What's in the "Blue Book"?

Soil Loss, Soils and Sediment Basin Test

Soil Loss Class

- Seven Soil Loss Classes based on RUSLE, BB Ref Table 4.2

Soil Loss Class	Calculated soil loss (tonnes/ha/yr)	Erosion hazard
1	0 to 150	very low
2	151 to 225	low
3	226 to 350	low-moderate
4	351 to 500	moderate
5	501 to 750	high
6	751 to 1,500	very high
7	>1,500	extremely high

Soil Loss Class

- To calculate Soil Loss Class, use:
  - local R-factor and K-factor
  - local slope gradient (L/S)
  - P-factor of 1.3 and C-factor of 1.0
  - Assume slope length 80m unless a lesser value can be justified

Soil Loss - exercise

- What is the estimated annual soil loss for a three hectare construction site on the Killingworth (ki) Soil Landscape near Newcastle where:
- The topsoil will be stockpiled and construction will occur within the subsoil (K-factor?), and
- The slopes are 8%? (LS-factor?)
- Use BB Appendix B (Map 9), Appendix C (Table 13) and Table A1

RUSLE

- Killingworth (ki) example solution
- RUSLE equation:

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

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

$A = 2{,}500 \times 0.036 \times 2.05 \times 1.3 \times 1.0$

$A = 239.85$ tonnes/ha/year

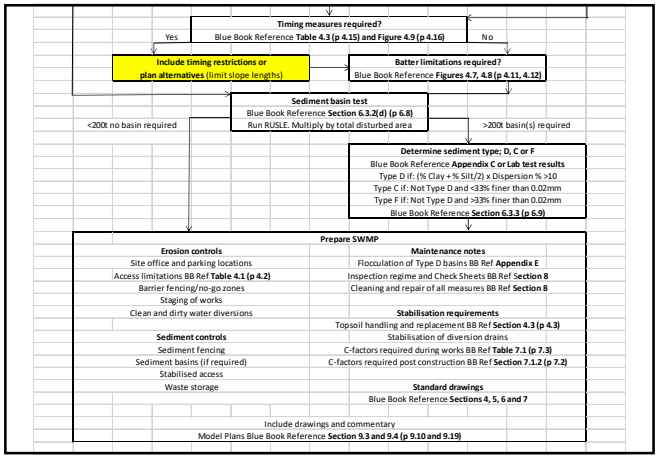
Class 3 (226-350 t/ha/yr) = Low-Moderate

Soil Loss Classes

- Class 1-2 low erosion hazard
  - Gently sloping
  - Stable soils
  - Low R-factor
- Class 6-7 high erosion hazard
  - Steeply sloping
  - Erodible soils
  - High R-factor

Soil Loss Class - examples

- Northern Tablelands/Southern Highlands
  - Stable soils on basalt
  - Gentle slopes, 2%
  - Class 1
- Blue Mountains/Upper Hunter
  - Erodible and dispersible soils
  - Steeper slopes, 12%
  - Class 3
- Far North Coast/South Coast
  - Erodible, silty soils
  - Steep slopes, over 25%
  - Class 7



Timing Restrictions

- Soil Loss Class dictates recommended timing restrictions for works
- BB Reference Table 4.3 (p 4.15)
- Highlights months when work should or should not proceed
- At time when activity should be avoided:
  - C-factor >0.1 only when 3-day forecast suggests rain unlikely
  - Management regime in place for rapid stabilisation if required (RECPs etc.)

Soil Loss Class - exercise

- Calculate the Soil Loss Class for a 2.0ha subdivision site on the Dorrigo (do) Soil Landscape (Rainfall Zone 2) with a slope gradient of 20%?
- How would soil loss change if the default slope length could be reduced to 20m?
- Which are the optimum months to work on this site?
- What would be the requirements outside of this window?

RUSLE

- 20% slope (80m length)

A = 7,000 x 0.024 x 7.32 x 1.3 x 1.0

A = 1,599 tonnes/ha/year

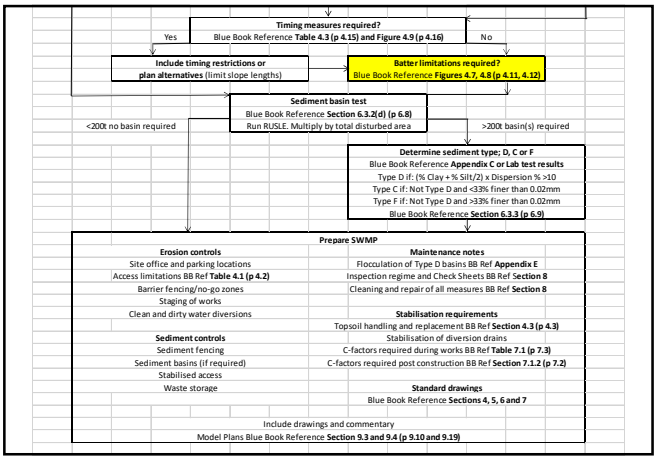
Class 7 (>1,500 t/ha/yr) = Extreme

- 20% slope (reduced 20m length)

A = 7,000 x 0.024 x 2.55 x 1.3 x 1.0

A = 557 tonnes/ha/year

Class 5 (501-750 t/ha/yr) = High



Batter Limitations

- BB Reference Section 4, Figure 4.7 and 4.8 (pages 4-11 and 4-12)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Batter Limitations

Relates batter gradients on constructed slopes to:

- R-factor (select correct chart)
- K-factor and Slope Length (metres)
- Read off maximum batter gradient recommendation

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Batter Limitations - exercise

- Review for Dorrigo site
  - R-factor = 7,000
  - K-factor = 0.011-0.024
  - Slope length = 20 metres
- BB Reference Section 4, Figure 4.8
- What are the maximum batter gradients for the topsoil and the subsoil?
- 2:1 (K=0.011) 4:1 (K=0.024)

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Soil Texture Class

- Clay particles are <0.002mm
- Silt particles are 0.002 – 0.02mm
- Fine sand particles are 0.02 – 0.2mm
- Coarse sand particles are 0.2 – 2.0mm
- Sediment fence typically has pore openings typically ~ 0.035 mm
- Which particles would you expect to be trapped and which to pass through?
- Clay, slit and fine sand will pass through

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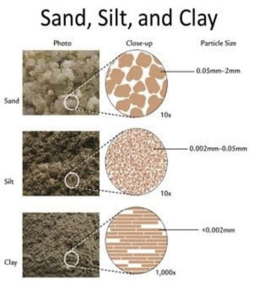
Soil Texture

- Sand grains
  - Visible to the eye
  - Roll between fingers
- Silt grains
  - Not visible to the eye
  - Roll between the fingers
- Clay grains
  - Not visible to the eye
  - Smooth to the touch



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Soil Texture Group

Blue Book describes three (3) groups:

- Type C: Coarse
- Type F: Fine
- Type D: Dispersible

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Soil Texture Group

- Type C: Coarse
  - Easier to capture or settle out
  - <33% clay and silt
  - Sediment basin not likely required or design relatively simple
- Type F: Fine
  - Harder to capture
  - Require longer time to settle out
  - >33% clay and silt
  - Require "total storm capture" sediment basins
  - Higher emphasis on erosion control

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Soil Texture Group

- Type D: Dispersible
  - Structurally unstable (slaking and dispersion)
  - Primarily affects clay and silt fraction
  - Not all clays are dispersible
  - Use Emerson test to check
  - Highly erodible if exposed
  - Hard setting and low permeability
  - Particles are kept apart by negative electrical charge
- Soil (stability) Demonstration

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Unstable soils

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Dispersible Soil

- Severe rilling of exposed (vertical) surfaces
- Dispersive soils subject to gully and tunnel erosion
- High risk of tunnel erosion or piping when used for earthworks
- Generates turbid runoff. May remain turbid for a long time, or never clear
- Negatively charged clay particles leaving a site can transport positively charged contaminants including heavy metals and nutrients

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Piping and Tunnelling

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Peabody

What's in the "Blue Book"?

8 April 2025

Sodic Soils

- All sodic soils are dispersive but not all dispersive soils are sodic
- Cation Exchange Capacity (CEC) (K^+, Na^+, H^+, Ca^{++}, Mg^{++}, Al^{+++}) dominated by sodium (Exchangeable Sodium Percentage, ESP)
- Fluting is a common indicator of sodic soils
- Sodosol and solonised terms

26

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Management of soil

- (1) Expose only by necessity
- (2) Cover with non-dispersive soil before applying further treatments (erosion controls) or revegetation
- (3) Soil Amelioration:
  - Gypsum application can significantly improve soil stability (dry preferred to liquid form)
  - Blending best approach at application rates 5 – 35 t/ha

27

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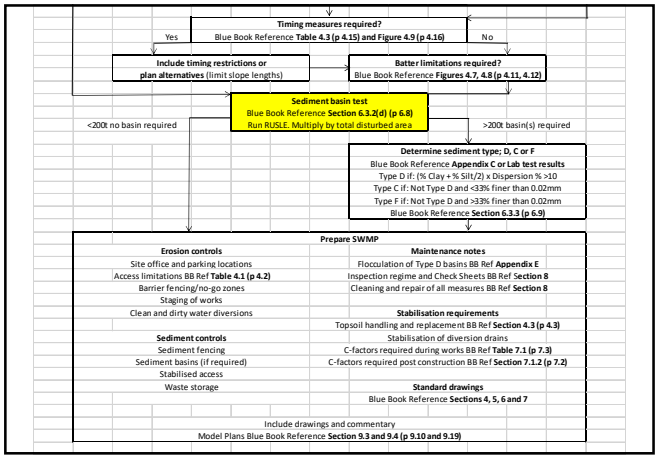

Sediment Basin Test

- BB Reference Section 6.3.2(d)
- Some small and flat sites may not warrant construction of a sediment basin i.e. those <2,500m^2 disturbed area for which a ECSP (rather than a SWMP) is required
- Run RUSLE to check the annual soil loss from the 'total disturbed area'
- If annual soil loss <150m^3 (150m^3 = 200 tonnes) a sediment basin may not be required
- If so, employ alternative measures

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Sediment Basin Test - exercise

Is a sediment basin required for the following?

- A 2.5ha site at Tamworth, of which 1.8ha will be disturbed
- Located on the Orchard Creek Soil Landscape (Table C8)
- Site gradient (slope) is 4%
- Ground is properly prepared (P=0.9)

- If a sediment basin is not required, what other measures would be appropriate?

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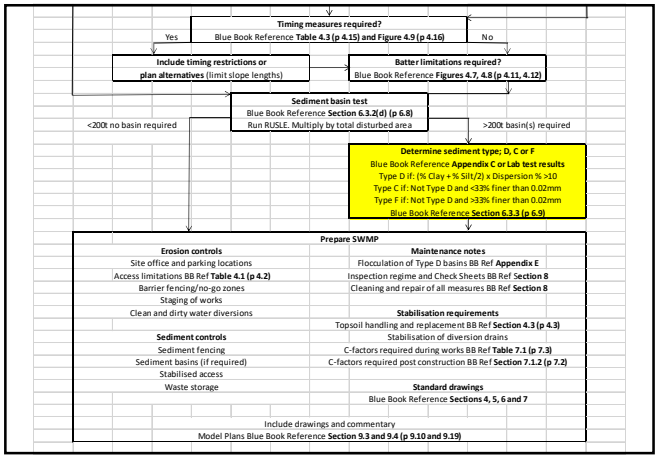
RUSLE solution

- Sediment Basin Test – Tamworth site
- Equation: A = R x K x LS x P x C

A = 1,500 x 0.08 x 0.91 x 0.9 x 1.0
A = 131 tonnes/ha/year

- Result = 98.28t x 1.8ha = 176.9 tonnes (~136m^3)

Sediment basin not required



Soil Texture Group

- BB Reference Section 3.2.6
- A soil is 'significantly dispersible' if:
  - the percentage of clay (<0.002 mm) plus half the silt (0.002-0.005 mm) fraction
  - and multiplied (x) the dispersion percentage (decimal) is greater than or equal to 10

Sediment types - exercise

What is the sediment type for a site:

- At Boolaroo on the Cockle Creek (cc) Soil Landscape? (Table C13)
- At Cassilis on the Ant Hill (ah) Soil Landscape? (Table C10)

- How would you manage each?
- Refer BB Appendix C

Sediment types - exercise

- For each of the following soils described by Particle Size Analysis and Dispersion Percentage (DP), determine the sediment type, C, F or D (use BB design spreadsheet)

Clay	Silt	Fine Sand	Coarse sand	Gravel	DP	Sed type
26%	20%	15%	35%	4%	25%	F (9.0)
5%	20%	62%	10%	3%	55%	C (8.25)
52%	14%	20%	13%	1%	23%	D (13.57)