



GOOD PRACTICE GUIDE FOR HANDLING SOILS

Sheet 1:

Soil Stripping with Excavators and Dump Trucks

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MAFF FOREWORD

Standards of restoration of minerals and waste sites have steadily improved in recent years, with operators increasingly aware of their environmental responsibilities. The industry is putting forward more imaginative restoration concepts to a variety of afteruses, and is more aware than ever that it will be judged on the standard of that restoration, and the sustainability of the development.

Sustainable mineral development means balancing economic, environmental and social needs, whilst using resources wisely. The UK Strategy for Sustainable Development recognises the importance of safeguarding agricultural land to meet the needs of future generations, and minimising the loss of soils to new development*.

Improved restoration standards have sometimes enabled planning permission to be given for best and most versatile agricultural land to be worked for minerals, on the basis that it can be restored in a way that safeguards its long-term agricultural potential**. Inherent in these high standards of restoration is the requirement to handle soils in such a way that damage to their structure is minimised. It is the aim of this Guide to provide comprehensive advice on soil handling “Good Practice” to operators, soil moving contractors, consultants and planning authorities.

The Guide is in the form of 15 Sheets giving advice on soil stripping, the forming and taking down of soil storage mounds, and soil replacement operations using excavators, earth scrapers or bulldozers. There are also four Guidance Sheets on remedial works involving the removal of stones and damaging materials, and decompaction during the replacement operations.

This document should be cited as MAFF (2000), Good Practice Guide for Handling Soils (version 04/00). FRCA, Cambridge.

Any views expressed in the guidance are those of the consultant and do not necessarily represent the view of the Ministry of Agriculture, Fisheries and Food.

*(DETR, A Better Quality of Life, May 1999, paragraphs 6.66 and 8.50)

**MPG7 (November 1996, paragraph 3).

Acknowledgements

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SHEET 1 SOIL STRIPPING WITH EXCAVATORS & DUMP TRUCKS

The purpose of this Guidance Sheet is to provide a model method for best practice where excavators and dump trucks are to be used to strip soil. This Guidance Sheet comprises 6 pages of text, 3 figures and a user response form.

The model method may need to be modified according to site conditions or requirements of the Planning Authority. Where this is the case, deviation from the model should be recorded with reasons. The guidance does not specify the type, size or model of equipment, but this should have been agreed as part of the planning conditions or as a reserved matter. The machines should be of a kind which will cause the minimum compaction whilst being operationally efficient (eg wide tracked), and must be well maintained at all times.

Persons involved in the handling of soils, overburden etc., and in the construction or removal of mounds or tips, must comply with the Health and Safety at Work Etc. Act 1974 and its relevant statutory provisions, and in particular those aspects which relate to the construction and removal of tips, mounds and similar structures. This requirement takes preference over any suggested practice in the Sheets.

The user of these guidelines is solely responsible for all liabilities that might arise. No liabilities are accepted for any losses of any kind arising from the use of this guidance.

This soil handling method uses back-acting excavators in combination with dump trucks (articulated or rigid bodied). An excavator is used to strip soil and load it into dump trucks for transportation to replacement areas or to storage.

The soil handling method can affect the agricultural quality of the restoration through severe soil deformation (compression and smearing). This is primarily caused through trafficking, the effects of which increases with increasing soil wetness.

The advantage of this model method, if correctly carried out, is that it should avoid severe deformation of the soil as trafficking is minimised. Consequently, there should be no need for decompaction treatment during the operation.

The key operational points to ensure avoidance of severe soil deformation are as follows:

- (i) To minimise compaction:
 - the dump trucks must only operate on the 'basal'/non-soil layer, and their wheels must not on any circumstances run on to the soil layer(s).
 - the excavator should only operate on the topsoil layer.
 - the adoption of a bed/strip system avoids the need for the trucks to travel on the soil layers.
 - the machines are to only work when ground conditions enable their maximum operating efficiency.
 - if compaction is caused then measures are required to treat it (see Sheets 18 & 19).
- (ii) To minimise soil wetness and re-wetting:
 - the soil layers should have a moisture content below their lower plastic limit*. Moisture content should be assessed by oven drying* of samples taken from representative locations and mid/lower points of each soil horizon. [*Or as required in the planning conditions.]
 - the bed/strip system provides a basis to regulate the exposure of lower soil layers to periods of rain and a means of maintaining soil moisture contents. The soil profile within the active strip should be stripped to the basal layer before rainfall occurs and before stripping is suspended.

- measures are required to protect the face of the soil layer from ponding of water and maintain the basal layer in a condition capable of supporting dump trucks.
- the area to be stripped is to be protected from in-flow of water, ponding etc. Wet sites should be drained in advance.
- the maintenance of a transpiring crop is important, and an appropriate cropping regime should be established for the year of soil stripping. Before stripping, excess vegetation should be removed; in the case of grassland it should be cut or grazed short and arable crops should have been harvested.

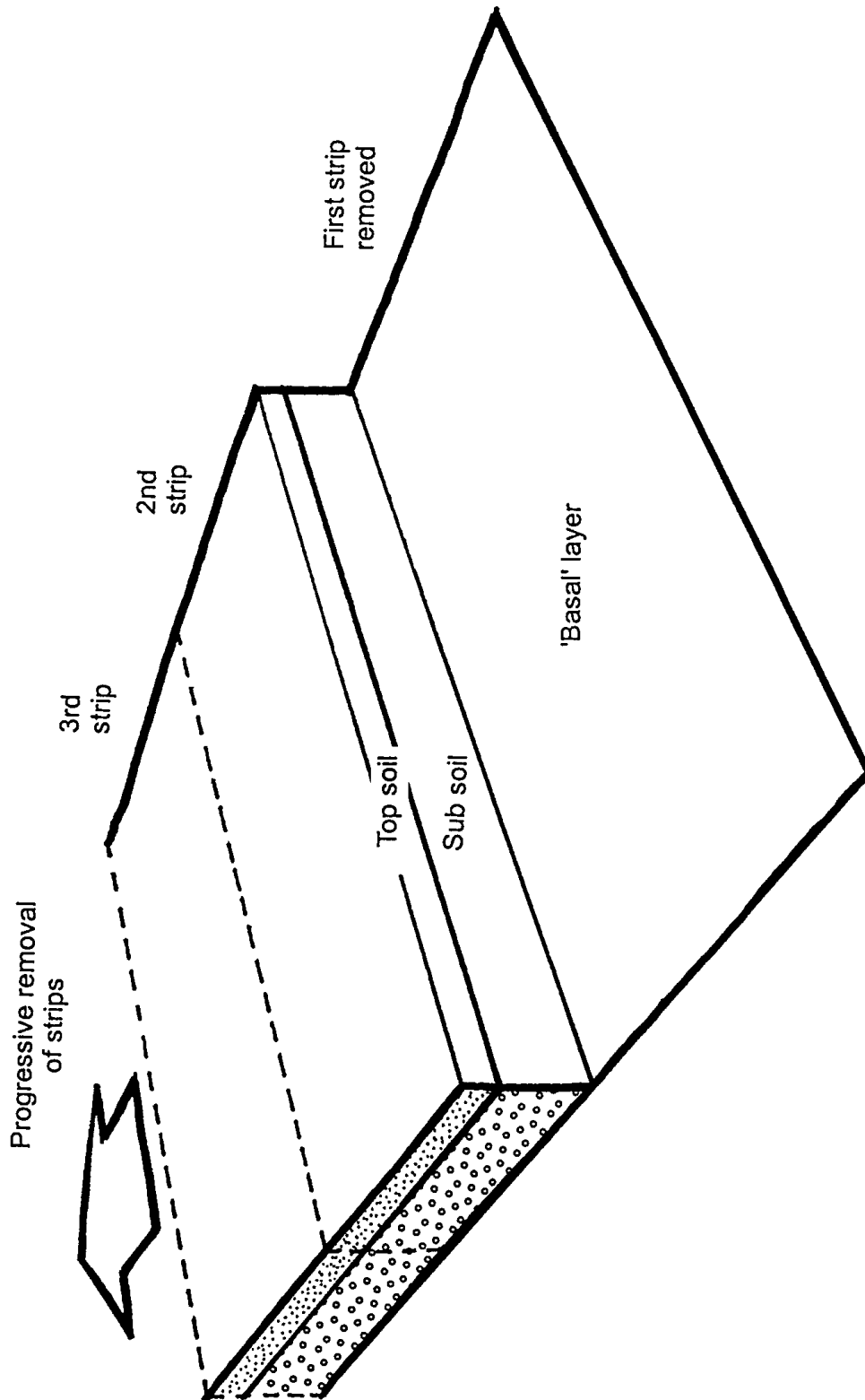
The Stripping Operation:

- 1.1 The area to be stripped is to be protected from in-flow of water, ponding etc. Wet sites should be drained in advance.
- 1.2 Soil stripping operations should not start until the required soil moisture levels are reached (as determined by the agreed method), and should be suspended as soon as the water content returns to these levels. Prior to work commencing a Meteorological Office forecast should be obtained which gives reasonable confidence of soil stripping proceeding without interruptions from rainfall events. If significant rainfall occurs during operations, the stripping must be suspended, and where the soil profile has been disturbed it should be removed to base level. Stripping must not restart unless the weather forecast is expected to be dry for at least a full day.

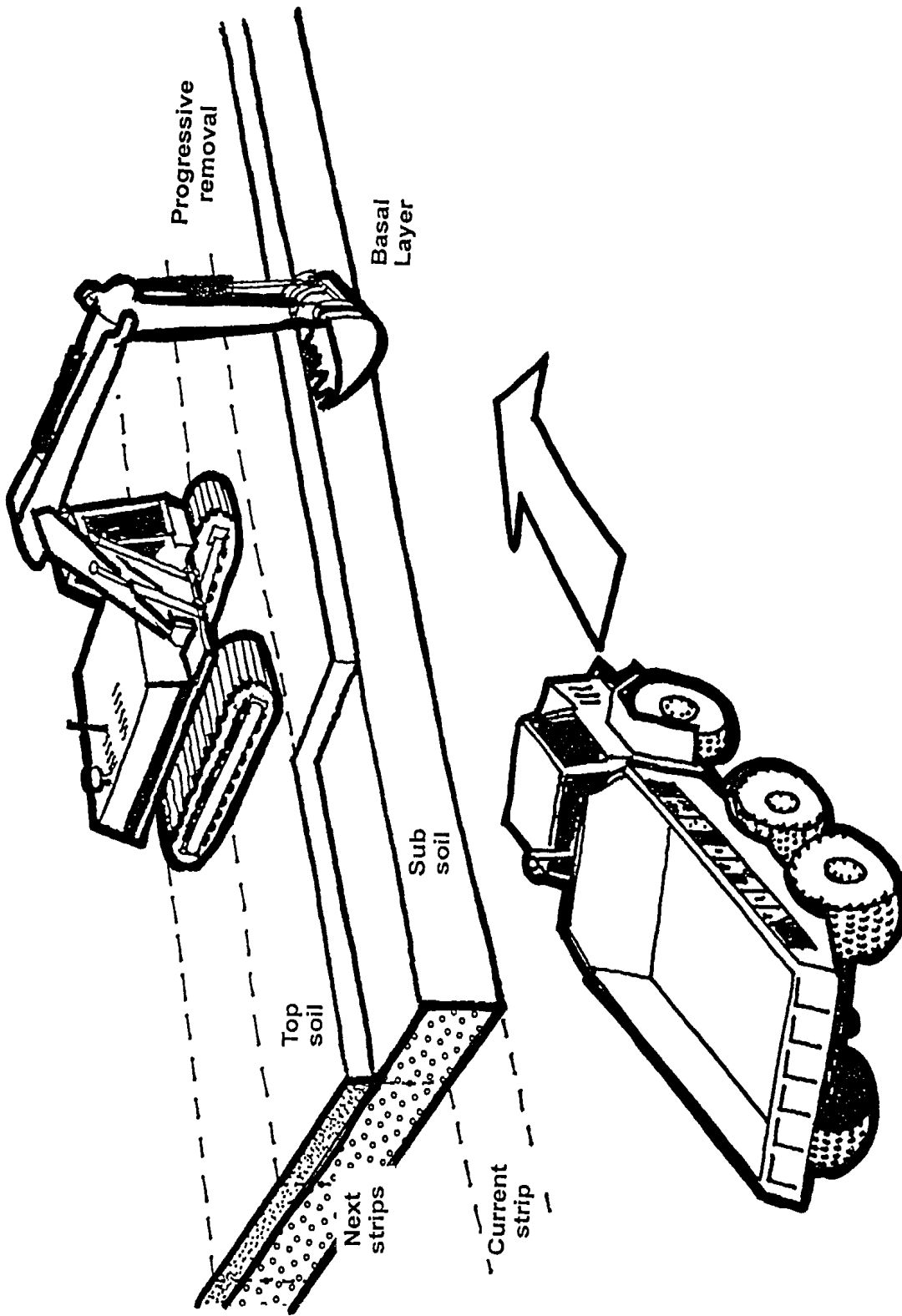
- 1.3 All machines must be in a safe and efficient working condition at all times.
The machines are to only work when ground conditions enable their maximum operating efficiency. The operation is to be suspended before traction becomes a problem or the integrity of the basal layer and haul routes fail.
- 1.4 The operation should follow a detailed stripping plan showing soil units to be stripped, haul routes and the phasing of vehicle movements. The soil units should be defined on the site with information to distinguish types and layers, and ranges of thickness. Detailed daily records should be kept of operations undertaken, and site and soil conditions.
- 1.5 Within each soil unit the soil layers above the base/formation layer are to be stripped in sequential strips with the topsoil layer stripped first, followed by the subsoil layers; each layer stripped to its natural thickness without incorporating material from the lower layers. The next strip is not started until the current strip is completely stripped to the basal layer. This is often referred to as the 'bed or strip system'. The system involves the progressive stripping of the soil in strips (Figure 1.1). Where there is a gradient to the site, the main axis of the soil strips should be along the main axis of the slope.
- 1.6 The haul routes and soil storage areas must be defined, and should be stripped first in a similar manner.
- 1.7 The excavator is only to work on the topsoil layer; the dump trucks are only to travel on the basal/formation layer.
- 1.8 Stripping is to be undertaken by the excavator standing on the surface of the topsoil and digging the topsoil to its maximum depth, and it loading into dump trucks. Generally a bucket with teeth is preferable to one without. The dump trucks draw alongside the exposed soil profile, standing and travelling only on the basal layer (Figure 1.2).

- 1.9 The initial strip width and axis should be demarcated. Strip width is determined by the length of the excavator boom less the stand-off to operate; typically about 3-4m. Effective boom length can also reduce with profile depths greater than 1m; at 1.5m effective reach of standard boom may result in 2m wide strips.
- 1.10 Topsoil should be recovered to the full width of the strip without contamination with subsoil (not more than 20% of the lower horizon should be exposed at the layer junction within the strip). The thickness and identification of the horizon junction must be verified before and during stripping. The full thickness of the topsoil horizon should be stripped progressively along the strip before subsoil horizons are started (Figure 1.2).
- 1.11 The upper subsoil in the current strip is to be stripped and monitored in the same manner. The final 25cm of the subsoil layer should be left as a step to protect the adjacent topsoil layer from local collapses. The process is to be repeated for the lower subsoil and any other lower layer to be recovered as a soil material (Figure 1.3).
- 1.12 On completion of the strip, the procedures are repeated sequentially for each subsequent strip until the area is completely stripped.
- 1.13 Where the soils are to be directly replaced without storage in mounds, the initial strip of the upper horizons will have to be stored temporarily to release the lowest layer and enable the sequential movement of materials. The stored initial soil material would normally be placed on the lower layer removed from the final strip at the end of the programme or on partially completed profiles if rain interrupted the operation.

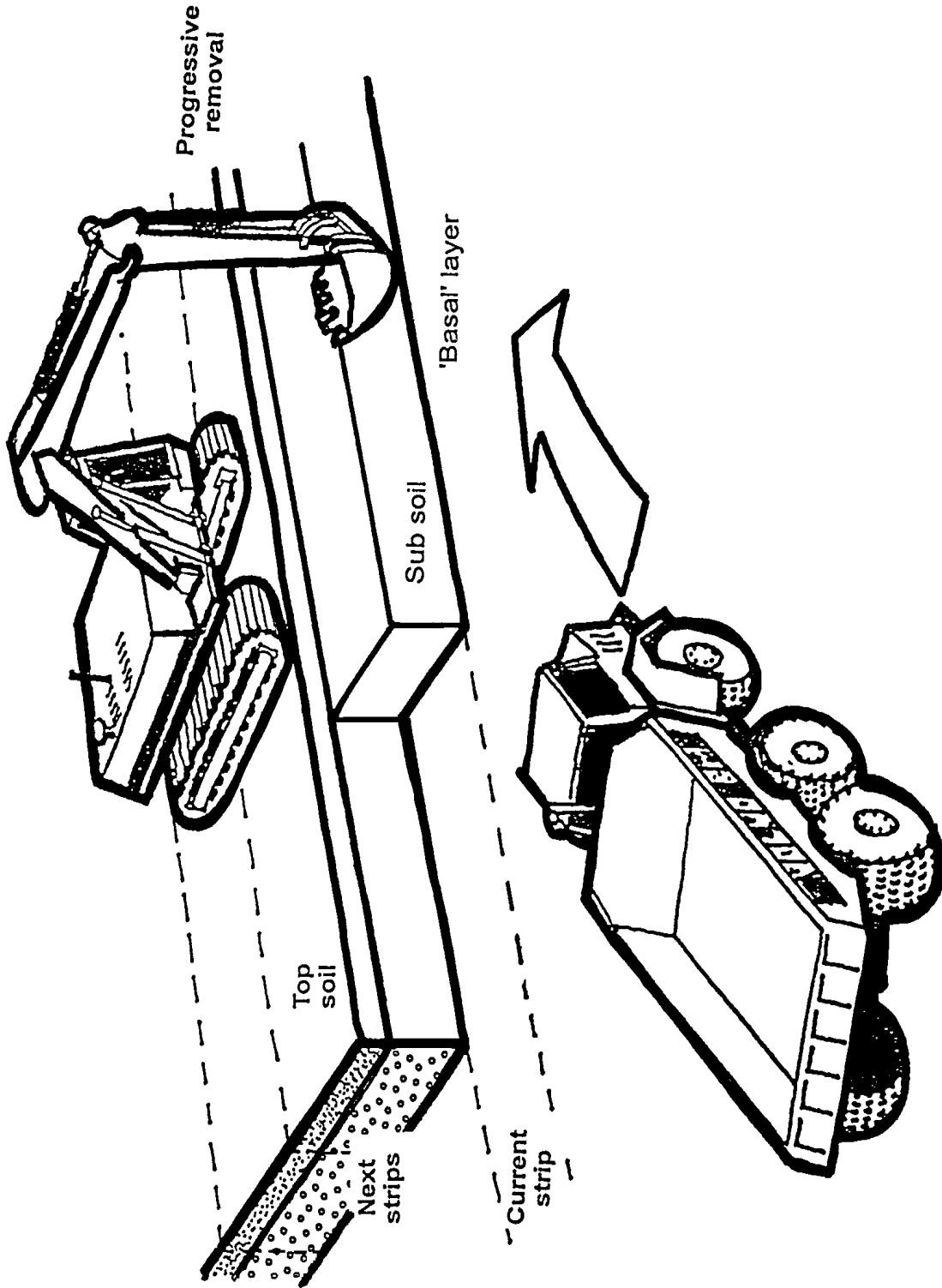
- 1.14 Where the stripping operation is likely to be interrupted by rain or there is likely to be over-night rain remove any exposed subsoil down to the basal layer before suspending operations. Make provisions to protect base of current or next strip from ponding/runoff by sumps and grips, and also clean and level the basal layer. At the start of each day ensure there is no ponding in the current strip or operating areas, and the basal layer is to level with no ruts.



**Figure 1.1 Soil stripping with excavators and dump trucks:
The bed system**



**Figure 1.2 Stripping with excavators and dump trucks:
Removal of top soil from a strip**



**Figure 1.3 Stripping with excavators and dump trucks:
Removal of sub soil from a strip**

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