of groundwater at or near the soil surface is highly dependent on seasonality and rainfall rates, strategies and controls to mitigate the groundwater effects can reasonably be assessed during site clearing and then, if required, determined concurrently with the progression of works.

3.8 Drainage structures during construction

During construction, there is a risk of offsite and onsite water mixing at various locations due to the undulating and steep topography which would limit the ability to install cross-alignment drainage as early works and divert offsite water in some locations. Individual locations where this issue has been identified are detailed in the Concept ESCPs in Appendix 2.

The risk of offsite and onsite water mixing is also high at the proposed roundabout construction area because existing drainage along the Princes Highway would direct upslope runoff to that location.

Wherever possible, permanent cross-alignment drainage (i.e. pipes or culverts) would need to be replaced, extended or installed as early as possible to facilitate effective separation of offsite and onsite water. In addition, temporary cross-alignment drainage would be required in a number of locations to facilitate effective drainage control during construction. Recommendations regarding this are included in Section 5 and on the accompanying ESCPs (Appendix 2).

3.9 Biodiversity

Biodiversity impacts and clearing would be minimised on this proposal. This is noted in Umwelt (2020).

Occasionally, this requirement can present a significant constraint for water quality management because it can limit the locations for structures such as sediment basins. However, on this proposal, the steep topography is the most significant limiting factor for the construction of sediment basins.

The ESCPs in Appendix 2 show the conceptual location for a construction-phase sediment basin. In locating this structure, local biodiversity and clearing limits have been considered.

3.10 Existing services

Existing services and utilities are a significant constraint for the construction of a proposed sediment basin, both underground (optic fibre) and overhead (electricity). This is discussed further in Section 5.2.
3.11 Land availability

Land availability is a common constraint for major road proposals during construction, especially for:

- Establishing stockpiles; and
- Constructing sediment basins.

Limited space in a narrow construction corridor can be compounded by topographical and ecological constraints, which can limit the location and sizing of sediment basins.

The accompanying Concept ESCPs (Appendix 2) identify the recommended location for a sediment basin and offsite and onsite water drains, along with recommendations for alternative management where sediment basins cannot reasonably be constructed.

Further, Section 5 includes recommendations regarding alternative management and mitigation measures where land availability constrains the potential to install structures such as sediment basins.

3.12 Design and construction constraints

3.12.1 Proposed drainage

As part of the ESMR process, we have considered how the design of the proposed drainage structures might help or hinder effective erosion and sediment control during construction. Specifically, this includes assessing:

- The feasibility for any new pits and pipes to convey dirty onsite water to sediment basins during construction
- The feasibility for new cross-alignment culverts to be installed early so they can convey offsite water across the work area; and
- The co-location of temporary (during construction) and permanent (for operation) drainage structures to assist with managing offsite and onsite water.

Comments based on this assessment are included in Table 5-1: Assessment of the feasibility to undertake typical erosion and sediment control measures on this proposal. Table 5-1 in Section 5 and in the Concept ESCPs in Appendix 2.

3.12.2 Sediment tracking onto surrounding roads

The proposal includes construction interactions with existing live traffic on several existing roads. As such, there is a risk of sediment tracking onto existing sealed live roadways from construction areas.

Refer to Section 5 for an assessment of the potential to manage sediment tracking during construction, along with recommendations for any identified constraints.
3.13 Erosion hazard

An evaluation of the erosion hazard was made using the approach in Chapter 4 of the Blue Book (Landcom, 2004). Given the slope gradients that occur along the proposal alignment, the proposal is considered as “high risk” and therefore calculations are required to assess each catchment. This process involves calculating the predicted annual average soil loss using the Revised Universal Soil Loss Equation (RUSLE) as follows:

\[ A = R \times K \times LS \times P \times C \]

Appendix 1 contains calculations for erosion hazard. Table 3-3 provides a summary of the conditions that are most frequently encountered.

Table 3-3: Erosion hazard calculations (from Landcom, 2004). For further details, refer to Appendix 1.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Definition</th>
<th>Values for this proposal</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>20% slopes</td>
</tr>
<tr>
<td>A</td>
<td>Total calculated soil loss (t/ha/yr)</td>
<td>896 t/ha/yr</td>
</tr>
<tr>
<td>R</td>
<td>Rainfall erosivity factor (refer to Section 3.1)</td>
<td>3710</td>
</tr>
<tr>
<td>K</td>
<td>Soil erodibility factor (Refer to Section 3.3)</td>
<td>0.043</td>
</tr>
<tr>
<td>LS</td>
<td>Slope length and gradient factor</td>
<td>40 m, 20% (LS-factor of 4.32)*</td>
</tr>
<tr>
<td>P</td>
<td>Conservation practice factor</td>
<td>Maximum of 1.3 assumed</td>
</tr>
<tr>
<td>C</td>
<td>Ground cover factor</td>
<td>Maximum of 1.0 assumed</td>
</tr>
<tr>
<td>Erosion hazard (from Landcom, 2004)</td>
<td></td>
<td>Very high</td>
</tr>
<tr>
<td>Catchment size trigger for sediment basins</td>
<td></td>
<td>0.22 ha (2,200 m²)</td>
</tr>
</tbody>
</table>

* Typically, 80m slope lengths are adopted. However, steep slopes of 20% or 30% don’t generally exceed 40m in length on the construction boundary, except in the area around the electricity easement. If a slope length of 80m was adopted in those areas it would generate an extreme erosion hazard and, as such, maintaining slope lengths at no more than 40m is proposed. Alternatively, temporary ground covers are proposed to minimise the risk of erosion on steep slopes during construction.

Included in Table 3-3 is an assessment of the construction catchment size that would trigger the need for constructing a sediment basin for a theoretical catchment with the nominated slope conditions, in compliance with Landcom (2004) and DECC (2008). This has been taken into account in positioning and sizing the sediment basins shown on the Concept ESCPs in Appendix 2. Where a sediment basin is triggered but cannot reasonably be provided, alternatives would need to be proposed. This is discussed further in Section 5.
4. Design standards for erosion and sediment control

4.1 Sediment basins

The Blue Book (Landcom, 2004 and DECC, 2008) notes that a sediment basin should be included in catchments where the erosion hazard exceeds 150 m$^3$/year (i.e. 200 tonnes/year) of soil loss. It is standard practice that each affected catchment on a road construction proposal be assessed against this requirement.

Following on from the erosion hazard assessment in Section 3.13 and the calculations in Table 3-3, an assessment of all catchments (existing catchments and future catchments once earthworks are complete) has been undertaken. It was identified that sediment basins would be required for most catchments disturbed during construction.

The design criteria for any sediment basins at this proposal are as follows (from Landcom, 2004):

- Design rainfall depth: 37.4 mm (5-day, 85th percentile for Batemans Bay) for all areas
- Basins designed for Type F (fine, non-dispersive) sediment
- Volumetric runoff coefficient ($C_v$): 0.8 adopted to account for compacted soils and steep slopes. This is an increase above the 0.64 value recommended in Appendix F in Landcom (2004).

There are severe topographical constraints to constructing sediment basins, so alternative measures would need to be implemented in locations where a basin is theoretically required but cannot be provided. A single sediment basin has been included in the ESCPs in Appendix 2, along with conceptual sizing and discussion regarding land availability.

For all catchments where a sediment basin is not feasible (but is theoretically required), alternative sediment controls such as mulch bunds (or equivalent) would be required, with compulsory ‘returns’ at 20 metre or 40 metre intervals (depending on erosion-hazard calculations). The ‘returns’ help to distribute runoff over the extended length of the alternative sediment control and avoid point-loading. They also help to ensure that the contributing catchment into each section of the alternative sediment control does not exceed the threshold for triggering the requirement for a sediment basin (1,400 m$^2$ on the steepest areas, from Table 3-3).

In addition to the alternative sediment controls (e.g. mulch bunds) and to offset the lower level of sediment control adopted, these catchments would need to be subject to enhanced erosion control, mainly in the form of temporary ground cover over high-risk areas (i.e. steep (>30%) batters and concentrated flow paths). This is discussed further in Section 5 (specifically in Table 5-3) and is noted on the Concept ESCPs in Appendix 2.
4.2 Onsite and offsite water separation

During construction, drainage is required to divert offsite water from upslope away from construction areas, either by using operational drainage structures or by installing temporary drainage. As much as is practicable, such drainage structures would need to be installed early to aid efficient construction and minimise the risk of erosion. This is detailed on the Concept ESCPs (Appendix 2).

In addition, temporary drainage would be required in some locations to ensure that:

- Offsite water is bypassed through or around work areas and away from sediment control structures; and
- Onsite water is diverted to sediment control structures such as sediment basins.

The recommended locations for temporary drainage are detailed on the Concept ESCPs (Appendix 2).

As much as possible, cross-alignment pipes or culverts should be installed or extended early to assist with separating onsite and offsite water during construction. In some locations, temporary cross-drainage would be required to achieve adequate separation due to the prevailing topography and design of the road. Those locations are marked on the Concept ESCPs (Appendix 2).
5. Management measures

5.1 Assessment of feasibility of erosion and sediment controls

In preparing the Concept ESCP drawings (Appendix 2), a review was conducted of the proposed concept design and the existing environment to determine how these might impact on effective implementation of erosion and sediment control during construction. Numerous constraints were identified that limit the establishment of features such as sediment basins.

Table 5-1 provides details of the principles of erosion and sediment control typically adopted on major road proposals, along with an assessment of whether each can be effectively implemented on this proposal.

Where constraints to the effective implementation of typical erosion and sediment controls are identified in Table 5-1, details of proposed safeguards, mitigation and/or management measures for each are contained in Table 5-3 and also on the Concept ESCPs in Appendix 2.

Table 5-1: Assessment of the feasibility to undertake typical erosion and sediment control measures on this proposal.

<table>
<thead>
<tr>
<th>No.</th>
<th>Erosion and Sediment Control Principle</th>
<th>Can this be applied on this proposal using typical default Blue Book controls?</th>
<th>Details or comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Assess constraints and opportunities for erosion and sediment control during the planning/design phase.</td>
<td>Yes – this report includes an assessment of constraints and opportunities for erosion and sediment control.</td>
<td>N/A</td>
</tr>
</tbody>
</table>
| 2   | Plan early for erosion and sediment control. | Yes – this report and the accompanying Concept ESCPs (Appendix 2) demonstrate early planning. 
Progressive ESCPs would be prepared during construction showing the location of controls for each stage of work. This is a typical requirement in Roads and Maritime QA G38 specification. 
The requirement to keep an up-to-date register of ESCPs during construction is typically included in Roads and Maritime QA G38 specification. | Ensure that Roads and Maritime QA G38 specification includes a requirement for progressive ESCPs. This is noted in Table 5-3. 
Ensure that Roads and Maritime QA G38 specification includes a requirement for a register of progressive ESCPs to be kept up to date. This is noted in Table 5-3. |
| 3   | Minimise the extent and duration of disturbance. | Yes. As part of the REF process, clearing limits were established that take into account biodiversity constraints. 
Flattening batters (i.e. not too steep) and sediment basins often contribute to the disturbed footprint. This has been taken into account. | N/A. |
<table>
<thead>
<tr>
<th>No.</th>
<th>Erosion and Sediment Control Principle</th>
<th>Can this be applied on this proposal using typical default Blue Book controls?</th>
<th>Details or comments</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>account and balanced with the need to minimise the extent of disturbance. Numerous access tracks would be required and have been included in the construction boundary. A standard suite of erosion and sediment controls would be feasible for these tracks. Notes to this effect have been included in the Concept ESCPs in Appendix 2. Refer also to Item 6 below.</td>
<td></td>
</tr>
</tbody>
</table>
| 4   | Manage soils, including conserving topsoil for later reuse in rehabilitation. | No. The following issues were identified:  
- Topsoil resources are limited. Topsoil might need to be imported to facilitate rehabilitation or alternatives employed such as compost blankets  
- Soils are strongly acidic, which could impact the success of rehabilitation.  
- Soils have low fertility and low water holding capacity, which could impact on the success of rehabilitation.  
Typical Roads and Maritime QA G38 specification and Blue Book requirements for stockpiling are feasible (including the requirement to cover erodible materials within 10 days).  
Refer to Table 5-3 for details regarding infertile and acidic soils.  
Comments are also included in Table 5-3 regarding the potential need to import topsoil or use compost blankets for effective rehabilitation. | |
| 5   | Control water flow on, through and off the site. | No. The following issues were identified:  
- Temporary drainage would be necessary in numerous locations to achieve adequate separation of offsite and onsite water, or to ensure dirty onsite water is directed to sediment basins  
- Some cross-drainage culverts would need to be constructed early or alternatives provided to allow for the flow of offsite water through the work area  
- Some cross-drainage culverts could not reasonably be constructed early due to construction constraints and the need to conduct earthworks first.  
It is generally feasible to divert upslope catchments around construction areas. However, some areas of offsite water could not be diverted away from the Concept ESCP | Refer to Table 5-3 and the Concept ESCPs in Appendix 2 for locations and details plus recommendations, mitigation and management measures to address each issue. |
<table>
<thead>
<tr>
<th>No.</th>
<th>Erosion and Sediment Control Principle</th>
<th>Can this be applied on this proposal using typical default Blue Book controls?</th>
<th>Details or comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>Minimise erosion as much as possible.</td>
<td>proposed sediment basin catchment, so the sediment basin has been increased in size to accommodate the additional catchment area.</td>
<td>Refer to Table 5-3 and the Concept ESCPs in Appendix 2 for locations and details.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Yes. In addition to the standard suite of erosion controls, enhanced erosion controls would be required to offset the reduced sediment control standard in those catchments where sediment basins are triggered but cannot feasibly be constructed. This is detailed in Item 7, below. Numerous access tracks would most likely be required and have been included in the construction boundary. A standard suite of erosion and sediment controls is feasible for these tracks including:</td>
<td></td>
</tr>
</tbody>
</table>
|     |                                      | • Whoa-boys (i.e. earth rollovers, or humps)  
• Gravel sheeting of steep (>10%) sections  
• Crowning of access tracks  
• Pipe culverts at sag points, including rock dissipaters  
• Relief culverts under access tracks at 80m intervals to ensure all water isn’t funnelled to the sag points  
• Ground covers used on cut and fill batters (e.g. fabric, mulch, polymer binder).  
Notes to this effect have been included in the Concept ESCPs in Appendix 2. | |
| 7   | Maximise sediment retention onsite.  | No. The following issues were identified:  
• Sediment basins are theoretically required in any catchment exceeding 1,400 m² (where slopes are greater than 20%) or 2,200 m² (for slopes up to 20%). Very steep and complex topography restricts the feasibility to install sediment basins in all but one catchment  
• Mulch bunds or equivalent controls are proposed for all catchments where sediment basins are not feasible. The proposal would be expected to generate significant quantities of mulch that | Refer to Table 5-3 and the Concept ESCPs in Appendix 2 for locations and details of alternatives, plus recommendations and management measures to address this issue in each catchment. |
<table>
<thead>
<tr>
<th>No.</th>
<th>Erosion and Sediment Control Principle</th>
<th>Can this be applied on this proposal using typical default Blue Book controls?</th>
<th>Details or comments</th>
</tr>
</thead>
</table>
| 8   | Rehabilitate disturbed lands progressively, ensuring rehabilitation is effective to reduce the erosion hazard. | Yes, however, the following issues were identified:  
- Soils are inherently infertile, acidic and have low water holding capacity. This could limit the success of revegetation unless effectively addressed  
- Steep topography can limit the potential for effective vegetative rehabilitation.  
The topographic and site conditions are not expected to limit the feasibility to spray water onto rehabilitated areas from a water cart. | Refer to Table 5-3 for details plus recommendations, mitigation and management measures. |
| 9   | Conduct regular inspections of the site to identify potential problems and allow for rectification or repair. | Yes. The requirement for documented inspections is typically included in Roads and Maritime QA G36 and G38 specifications. | No specific requirements for this proposal. |
| 10  | Maintain all erosion and sediment controls, including cleaning out sediment traps, until the upslope catchments are | Yes. The requirement to maintain and/or clean out erosion and sediment controls until the upslope catchments are rehabilitated is typically included in Roads and Maritime QA G36 and G38 specifications. | No specific requirements for this proposal. |
5.2 Concept ESCP sediment basin positioning

As part of the process of developing concept ESCPs (Appendix 2), each catchment was assessed to determine if a sediment basin would be required to meet typical Blue Book guidelines (Landcom, 2004 and DECC, 2008) and also to assess whether a sediment basin might feasibly be constructible for each catchment (Table 5-3).

Table 5-2: Catchment assessment to determine sediment basin triggers.

<table>
<thead>
<tr>
<th>Catchment ID*</th>
<th>Catchment Area (ha)</th>
<th>RUSLE Calculation (t/ha/yr)**</th>
<th>Catchment erosion hazard (t/yr)</th>
<th>Is a sediment basin triggered?</th>
<th>Is a sediment basin feasible?</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>CA1</td>
<td>2.43</td>
<td>896</td>
<td>2,177</td>
<td>Yes</td>
<td>No</td>
<td>Extensive tree removal would be required for a sediment basin. Steep slopes downslope of this catchment limit basin constructability.</td>
</tr>
<tr>
<td>CA2</td>
<td>1.12</td>
<td>896</td>
<td>1,004</td>
<td>Yes</td>
<td>No</td>
<td>Extensive tree removal would be required for a sediment basin. Steep slopes downslope of this catchment limit basin constructability.</td>
</tr>
<tr>
<td>CA3</td>
<td>0.54</td>
<td>896</td>
<td>484</td>
<td>Yes</td>
<td>No</td>
<td>Extensive tree removal would be required for a sediment basin. Steep slopes downslope of this catchment limit basin constructability.</td>
</tr>
<tr>
<td>CA4</td>
<td>3.15</td>
<td>1387</td>
<td>4,369</td>
<td>Yes</td>
<td>Yes</td>
<td>Refer to text below for options that were assessed.</td>
</tr>
<tr>
<td>CA5</td>
<td>0.54</td>
<td>1387</td>
<td>749</td>
<td>Yes</td>
<td>No</td>
<td>Extensive tree removal would be required for a sediment basin. Steep slopes downslope of this catchment limit basin constructability.</td>
</tr>
<tr>
<td>CA6</td>
<td>0.31</td>
<td>1237</td>
<td>383</td>
<td>Yes</td>
<td>No</td>
<td>Extensive tree removal would be required for a sediment basin.</td>
</tr>
<tr>
<td>Catchment ID*</td>
<td>Catchment Area (ha)</td>
<td>RUSLE Calculation (t/ha/yr)**</td>
<td>Catchment erosion hazard (t/yr)</td>
<td>Is a sediment basin triggered?</td>
<td>Is a sediment basin feasible?</td>
<td>Comments</td>
</tr>
<tr>
<td>--------------</td>
<td>---------------------</td>
<td>-------------------------------</td>
<td>-------------------------------</td>
<td>-----------------------------</td>
<td>-----------------------------</td>
<td>----------</td>
</tr>
<tr>
<td>CA7</td>
<td>0.39</td>
<td>1237</td>
<td>482</td>
<td>Yes</td>
<td>No</td>
<td>Steep slopes downslope of this catchment limit basin constructability. Extensive tree removal would be required for a sediment basin. Steep slopes downslope of this catchment limit basin constructability.</td>
</tr>
<tr>
<td>CA8</td>
<td>1.24</td>
<td>1237</td>
<td>1534</td>
<td>Yes</td>
<td>No</td>
<td>Extensive tree removal would be required for a sediment basin. Steep slopes downslope of this catchment limit basin constructability.</td>
</tr>
<tr>
<td>CA9</td>
<td>0.17</td>
<td>201</td>
<td>34</td>
<td>No</td>
<td>N/A</td>
<td>Risk threshold for a sediment basin not exceeded.</td>
</tr>
<tr>
<td>CA10</td>
<td>0.85</td>
<td>201</td>
<td>171</td>
<td>No</td>
<td>N/A</td>
<td>Risk threshold for a sediment basin not exceeded.</td>
</tr>
</tbody>
</table>

* refer to Concept ESCP in Appendix 2 for Catchment IDs.

**Refer to RUSLE calculations in Appendix 1.

Only one feasible location was identified, which is within the electricity easement downslope of the proposed roundabout on the Princes Highway and collects runoff from Catchment CA4. The identified location is constrained by overhead power lines and underground fibre optic cables, and lies in the invert of a steep drainage line. Refer to the Concept ESCP in Appendix 2 for details.

The steep terrain and the existing overhead and underground services limit the constructability and capacity of a sediment basin around the identified location. A number of iterations of basin positioning were investigated, with the Concept ESCP (Appendix 2) showing the basin in a position within the existing electricity easement that provides the maximum possible capacity, while avoiding underground services and minimising the risk of ponding water against the proposed fill batter for the road.

Figure 5-1 shows several other locations that were assessed for sediment basins in Catchment CA4. The following issues were identified for each:

- Location A is within the existing electricity easement and would have necessitated building an earth wall for the sediment basin over existing underground utilities.
- Location B is within the existing electricity easement but positioned so as not to sit under the overhead electricity lines. However this location could not achieve the required basin capacity without having water pond back against the proposed fill batter for the road.
- Location C is outside the electricity easement but a basin in this location could not achieve the required basin capacity without having water pond back against the proposed fill batter for the road.
• Location D (i.e. two basins, positioned either side of the natural gully line) were assessed as being too steep. Basins in those locations could not achieve the required capacity and would require extensive earthworks on very steep slopes.

Figure 5-1: Assessed locations for a sediment basin in Catchment CA4.

The estimated maximum achievable basin capacity for the selected location as shown on the Concept ESCP (Appendix 2) (and also shown in Figure 5-1) is 1,246m³, which is 212m³ less than the calculated capacity for what the basin should be, assuming a design requirement for the 5-day, 85th percentile rainfall depth (refer to Section 4.1 for details).

It is noted that, if the 5-day, 80th percentile rainfall depth was adopted instead of the 85th percentile (i.e. 28mm instead of 37.4mm), the required basin capacity would be 1,222m³, which is within what is estimated as being achievable in the identified location. However, given the requirement to design sediment basins for the 5-day, 85th percentile rainfall depth (because the basin would likely be in place for more than six months and the receiving environment includes a wetland on Hanging Rock Creek about 800m downstream, and the Batemans Marine Park about 3km downstream of the proposed sediment basin discharge location), if the 5-day, 80th percentile rainfall depth were to be adopted instead for the basin design, this would need to be offset by enhanced erosion controls. This could, for example, involve providing temporary ground cover over the fill batter during construction whenever rain is forecast.
5.3 Proposal-specific management measures

Table 5-3 contains a summary of those locations and aspects identified in Table 5-1 where proposal-specific management measures are required to address the inherent risk or the inability to employ typical best-practice erosion and sediment controls. Note that alternative options could feasibly be developed but should be based on consultation with a certified soil conservationist.

Table 5-3: Proposal-specific recommendations.

<table>
<thead>
<tr>
<th>No.</th>
<th>Location/aspect</th>
<th>Reason for adoption as a high risk area/aspect</th>
<th>Reference from Table 5-1</th>
<th>Recommended action(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Whole proposal</td>
<td>The staged nature of the construction activities would necessitate a progressive approach to erosion and sediment control planning.</td>
<td>2</td>
<td>Amend Roads and Maritime QA G38 specification to include a requirement for progressive ESCPs to be prepared for each construction stage prior to related works commencing.</td>
</tr>
<tr>
<td>2</td>
<td>Whole proposal</td>
<td>Acidic and infertile soils can limit the potential for effective revegetation.</td>
<td>4 and 8</td>
<td>Amend Roads and Maritime QA G38 specification to include a requirement to:</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• Test the pH and lime-treat as required any soil that will be used for revegetation.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• Apply fertiliser and/or compost to topsoils to improve fertility. The application rate is to be determined by soil testing.</td>
</tr>
<tr>
<td>3</td>
<td>Whole proposal</td>
<td>Soils have low water holding capacity, which could affect the success of revegetation.</td>
<td>4 and 8</td>
<td>Amend Roads and Maritime QA G38 specification to include a requirement to:</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• Include water holding crystals in site-won soils that are respread for revegetation</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• Water (via water cart or via irrigation lines) revegetation areas if natural rainfall is insufficient to promote vegetation growth.</td>
</tr>
<tr>
<td>4</td>
<td>Whole proposal</td>
<td>Topsoil resources are limited. This could limit the success of revegetation.</td>
<td>4 and 8</td>
<td>If there is insufficient viable topsoil available for re-use onsite for revegetation, consider use of compost blankets or imported topsoil.</td>
</tr>
<tr>
<td>No.</td>
<td>Location/aspect</td>
<td>Reason for adoption as a high risk area/aspect</td>
<td>Reference from Table 5-1</td>
<td>Recommended action(s)</td>
</tr>
<tr>
<td>-----</td>
<td>--------------------------</td>
<td>--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>-------------------------</td>
<td>-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>5</td>
<td>Cross-alignment drainage</td>
<td>Cross-alignment permanent drainage should ideally be installed early to facilitate the passage of offsite water through the construction area. This would not be feasible in most areas because earthworks would need to be conducted prior to being able to install the permanent drainage. Temporary drainage for offsite water would be required during construction.</td>
<td>5</td>
<td>The Concept ESCPs in Appendix 2 note where temporary cross-alignment drainage will be required during construction.</td>
</tr>
<tr>
<td>6</td>
<td>Enhanced erosion controls</td>
<td>Enhanced erosion controls would be required to offset the lower level of sediment control adopted in most catchments.</td>
<td>6</td>
<td>Refer to Item 7, below.</td>
</tr>
<tr>
<td>7</td>
<td>Sediment basins</td>
<td>Due to steep topography, only one feasible sediment basin location has been identified. Steep terrain, existing services and the proximity of the fill batter all constrain the feasibility to locate and construct a sediment basin designed for the 5-day, 85th percentile rainfall depth.</td>
<td>7</td>
<td>The sediment basin or alternative sediment controls as shown in Appendix 2 should be included in the proposal as the design is progressed. As the proposal design is progressed, continue to develop the concept ESCP to ensure a feasible configuration of sediment management controls is included that caters for the environmental requirements of the site. If the 5-day, 80th percentile rainfall depth is adopted for basin design, enhanced erosion controls should be one of the options to be considered to offset this. In all catchments that do not drain to a sediment basin, a requirement for batters to be covered whenever the forecast predicts &gt;50% chance of 10mm or more in the next 24 hours. This is noted in the Concept ESCPs (Appendix 2).</td>
</tr>
<tr>
<td>No.</td>
<td>Location/aspect</td>
<td>Reason for adoption as a high risk area/aspect</td>
<td>Reference from Table 5-1</td>
<td>Recommended action(s)</td>
</tr>
<tr>
<td>-----</td>
<td>----------------</td>
<td>-----------------------------------------------</td>
<td>-------------------------</td>
<td>-----------------------</td>
</tr>
<tr>
<td></td>
<td></td>
<td>sediment controls, which would be offset with enhanced erosion controls.</td>
<td>5-1</td>
<td>covered whenever the forecast predicts &gt;50% chance of 10mm or more in the next 24 hours. This is noted in the Concept ESCPs (Appendix 2).</td>
</tr>
<tr>
<td>9</td>
<td>Whole proposal</td>
<td>Steep topography means that rehabilitation may be difficult or unachievable in some locations using typical methods such as topsoil spreading and seeding. This is a design issue with significant cost implications for a contractor so would need to be detailed as part of the tender documentation on the design drawings.</td>
<td>8</td>
<td>Consider site-specific rehabilitation treatments that might include heavy duty spray treatments (e.g. compost blankets) which combine suitable binders, fertilizers and seed species appropriate for steep slopes and extreme conditions. Alternatively, engineered surface finishes may be required in some areas where rehabilitation cannot be achieved.</td>
</tr>
</tbody>
</table>
6. Conclusion

Transport for NSW is proposing to connect the Princes Highway with the existing South Batemans Bay Link Road at Glenella Road (the proposal). The proposal would include a new roundabout on the Princes Highway south of Batemans Bay and a new two-lane road (one lane in each direction) between the roundabout and Heron Road. The proposal would generally follow the current alignment of Glenella Road between Heron Road and the Princes Highway to complete the South Batemans Bay Link Road project.

The purpose of this report is to determine management issues for construction-phase erosion and sediment control.

- Section 3 identifies site conditions and identifies any potential constraints to construction-phase erosion and sediment control
- Section 4 identifies design considerations for erosion and sediment control measures
- Section 5 assesses the feasibility for constructing typical erosion and sediment control structures such as sediment basins, with a series of recommendations to manage or mitigate potential impacts relating to construction-phase erosion and sediment control.

Section 5 is accompanied by a set of Concept ESCP drawings (Appendix 2) showing the recommended setup of key erosion and sediment control measures such as sediment basins and up-gradient water diversions.

In preparing the Concept ESCP drawings (Appendix 2), a review was conducted of the site conditions to determine how these might impact on effective implementation of erosion and sediment control during construction. In a number of locations the steep topography limits the effective implementation of erosion and sediment control. In those locations, recommendations have been included to address this, with duplicate comments in Table 5-3.

Providing the recommendations in Section 5 of this report and the Concept ESCPs (Appendix 2) are adopted during the future design phases and construction, the risk of pollution from erosion and subsequent sediment runoff can be managed in accordance with recognised best-practice in NSW (i.e. Landcom 2004 and DECC, 2008).

Table 5-3 in Section 5 details a series of erosion and sediment control recommendations where typical controls are not feasible or would not suffice due to inherent site constraints. Note that alternative options could feasibly be developed but should be based on consultation with a certified soil conservationist.

It is recommended that Transport for NSW G38 specifications be modified to ensure that the recommendations in Table 5-3 are incorporated and thus carry through to the construction-phase of the proposal.
7. References


OEH NSW Government eSpade web portal. www.espade.environment.nsw.gov.au

Umwelt (2020). Biodiversity Assessment: South Batemans Bay Link Road.
Appendix 1

Erosion Hazard and Sediment Basin Calculations
## Site Name: South Batemans Bay Link Road

### Site Location: South Batemans Bay

**Precinct/Stage:** All

**Other Details:** EH=Erosion Hazard. SB1 uses 85th percentile. SB1A uses 80th percentile.

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

<table>
<thead>
<tr>
<th>Site Area</th>
<th>Sub-Catchment or Name of Structure</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total catchment area (ha)</td>
<td>EH1</td>
<td>EH2</td>
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<tr>
<td>Disturbed catchment area (ha)</td>
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<td>1</td>
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</table>

### Rainfall Data

<table>
<thead>
<tr>
<th>Rainfall Data</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Design rainfall depth (no of days)</td>
<td>5</td>
</tr>
<tr>
<td>Rainfall depth (percentile)</td>
<td>85</td>
</tr>
<tr>
<td>10-year, 100th percentile rainfall event (mm)</td>
<td>37.4</td>
</tr>
<tr>
<td>Rainfall R-factor (if known)</td>
<td>F</td>
</tr>
<tr>
<td>FD: 2-year, 6-hour storm (if known)</td>
<td>13.1</td>
</tr>
</tbody>
</table>

### RUSLE Factors

<table>
<thead>
<tr>
<th>RUSLE Factors</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rainfall intensity (K-factor)</td>
<td>0.043</td>
</tr>
<tr>
<td>Soil erodibility (K-factor)</td>
<td>0.043</td>
</tr>
<tr>
<td>Rainfall length (m)</td>
<td>40</td>
</tr>
<tr>
<td>Slope gradient (%)</td>
<td>30</td>
</tr>
<tr>
<td>Length/width (L/S-factor)</td>
<td>4.22</td>
</tr>
<tr>
<td>Sediment control practice (T-factor)</td>
<td>1.3</td>
</tr>
<tr>
<td>Ground cover (C-factor)</td>
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</tbody>
</table>

### Sediment Basin Design Criteria (for Type D/F basins only. Leave blank for Type C basins)

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Value</th>
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<tbody>
<tr>
<td>Storage (soil) zone design (no of months)</td>
<td>2</td>
</tr>
<tr>
<td>CV (Volumetric runoff coefficient)</td>
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### Calculations and Type D/F Sediment Basin Volumes

<table>
<thead>
<tr>
<th>Volume</th>
<th>Value</th>
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<tbody>
<tr>
<td>Soil loss (ton/yr)</td>
<td>896</td>
</tr>
<tr>
<td>Soil Loss Class</td>
<td>6</td>
</tr>
<tr>
<td>Soil loss (m²/ha/yr)</td>
<td>689</td>
</tr>
<tr>
<td>Sediment basin storage (soil) volume (m³)</td>
<td>299</td>
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<tr>
<td>Sediment basin settling (water) volume (m³)</td>
<td>325</td>
</tr>
<tr>
<td>Sediment basin total volume (m³)</td>
<td>1458</td>
</tr>
</tbody>
</table>
Appendix 2

Concept Erosion and Sediment Control Plans