## Session 4

# Erosion and Sediment Control Best Management Practices (BMPs)



## Overarching Principles

**Erosion control is the key!!!**

Manage Water

- look up, around and down
- assess where water comes from, how it will move through the site, and where it ends up

Manage Soils

- understand soil erodibility – some soils more erodible than others
- protect soils accordingly



## Planning

Planning considerations:

- Limit construction activities to the shortest practical duration
- Restrict active works areas to a manageable size
- Plan for diversion of run-on stormwater



## Scheduling

On sensitive or high erosion hazard sites, if possible plan construction for times when the rainfall activity is typically lower

High erosion hazard site >500 t/ha/yr calculated soil loss using RUSLE

Be prepared though, heavy rain can occur at any time of year!



## Reduce Disturbance Areas

- Stage development where practical, reducing the area exposed to erosion at any one time
- Limit disturbance to 5m (preferably 2m) from essential work areas
- Use barrier fence (upslope) and sediment fence (downslope) to define work areas and “no-go” zones



## Managing Water
## Catch Drains/Diversion Banks



## Purpose

- Divert clean stormwater around works areas and help keep work areas dry
- Capture and convey dirty water to sediment traps
- General stormwater conveyance
- Shorten slope lengths
- Temporary or permanent features
- Very important tool in erosion control!



## Catch Drains



## Perimeter Bank



## Clean Water Diversion



## Bitumen Emulsion

## Shotcrete

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## Managing Water Chutes for Steep Slopes

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## Check Dams

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## Check Dams

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## Purpose

- Reduce velocity of flow in channels, reducing erosive energy
- Can provide moderate filtering/trapping capacity for coarse sediment
- Longer detention times can allow settling of some fine sediment, but this would almost certainly be re-eroded unless removed after each storm

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## Example – 'Geo-ridge'

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## Example – biodegradable logs

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## Maintenance

- Check for erosion problems during and after rain, especially at inlets and outlets
- Repair scoured areas and line with erosion resistant materials
- Remove accumulated sediment
- Provide new drains as construction proceeds to new areas
- Look for signs of localised flooding and redesign drains if necessary

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## Inlet / Outlet Protection

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## Failed Inlet Protection

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## Velocity Reduction

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## Stabilised Access

- Establish a single stabilised site access
- Helps limit disturbance and reduce erosion at a high traffic point(s)
- Reduces sediment tracking to road
- Reduces down-time after rain

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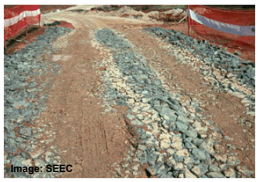
## Maintenance

- Even out wheel ruts
- Remove sediment from sediment basin and replace or resurface gravel periodically
- Repair surface drains
- Sweep the road

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## What would you do here?

Image: Strategic Environmental and Engineering Consulting (SEEC)

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## "Stonewall" Stabilised Shoulders / Batters

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## Stockpiles

- Store topsoil and subsoil separately
- Understand dispersive soil types (typically subsoils) – do not mix
- Preserve seed viability and soil structure (minimise re-working)
- Control erosion and prevent sediment pollution
- Longer term stockpiling – mulch cover or revegetation is a good option

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## Stockpiles


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## Construction / Maintenance

- Place at least 2 m from property boundaries and hazard areas (e.g. waterways, roads, existing vegetation)
- Place stormwater diversion drains upslope and sediment fence downslope
- Keep height < 2 m if possible, and batters with 2:1 maximum slope
- Stabilise stockpiles that are in place for more than 10 days using vegetation or cover (~60% effective cover)

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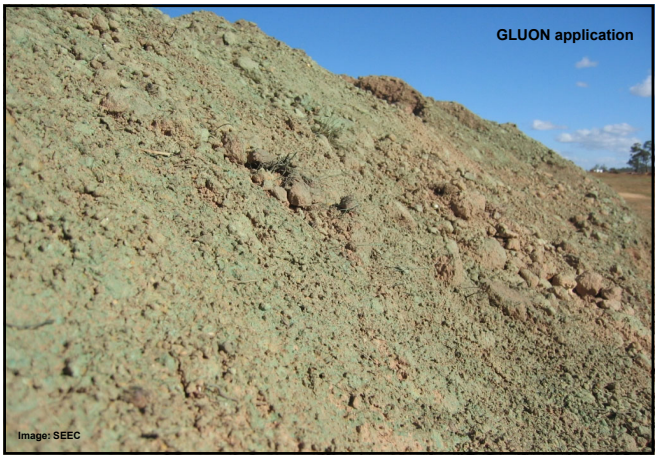
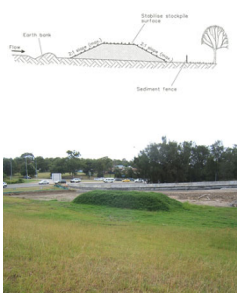



## Topsoil Stockpiles



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## Sediment Controls

- Erosion controls must be a major priority at any development site, but inevitably are not 100% effective
- Sediment controls act along with good erosion control to minimise off-site pollution, as part of an overall “treatment train”

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## Pollutants – Not Just Soil

- Suspended solids, especially sediment that can carry other pollutants “piggy-back” (e.g. nutrients, heavy metals)
- Nutrients
- Organic matter and other oxygen-depleting materials
- Pesticides
- Litter, construction wastes, hydrocarbons

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## Vehicle Washdown

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## Example – good practice


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## Soil Type and Sediment Trapping Effectiveness

- The coarser the sediment, the easier to trap (generally)
- Effective capture of finer silts and clays requires long detention times and/or flocculation
- Dispersible sediments in particular may never settle out except with flocculation!

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## Catchment and Runoff Characteristics

- For smaller catchments (<4,000 $m^2$) small sediment traps (e.g. sediment fence) can be used to good effect if designed and installed properly
- Larger catchments require much larger traps (i.e. sediment basins)
- Possible to estimate sediment yield to help size sediment traps
- Keep traps offline (avoid concentrated flow) and divert clean water to improve effectiveness

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## Function of Sediment Traps

- Sediment traps generally work by reducing flow velocities, allowing sediment and other pollutants time to settle
- It is a common misconception that traps work by "filtering" water (although this is a partial mechanism in some traps)

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## Maintenance of Sediment Traps

- Inspect devices after each storm and:
  - remove sediment when sediment reaches 1/3 to 1/2 capacity
  - repair damage
  - assess effectiveness and install additional erosion and sediment controls as required
  - flocculate sediment basins capturing fine or dispersible sediment

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## Mulch Bund Filter Strip

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## Sediment Fence

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## Purpose

- Use downslope of all disturbed areas
- Best used to dam water where it is inclined to pond (e.g. flat areas at base of batters)
- Designed for sheet flow, not concentrated flow
- Not appropriate in waterways
- Woven geotextile supported by star pickets, hardwood posts etc.
- Reinforce with steel wire or mesh for higher flows
- Construct along the contour to prevent water concentrating at one point
- Trap mainly sand and gravel – most silt and clay will pass through

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## Effectiveness

- Sediment fence typically has pore openings typically ~ 0.035 mm
- clay and silt are <0.02 mm and much will pass straight through
- sand >0.02 mm and gravel caught with greater efficiency
- Trapped material will improve efficiency to a point……maintenance required to ensure continued performance

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## Examples - Poor Practice?

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## Poor Location?

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## Examples - Good Practice

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## Inappropriate Use

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## Maintenance Required


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## Gravel Sausages and Kerb Inlet Filters

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## Purpose

- Used to protect kerb-side stormwater inlets, grated drains etc.
- Can be moderately effective at trapping coarse sediment when selected, installed and maintained correctly
- Remove sediment regularly otherwise it will be re-mobilised
- Take care to avoid causing downstream flooding

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## Examples – Good Practice


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## Examples – Good Practice


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## Example
## What's Good? What's Bad?

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## Filter Bags/Dewatering

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## Purpose

- Place at end of pipes to filter sediment
- Use when dewatering pits, trenches and sediment traps
- Locate in a well grassed area away from waterways during use
- Max. pore size ~0.2mm (traps sands and some silts)

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## Dewatering – example

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## Coarse Sediment Traps

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## Example – 'U' Traps

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