



Sediment and Erosion Plan and Strategy

The New Primary School at Warnervale

Prepared for Billard Leece Partnership
6 August 2019

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1 Introduction

1.1 Purpose

SMEC Australia Pty Ltd (SMEC) were engaged by Billard Leece Partnership Pty Ltd (BLP) on behalf of School Infrastructure NSW to develop a Sediment and Erosion Plan and Strategy (SEPS) for The New Primary School at Warnervale at 75 Warnervale Road, Warnervale NSW (the site). This SEPS forms part of the technical inputs to the Environmental Impact Statement (EIS) for the project. The Project has been deemed State Significant Development (SSD 9439).

It must be acknowledged that this document is for information only and has been solely developed for the EIS assessment with School Infrastructure NSW, Department of Education (the applicant), Department of Planning and Environment and Central Coast Council as the target audiences. It is expected a project approved Erosion and Sediment Control Plan (ESCP) will be developed by the construction contractor in consultation with School Infrastructure NSW, Department of Education (the applicant), Department of Planning and Environment, Central Coast Council and relevant stakeholders prior to the commencement of any works.

1.2 Scope

This management plan specifically relates to the associated site establishment and capital works construction. This plan covers the locations as shown on the drawings only and do not cover any other areas or scope of works. Erosion and sediment controls will need to be re-assessed for future works and revised plans will be required (or these plans can be updated) to reflect final detailed design and construction staging. The plan does not cover rehabilitation or landscaping.

The SEPS serves as an information document to provide guidance to the New Primary School at Warnervale EIS principal consultant (BLP) on how management erosion and sediment control during construction may occur. This SEPS has been designed in accordance the following standards and guidelines:

- Managing urban stormwater: soils and construction Volume 1, Landcom, 2004 (the 'Blue Book')
- Managing urban stormwater: soils and construction Volume 2D, Main road construction, Department of Environment and Climate Change, NSW, 2008.

The SEPS is to be read in conjunction with Cardno Limited sedimentation and erosion control plan (Appendix A).

1.3 Project Description

The proposed development comprises demolition of all existing structures and construction of a new school accommodating 460 students. The school is to include

- New Core 35 Hall
- New Core 21 Administration & Staff Building
- New Core 21 OOSH
- New Core 21 Canteen
- New Core 21 Library
- New Core 21 (2x) Special Programs
- New Teaching Spaces 20 (Includes 2 Special Education Teaching Spaces)
- New Core 21 Student Amenities
- New Core 21 COLA
- Considerations for Future Expansion
- Staff Carpark 21 Spaces
- Visitor 5 Spaces
- Accessible 2 Spaces
- Related Road Works & Drop off/pick up Zone
- New Games Court

The design is intended to account for the possibility of future expansion of teaching and core facilities for up to 1,000 students.

1.4 Demolition and Construction Staging

The demolition and construction stages will be detailed during detailed design and seeking to minimise disruption school operational requirements and managed in consultation with the project construction traffic management planning.

1.5 Assumptions

At this current stage of the planning process there are a few project variables to be defined by the construction contractor during the demolition and construction phasing. To provide a more progressive ESCP the following assumptions have been made:

- Demolition and construction may occur progressively
- Each stage will have up gradient surface flow managed via existing drainage infrastructure
- Building identified for demolished and renovation will retain operational drainage assets where possible and do not require additional erosion and sediment controls
- Proposed demolition works does / does not include demolition of any roadways or underground utilities associated with stormwater or sewer mains. These may need specific controls implemented during decommissioning if required.

2 Existing Environment

The study area has an elevation of about 20 metres and is largely flat with a slight swale in the middle of the study area running north/south. The terrain of the study area has been modified as a result of establishing the existing school complex including buildings and some derelict fencing and regeneration of local vegetation. About 450 metres to east of the site is an ephemeral tributary to Porters Creek flowing in north to south direction towards the Porters Wetland and draining to Wyong River. The study site currently is well vegetated and so the ephemeral creek and is surrounded by dense remnant or regrowth vegetation.

2.1 Soil landscapes

The site is mapped as occurring on the Gorokan Erosional Soil Landscape on the soil landscape of the Gosford-Lake Macquarie 1:100,000 Sheet (Murray, 1993). The Gorokan landscape is described as occurring on undulating low hills on lithic sandstone of the Tuggerah Formation. Soils are moderately deep and the dominate materials include loose dark brown loamy sand, yellowish brown hard setter clayey sand, yellowish brown strongly pedal clay and light grey massive clay. This soil landscape occurs over the Narrabeen Group – Clifton Subgroup – Tuggerah Formation geology which is light coloured lithic sandstone, pebbly in part, red brown and grey green claystone and siltstone with rare conglomerate (Murphy, 1993).

2.2 Study area catchment

The study area drains to the Porters Creek and wetlands which is a tributary of Wyong River catchment, which flows into Tuggerah Lake 4.5 km to the southeast.

The study areas immediate catchment boundary is defined by up gradient surface flows being managed by Warnervale Road stormwater infrastructure. These up gradient areas contain remnant or regrowth vegetation and pasture areas.

Down gradient is a revegetated wooded area with good understorey coverage as well with no defined released location of the site due to low undulations associated with the lay of the land.

The demolitions sub catchments requiring management during construction to control soil and water impacts are further detailed in Section 4.

A search of the WaterNSW database, identified 17 registered groundwater bores within a 2 kilometre radius of the Site. Two bores were located within 500 metres of the Site and described as:

- GW080833 – Test Bore (120m to the north-east, adjacent to the Warnervale Oval). No details were provided on the well construction detail or water bearing zones; and
- GW200569 – Test Bore for irrigation (154 metres south-east, within adjacent property). The bore log identified that the well was drilled to 66m bgs, with the first water bearing zone comprising a sand deposit at substantial depth (24m bgs).

The cluster of five wells east of the site are listed as test wells and the cluster of nine wells to the north-east are listed as monitoring wells (Kleinfelder, 2018).

2.3 Climate

Bureau of Meteorology climatic statistics for The New Primary School at Warnervale (about 11 kilometres west from Norah Head AWS 061336) are contained in Table 2-1. Table 2-1 show that rainfall occurs throughout the year although with a slight summer dominance. Temperatures are warm to mild. As a coastal area, winds can be strong at any time of year. Prevailing summer winds are from the north-east, and from the south-east in winter. (BoM, 2018).

Table 2-1 Monthly climate averages for Norah Head (AWS 061336) as at May 2019.

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Rainfall (mm)	82.7	107.7	115.2	128.9	132.8	156.6	820	67.36	61.3	63.9	93.9	67.9	1153.5
Mean no. of days with >1mm	8.1	8.4	9.1	9.0	9.1	10.0	7.2	6.0	7.2	6.9	8.5	7.1	96.6
Mean min temp (oC)	19.8	20.0	18.9	16.0	13.1	11.1	9.8	10.5	12.8	14.9	16.8	18.5	15.2
Mean max temp (oC)	26.2	26.1	25.2	23.0	20.3	18.0	17.5	18.9	21.1	22.7	23.8	25.0	22.3
Mean 9am wind speed (km/h)	18.5	18.0	17.8	16.0	15.8	16.4	15.5	15.5	16.1	18.0	19.9	18.6	17.2

2.4 Surface water quality

An Initial Evaluation of Contamination Potential Report was prepared by Kleinfelder in September 2018 (Kleinfelder, 2018). A site walkover and map search did not reveal any obvious surface water features such as creeks or dams. The gradient across the site moves down and away in an easterly direction. A small dam is located approximately 185 metres from the eastern boundary of the Site at the adjacent easterly property. Several small dams are also located to the south within grazing lands.

2.5 Erosion hazard areas

In accordance with Section 4.4.2 of the Blue Book, areas which pose a 'high' erosion hazard are those which have a Soil Loss Class (SLC) of 5 or greater. This equates to a calculated soil loss of greater than 500 (tonnes / hectare / year). Soil loss equations for construction catchments are to be provided once construction staging is defined.

Common areas which would present a high risk of soil erosion and resulting environmental impacts include areas of concentrated flows and locations where surface gradients and slope lengths combine to increase the erosive potential of stormwater runoff. During the construction phase these locations would typically include:

- Road embankments and cut faces
- Stormwater asset realignments
- Culverts and drainage outlets
- Cut to fill for site levelling and embankments.

2.6 Environmentally Sensitive Receiving Areas

Sensitive areas in proximity to the study area include:

- To south west of the project is Porters Creek Wetland before flowing into the Wyong River and Tuggerah Lake.
- The site is surrounding heavily vegetated areas of remnant or regrowth vegetation There are remnant trees in the southern segment the development
- One small farm dam 200 metres east of the project (south of Warnervale Road)

- Agricultural landuse to the east
- Urban residential subdivision immediately to the north.

3 Design Criteria And Assumptions

The Preliminary ESCP and the associated calculations and drawings have been prepared based on the concept design for drainage.

The proposal involves the demolition of all residential structures and leaving the road pavement, footpaths and stormwater drainage intact.

3.1 Demolition Staging

Collectively these constraints present significant spatial challenges for the proposal to meet typical Blue Book objectives. A number of design inputs, construction methodology and property acquisition are required for final catchment size calculations in accordance with the Blue Book during detailed construction planning. Additional construction sub staging is required to assess catchments at intersections to manage traffic flows, up gradient offsite water diversions or drainage cross overs and existing stormwater asset decommissioning are not assessed in this report.

3.2 Construction Catchments

Preliminary construction catchments have been identified for the entire length of the proposal in accordance with the proposed design (refer to Appendix A). Each construction catchment has been assessed in principle with Blue Book and using the Revised Universal Soil Loss Equation (RUSLE) to determine the need for likely sediment basin locations.

The design of construction catchments followed a best practice management approach in accordance with the Blue Book which included the following considerations:

- A maximum value / worst case scenario has been adopted for design input data
- Slope lengths have been calculated as the distance from the origin of overland flow along its flow path to the location of either concentrated flow or deposition.
- Where required (e.g. intersections) catchments were sized to be inclusive of all sub stages to improve efficiency of control implementation.

Review of catchment sizing will be required at construction to reflect available lands due to acquisitions and contractor construction phasing. Up gradient urban stormwater catchments may also need to be considered in some events where offsite water diversion controls are being temporarily or permanently impacted.

3.3 Design Parametres

In accordance with the Blue Book,

Table 3-1 details the design parameters which have been used to estimate the Revised Universal Soil Loss Equation (RUSLE) for each identified construction catchment of the proposal. Additional RUSLE calculations may need to be reviewed subject to detailed construction staging and planning details based on revised slope length and gradient factors.

Table 3-1 Demolition catchment assessment parameters.

Parameter	Value	Blue Book Reference
Sediment Type	Gorokoan Soil Landscape Type D	Table C17. Gosford-Lake Macquarie
Soil Hydrological Group	Gorokoan Soil Landscape Group C	Table C17. Gosford-Lake Macquarie
Volumetric Runoff Coefficient (Cv)	0.42 – moderate to high	Table F2 in Appendix F
Rainfall Data	26.8mm (5 day 75th%tile)	Table 6.3(a)
Rainfall Erosivity (R factor)	3500	Appendix B, Map 10
Soil Erodibility (K factor)	0.05	Table 17
Erosion Control Practice (P factor)	1.3	Appendix A Table A2
Ground Cover and Management Factor (C factor)	1	Appendix A Section A6

3.3.1 Slope length and gradient factor

The slope length and gradients have been measured using each designated flow path length. The values have been used to calculate the LS factor using Table A1 of the Blue Book.

3.3.2 Erosion control practice factor

A default P factor of 1.3 has been adopted. This reflects a worst case scenario ‘compacted and smooth’ surface condition of the site.

3.3.3 Ground cover and management factor

A default C factor of 1 has been adopted. This reflects a worst case scenario cover factor where topsoil has been stripped.

4 Catchment Risk Assessment

4.1 Construction Catchment Sizing

Catchment sizing is based on the proposed construction activity area, project engineered elements like new pavement, new drainage features and temporary school facilities required during the construction phase schedules. The requirement for sediment basins has been considered throughout the concept design process. Placement of proposed basins have been assessed for co-location potential with the proposed permanent operational water quality basins or detention tanks.

Sizing of catchments may need to be further defined once construction staging planning is underway. Provisions for potentially larger up gradient stormwater catchments would be taken into consideration during higher risk activities for example: redirecting live stormwater assists, or when bridge deck surface water is connected to site water.

4.2 Erosion Risk Hazard and High Risk Area

An evaluation of the erosion risk was made using the Revised Universal Soil Loss Equation (RUSLE) methodology. The RUSLE formula is outlined below:

$$A = R \times K \times LS \times P \times C$$

Where:

- A is computed soil loss (tonnes/hectare/year)
- R is rainfall erosivity factor
- K is soil erodibility factor
- LS is slope length and gradient factor
- P is soil conservation practice factor
- C is ground cover factor.

The values identified in Table 3.1 Section 3.3 have been used in the assessment of each construction catchment. Construction catchments for Stage 1-4 construction phases is detailed in Appendix A.

The designer (Cardno Pty Ltd) has recommended not applying the RUSLE in calculation due to its recommendation for the site representing a low erosion hazard. Soil and water management computation for the construction catchments are included in Appendix B.

4.3 Soil Loss Results

As detailed in Section 6.3.2 (d) of the Blue Book 'the building of a sediment retention basin can be considered unnecessary' if the computed soil loss from a catchment is less than 150 m³ per year. For all catchments, which exceed this requirement, a sediment basin is required.

Where the construction contractor chooses to vary the size of a construction catchment (e.g. through a change in construction staging) and final design and property acquisitions, further assessment of the soil loss from the catchment should be undertaken to confirm if a sediment basin will be required in accordance with the Blue Book.

The "Soil Loss Class" is a measure of erosion hazard that underpins the erosion control aspects of these guideline.

The current calculation of the soil loss class according to Soil and Water Computation provided by the drainage designer (Cardno), rates the site as low risk for soil loss. Calculations are provided in provided in Appendix B.

5 Erosion and sediment control planning

5.1 Key Management Strategies

Key management strategies for erosion and sediment control plans are to include:

- Minimise extent and duration of construction disturbance
- Ensure /separation of offsite water from site water
- Use erosion control measures to prevent offsite impacts
- Inspect and maintain erosion controls measures.
- Progressively stabilise and/or rehabilitate disturbed areas as soon as operationally possible.

5.2 Primary and Progressive ESCP

The best practice management guidance for the construction of main roads and highways is provided in “Blue Book” assist in planning and implementation of appropriate controls to minimise soil erosion and control sedimentation. The purpose of these documents is to outline the intentions and fundamental principles that would be followed in the planning and implementation of erosion and sediment control measures for the proposal.

The primary ESCP contains detailed background information, risk assessment and discussion, while a series of subordinate progressive ESCPs provide up-to-date detail regarding location and installation of control measures.

Progressive ESCPs are typically developed as the project proceeds, as site conditions evolve and as flow paths are changed. Over the construction and/or maintenance phase of a project, a series of progressive ESCPs would be prepared to address all stages of the work and to provide the necessary levels of flexibility. The following steps should be undertaken prior to construction within each designated catchment area.

- A series Progressive Erosion and Sediment Control Plan (PESCP) should be prepared which details the controls and management actions implemented to minimise soil and water impacts for construction staging and at specific discharge points and revised as necessary.
- Site personnel charged with the responsibility for implementation of the PESCP should have appropriate knowledge and experience in erosion and sediment control management in accordance with the Blue Book Volume 1 and Volume 2D.
- Where permitted by design, an offsite water diversion bank or similar should be constructed at the top of the construction activity zone or catchment to divert offsite water (offsite water) around the area of disturbance (refer to plans in Appendix C for catchment boundaries). Section 5.3 further details how offsite water diversions may be constructed.
- Where required, install sediment containment measures (e.g. excavated sumps, sediment fence, sandbag traps to treat runoff from the disturbed catchment area. Placement of these control measures are restricted to the available space within the project boundary and preferably outside of the construction zone. Where space is restricted, the capacity of sediment containment measures may be reduced by separating the catchment into smaller portions by way of diversion banks or temporary cut drains.

5.3 Standard Controls

The following erosion and sediment controls are indicative of controls to be used to manage soil and water impacts during construction. Table 5-1 details the relevant section from the Soils and Construction Volume 1 (Landcom, 2004) and Volume 2D (DECC, 2008) where the drawings are detailed. Controls should be implemented where appropriate and maintained to ensure proper function.

Selection of control measures requires the following:

- Identifying the problem (erosion or sedimentation) to be managed
- Where the problem is erosion, identifying whether it is caused by raindrop impact or concentrated flow
- Where the problem is sedimentation, identifying if sediment is conveyed by sheet or concentrated flow
- Selecting the appropriate techniques depending on the identified specific nature of the problem.

Table 5-1 Standard erosion and sediment controls.

Control	Blue Book Drawing Reference	Blue Book Page Reference
Earth Bank (low flow)	SD 5-5	5-25
Earth Bank (high flow)	SD 5-6	5-26
Concentrated Flow (Batter Chute)	SD 5-7	5-28
Mesh and Gravel Inlet Filter	SD 6-11	6-40
Geotextile Inlet Filter	SD 6-12	6-41
Stabilised Site Access	SD 6-14	6-48
Stockpiles	SD 4-1	4-5
Rock check dams	SD 5-4	5-22
Sediment Fence	SD 6-8	6-36
Sediment Traps at drop inlets	C5	Vol 2D Appendix C, 60

Additional soil and water management notes by the designer for the preliminary ESCP is located in Appendix C.

5.3.1 Works Staging

Works are to be staged in the following order for each work stage with the relevant erosion and sediment controls implemented prior to and during each section of works as specified:

- Ensure site boundary limits and no-go areas are defined – Install site barrier fencing (or alternative measures) or maintain existing fencing/walls where suitable. Refer to the 'Access Control' notes below
- Establish stabilised temporary site access/egress points (Standard Drawing SD 6-14), using rumble grids or similar. Refer to the 'Site Entry and Exit Points' notes. These don't need to be installed if existing sealed driveway/s remain intact and sediment tracking is alternatively managed. Locations shown on the plans are indicative only and can be moved to suit demolition. However, note that in doing so, other surrounding ESCPs must still be implemented to same effect.
- Continue using existing street layout for site facilities (e.g. car parking, site sheds, hardstand laydown) and avoid any further ground disturbance until sediment, drainage and erosion controls are in place as outlined below. The principle of minimum disturbance to existing vegetation to be implemented with 'no-go' zones isolated with flagging etc.
- 'Offsite' and 'Site' runoff to be separated.
- Where required, sediment basins and 'offsite' and 'site' water drains to be constructed immediately as permitted.
- Temporary erosion and sediment controls to be installed prior to site disturbance where reasonable and feasible.
- Install Drain Wardens (SD GB – 01) or similar pit protection around any onsite drop inlets (locations to be determined onsite prior to works). Note onsite pits may not be present onsite and in that case, this requirement is not relevant.
- Maintain existing curb and gutters and roadside stormwater drainage as shown to collect and keep offsite water flows outside of the work area (unless specified by others).
- Protect existing storm water drains in roadside and curb with sand bags or gravel socks or similar as per SD 6-11, along all streets.
- Runoff control from formations/tops of fills to sediment basins to be via one or a combination of fill shaping, diversion drains/banks, earth bunds along top edges of fill batters discharging to batter drains and storm water pits etc.
- Install sediment fences, traps and sediment filter outlets (i.e. rock filter outlets or modular sediment traps). This includes installing stabilised outlet points. Refer to the 'Sediment Control' notes and to the plans for details.

- Install containment/diversion bunds (or equivalent) and stabilise by covering with Fabric (or similar). Refer to the drawings for locations and details. In locations where there is a fence or wall present, the wall can be used in place of containment bunds as long as the wall is sealed underneath so water cannot flow through.
- The onsite team is to ensure the proposed slope lengths are adhered to.
- Disturbed areas to be progressively stabilized (e.g. final design treatments such as concrete or revegetation). Where disturbed areas are not being worked for long periods (>30 days), temporary stabilization treatments are to be considered.
- Establish a stockpile area(s), separate materials if required in accordance with the 'Stockpiling' notes.
- Form internal haul roads (truck access road), if required and stabilise in accordance with engineering specifications (e.g. compacted earth with DGB and spray seal finish. To improve and lengthen surface stability trafficable polymers are to be applied to the surfaces (e.g. Vital HR or similar).
- Ground works can now commence to establish site facilities (e.g. material storage, workshop, site office, waste skip, concrete agi and concrete pump wash out),
- All surfaces excluding the immediate earthworks (cut/excavation works) are to be maintained as stabilised hardstand surfaces. In locations where hardstand surfaces are not formed or to improve and lengthen surface stability trafficable polymers are to be applied to surfaces (e.g. Vital HR or similar).
- Dewatering of excavations, etc. to be conducted as per the requirements of the SITE WATER TREATMENT AND DISCHARGE REQUIREMENTS below.
- The tracking of mud/soil material onto local roads to be monitored and controlled (e.g. shaker/rumble grids, manual wheel washing, street sweeper etc.).
- Dust to be controlled on site and along unsealed roads with controls such as water carts and or limiting vehicle speeds.
- Temporary controls to be inspected regularly with maintenance/repairs undertaken as required particularly after rain events.
- This plan in Appendix C has been prepared as per 'Blue Book' guidelines and standard drawings - Volumes 1.
- Controls shown on the Plan are to be installed unless otherwise noted.
- This Plan to be revised when required (e.g. change in construction methods and/or site conditions).

5.3.2 Access Control

- Install barrier fences or suitable administrative controls to define the project works and clearing limits.
- Barrier fencing for erosion and sediment control purposes can be simply made from tape or flagging around star pickets or stakes. Alternatively, sediment fence, site security /safety fence or chain wire fences can be used for this purpose if so desired. Existing fences and or site fluffing can also be used where they are present in the relevant locations.
- Stabilised site access points (SD 6-14) are to be provided in all locations where construction/demolition vehicles enter and exit the works onto Ivanhoe PI or public roads.
- Barrier and sediment fencing are to be used to ensure that all vehicles leaving the site pass over stabilised access point to minimise bogging in these areas and minimise sediment tracking onto public roads.
- Barrier fencing is to be used to delineate all 'no work' areas.
- Barrier fencing is to be used at the discretion of the site manager to delineate other 'No Go' areas.

5.3.3 Soil Management and Stockpiling

- Stockpile areas are to be established within the staged locations specified in the plans. If additional or alternative locations for stockpiling are required, then they are to be subject to approval prior to establishment. All stockpiles should incorporate clearly defined access controls and comply with the regulations outlined below. Progressive ESCPs are to detail the required erosion and sediment controls for each stockpile area.
- All stockpiles are to be constructed and maintained generally in accordance with Standard Drawing SD 4-1 and the following regulations:
 - Potentially contaminated materials are not to be stockpiled with un-contaminated materials or on un-contaminated surface areas. Separate stockpile areas are to be established to ensure this. All stockpiles must have sediment fencing or equivalent installed downslope as per SD4-1.

- Different materials types (e.g. mulched vegetation, topsoil, subsoil and other materials) are to be stockpiled separately wherever possible.
- Soil stockpiles are to be stabilised to achieve a C – factor of 0.1 (i.e. equivalent to 60% grass cover) within 10 days of formation using a temporary soil stabiliser (e.g. VitalP74.Stonewall), geotextile, jute matting or equivalent. Also refer to table 1.
- Topsoil stockpile (where practical) should be constructed to no more than 2 meters in height wherever possible.
- Stockpiles should be battered down to a maximum slope of 2:1 wherever possible.

5.3.4 Stabilisation

- Undertake progressive stabilisation of disturbed ground surfaces as they are completed rather than at the end of the works program.
- Final stabilisation is to achieve the C – factor (ground cover) detailed in Table 3-1.
- Final rehabilitation is to be accordance with the landscaping/rehabilitation plans.
- Areas to be revegetated are to be topsoiled first using the topsoil stripped during the initial stages of works (if suitable) or using approved imported topsoil. Refer to Standard Drawings SD4-2) for instructions regarding topsoil replacement.
- Appropriate seedbed preparation should be carried out when revegetating lands (See SD 7-1)
- Jute mesh, erosion control matting (ECM), soil stabilisers (e.g. Vital stonewall) hydro mulching or an appropriate approved alternative is to be used to provide suitable ground cover until vegetation is established.
- Temporary diversion drains are to be stabilised to achieve the C-factors as detailed in Table 1, using jute matting, geotextile fabric, rock or TRM etc. Refer to the plan for details. Also refer to Standard Drawings SD 5-6 and SD 5-7.
- Refer to engineering drawings for any permanent drain size lining detail, if applicable.
- Refer to the stockpiling notes for stabilisation requirements of stockpiles. Also refer to Table 1 and SD 4-1.
- As surfaces are stabilised (at least 90% of any finished area has at least 70% ground cover and permanent drainage measures are installed, temporary erosion and sediment control structures and water management structures can be removed (e.g. sediment fence and diversion drains).
- Temporary stabilisation on high risk areas will be undertaken prior to rainfall in accordance with the 'Rainfall Preparation Procedure' notes
- Highly trafficable areas (i.e. site access egress haul roads) will be stabilised where reasonable and feasible with suitable material such as DGB, roadbase, gravel or Dustex to minimise erosion and provide stability to vehicle movements. In catchments not draining to a sediment basin or sump (i.e. areas shown as stabilised /sealed), stabilisation of haul roads and site compound surfaces is essential.

5.4 Sediment controls

Sediment fencing or alternatives

- Install sediment fencing in accordance with Standard Drawing SD 6-8.
- Sediment fences must be firmly trenched into the ground for their entire length.
- If sediment fences cannot be trenched into the ground (i.e. If hardstand/pavement surfaces are present) sediment fences can be secured by placing tightly abutting sandbag or coir log bunds over the fabric to hold it down.
- Tightly abutting gravel bags, coir log bunds or sand bags or can also be used in place of sediment fencing where sediment fencing cannot be installed (i.e. on hardstand areas or constantly changing areas). However, gravel bags and sand bags are to be min. 2 bags high and consideration should be given to ongoing traffic and construction movements to avoid damaging the bunds.
- Sediment fences are to be held up by securing to star pickets placed at max. 2.5m centres alternatively they can be securely attached to site security fencing.
- Sediment fences must include small 'returns' at maximum 20m intervals (see Standard Drawing 6-8) to minimise the risk of water flowing along them rather than through them. Sandbag bunds can be used for this purpose if desired.
- If available mulch may be use on in 200mm high rows instead of sandbags to break up and achieve slope lengths.

5.4.1 Sediment Traps/Rock Filter Dams/Modular Sediment Traps

- Sediment traps are to be formed as a sump (detention storage area) with sediment filter outlet.
- Sediment trap sumps may be split throughout the catchment as long as the filter outlets remain as to what is specified within this plan for each overflow point.
- Sediment sump sizing details are specified on the plan.
- Install the filter outlets as either a rock filter or a modular sediment trap in accordance with sizing and details shown on the plan.
- Rock filter dam outlets (if adopted) are to be installed in accordance with IECA SD RFD 01&02.
- Modular traps (if adopted) are to be built as either two sediment fences with straw bales between or as two sediment fences with 15-25 mm aggregate fill in between.
- If the above filter outlets cannot be constructed due to site/construction conditions tightly abutting coir logs or gravel filled bags are to be used as the filter outlet. Ensure the coir logs/bags are securely held in place.
- All filter outlet structures are to be built to incorporate a primary outlet (weir overflow/spillway/to ensure overflows are controlled and are stable.
- It is recommended that gypsum is placed at the inlets to the sediment traps prior to rainfall to help pre-heat site water.
- Sediment is to be removed from sediment traps and filter outlets regularly and filter aggregate/fabric/straw bales replaced as required.

5.5 Dust Suppression

- Avoid dust generating activities during dry windy conditions where control options (e.g. wetting) are limited.
- Regularly clean machinery and vehicle tyres to prevent track-out of dust to public roads
- Restrict vehicle speeds on unsealed haul roads to reduce dust generation.
- Dust suppression should be carried out wherever necessary to minimise sediments becoming airborne due to wind erosion.
- Internal access tracks to be maintained/kept wet to prevent dust generation
- An appropriate water source for dust suppression and/or dust suppressant management system (e.g Vital Stonewall, Dustex, Dustguard, or equivalent) must be identified and approved by the site Environment Manager prior to starting construction works.
- Temporary stabilisers (e.g. vital bond-matt P47), geotextile, jute matting or equivalent can be used in non-trafficked areas to assist with dust control.
- Wherever possible haulroad running surfaces to be stabilised with crushed rock, aggregate, road base, a trafficable soil stabiliser or equivalent to assist with dust control on these surfaces.

5.6 Dirt water treatment and discharge requirements

Water accumulation in sediment traps, sumps, trenches, excavations or in any other low points on site can either be:

- Re-used for dust suppression or construction purposes; or
- Pumped into a tank, truck or other holding area for later treatment; or
- Treated (If required) and tested in situ, then released off site once it meets the required water quality discharge criteria (see below); or
- Any such discharge of water from the project (i.e. where water is moved off site once it meets the required water quality discharge criteria (see below); or
- Any active discharge of water from the project (i.e. where water is moved offsite via direct action such as pumping rather than flowing off the project (i.e where water is moved offsite via direct action such as pumping rather than flowing off the project as a result of heavy rainfall is to achieve:
 - 50mg/L or less TSS (Total Suspended Sediment)
 - pH 6.5 to 8.5 and
 - hydrocarbon sheens, no visible trace
- Discharge of any site water to the environment or for reuse on site is to be managed through the approved procedure.

- Adequate water quality can be achieved by using gypsum at a rate of approximately 30kg per 100m³ of stormwater. Alternative flocculating agents can only be used if the regulating authority has granted approval. Refer to manufacturer's guidelines.
- Sediment traps must be emptied within 5 calendar days of rainfall event. This includes treating water testing to confirm adequate quality, de-watering and, if required de-silting.
- These de-watering requirements apply to site water accumulating in any sort of excavation, trench, or other ponded water body on the site.
- If water is going to be used within the site for dust-suppression or construction purposes and will drain back into the sediment capture system, it does not require treatment.

5.7 Slope lengths

Slope lengths are to be restricted to 80m intervals or smaller across all exposed surfaces prior to and during rainfall.

Diversion bunds/drains, low flow earth banks (SD5-5) or sandbags/equivalent should be installed prior to rainfall events to achieve this where required. However, slope lengths are often naturally minimised due to the topography of the works and in this case additional slope breaks may not be necessary.

5.8 Rainfall preparation procedure

The weather forecast is to be monitored regularly (at least daily and hourly when rainfall imminent), by the site foreman, Environmental Manager (or their representative).

The sump and containment wall available capacity is to be continually assessed and volume/levels increased as required to appropriately manage the expected rainfall (in accordance with construction detail).

Prior to forecast rainfall (> 50% chance of 10mm or more over 24 hours), the following will occur:

- All exposed batters not draining to sediment basin or sump (i.e. exposed site compound surfaces or batter surfaces adjacent to Ivanhoe PI or the nearby creek) are to be stabilised with temporary ground covers (i.e. vital stonewall, P47, geotextile or black plastic or equivalent)
- Batter chutes and check dams are to be installed (if not already in place)
- Progressive ESCPs to detail batter chute locations.

Prior to forecast rainfall (>50% chance of 20mm or more over 24 hours), the following will occur:

- Slope breaks will be pushed up or cut in across large exposed areas to slow down flows and minimise erosion. Refer to slope lengths notes for details.
- Additional bunds and sumps/traps are to be installed for general works areas where required to separate catchments and minimise reliance on sediment ponds (as per Engineering instruction) PESCPs to show details.

5.9 Site Inspection, monitoring and maintenance

Regular site inspections are to be conducted by the site environment manager (or their representative).

- At least weekly during normal construction hours:
 - Prior to forecast rainfall of 5mm or more over 24 hours; and
 - Daily during rain events (if safe to do so); and
 - Within 24 hours of the cessation of a rain event that causes runoff (if safe to do so).
- Inspections should include documenting any urgent repair maintenance or improvement works. Records are to be kept including details of actions and their close outs.
- Additional erosion and sediment controls will be installed as necessary to ensure satisfactory outcomes in keeping with project conditions and best-practice Blue Book guidelines.
- This ESCP will be updated or Progressive ESCPs prepared as required.
- Sediment or rocks tracked from the site will be removed from public roads as soon as possible (i.e. with street sweepers).
- After rainfall, sediment accumulated in trapping devices (e.g. in sediment fences) will be removed a secure location where it can't wash or blow offsite (preferably to an active stockpile).

- Weather conditions will be monitored and daily rainfall will be recorded. A BOM weather station is located nearby Norah Head, Station Number: 061336, rainfall readings can be used.
- Safe storage areas for wastes, fuels, excess concrete and other potential contaminants are to be delineated by the site supervisor.
- Adequate supplies of erosion control measures (e.g. geofabric rolls, filter socks or similar) are to be maintained onsite for rapid deployment as required.
- If required, water treatment chemical(s) and equipment are to be maintained onsite.
- Dust suppression is to be undertaken as required to minimise the risk of offsite dust impacts.
- After rainfall, sediment accumulated in trapping devices (e.g. in sediment fences) will be removed a secure location where it can't wash or blow offsite (preferably to an active stockpile).
- Weather conditions will be monitored and daily rainfall will be recorded. A BOM weather station is located at Norah Heads, about 11 kilometres from Warnervale, and rainfall readings can be used. The BOM station details are as follows: Station Number:061336.
- Safe storage areas for wastes, fuels, excess concrete and other potential contaminants are to be delineated by the site supervisor.
- Adequate supplies of erosion control measures (e.g. geofabric rolls, filter socks or similar) are to be maintained onsite for rapid deployment as required. If required, water treatment chemical(s) and equipment are to be maintained onsite. Dust suppression is to be undertaken as required to minimise the risk of offsite dust impacts.

6 Recommendations

It is the contractor's responsibility to prepare detailed ESCPs noting the above recommendations and the following measures:

- Nomination of a suitably qualified environmental representative on site to complete self-audits and monitor Soil and Water Management Plans.
- Implementation of this plan and responsibility for nomination of a suitably qualified environmental representative to ensure on going monitoring, maintenance and prevention of pollution is the responsibility of the contractor
- A PESCP is to be prepared for the works should be developed progressively through the constructing phase. PESCP's should be in accordance with the requirements of Managing Urban Stormwater: Soils and Construction (Landcom, 2004) and Managing Urban Stormwater-Volume 2D Main Road Construction (DECC, 2008)
- In locations where proposed post-redevelopment water quality basins are planned outside the demolition footprint, demolition phase sediment basins or other sediment control elements may be located in these places during demolition phase, subject to designs being compatible with subsequent post-redevelopment water treatment requirements
- Sizing of detailed demolition sub-catchments may need to be further defined once detailed demolition staging planning is underway. Provision for potentially larger up gradient stormwater catchments may need to be considered during higher erosion risk activities, such as redirecting live stormwater assists, changes to pavement drainage, or when bridge deck surface water is connected site water.

7 References

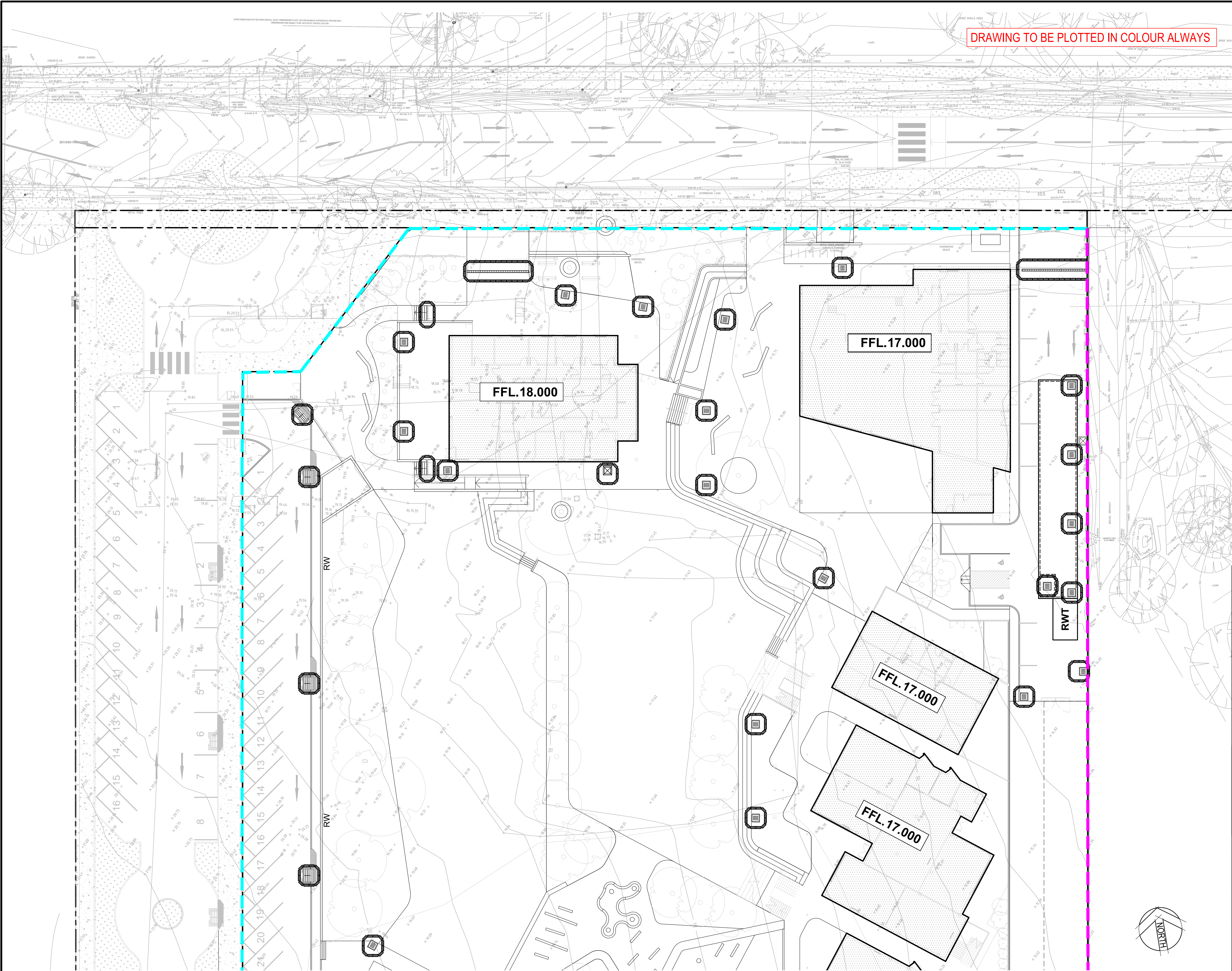
Bom, 2018 http://www.bom.gov.au/climate/averages/tables/cw_061366.shtml accessed 10 May 2019

Managing urban stormwater: soils and construction Volume 1, Landcom, 2004 (the 'Blue Book')

Managing urban stormwater: soils and construction Volume 2D, Main road construction, Department of Environment and Climate Change, NSW, 2008.

Murphy, C. L (1993). Soil Landscapes of the Gosford-Lake Macquarie 1:100, 000 Sheet Map and Report, Department of Conservation and Land Management, Sydney.

Appendix A Drainage Design



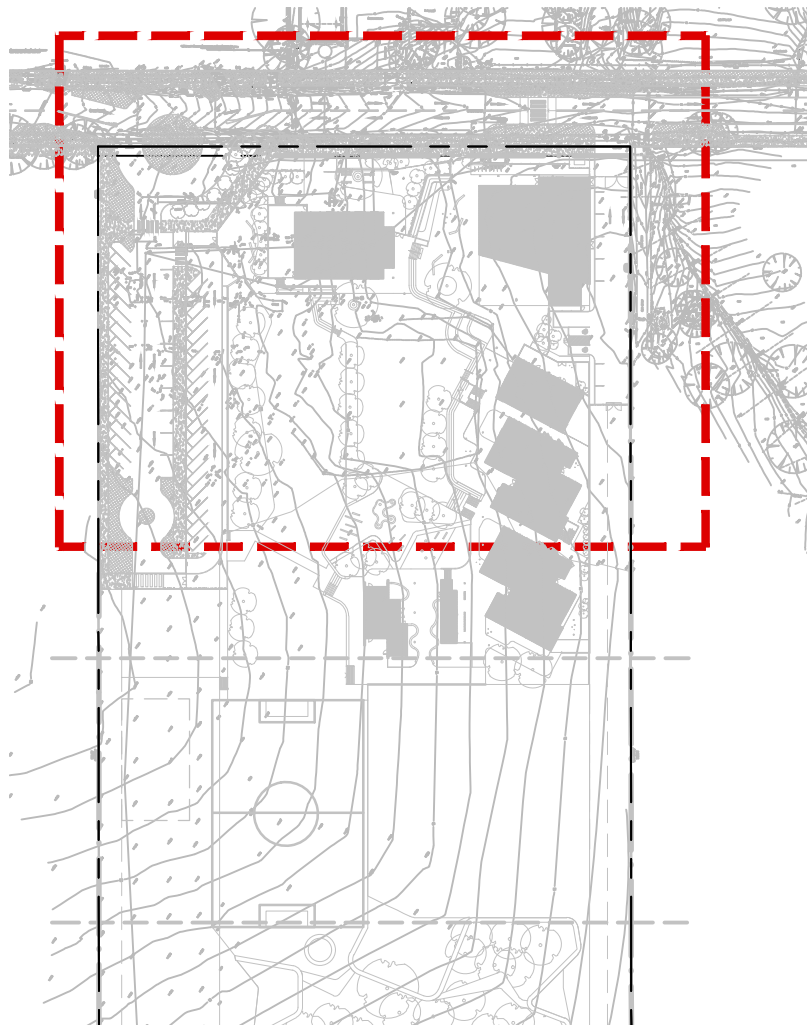
DRAWING TO BE PLOTTED IN COLOUR ALWAYS

LEGEND

- SITE FENCE
- SILT FENCE
- STORMWATER PIT
- SILT TRAP/SAND BAGS
- TEMPORARY CONSTRUCTION VEHICLE EXIT

NOTE

SITE ACCESS AND STOCKPILE LOCATION MAY CHANGE DEPENDING ON CONSTRUCTION PREFERENCE



SITE KEY PLAN
SCALE 1:2000

Rev.	Date	Description	Des.	Verif.	Appd.
4	05/08/2019	ISSUE FOR SSDA	GM	KP	KL
3	29/07/2019	ISSUE FOR SSDA	GM	KP	KL
2	05/06/2019	ISSUE FOR SSDA	GM	KP	KL
1	16/05/2019	SCHEMATIC SKETCH DESIGN ISSUE	GM	KP	VJ



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Approved	Date MAY 2019	

Client	BILLARD LEECE PARTNERSHIP	
Project	THE NEW PRIMARY SCHOOL AT WARNERVALE 75 WARNERVALE RD WARNERVALE 2259 NSW	
Title	SEDIMENTATION AND EROSION CONTROL PLAN LAYOUT 1	

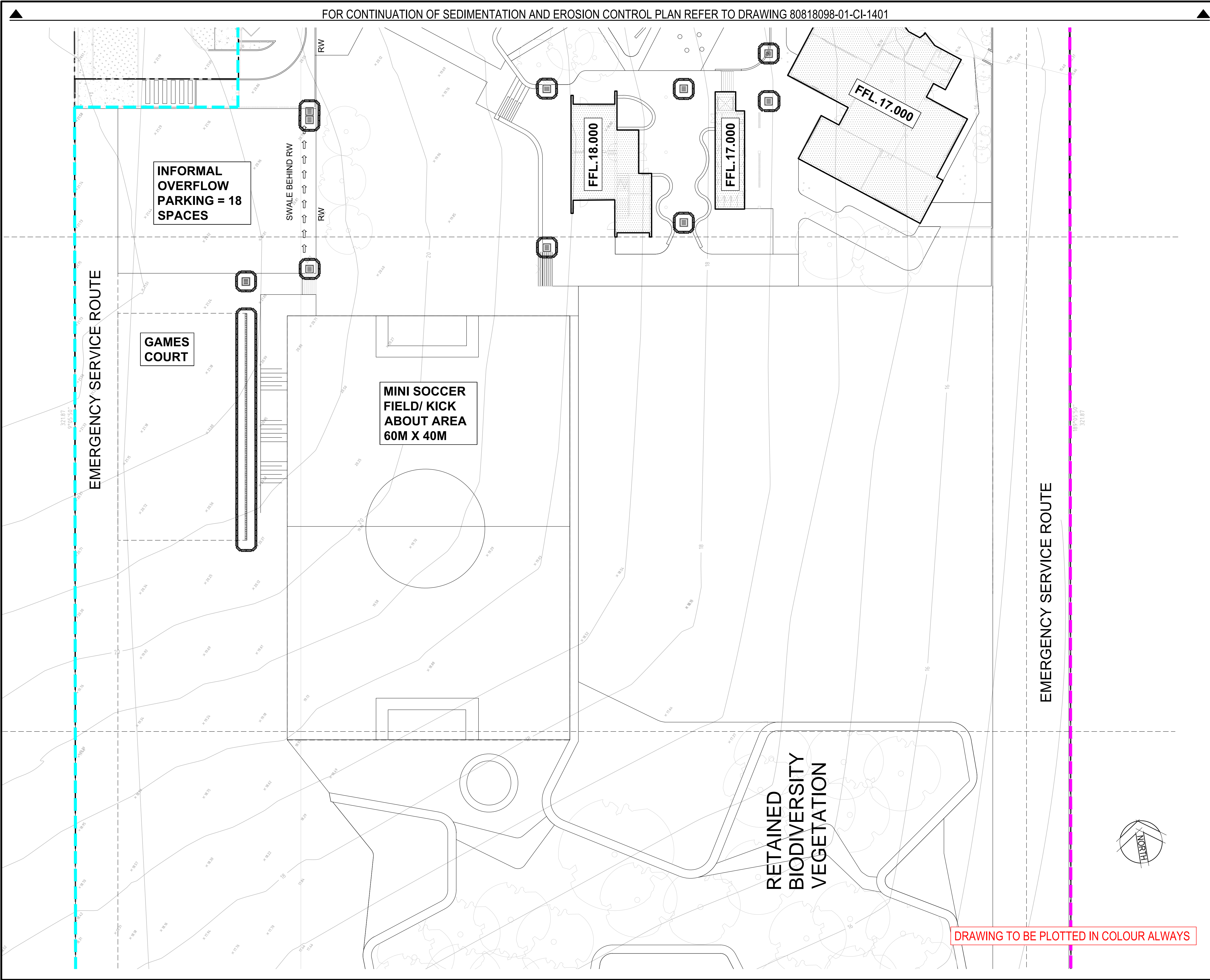
Status	PRELIMINARY NOT TO BE USED FOR CONSTRUCTION PURPOSES	
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Datum	AHD	Scale	1:250	Size	A1
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Drawing Number	80818098-01-CI-1401			Revision	4
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FOR CONTINUATION OF SEDIMENTATION AND EROSION CONTROL PLAN REFER TO DRAWING 80818098-01-CI-1402

DATE PLOTTED: 5 August 2019 6:54 PM BY: GORAN MILENKOVIC
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FOR CONTINUATION OF SEDIMENTATION AND EROSION CONTROL PLAN REFER TO DRAWING 80818098-01-CI-1401

LEGEND

SITE FENCE

SILT FENCE

STORMWATER PIT

SILT TRAP/SAND BAGS

TEMPORARY CONSTRUCTION VEHICLE EXIT

NOTE
SITE ACCESS AND STOCKPILE LOCATION MAY CHANGE DEPENDING ON CONSTRUCTION PREFERENCE



SITE KEY PLAN
SCALE 1:2000

4	05/08/2019	ISSUE FOR SSDA	GM	KP	KL
3	29/07/2019	ISSUE FOR SSDA	GM	KP	KL
2	05/06/2019	ISSUE FOR SSDA	GM	KP	KL
1	16/05/2019	SCHEMATIC SKETCH DESIGN ISSUE	GM	KP	VJ
Rev.	Date	Description	Des.	Verif.	Appd.

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Checked	V.J.	Date	MAY 2019
Designed	V.J.	Date	MAY 2019
Verified	V.J.	Date	MAY 2019
Approved		Date	MAY 2019

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Client BILLARD LEECE PARTNERSHIP

Project THE NEW PRIMARY SCHOOL AT WARNERVALE
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WARNERVALE 2259 NSW

Title SEDIMENTATION AND EROSION CONTROL PLAN
LAYOUT 2

Status PRELIMINARY
NOT TO BE USED FOR CONSTRUCTION PURPOSES

Datum	AHD	Scale	1:250	Size	A1	
Drawing Number	80818098-01-CI-1402				Revision	4

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Appendix B Soil loss calculations

1. Erosion Hazard and Sediment Basins

Site Name: The New Primary School at Warnervale

Site Location: 75 Warnervale Road, Warnervale

Precinct/Stage: Concept design

Other Details: construction stage, whole of site construction footprint.

Site area	Sub-catchment or Name of Structure						Notes
	C1						
Total catchment area (ha)	2.2						3 lanes and 1 new lane
Disturbed catchment area (ha)	2.2						1 new lane

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

Sediment Type (C, F or D) if known:	C						From Appendix C (if known)
% sand (fraction 0.02 to 2.00 mm)							Enter the percentage of each soil fraction. E.g. enter 10 for 10%
% silt (fraction 0.002 to 0.02 mm)							
% clay (fraction finer than 0.002 mm)							
Dispersion percentage							E.g. enter 10 for dispersion of 10%
% of whole soil dispersible							See Section 6.3.3(e). Auto-calculated
Soil Texture Group	C						Automatic calculation from above

Rainfall data

Design rainfall depth (no of days)	5						See Section 6.3.4 and, particularly, Table 6.3 on pages 6-24 and 6-25.
Design rainfall depth (percentile)	75						
x-day, y-percentile rainfall event (mm)	26.8						
Rainfall R-factor (if known)	3500						Only need to enter one or the other here
IFD: 2-year, 6-hour storm (if known)							

RUSLE Factors

Rainfall erosivity (R -factor)	3500						Auto-filled from above
Soil erodibility (K -factor)	0.038						RUSLE LS factor calculated for a high rill/interrill ratio.
Slope length (m)	80						
Slope gradient (%)	1						
Length/gradient (LS -factor)	0.19						
Erosion control practice (P -factor)	1.3	1.3	1.3	1.3	1.3	1.3	
Ground cover (C -factor)	1	1	1	1	1	1	

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

Storage (soil) zone design (no of months)	12						Minimum is generally 2 months
Cv (Volumetric runoff coefficient)	0.47						See Table F2, page F-4 in Appendix F

Calculations and Type D/F Sediment Basin Volumes

Soil loss (t/ha/yr)	33						
Soil Loss Class	1						See Table 4.2, page 4-13
Soil loss (m ³ /ha/yr)	26						Conversion to cubic metres
Sediment basin storage (soil) volume (m ³)	56						See Sections 6.3.4(i) for calculations
Sediment basin settling (water) volume (m ³)	277						See Sections 6.3.4(i) for calculations
Sediment basin total volume (m ³)	333						

NB for sizing of Type C (coarse) sediment basins, see Worksheet 3 (if required).

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