Dorset County Council

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Natural Environment Team
guidance sheet

soil in landscape & engineering projects

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Introduction

The purpose of this guidance is to promote and encourage the sustainable use and management of soils and vegetation on new and existing projects and to illustrate how this can achieve significant cost savings as well as landscape and biodiversity benefits.

The value of soil

Soil is a medium in which plants grow and is a habitat for animals and other micro-organisms. It is also important in nutrient cycling and in regulating and controlling water flow. Soil influences the character of our local landscapes and preserves archaeological remains. The underlying geology and associated soils are fundamental to defining Dorset's unique and varied landscape character.

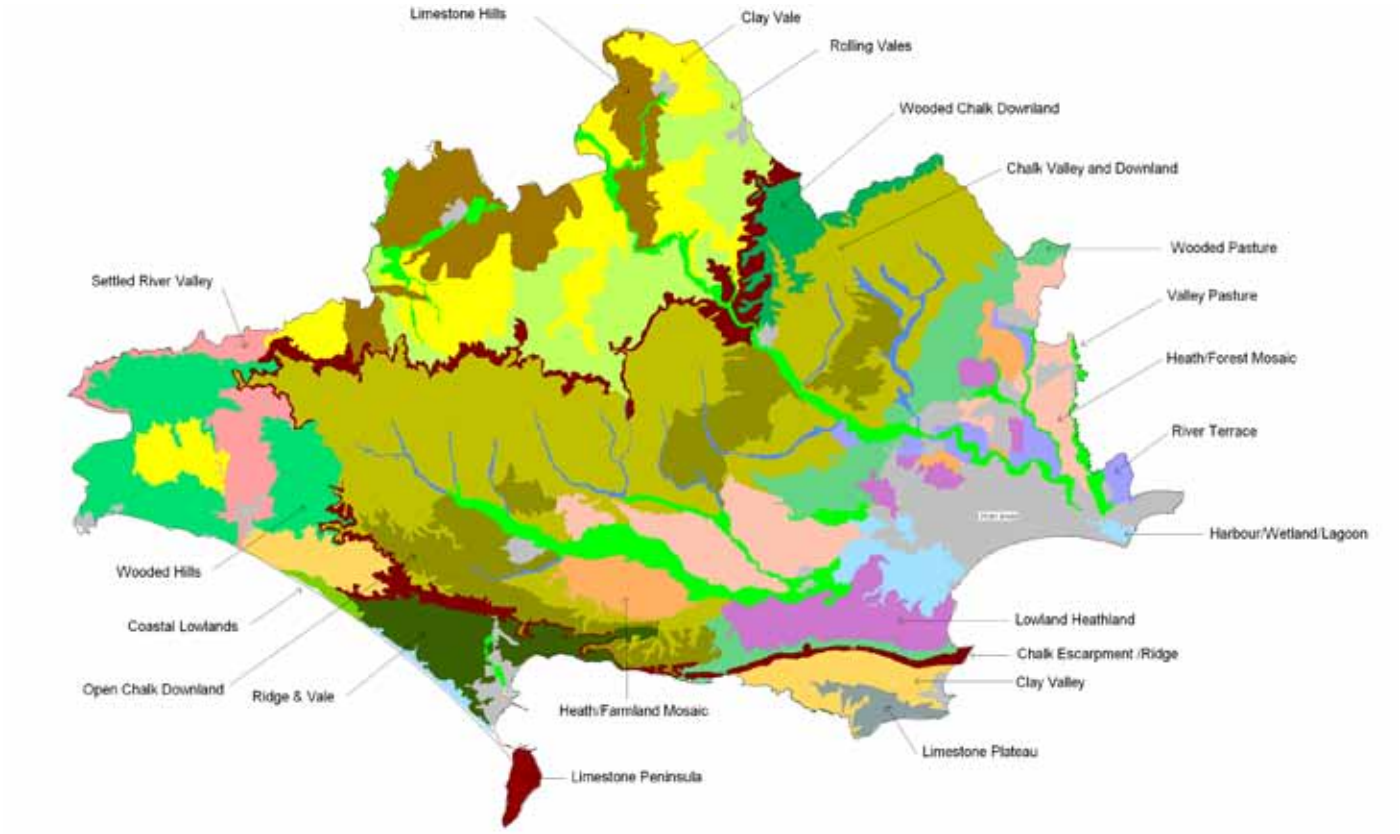


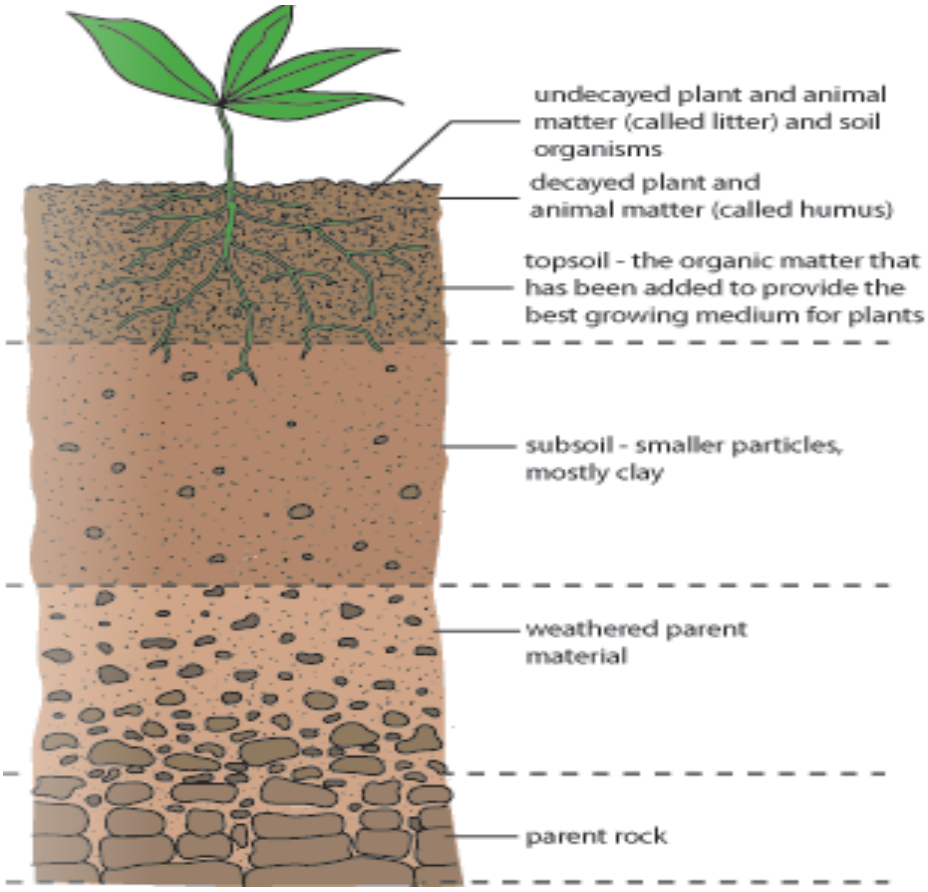
Figure 1: Dorset Landscape Character Assesssment: maps the diverse character of Dorset.

The county can be very broadly divided into two major soil types:

- Acidic sandy soils associated with the Poole basin covering the south east of the county.
- Calcareous chalk and limestone soils associated with the chalk downland and limestone hills across the rest of the county.

Topsoil and subsoil

Topsoil provides an anchorage and oxygen for plant roots, slowly releases nutrients and in conjunction with the underlying subsoil, retains moisture to sustain plant growth during dry periods. Soil also harbours mycorrhizal fungi which provide an important relationship with many plants specific to a particular habitat and locality without which these plants will fail to thrive. For this reason it is often better to conserve existing soil from a particular site if possible rather than import new sterile topsoil.



Once re-usable soil resources have been identified within a site it is important to strip them carefully for beneficial reuse on or off-site. Topsoil is a valuable resource and if not reused on site should be appropriately saved and reused elsewhere or sold.

The subsoil is an essential component of most soil, providing storage of moisture, transmitting rainfall to deeper layers or watercourses and enabling deep rooting by trees, shrubs and grass. Only soil that is shallow over rock lacks a subsoil layer. The subsoil plays an important role in reducing surface water runoff and erosion, controlling the waterlogging of surface layers, helping vegetation to withstand summer droughts and providing anchorage for trees.

Soil characteristics & fertility

Since soil performs so many vital functions (ecosystem services) for mankind, its wise use and management is essential to sustainable development.

In particular an understanding of the links between land use and management, and good soil management and soil carbon storage, will be crucial for tackling the challenges of climate change. Understanding soil characteristics and its fertility is vital to identifying appropriate locations for habitat restoration and creation schemes and for achieving wider scale conservation objectives. It can also help make significant cost savings in management of land since the nature of the soil and its fertility has a direct link as to how fast vegetation grows in it.

Topsoil storage

The main aim when temporarily storing soil is to maintain soil quality and minimise damage to the soil's physical condition so that it can be easily reinstated once respread.

Handling soil to create stockpiles invariably damages the physical condition of the soil, so it should be ideally be stored when dry.

Stockpile heights of no more than 3m in height are recommended to avoid soil damage and shaped so as avoid collection of water in surface undulations. This minimises soil compaction and damage.

Stockpiles should not be positioned within the root or crown spread of trees, or adjacent to ditches, water-courses or areas of nature conservation interest. Soil will have a natural angle of repose of up to 40° but, if stable stockpiles are to be formed, slope angles will normally need to be less than that.

Once the stockpile has been completed the area should be fenced to prevent any disturbance or contamination by other construction activities.

Conservation & enhancement opportunities

The Natural Environment Team is encouraging the selection and use of lower fertility soils. Fertile soil increases grass growth and also encourages the more vigorous grass species which need cutting more. These, such as Cock's Foot, Rye grass and Yorkshire Fog, also have less value for wildlife/habitat creation as they out complete more 'interesting' grasses and wildflowers.

Using the right soil can help conserve and enhance landscape and biodiversity for example by creating suitable conditions for wildflower/grass establishment, as well as reducing long term maintenance costs. The use of sub soil instead of topsoil and wildflower seeding rather than vigorous rye grass has and will continue to be explored. It is important to ensure soils are not contaminated with invasive non native plants before reuse. Similarly pernicious weeds like docks and thistles must be sprayed off before soil stripping to avoid spreading these.

Early in the planning of any project, advice on the precise soil needs for any site should be sought from the Natural Environment Team, ideally at project inception and prior to ordering any new soils. This may help to save costs and ensure any long term maintenance issues are dealt with and ideally 'designed out' at an early stage.

Existing sites

The soil fertility of existing sites, for example to maintain highways infrastructure, can be reduced in a number of ways to create low nutrient/fertility conditions. These low nutrient and fertility conditions (eutrophic) mimic the natural situations in which these species have evolved.

- Topsoil inversion
  The principle of soil inversion is that the inverted topsoil profile buries the weed seed bank, reduces competition for moisture now held at depth, and makes topsoil accessible only to trees. The deeper rooting of trees improves establishment and growth rates, and produces more robust plantations better able to withstand gales and droughts. Where combined with tree planting, sowing on inverted topsoil may evolve a new woodland flora as humus accumulates under increasing light stress. The exposed low fertility subsoil also provides the ideal growing medium for wildflowers, free of vigorous weed competition, which grow less vigorously than standard seed mixes.

- Topsoil stripping and removal
  Remove surface vegetation by blading off, by scarification and raking, or kill off by application of a suitable non-residual herbicide applied not less than two weeks before stripping commences. Stripping should be undertaken by excavator standing on the surface of the topsoil, digging the topsoil to its maximum depth and loading into site or off-site transport vehicles. The transport vehicle should run on the subsoil layer where possible.

- Retention of rubble/subsoil and compacted surfaces
  In some situations it may be desirable to retain rubble, stone and other material and/or not break up the formation levels as this would normally be the desired specification for standard planting/seeding beds. It is in these ‘stressed’ environments that suitable conditions for wildflower/grass establishment can occur.

New sites

The soil fertility on new sites and projects, for example where new highway improvements or maintenance work are taking place to provide new cycle/footways, can be reduced in a number of ways. These low nutrient and fertility conditions (eutrophic) mimic the natural situations in which these species have evolved.

- Importation of low fertility soils

If soil is required for new sites e.g. if the existing retained soil is not suitable since its fertility is too high, then specific soils can be used such as one with a low topsoil percentage.

- Use of retained subsoil

- Topsoil is expensive to import and local subsoil is often taken off site to be tipped rather than recycled as the growing substrate. Some soils will be suitable to strip and retain for reuse on site as they provide the right low fertility environment required to achieve a low maintenance project.

Climate Change

Good soil management can help in the mitigation and adaptation to the threats of climate change. In terms of mitigating emissions, green infrastructure based on indigenous soils helps reduce the atmospheric concentration of carbon by locking it up in both soils and vegetation.

Good soil specification and management also helps to reduce flood risk by slowing peak flood volumes and runoff during rainstorms, improving water quality by filtering pollutants and in limiting soil erosion. One of the most important aspects of this wider management of green infrastructure is helping a wide range of flora and fauna to adapt to our changing climate by becoming more resilient. The provision of suitable habitats that allow them to survive and thrive and the conservation and enhancement of wildlife corridors that allows the migration of other species to more suitable environments is essential.

Examples of good practice

Weymouth Relief Road
Where the road cut through the chalk Ridgeway, soils were stripped from a 1.5 ha area and stored away from other soils. On completion of the cutting slopes they were spread very thinly to start to recreate 6ha of lowland calcareous grassland. Chalk grassland wildflower seed was hand collected from within the Weymouth and Portland area to supplement commercial seed supplies of Dorset or South West England provenance and sown on these slopes. The use of these soils was essential to establish downland turf more quickly than if a generic high fertility topsoil was used.

Priory Corner, Portland
The use of locally sourced wildflower and grass seed was sown in 1997 onto and around placed rocks and retained limestone soils, rocks and scree. This created a landscape in keeping with Portlands character and it also has required no maintenance after sowing due to the low fertility.

Hinton St Mary, near Sturminster Newton
As part of the carriageway narrowing project through the village retained subsoil from site was used to soil the new verges rather than imported topsoil. Wildflower and grass seeds where sown resulting in lower levels of maintenance and the gradual establishment of a more biodiverse verge.

Perryfields Nature Reserve, Portland
Quarry overburden, consisting of calcareous clays and small limestone slabs and stones, was shaped into low mounds by JCB. No topsoil was aplied at all, and the whole area was sown with locally harvested wildflowers, mainly Birds Foot Trefoil and Kidney Vetch.

Warmwell Quarry; mineral extraction restoration
Following woodland clearance at Upton Heath, as part of the heathland restoration work, the top surface of the heathland soil was scraped up. This seed laden soil was then spread over the restored landform surface at Warmwell quarry to help recreate heathland on suitable sandy soils stored for this use.

Contact details & further information

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