Constraint Analysis
Using the Data in E&SC Planning

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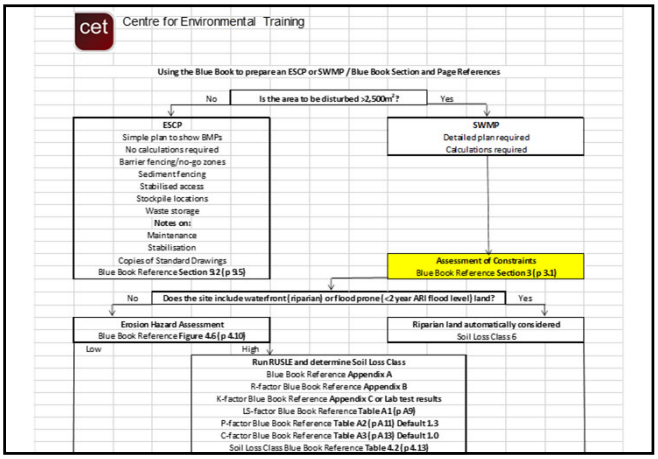

Assessment of constraints

Blue Book Reference Chapter 3

Consider:

- Waterfront (riparian) land: vegetated land adjacent to waterbodies BB Ch3.2.1
- Flooding: <2 year ARI flood level, automatically considered Soil Loss Class 6 – high erosion hazard BB Ch3.2.2
- Need to focus on erosion control
- Review soil characteristics BB Ch3.2.4

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Riparian and flood prone land

- What are the E&SC implications for riparian and flood prone land?
  - Local overland flooding or channel flooding
  - 2-year ARI flood level
  - Loss of bank stability
  - Natural sediment capture
  - Controlled Activity Area's (CAP)

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Watertables / Groundwater

- How can groundwater affect E&SC? BB Ch3.2.12
  - Flow into bores, wells and open excavations
  - Collapse of excavations
  - Impede site access
  - Perched watertables
  - Moisture fluctuations
  - Seasonal and permanent watertables
  - Implications for plant growth and stabilisation

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Salinity

- How can salinity affect E&SC? BB Ch3.2.13
  - Accumulation of salts in the upper soil profile
  - Implications for plant growth
  - Reduction in vegetational cover (C-factor) and consequent increase in erosion hazard
  - BB Reference Appendix C lists constraints in various Soil Landscapes throughout NSW, including salinity
- Soil Landscape Report for Dubbo (1998) also useful
  - Ulan (ul) = common across landscape
  - Lees Pinch (lp) = low

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Salinity

- Implications in both rural and urban settings

Acid sulfate soils

- How can acid sulfate soils affect E&SC? BB Ch3.2.14
  - Acid Sulfate Soil Risk Mapping
  - Common in coastal NSW
  - Excavations in and near coast and estuaries
  - ASSMP - Procedures for handling and pH stabilisation
  - Preliminary ASS assessment (PASSA)
- Not anticipated in MCO

Site Constraints

- ESCP preparation must also consider:
  - Soils
  - Topography
  - Climate
  - Water
  - Vegetation
  - Ecology
  - Cultural heritage

Soil Issues to Consider

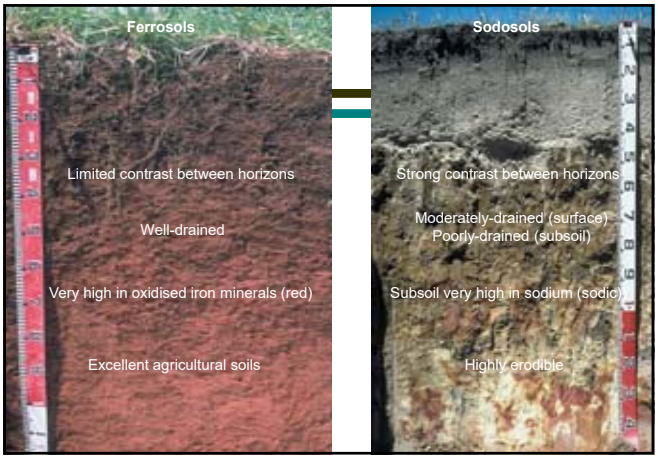
- Range of soil types; weak to strong horizon differentiation, gravels to clays
- Typically poor to moderate soil fertility, low pH, high erodibility, variable thickness
- Mass movement on steeper formations
- Erodible surface soils common
- Acidity, sodicity and dispersive soil conditions common
- Often moderate to high erosion hazard, particularly subsoils

Duplex soil

High organic matter and water holding capacity; coarse textured and strong structure →

May show bleaching at interface →

Moderate structure, imperfect drainage. Fine textured and low nutrient / organic matter →



Soil Data Collection

Chapter 3.3.1 of the Blue Book describes soil data requirements

- Link soils to landscape by key features:
  - Geology/rock type
  - Soil type
  - Position on slope
  - Landforms
  - Blue Book Reference Appendix C
- Used to derive Soil Texture Group and develop mitigation measures

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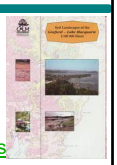
Soil Landscape mapping

NSW Soil Landscape Maps (OEH)

- 1:100,000 – 1:250,000 scale
- Detailed information in companion books
- Available at https://shop.regional.nsw.gov.au/collections/all/s landscapes



eSPADE in NSW NR atlas

- Electronic data, including borelogs
- http://www.environment.nsw.gov.au/eSpade2Webapp

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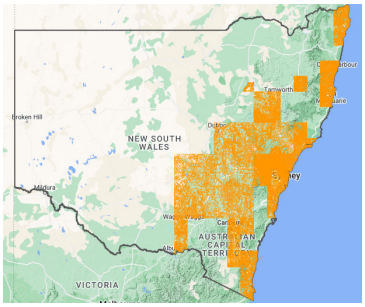
Mapping availability



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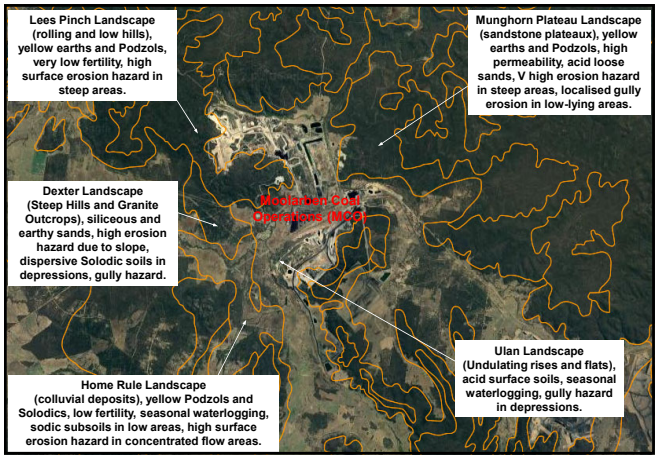
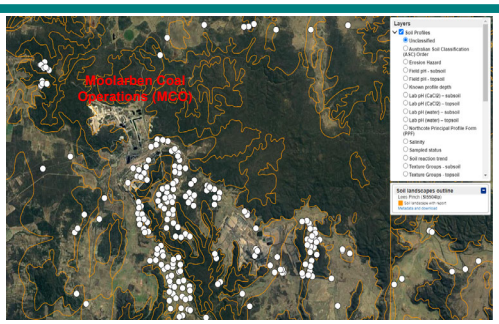


Soil Profile mapping



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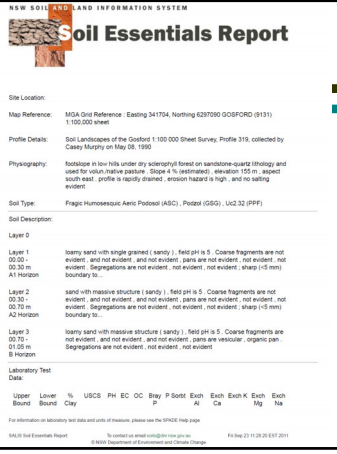
NSW SOIL AND LAND INFORMATION SYSTEM

Soil Essentials Report

Site Location:

Map Reference: MGA Grid Reference : Easting 341704, Northing 6297090 GOSFORD (9131) 1:100,000 sheet

Profile Details: Soil Landscapes of the Gosford 1:100 000 Sheet Survey, Profile 319, collected by Casey Murphy on May 08, 1990

Physiography: footslope in low hills under dry sclerophyll forest on sandstone-quartz lithology and used for volun./native pasture . Slope 4 % (estimated) , elevation 155 m , aspect south east . profile is rapidly drained , erosion hazard is high , and no salting evident

Soil Type: Fragic Humosesquic Aeric Podosol (ASC) , Podzol (GSG) , Uc2.32 (PPF)

Soil Description:

Layer 0

Layer 1 00.00 - 00.30 m A1 Horizon: loamy sand with single grained (sandy) , field pH is 5 . Coarse fragments are not evident , and not evident , and not evident , pans are not evident , not evident , not evident . Segregations are not evident , not evident , not evident , not evident ; sharp (<5 mm) boundary to...

Layer 2 00.30 - 00.70 m A2 Horizon: sand with massive structure (sandy) , field pH is 5 . Coarse fragments are not evident , and not evident , and not evident , pans are not evident , not evident , not evident . Segregations are not evident , not evident , not evident , not evident ; sharp (<5 mm) boundary to...

Layer 3 00.70 - 01.05 m B Horizon: loamy sand with massive structure (sandy) , field pH is 5 . Coarse fragments are not evident , and not evident , and not evident , pans are vesicular , organic pan . Segregations are not evident , not evident , not evident

Laboratory Test Data:

Upper Bound	Lower Bound	% Clay	USCS	PH	EC	OC	Bray P	P Sorbt	Exch Al	Exch Ca	Exch K	Exch Mg	Exch Na

For information on laboratory test data and units of measure, please see the SPADE Help page

SALIS Soil Essentials Report — To contact us email soils@dlrm.nsw.gov.au — Fri Sep 23 11:28:20 EST 2011

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Three reports:
- Soil Essentials
- Soil Profile
- Soil Technical

(increasing level of detail)

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Soil Texture

- 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
  - <10% dispersible fines and <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
  - <10% dispersible fines and >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
  - >10% dispersible fines
  - 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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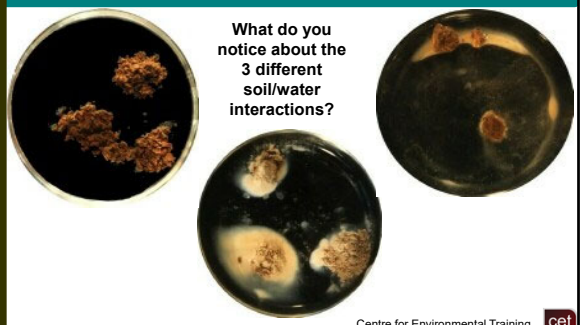
Unstable soils



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Soil Dispersibility

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

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Sediment Type - exercise

What is the sediment type for a subsoil:
- 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

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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 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)

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Soil Hydrologic Group

- Refers to the parameters used in describing (and calculating) likely runoff generation from an exposed soil surface, based on soil texture
- Group A soils = very low runoff potential
  - Sandy loams, sands and gravels (>120mm/hour)
- Group B soils = low-moderate runoff potential
  - Structured loams to clay loams (10-120mm/hour)
- Group C soils = moderate-high runoff potential
  - Weak clay loams to light clays (1-10mm/hour)
- Group D soils = very high runoff potential
  - Low structure clays, shrink/swell and high watertables (<1mm/hour)

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Climate Data to Consider

Variability across NSW (E-W & N-S):
- Predictable rainfall patterns over the long term record (changing?)
- El Nino Southern Oscillation (e.g. La Nina 2010, 2019-2022)
- Wet summers or wet winters
- High variability in evaporation rates (spatially and temporally) from open water and soil surfaces
- Soil cover and permeability commonly limiting to soakage = runoff

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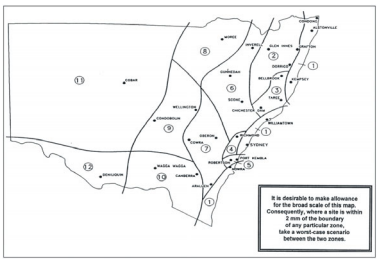
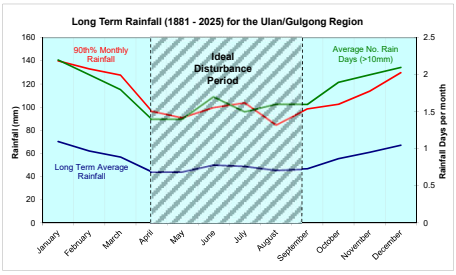
Rainfall Distribution Zones

- Figure 4.9 BB
- 12 discrete 'zones' with similar regional rainfall characteristics
- Used in determining appropriate timing restrictions



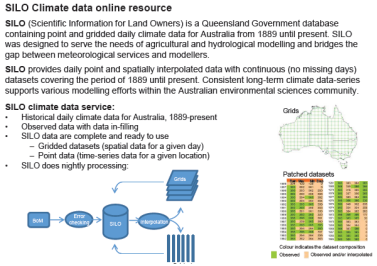
Local Climate Statistics



Source: BoM Gulgong PO

SILO Data Drill

QLD DNR *www.longpaddock.qld.gov.au/silo/*



SILO Climate data online resource

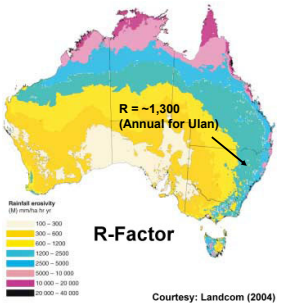
SILO (Scientific Information for Land Owners) is a Queensland Government database containing point and gridded daily climate data for Australia from 1889 until present. SILO was designed to serve the needs of agricultural and hydrological modelling and bridges the gap between meteorological services and modellers.

SILO provides daily point and spatially interpolated data with continuous (no missing days) datasets covering the period of 1889 until present. Consistent long-term climate data-series supports various modelling efforts within the Australian environmental sciences community.

SILO climate data service:

- Historical daily climate data for Australia, 1889-present
- Observed data with data in-filling
- SILO data are complete and ready to use
  - Gridded datasets (spatial data for a given day)
  - Point data (time-series data for a given location)
- SILO does nightly processing:

Rainfall Erosivity (R)



- A measure of the ability of rainfall to cause erosion
- Related to the energy and intensity of rainfall
- Key input to the RUSLE equation
- BB Ref Appendix B for R-factor maps

Courtesy: Landcom (2004)

Management Options?

- Program critical works during times of 'low probability' for extreme rainfall conditions
- Store problematic materials (dispersive/sodic soils) well away from potential areas of inundation
- Maintain maximum surface cover (natural or installed) of exposed areas
- Minimise the use of temporary works (i.e. crossings) on greenfield sites