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Nebraska Estate, St Georges Basin

Primary Erosion and Sediment Control Plan - Infrastructure Development

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Prepared for: Shoalhaven City Council

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1.0 INTRODUCTION

1.1. Purpose

Land that has been disturbed or cleared of vegetation is potentially subject to erosion as a result of stormwater runoff. Soil particles that are eroded in such a way are transported down-slope, usually settling in watercourses, wetlands and lakes.

Erosion and sedimentation may result in many adverse environmental impacts including:

- Reduction in water quality, increased turbidity and nutrient enrichment of water bodies,
- Damage to vegetation communities
- Disturbance to aquatic flora and fauna
- Increased potential for flooding
- Restrictions to navigation
- Reduction in recreational values
- Increased maintenance costs
- Promotion of weed growth
- Reduce agricultural, forestry and biomass production.

This plan will form the initial link in the chain to minimise on-site erosion and off-site sedimentation and therefore adverse environmental impacts.

1.2. Project Description

Nebraska Estate was a 'paper subdivision' registered in 1919 and released without any infrastructure to support its development. At the time of preparing this report, the land has very limited development potential due to the relevant planning controls. The land has generally remained undeveloped and un-serviced bushland with the exception of a few existing authorised structures.

After numerous studies and public exhibitions Council adopted a Planning Proposal based on a constrained development option that would enable up to 23 dwellings to be approved. The Planning Proposal was submitted to the Department of Planning and Infrastructure in late 2014.

The roads and service infrastructure are required to be constructed prior to the approval of individual dwellings. The costs associated with the provision of this infrastructure will be borne by the property owners.

1.3. Scope of this Plan

The purpose of this document is to serve as a broad based erosion and sediment control plan (ESCP) to outline the requirements and fundamental principles that must be followed in the planning and implementation of erosion and sediment control measures for the construction of the infrastructure works including road, drainage and fire trail construction.

A separate Primary ESCP has been developed for the management of development of lot based infrastructure on individual allotments.

This Primary ESCP will need to be supplemented with numerous Progressive ESCP's which detail the individual work areas and control measures required as construction of the project progresses. The progressive plans must be:

- Prepared by a suitably qualified practitioner with experience in the preparation of ESCP's.
- Integrated with work procedures, work method statements, activity statements and their scheduling.
- Site specific and will generally not need to repeat the information contained in this Primary ESCP and/or the Contractors EMP.
- Given a sequential number
- Controlled and distributed in accordance with the Contractors quality system procedures for document control.'

1.4. Legislative Requirements

The key environmental legislation relating to soil and water quality management includes:

- The Protection of the Environment Operations Act 1997 (POEO Act)
- The Environmental Planning and Assessment Act 1979 (EP&A Act)
- The Roads Act 1993

1.5. Supporting Documents

This document should be read in conjunction with the following supporting documents:

- Shoalhaven City Council Construction Specification Work Section 1102 – Control of Erosion and Sedimentation.
- Managing Urban Stormwater: Soils and Construction – Volume 1.
- Managing Urban Stormwater: Soils and Construction – Volume 2C, Unsealed Roads

2.0 SITE CHARACTERISTICS

2.1. Topography

The subject land is characterised by undulating slopes and three broad drainage depressions, draining to St Georges Basin at Home Bay via three unnamed watercourses and shown in Figure 1.

The south western and south eastern edge of the site are bounded by unnamed water courses, with the third water course running through the centre from north east to south west. The entire site thus comprises of four main sub-catchments separated by one ridge orientated north to south, and another orientated north east to south west.

The land is generally gently inclined with slope ranges of between 0-5˚ and elevations ranging between 2 and 22 metres AHD.

Figure 1 - Elevation of Subject Land (source SCC On-Site Effluent Disposal Assessment)

2.2. Soils and Geology

The geology of the area is dominated by Shoalhaven Group (Permian sedimentary formations) with the exception of Quaternary alluvial deposits in lower areas and creek lines.

The Land Capability Assessment conducted by Morse McVey & Associates Pty Ltd in 1994 identified two soil landscapes:

- Wandrawandian – occurs on crests and side slopes. Duplex (textural contrast) soils (typically clay loam topsoil over light-medium clay subsoil). Topsoil limitations include high erodibility, low fertility and strong acidity. Subsoil limitations include moderate to high erodibility, low fertility, strong acidity, potential aluminium toxicity and poor drainage.
- Tomerong Creek soil landscape – occurs on the lower lying land associated with the un-named watercourses. Characterised by low slopes (<5%) and high clay and silt content with high reactivity (large shrink-swell characteristics), low fertility, strong acidity, and potential aluminium toxicity.

Significant soil constraints were identified and include:

- High soil erodibility (values of 0.026 and 0.046 used in the universal soil loss equation – USLE), and;
- Moderately dispersive subsoil (with dispersion percentage ranging from 1.3 – 3.3), meaning that the clay particles can be more readily eroded and transported to the downstream environment. Soils on the site have been classified as Type F (fine textured) soils.

Acid Sulfate Soils

The lower reaches of the flood prone land were identified by the Huskisson Acid Sulfate Soils Risk map as having a high probability of Acid Sulfate Soils (ASS) occurring within one metre of the ground surface. This land is identified as 'Class 2' on the Acid Sulfate Soils map that forms part of Shoalhaven LEP 2014, to which clause 7.1 applies. Clause 7.1 can also be triggered for works within 500m of adjacent Class 1, 2, 3 and 4 land that is below 5m AHD. Refer to Clause 7.1 of SLEP 2014 for further details.

The affected area is encompassed within the area that is proposed to be zoned E2 – Environmental Conservation, where no additional residential development is proposed. Appropriate investigations, including preparation of an ASS management plan, would be required to be undertaken prior to undertaking any works associated with upgrading of Fisherman Road or excavation for the purpose of providing water or sewerage services.

In 2001, Environmental and Earth Sciences P/L undertook an ASS investigation along the path of the proposed sewerage line for Park Road, Nebraska Estate. This investigation involved soil and groundwater testing at the southern end of the subject land. The results of the investigation are summarised below:

- There was negligible PASS. A borehole within the main watercourse contained low concentrations of soil sulphides but these were considered non-reactive.
- As a cautionary measure, it was recommended that any soil excavated from the watercourse, should be mixed with 4 kg of lime per ton of soil.
- Groundwater should be monitored if dewatering is undertaken for periods exceeding one week.
- Any concrete or metallic structures placed between the banks of the watercourse should have a buffer of at least 150 mm of sand mixed with lime at a ratio of 5 kg per ton of sand.

2.3. Flooding

The modelled extent of stormwater inundation in Nebraska Estate is shown in Figure 2, This figure displays the results from several flood studies:

- 'St Georges Basin Flood Study', Webb, McKeown and Associates P/L, 2001
- 'St Georges Basin Floodplain Risk Management Study and Plan Climate Change Assessment', WMA Water 2013
- A site specific draft preliminary catchment analysis prepared from airborne laser scanning (ALS) survey over Nebraska Estate by Shoalhaven City Council, 2006.

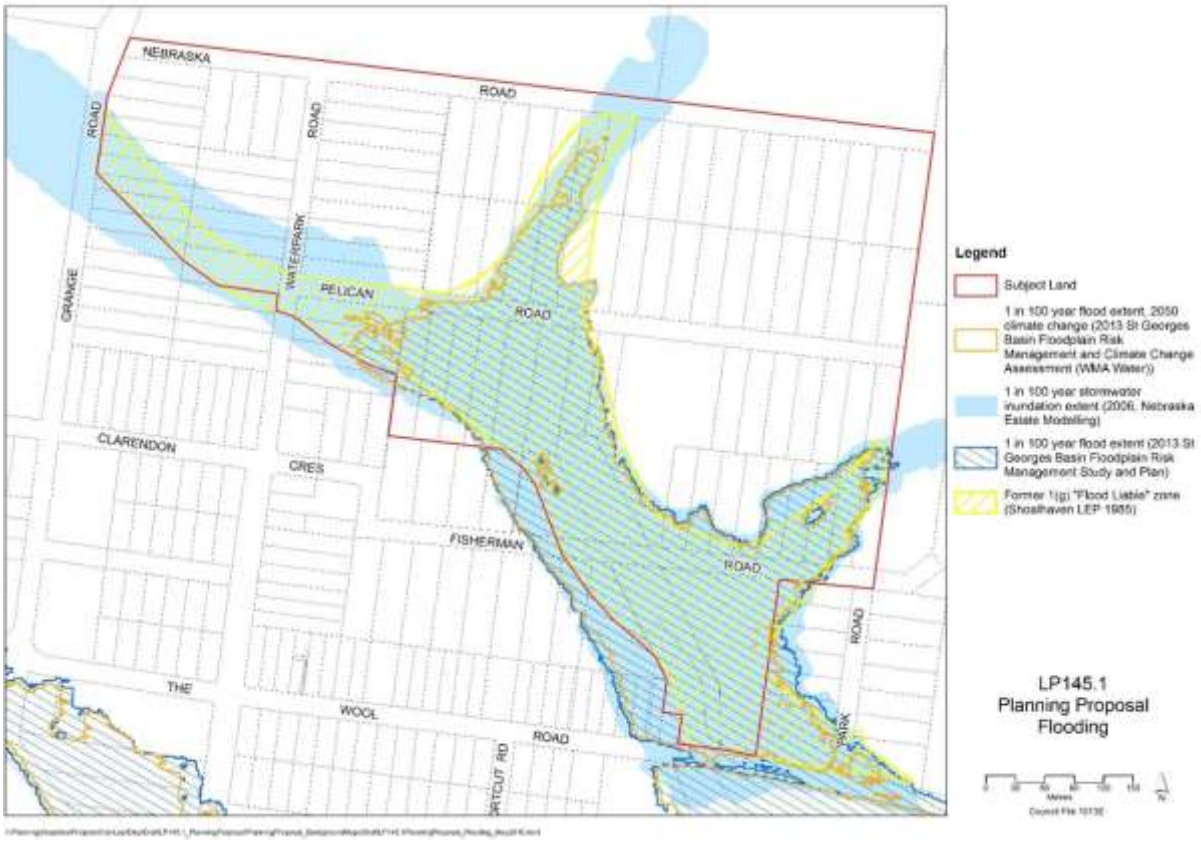

Figure 2 – Flood-related information (source SCC Project Brief)

2.4. Flora and Fauna

The subject site is home to a number of endangered, threatened or protected plant species. Swamp Sclerophyll Forest, is categorised as an endangered ecological community (EEC) under the NSW Threatened Species Conservation Act (BES, 2009). This EEC broadly corresponds to the flood prone land area, which also contains a population of protected Biconvex Paperbark (Melaleuca biconvexa). The north east corner of the subject land also contains a large number of threatened orchid species, one of which (Pterostylis ventricosa) was actually discovered in Nebraska Estate in 2000.

2.5. Aboriginal Cultural Heritage

Archaeological studies were undertaken in Nebraska Estate in 1994, 1995 and 2001. The first of these identified two small scatters of stone artefacts and one isolated artefact within the drainage lines. All three Aboriginal sites are located within the proposed E2 zone and no further residential development is proposed on the affected land. Some ground disturbance will be necessary for the construction of infrastructure and if these works uncover any additional artefacts the necessary requirements will be undertaken in order to comply with the NSW National Parks and Wildlife Act and regulations.

3.0 CALCULATED SOIL LOSS

The annual average soil loss during construction activities on the subject site has been estimated at 560 tonnes/ha/year using the Revised Universal Soil Loss Equation as defined in Managing Urban Stormwater: Soils and Construction, Volume 1 and using the values below.

Parameter	Adopted Value	Source/Comment
R – Rainfall Erosivity Factor	4,550	Morse Mcvey, 1994 (Section 2.7)
K – Soil Erodibility	0.046	Morse Mcvey, 1994 (Section 3.2) based on Tomerong Creek Soil Landscape (worst case scenario)
LS – Slope Length/Gradient Factor	2.05	Based on 8% gradient (approx. 5 degrees) and maximum 80m slope
P – Erosion Control Practice Factor	1.3	Assumed Compacted and Smooth
C – Cover Factor	1.0	Recently disturbed soil with no cover

Based on the above calculated soil loss rate the subject site is classified as having **Soil Loss Class 5** and **HIGH Erosion Hazard**.

4.0 KEY MANAGEMENT STRATEGIES

In comparison to urban development rural road construction has a number of key characteristics and differences and therefore the approach to erosion and sediment control needs to be tailored accordingly. Some of the key characteristics of rural road construction include;

- they are linear
- they cross multiple catchments and have numerous discharge points
- the road corridor is often limited in width.

With conventional subdivision, road construction occurs prior to release of the subdivision certificate thereby providing the contractor with the ability to utilise future lots for the construction of temporary sediment controls.

At Nebraska Estate, however the lots have already been subdivided and are in private ownership and therefore the ability to utilise such land for temporary sediment control is very limited. Furthermore, the land proposed to be zoned E2 is affected by one or more environmental constraints, hence the degree of disturbance should be minimised from an environmental perspective.

Given the above constraints erosion and sediment controls implemented for road construction will need to be confined to the public road corridors. Due to the limited space available within the existing road reserve the adoption of source controls in combination with sound site management practices is considered the most appropriate form of soil and erosion control.

The following site management practices and temporary and permanent treatment measures should be considered and incorporated, as deemed appropriate, into any Progressive Erosion and Sediment Control Plans prepared for construction of the public road network and service infrastructure.

4.1. General

- Ensure erosion and sediment control are installed at all sites associated with the construction activities including access roads and tracks, office and compound sites.
- Develop relevant documentation and systems for recording erosion and sediment control activities via:
    - Progressive ESCP
    - Inspection reports
    - Maintenance checklists
    - Meeting/Toolbox Talk Minutes

- Highlight the importance of soil conservation issues during site induction and continually address relevant matters at regular toolbox meetings during the course of the project.

4.2. Site Management Practises

Managing Urban Stormwater: Soils and Construction, Volume 2C – Unsealed Roads, provides guidance on appropriate site management measures that should be implemented during construction in order to ensure effective erosion and sediment control. These measures include;

- timing of construction to avoid erosive rainfall periods
- programming construction stages to minimise erosion
- minimising the extent and duration of disturbance
- conveying clean water through the site
- practicing good site housekeeping

A summary of each measure is provided below. For further information refer to Volume 2C, Section 6.2.

4.2.1. Timing of Construction

Based on the soil loss rate calculated in Section 3.0 the subject site is classified as having a Soil Loss Class 5 and therefore, in accordance with Table 4.3 *Managing Urban Stormwater: Soils and Construction, Volume 1,* works should be not be scheduled to be undertaken during either February or March.

4.2.2. Construction Sequencing

Implement construction programming that promotes good erosion and sediment control including;

- early installation of culverts and other permanent drainage works
- installation of culvert outlet and inlet protection works immediately following culvert installation
- early installation of permanent catch drains (where relevant) and lining
- constructing the bio-retention trench component of the bio-swales after sealing of the road surface and stabilisation of roadside batters. Alternatively consideration could be given to the placement of a temporary geotextile and sacrificial topsoil layer over the bio-retention trench, removing this on completion of road sealing and then placing the final topsoil layer and vegetating.

- regular watering and weeding of swales/bio-swales during the establishment period and until a good cover is achieved. This may require water tankers to be used to irrigate the swales to ensure grass survival. Drought tolerant species are to be used.
- Removal of excess sediment accumulation in swales/bio-swales during the establishment period and until the site has settled and sealed.
- progressive revegetation throughout the project
- progressive stabilisation of batters.

4.2.3. Minimising Extent of Soil Disturbance

- Clearing and grubbing shall be limited to two (2) metres from the edge of any essential engineering activity (i.e. top and toe of batters, stormwater outlet).
- Clear and grub to leave the soil surface in a reasonably rough condition with some surface vegetative cover.
- Stage construction works to minimise the extent of disturbance at any given time in order to negate the need for construction phase sediment basins. For example constructing, sealing and stabilising batters on one road/section prior to commencing construction on the road/next section. The extent of disturbance should be no more than that which limits the average annual soil loss from the total area of land disturbed to less than 150 cubic metres per year.
- Completing works and stabilising disturbed areas quickly and progressively.
- Stabilise drainage structures as soon as possible following construction

4.2.4. Control of Stormwater Runoff

- Separate clean run-on water from dirty (e.g. turbid) construction area runoff through the use of diversion banks and drains.
- Construct permanent drainage structures early in the project such as catch drains and culverts (including associated inlet and outlet protection works)
- Maximise the diversion of turbid construction runoff into sediment control devices such as sediment basins and filters.
- Divert runoff from the road formation into the stormwater drainage system as soon as practical to reduce surface flow lengths.

4.2.5. Practicing good site house keeping

Essentially good site housekeeping means keeping the site in a clean and orderly manner and includes;

- limiting the number of sediment sources by minimising the number of stockpiles. Placing material as it is excavated will help reduce the number of stockpiles. And also minimises double handling.

- removing unwanted spoil stockpiles progressively and quickly
- locate stockpiles away from heavily trafficked areas, areas prone to inundation and drainage lines.

4.2.6. Use of Erosion Control Measures

- Stockpile soil materials in low hazard areas clear of natural depressions, drainage channel or watercourses. Additional protection to be afforded with temporary vegetation, diversion banks and sediment control measures, as required.
- Construct a range of erosion controls including sediment fences, rock check dams and straw bale filters within the various road catchments to complement and increase the effectiveness and efficiency of any sediment controls in the lower areas.
- Use geotextile linings to provide temporary surface protection in areas of concentrated flows.
- Construct control measures as close as practical to the potential sediment source.
- Control the deposition of mud and soil materials onto local roads through the use of an appropriate stabilised site access.

4.2.7. Stabilisation of Disturbed Areas

- Ensure the success of the later revegetation by utilising good quality topsoil.
- Ameliorate exposed/disturbed subsoils with gypsum (or other suitable chemical ameliorant) at a rate of 2.5kg/10m^2 to reduce soil dispersion.
- Progressively and quickly revegetate disturbed areas utilising appropriate species.
- Control dust through progressive revegetation and water tankers.

4.2.8. Inspection and Maintenance

- Ensure the progressive and continual implementation and maintenance of temporary erosion and sediment controls (e.g. sediment fences, diversion banks, diversion drains, sediment traps)
- Initiate a program to ensure regular maintenance of all erosion and sediment control measures. Sediment cleaned from structures is to be deposited in a secure location where further pollution will not occur.
- Arrange regular inspections to review and update control measures. Additional inspections shall be conducted during and/or immediately following significant (i.e. >10mm/24hrs) rainfall events to monitor the functioning of controls.

4.3. Temporary Control Measures

Temporary erosion and sediment control measures considered suitable for use during road and service infrastructure construction activities include, but are not limited to the following;

- silt fences
- check dams
- excavated, straw bale or sand bag sediment traps
- temporary diversion drains
- geotextile pit inlet filters
- lining swales with biodegradable jute matting

A suite of standard erosion control measures that may be implemented on site are included in Appendix A and have been extracted from *Managing Urban Stormwater; Soils and Construction, Volume 1* (Landcom , 2004).

In determining of the most appropriate erosion and sediment control measures to incorporate into the Progressive ESCPs the designer should make reference to *Managing Urban Stormwater; Soils and Construction, Volume 1* (Landcom , 2004).

The design criteria to be adopted for the design of temporary erosion control measures should be in accordance with Table 1. The subject site is considered to be in a sensitive environment given the environmental sensitivity and constraints of the site.

Table 1 - Design Storm Event for Temporary Erosion and Sediment Control Measures (source MUS, Vol 2c)

Control Measure Description	**Standard Design**	**Sensitive Environment[1]**
Temporary drainage (erosion) control (e.g. diversion banks, perimeter banks, catch drains, level spreaders, check dams, batter drains and chutes) should be designed to have a non-erosive hydraulic capacity (excluding freeboard) sufficient to convey the	2 year ARI	5 year ARI

nominated design storm event.		
Temporary Sediment Control (e.g. sediment fences, stacked rock sediment traps) in small catchment were used as a 'last line of defence' (i.e. without a sediment basin down-slope) should be constructed to remain structurally sound in the nominated design storm event.	2 year ARI	5 year ARI

[1] A 'sensitive environment' is one with a high conservation value, or that supports human uses of water that are particularly sensitive to degraded water quality.

5.0 REFERENCES

Landcom (2004) *Managing Urban Stormwater; Soils and Construction – Volume 1 (4th Edition)*

Landcom (2008) *Managing Urban Stormwater; Soils and Construction – Volume 2C*

Morse McVey (1994) *Land Capability Report for Nebraska Estate, The Wool Road, St Georges Basin,* Morse McVey and Associates.

APPENDIX A

Standard Erosion Control Measures