CHAPTER 9
Silvicultural Standards

The maintenance of high silvicultural standards compatible with the protection of our environment is of paramount importance. The following standards and specifications indicate the minimum acceptable for grant aid under the various grant schemes and should be read in conjunction with the Code of Best Forest Practice and the suite of environmental guidelines.

Responsibility for the successful establishment and management of forests rests with the applicant. The Department will not be held liable for any issue that arises regardless of whether the site had received a Departmental Inspection or not.

9.1 Species Selection

A prerequisite for grant aid is that the site is capable of producing a commercial crop of wood and it is necessary to carry out a proper assessment of site, soil and species suitability in order to establish this. Yield class is a measure of the average rate of growth of forests measured in cubic metres of commercial timber per hectare per year (M^3/ha.yr), assuming the crop will be grown on to the age of maximum mean annual increment.

Tables 5 and 6 are extracts from 'Species Selection and Silviculture Manual, (Horgan, Keane, Lally, McCarthy, Thompson, and O'Carroll) 2003. This Manual is available from COFORD. **The tables are not intended as a 'quick fix' and should not be read in isolation. When read in conjunction with other chapters in the above manual they provide a sound basis for species selection.**

Table 5 colour codes the suitability of a species or mixture from 'optimal' to 'unsuitable'. Using this colour code, certain species can be disregarded immediately as not being suitable for a particular site. The species which are deemed more suitable can then be evaluated, based on additional information (susceptibility to frost, exposure, etc.) from Table 6

For reforestation sites on many podsols and peaty podsolised gleys, the potentially suitable species range may be expanded due to the ameliorative effect of the previous crop. In addition, it should be noted from Table 5 that some species might grow too rapidly on certain fertile sites, leading to coarse growth, poor form or instability. The suggested combinations of site and species where this may occur are marked in the Table by an X.

Table 5. Species choice by soil type

Species		Soil Type																
		A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
Alder	Common																	
	Grey*																	
	Italian*																	
Ash	Common																	
Beech	European																	
	Southern																	
Birch	Downey*																	
	Silver*																	
Cherry	Wild																	
Chestnut	Spanish																	
Hornbeam	Common*																	
Lime	Common																	
Maple	Norway																	
Oak	Pedunculate																	
	Red																	
	Sessile																	
Rowan*																		
Sycamore																		
Cedar	Western red	X																
Cypress	Lawson																	
	Monterey																	
Fir	Douglas	X																
	Grand																	
Hemlock	Western	X																
Larch	European	X																
	Hybrid	X																
	Japanese	X	X															
Pine	Austrian	X	X		X													
	Corsican																	
	Lodgepole (NC)																	
	Lodgepole (SC)	X	X	X	X	X						X	X		X			
	Macedonian																	
	Monterey	X																
	Scots	X																
Redwood	Coast																	
Spruce	Norway																	
	Serbian																	
	Sitka																	
Mixture	SS/DF	X																
	SS/JL	X	X															
	SS/HL	X																
	SS/LP (NC)																	
	SS/LP (SC)																	

Optimal **Unsuitable**

* Tree species not currently on Forest Service approved species list. These species may be considered in certain circumstances after consultation with the Forest Service.

Soil Types

A	Alkaline brown earths and free draining, deep grey brown podzolics	**J**	Gleys/peaty gleys (mottled profile) and gleyed grey brown podzolics (fertility class A or B)
B	Acid brown earths and brown podzolics	**K**	Gleys/peaty gleys (blue/grey or yellow profile) (fertility class B)
C	Rendzinas/shallow brown earths/shallow grey brown podzolics	**L**	Gleys/peaty gleys (fertility class C)
D	Podzols/peaty podzols +/- weakly developed iron pan	**M**	Flushed and/or reclaimed blanket peat
E	Indurated ironpan podzols (organic layer or furze present)	**N**	Unflushed blanket peats and intact raised bogs
F	Indurated ironpan podzols (scrawed, with heather)	**O**	Cutaway blanket bogs (milled peat)
G	Peaty podzolised gleys (fertility class C) - organic layer present	**P**	Cutaway raised bogs (milled peat) post 1980 and fen peats
H	Peaty podzolised gleys (fertility class C) - scrawed	**Q**	Cutaway raised bogs (hand or machine, sod) pre 1980
I	Lithosols		

X Denotes species predisposed to coarse growth, poor form, instability or butt rot by the excessively favourable growing conditions and/or the high pH provided by the soils in question.

- Where free calcium carbonate is present in the topsoil, most species will suffer from lime induced chlorosis. Soils most at risk are A, C, P and Q
- On reforestation sites, particularly in the case of soils D, E, F, G and H, the ameliorative effect of the previous/pioneer crop will result in the upgrading of many species to a higher level than that shown in the table above. This also applies where these soils have been reclaimed or modified in some way for agricultural purposes.

Any intended development outside these specifications should be referred to the Forest Service.

Table 6 is intended to aid in maximising site potential by indicating the most suitable trees to be planted in a range of site types.

Table 6. Species Silvicultural Characteristics

		Characteristics								
Species		**A**	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**I**
Alders:	Common alder	1	1	3	4	5	4	5	1	1
	Grey alder	1	2	3	4	4	4	4	2	1
	Italian alder	3	4	4	3	3	4	5	2	1
Ash:		2	5	4	3	4	5	5	3	
Beech:	European beech	2	4	3	4	3	4	1	1	1
	Southern beech	3	4	4	4	3	3	4	3	
Birch:	Downy birch	3	1	3	4	4	3	3	4	1
	Silver birch	3	2	4	4	2	4	5	4	1
Cherry:	Wild cherry	2	4	5	4	3	5	5	5	
Chestnut:	Spanish chestnut	2	5	5	5	3	4	4	1	1
Hornbeam:		2	1	4	4	2---4	3	1	1	1
Lime:		2	3	4	4	3	4	3	2	1
Maple:	Norway maple	2	2	4	2	3	4	4	2	
Oaks:	Pedunculate oak	2	4	5	3	4	5	5	1	
	Red oak	2	3	4	3	3	3	4	1	1
	Sessile oak	2	5	5	3	3	4	4	1	
Rowan:		1	1	3	2	3	4	5	2	1
Sycamore:		2	2	2	2	3	5	4	1	
Cedar:	Western red cedar	3	2	4	3	4	4	2	3	1
Cypress:	Lawson cypress	3	2	3	3	4	3	1	4	
	Monterey cypress	4	3	1	1	3	3	4	3	
Firs:	Douglas fir	3	3	5	5	2	3	4	2	1
	Grand fir	2	2	5	4	4	5	2	2	1
Hemlock:	Western hemlock	3	4	4	3	3	3	1	3	
Larch:	European larch	3	4	4	5	3	4	5	2	1
	Hybrid larch	2	3	3	2	4	3	5	2	1
	Japanese larch	2	3	3	2	4	3	5	2	1
Pines:	Austrian pine	3	2	3	2	2	3	3	3	
	Corsican pine	3	2	3	5	2	4	5	2	1
	Lodgepole pine	3	1	2	1	1---4	1---3	5	1	1
	Macedonian pine	4	1	1	3	3	3	4	1	1
	Monterey pine	4	2	4	1	2	3	5	1	1
	Scots pine	2	1	4	3	2	3	5	1	1
Redwood:	Coast Redwood	2	5	5	2	3	5	3	3	
Spruces:	Norway spruce	4	3	5	5	4	4	3	4	
	Serbian spruce	3	2	2	3	2---4	2---4	3	3	
	Sitka spruce	1	4	2	2	2---4	3---5	5	3	

Characteristics rated on a scale of 1 to 5					
A	Establishment	1	Easy →	5	Very difficult
B	Spring frost	1	Tolerant →	5	Very intolerant
C	Exposure	1	Tolerant →	5	Very intolerant
D	Salt spray	1	Tolerant →	5	Very intolerant
E	Soil moisture	1	Low →	5	Very high
F	Soil nutrient	1	Low →	5	Very high
G	Shade/Light	1	Shade bearer →	5	Light demander
H	Rooting depth	1	Deep →	5	Very shallow
I	Soil improver	1	Yes →	5	

Characteristic A (ease of establishment) includes a number of factors in the first five years following out-planting. These include survival, ability to compete with vegetation, growth rate and juvenile instability.

Conifers suit acid to neutral soils with a pH of 4.5 to 7 (assuming the soil is free draining with non fluctuating water tables, especially at higher pH levels).

Broadleaves suit slightly acid to moderate alkaline mineral soils with a pH of 4.5 to 8. In general, broadleaves should not be planted over 185 metres elevation in the east and 120 metres in the west of Ireland.

Table 7. Acceptable Tree Species for Grant aid

Conifers	**Botanic name**	**Abbreviation**
Lawson cypress	*Chamaecyparis lawsoniana*	LC
Leyland cypress	*Cupressocyparis leylandii*	LeyC
Monterey cypress	*Cupressus macrocarpa*	CM
Western hemlock	*Tsuga heterophylla*	WH
European larch	*Larix decidua*	EL
Hybrid larch	*Larix eurolepis*	HL
Japanese larch	*Larix kaempferi*	JL
Douglas fir	*Pseudotsuga menziesii*	DF
Grand fir	*Abies grandis*	GF
Austrian pine	*Pinus nigra (var. nigra)*	AP
Corsican pine	*Pinus nigra (var. maritima)*	CP
Lodgepole pine	*Pinus contorta*	LP
Monterey pine	*Pinus radiata*	MP
Scots pine	*Pinus sylvestris*	SP
Norway spruce	*Picea abies*	NS
Serbian spruce	*Picea omorika*	Serb S
Sitka spruce	*Picea sitchensis*	SS
Western red cedar	*Thuja plicata*	WRC
Coast redwood	*Sequoia sepervirens*	CR
Broadleaves		
Common alder	*Alnus glutinosa*	Ald
Ash	*Fraxinus excelsior*	Ash
Beech	*Fagus sylvatica*	Be
Southern beech	*Nothofagus procera / N. obliqua*	SBe
Cherry	*Prunus avium*	Ch
Spanish (Sweet) chestnut	*Castanea sativa*	SC
Lime	*Tilia cordata / T.platyphyllos*	Lime
Norway maple	*Acer platanoides*	NM
Sycamore	*Acer pseudoplatanus*	Syc
Pedunculate oak	*Quercus robur*	PO
Sessile oak	*Quercus petraea*	SO
Red oak	*Quercus rubra*	RO
Additional broadleaves	-	Adb

Other species may be considered in certain circumstances after consultation with the Forest Service.

It is recommended to introduce up to 5% of other native species such as birch, rowan, crab apple and willow into plantations for a variety of environment enhancing reasons. Where possible home collected seed or plants from an Irish seed source should be used. These can be established either within the plantation or where appropriate at edges of woodland.

9.2 Soil Analysis

Each site being assessed for suitability should, amongst other things, undergo a preliminary soil investigation by an approved forester. In areas where the soil reacts or where there is clear effervescence with dilute (10%) Hydrochloric Acid (HCl) occurring within 70 cm of the surface, a detailed soil sampling and analysis must be carried out. The full procedure for the collection of soil samples in Appendix 17 must be followed. A soil sample form (Appendix 17) must be supplied to the soil testing laboratory along with the maps described in Appendix 17). The testing laboratory should be independent of the contracting company.

For assessing the sensitivity of surface water to acidification refer to Appendix 19.

9.3 Provenance Selection

9.3.1 Accepted Seed Origins/Provenances

Accepted seed origins/provenances for planting material are listed in Table 8.

Where possible home collected seed from registered seed stands should be used and applicants are encouraged to ask first for plants from Irish seed.

Only the origins/provenances in Table 8 will be approved for grant aid. Applicants must check with and seek written approval from the Forest Service before purchasing plants with origins/provenances other than those listed and registered material in the category "Source Identified". Otherwise full responsibility for replacement and compensation, including loss of increment, rests with the applicant, approved forester or self assessment company.

Conifers	
Sitka spruce ***Picea sitchensis***	Registered Irish and British seed stands and material from Danish and British seed orchards. Seed imports under EU derogation from the Queen Charlotte Islands, coastal Washington and Oregon. Rooted cuttings derived from genetically improved Washington or Queen Charlotte Island material.
- most sites *(low to mid elevation sites of less than 300m, except low lying midland bogs)*	*South Washington and North Oregon origins.*
- cold frost prone sites *(above 300m elevation and low lying midland bogs)*	*Queen Charlotte Islands (QCI) origins.*
Norway spruce ***Picea abies***	Registered Irish and British seed stands and registered seed stands in the low elevations of Denmark and Germany (north of Frankfurt). Seed imports under EU derogation from Sudetan and Beskid regions of the Czech Republic, Tatra Mountains of Slovakia, north east and lowlands of south Poland.

Serbian spruce ***Picea omorika***	Irish and British stands and seed imports from Serbia.
Lodgepole pine ***Pinus contorta***	Irish and British seed orchards and stands.
- in mixture with Sitka spruce	*Alaskan and North Coastal (including QCI and Vancouver Island origins).*
- exposed, infertile sites	*QCI, Vancouver Island and Interprovenance hybrids.*
- less exposed, mineral soils	*Interprovenance hybrids, Lower Skeena River (Terrace, Kalun Lake and Hazelton) and South Coastal seed orchard material.*
Scots pine ***Pinus sylvestris***	Irish and Scottish seed orchards and registered seed stands
Austrian pine ***Pinus nigra (var. nigra)***	Registered Irish and British seed stands.
Corsican pine ***Pinus nigra (var. maritima)***	Registered Irish, British and Corsican seed stands.
Monterey pine ***Pinus radiata***	Guadalupe Island (Mexico) or stands derived from this origin and home grown Irish healthy, non-yellowing trees
Douglas fir ***Pseudotsuga menziesii***	Registered Irish and British seed stands and seed imports under EU derogation from coastal Washington and northern Oregon.
Grand fir ***Abies grandis***	Irish and British stands and imports from Olympic peninsula, Puget sound (Washington), Washington and Oregon coast range mountains and Vancouver Island.
Western hemlock ***Tsuga heterophylla***	Irish and British stands and seed imports from Puget Sound region of Washington state and the coast range and Cascade Mountains of Washington and Oregon.
Western red cedar ***Thuja plicata***	Irish and British stands and seed imports of seed from Vancouver Island (British Columbia) and coastal Washington and Oregon.
Japanese larch ***Larix kaempferi***	Registered Irish, British and European seed stands. Seed imports under EU derogation from Hokaido Island (Japan) and stands derived from this source as well as material from the Suwa region of the Nagano Prefecture (on Honshu Island) between 1,300 and 2,000m elevation and stands derived from these sources.

European larch ***Larix decidua***	Registered Irish, British, German (Schlitz) and low elevation Austrian (Wienerwald) seed stands. Seed imports under EU derogation from Southern Poland, Czech Republic (Sudetan Mountains) and Slovakia (Tatra Mountains).
Hybrid larch ***Larix eurolepis***	Irish, British, French Belgian Dutch, Danish, German, Swedish and Polish seed orchards.
Monterey cypress ***Cupressus macrocarpa***	Irish and British stands and seed imports from coastal southern Oregon and northern California.
Coast redwood ***Sequoia sempervirens***	Irish and British stands and seed imports from coastal southern Oregon and northern California
Lawson cypress ***Chamaecyparis lawsoniana***	Irish and British stands and imports from coastal southern Oregon and northern California.
Broadleaves	
Pedunculate oak ***Quercus robur***	First Choice: Registered Irish material Otherwise registered British (English and Welsh), French (north of Paris), Belgian, Dutch, Danish, German (north of Frankfurt) seed stands.
Sessile oak ***Quercus petraea***	First Choice: Registered Irish material. Otherwise registered British (English and Welsh), French (north of Paris), Belgian, Dutch, Danish, German (north of Frankfurt) seed stands.
Red oak ***Quercus rubra***	Registered Irish, British, French (north of Paris), Belgian, Dutch, Danish, German (north of Frankfurt) seed stands..
Beech ***Fagus sylvatica***	Registered Irish, British, French (north of Paris), Belgian, Dutch, German (north of Frankfurt) seed stands.
Ash ***Fraxinus excelsior***	First Choice: Irish native material. Otherwise Registered British (English and Welsh), French (north of Paris), Belgian, Dutch, Danish German (north of Frankfurt) seed stands.
Sycamore ***Acer pseudoplatanus***	Irish, British (English and Welsh), French (north of Paris), Belgian, Dutch, Danish, German (north of Frankfurt) stands.
Norway maple ***Acer platanoides***	Irish, British (English and Welsh), French (north of Paris), Belgian, Dutch, Danish, German (north of Frankfurt) stands.
Common alder ***Alnus glutinosa***	First Choice: Irish native material. Otherwise British, French (north of Paris), Belgian, Dutch, Danish, German (north of Frankfurt) stands.

Cherry ***Prunus avium***	First Choice: Irish native material. Otherwise British, French (north of Paris), Belgian, Dutch, Danish, German (north of Frankfurt) stands Not seeds resulting from fruit processing.
Southern beech ***Notofagus procera/N.obliqua***	Irish and British stands and *Nothofagus procera* imported from Chile (Malleco and Llanquihue). *Nothofagus obliqua* from Chile (Frutillar)
Lime ***Tilia cordata/T.platyphyllos***	Irish, British, French (north of Paris), Belgian, Dutch, Danish, German (north of Frankfurt) stands.
Spanish chestnut ***Castanea sativa***	French seed orchard material (not nuts collected for consumption)
Birch** ***Betula pubescens ***Betula pendula***	First choice: Irish native material Otherwise British materal
Rowan** ***Sorbus aucuparia	First choice: Irish native material Otherwise British materal

Table 8. Accepted Seed Origins/Provenances

* Up to 5% of these species may be planted for a variety of environmental enhancing reasons

9.4 EU Forest Reproductive Material Regulations

On 1 January 2003, the EU Directives 66/404/EEC and 71/161/EEC on forest reproductive material were repealed and replaced by a new single EU Directive, Council Directive 1999/105/EC on the marketing of forest reproductive material.

Forest reproductive material (FRM) is a collective term used to describe seeds, plants and other propagating material which are important for forestry purposes. The new marketing Directive updates the legislation to take account of the accession of new Member States since 1975, the Internal Market, and scientific advances including the availability of new material. It is also compatible as far as possible with the revision of the current OECD scheme for the control of FRM moving in international trade. In Ireland, the Forest Service, Department of Communications, Marine and Natural Resources is the national authority, with responsibility for the implementation of the Directive. The new Directive has been transposed into Irish legislation by the European Communities (Marketing of Forest Reproductive Material) Regulations 2002.

The new Directive applies to production with a view to marketing and to the marketing of species which are important for a range of forestry purposes including, but not exclusively, the production of wood. This Directive covers a much wider range of species which are important for forestry in Ireland including, ash, alder, birch, sycamore, cherry and lodgepole pine. Significantly a new category of material "Source Identified" is included. This is FRM derived from basic material which may be either a seed source or stand located within a single region of provenance. This will allow collection and marketing of seed from outside of "Selected" registered sources subject to official control and labelling.

A key principle of the Directive is that FRM remains clearly identifiable through the entire process

from collection to delivery to the end user. Under the new Directive there is a legal requirement for suppliers of FRM throughout the EU to be officially registered . All seed collectors, seed suppliers, nurseries, plant suppliers/brokers etc. must be registered with the Forest Service. All seed collections must be notified in advance following which a Master Certificate of Provenance will be issued. Seed and plants should only be purchased from registered suppliers and material must be accompanied by an approved Supplier's Document. These rules provide traceability and assurance to the end user regarding the origin and suitability of the planting stock. Details of the provenance/origin of planted material also provides an essential forest management record.

For the purpose of the Forest Service grant schemes, all planted material must be covered by a Supplier's Document in the format of a Provenance Declaration Form.

A **Provenance Declaration Form** – Supplier's Document (see Appendix 1) must be completed for all the species listed in Table 8. Only the origins/provenances listed in this table are acceptable.

Part A of the Provenance Declaration Form is completed by the Nursery/Supplier supplying the plants. The Nursery/Supplier must declare that the origin/provenance complies with the accepted list of Origins/Provenances (Table 8).

Part B of the form is completed by the Contractor or Applicant applying for the grant.

In all cases the Contractor or Applicant must submit an original signed Part B. The Contractor or Applicant must declare that the provenance details are correct.

Tick *"Part A is an Original"* when the original non-photocopied Part A is submitted.

Tick *"Part A is a Photocopy"* where the plants covered by Part A have been planted in more than one grant application/contract. The original non-photocopied Part A must be available for inspection.

Tick *"This Provenance Declaration Form accounts for: **All** of the trees planted of the above species on this contract"* where the delivery described in Part A covers all the trees. In other words no other deliveries of plants of that species have been planted in relation to this specific grant application.

Tick *"This Provenance Declaration Form accounts for: **Part** of the quantity planted of the above species on this contract"* where Part A does not cover all of the trees planted. In other words other deliveries of plants of that species have been planted in relation to this specific grant application, potentially with different Master Certificates of Provenance, seed origins/provenances, different suppliers etc. Additional Provenance Declaration Form(s), Part B, must be completed to cover all of the plants actually planted. The number of trees planted and the applicable Plot Number(s) must be indicated in each case.

9.5 EU Plant Health Regulations

Irish forests are recognised under the EU Plant Health Directive as being among the healthiest in Europe, with relatively few serious forest pests or diseases. This is mainly due to Ireland's island status, the relative newness of the forest estate, and the enforcement of forest plant health regulations.

The increasing movement between countries of forest plants and wood products (e.g. logs, sawn timber, wooden pallets, crates and ships dunnage) increases the risk of potentially very damaging forest pests and diseases spreading to Ireland.

The policy of the Forest Service in this area is to maintain a healthy forest environment by ensuring good management, identifying risks and maintaining a sustained commitment to measures which prevent the entry and establishment of destructive forest pests and diseases.

Under the EU Plant Health Directive strict regulatory controls are in place to prevent the entry of exotic insect pests and diseases which could seriously damage our forests. These relate to the movement of forest plants and wood products into Ireland both from within the EU and from non-EU countries.

The Forest Service carries out an ongoing survey of the national forest estate for quarantine forest pests and diseases. Early detection of a newly introduced pest or disease is essential and forest owners and the forest industry are encouraged to be ever vigilant in detecting such introductions. **If any <u>unusual</u> pest or disease is observed please immediately contact your local Forest Service Inspector.**

9.5.1 Plants originating in Ireland and other EU Countries

In the context of the Internal Market, Ireland has been granted a special Protected Zone status with regard to 11 harmful forest pests and diseases. A Protected Zone is essentially an area in the EU where a pest of quarantine significance, established in other parts of the EU, is not present despite favourable conditions for it to establish.
Plants of the genera listed in Table 9 should only be purchased from nurseries registered under the EU Plant Health Directive and the plants must be accompanied by a valid EU Plant Passport to certify freedom from specific pests and diseases.

Plants of the 5 conifer genera and Sorbus plants require a special Protected Zone Plant Passport valid for the island of Ireland. This is normally issued using the codes indicated in Table 9. These details are found on the delivery note and/or accompanying label issued by the registered nursery and also on the Provenance Declaration Form. The following is an example of a valid Plant Passport for rowan, *Sorbus aucuparia*. DAF is an abbreviation for the statutory authority for plant health, the Department of Agriculture and Food, 1234 is a unique registration number for the producer. ZP B2 is the coding to indicate that the plants are free of fireblight disease and are free to move into or within Ireland. The quantity and a unique batch number must also be supplied.

EU Plant Passport IRL/DAF/1234.
Sorbus aucuparia ZP B2

Table 9. Forest Plants requiring an EU Plant Passport

Conifers	**Protected Zone Code**	**Broadleaves**	**Protected Zone Code**
Abies	ZP Conf.	Sorbus	ZP B2
Larix	ZP Conf.	Prunus	Not applicable
Picea	ZP Conf.		
Pinus	ZP Conf.		
Pseudotsuga	ZP Conf.		

9.5.2 Plants originating in non-EU countries

Plant imports from many non-EU countries are prohibited. Where imports are allowed from non-EU countries they must be accompanied by a Phytosanitary Certificate and importers must be formally registered with the Forest Service, Department of Communications, Marine and Natural Resources. The plants must also comply with the forest reproductive material regulations.

9.6 Conifer Mixtures

All crops to be approved under the afforestation scheme must consist either of pure blocks or of silviculturally acceptable mixtures. Mixtures are often used to enhance the visual impact and productivity of a new plantation.

Table 10 shows the species which can be considered in mixture. Where alternative mixtures are proposed the Forest Service must be consulted.

Table 10. Compatability of Conifer Intimate and line Mixtures

	SS	LP	DF	NS	SP	HL	JL	EL	WH	WRC
Sitka spruce		Y	Y			Y	Y		Y	Y
Lodgepole pine	Y									
Douglas fir (DF)	Y					Y	Y	Y	Y	Y
Norway spruce (NS)					Y			Y		
Scots pine (SP)				Y				Y		
Hybrid larch	Y		Y							
Japanese larch (JL)	Y		Y							
European larch (EL)			Y	Y	Y					
Western hemlock (WH)	Y		Y							
Western red cedar (WRC)	Y		Y							

Y = compatable or compatable on certain sites, otherwise not compatable

9.7 Drainage

9.7.1 General Drainage Objectives

Drainage has a direct bearing on the economic, environmental and social potential of the forest for the full rotation and beyond. A site which cannot be adequately drained should not be submitted for preplanting approval or payment

- Conifers should have a minimum free draining rooting depth of 45-60cm throughout the year.
- Broadleaf species require a greater depth.
- Root structure should radiate in all directions on the horizontal plane.
- It is important not to impair harvesting efficiency by creating obstacles.

- Drainage should not impair site access and should be designed in conjunction with the road network.
- Traditional drainage routes must be respected and maintained

Buffer zones and exclusion zones must be considered when designing a forest. A buffer zone is an area where forest operations are curtailed and which is managed for environmental protection and enhancement. Within a buffer zone, natural ground vegetation is allowed to develop with additional planting of suitable riparian tree species (pit planted). An exclusion zone excludes all operations (see for example Forestry and Archaeology Guidelines).

In most cases slope will allow for drainage channels to taper out or be connected to an interceptor drain rather than enter a buffer zone. However on flat sites or those with low slopes it will be necessary to connect drains into the aquatic zone. This may be done only where it will not result in sediment or any pollutants entering the aquatic zone.

9.7.2 'Flat' difficult to drain areas

All drainage channels, slope allowing, should taper out before entering the buffer zone.
The objective is to ensure that sediment does not enter the aquatic zone. The buffer zone filters the water of sediment and decreases nutrient exports, if any, from the site.

However on flat sites this is not feasible as the site would not be drained. In these cases it will be necessary that the drains would connect up to the aquatic zone provided it can be assured that sediment will not enter the aquatic zone. There should be no erosion risk on these flat sites or, if there is, sediment traps will negate the risk. On some sites it may be feasible and desirable to close the drain either fully or partially after successful drainage and crop establishment

A drainage survey should be carried out in flat areas or where there are doubts about the drain ability of a site and this should be submitted at Form 1 stage. This survey should be carried out by a qualified Surveyor or Engineer at the appropriate time of the year to take account of raised water tables. The Drainage Survey should include:

- A certified species Map indicating date of survey and clearly showing surface levels throughout site relative to outfall water levels. Design calculations and details including longitudinal sections where necessary.
- A declaration by the Surveyor or Engineer that drainage of the site will achieve a water table which is continuously 45-60cm below the current surface of the soil and will satisfy the following formula:-

  E = (L/300) + K

  where : L is the distance from a proposed planting area (point A) to an outfall (point B)
  K is the minimum continuous water table depth to be achieved (45-60cm)
  E is the minimum allowable elevation difference between the surface at point A and the outfall at point B.
  Example
  If L is 200 metres, K is 60 cm (or 0.6 m) and therefore E (the elevation of A minus B) needs to be a minimum of 1.26 metres.

- A declaration from the applicant that the site, to the best of the applicant's knowledge, is not prone to flooding.

9.7.3 Drainage and Cultivation Plan

The drainage and cultivation plan, (see map 3) whether mandatory (for areas of 10 ha or greater) or optional should address the following:

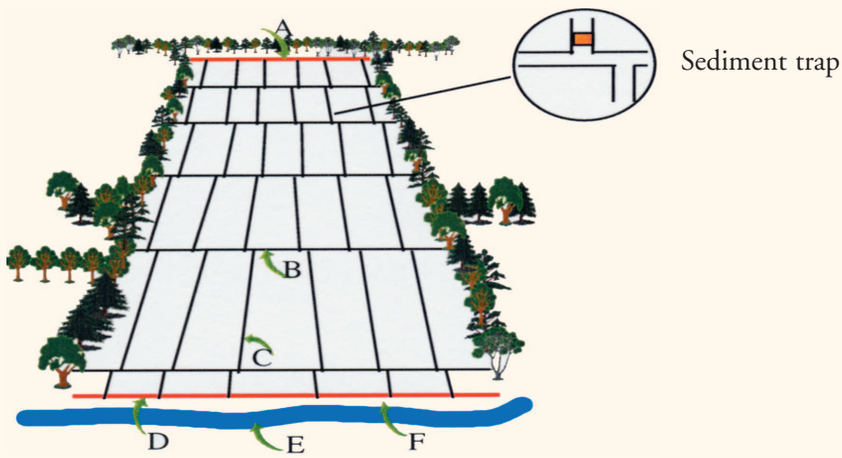
- Cultivation type and direction
- Appropriate exclusion and buffer zones.
- Number, type and location of sediment traps - ensure that they are on the more level part of the topography
- Location of any crossings of aquatic zones.
- Location and direction of collector drains/main drains/existing drains
- Clearance of vegetation prior to cultivation.

9.7.4 Drain types

Collector Drains
Collector drains (which collect water from mound drains, plough furrows, mole drains etc.) should not be greater than 80 metres apart and should run at acute angles to the contour. These acute angles should be no greater than 2 degrees (1 in 30) on slopes greater than 3 degrees (1 in 20). They should be excavated to a depth not greater than10-15cm below the depth of mound drains. Where collector drains have to be extended into erodable material, 'mini' silt traps should be placed appropriately by deepening the drains in places. They should discharge via sediment traps and/or an interceptor drain (see below) into the buffer zone or in flat sites into the aquatic zone via sediment traps.

Interceptor Drains
These are constructed along the edges of aquatic buffer zones. They collect the discharge from the drainage subcatchment and allow it to overflow into the buffer zone.

Cut off Drains
These are constructed immediately up slope of a site and are designed to direct water away from the site.



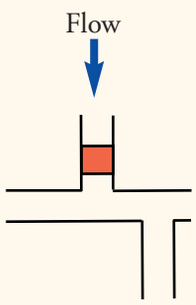
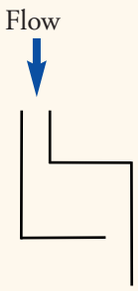
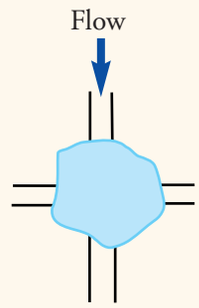
A = Cut off Drain B = Collector Drain C = Mound Drain
D = Interceptor Drain E = Aquatic Drain F = Buffer Drain

Figure 1. Diagram illustrating the use of sediment traps and different drain types. Note that each site will have to be assessed individually to determine the appropriate drainage design. Designs similar to the one above may be suitable for steeper erodable sites.

9.7.5 Sediment Control and Management.

This can be achieved by minimising flow rate and flow volume. Riparian zone type vegetation of grasses, reeds and shrubs efficiently filters out sediment if the water flows over it.

Figure 2 Sediment Trap types (often referred to as 'Silt Traps').

No. 1 (Pit)	**No. 2 (Staggered Type)**	**No. 3 (Run Off type)**	**No. 4 (Swamp Type)**
			
The end of the mound drain is slightly deepened for approx. .3m before it enters the collector drain	Forces water to slow down within the trap – more efficient than if the water ran straight through the trap.	Caters for runoff events that exceed the design capacity. Useful on slopes. Overflows floods onto vegetation. Do not plant within 4 metres of the lower side in order to conserve dense vegetation.	Many drains may enter a natural depression to create a mini "swamp". Dimensions of the "swamp" depend on the needs of the site. May be c. 20 sq. metres. Do not plant within 4 metres of the "swamp".

A large number of small sediment traps (located throughout the site) are usually more efficient than a small number of big traps. Sediment traps should be of such number, design and size that they are sufficient for the full rotation. If they prove inadequate and fill with sediment additional traps should be created or the existing ones maintained so that there is no risk of sediment reaching the aquatic zone. They should be located on level ground, should be maintained - sediment traps can fill within days on highly erodable sites (see Table 11). Sediment traps can be a site hazard and both safety and access for maintenance must be considered at the planning stage. Sediment traps should be rectangular with the longer side parallel to the feeder drain.
Small dams made from straw, vegetation, timber or stone have been used with success to slow water flow and encourage the dropping of sediment.

Use existing agricultural drains wherever practical. Clear them of vegetation and change their shape

only if this is essential to their function. In this event prior installation of sediment traps will be required.

Drains should be excavated prior to mounding.

Construction of new drains or changing the shape of drains should not take place in exclusion zones and should only enter aquatic buffer zones where the site is flat or almost so and will not result in sediment entering the aquatic zone.

Flood events are inevitable - plan for them.

Buffer zones and exclusion zones must not be disturbed during the site preparation operation as erosion channels can result.

Table 11. Rating scheme for soil erodability
(L = low, M = medium, and H = high)

Soil Type	Slope Class					
	<3° 1 in 20	**3°-6°** 1 in 20 to 1 in 10	**6°-8°** 1 in 10 to 1 in 17	**8°-17°** 1 in 7 to 1 in 3	**17°-30°** 1 in 3 to 1 in 2	**>30°** >1 in 2
Least erodable e.g. gleys	L	L	L	L	M	H
Erodable e.g. brown earths	L	L	M	H	H	H
Very erodable, e.g. podsols, some peats	M	H	H	H	H	H

The more erodable the soil, greater care needs to be taken on all the above points.

9.8 Woody Vegetation Clearing and Burning

The site may have a covering of dense woody vegetation such as gorse (furze) or bramble. The nature and extent of this will require a decision as to whether or not it should be removed. If mechanically removed it should be pulled or where it is dozed particular care is required to ensure against topsoil damage, compaction or removal. Subsequent spraying will normally be also required Pockets of broadleaf scrub and hedgerows should be maintained for habitat and biodiversity purposes.

Burning and destruction of vegetation is regulated by the Wildlife Act 1976 as amended by the Wildlife Act 2000. Burning of vegetation is not permitted between the 1st March and 31st August. If further details are required, Department of Environment, Heritage and Local Government (formerly Dúchas) Wildlife Rangers should be consulted. The Gardaí and the owner of the plantation should be notified, in writing, not less than 7 days in advance of the intention to burn vegetation within one mile of a plantation. This is required under Section 61 of the Forestry Act, 1946.

Woody vegetation such as furze may need to be burned prior to planting. This is normally done in the season before planting. It may also be treated by flailing but the regrowth will need to be

sprayed.

If essential for site development, hardwood scrub (birch, sally etc.) should be windrowed using an excavator. Where trees are required to be removed a felling licence is necessary. Scrub areas can provide important areas for biodiversity enhancement and may be included as an ABE.

9.9 Ground Cultivation

9.9.1 Cultivation Methods

Soil Type	Recommended Cultivation
Blanket Peat	Option 1 - Mound Option 2 - D.M.B. Plough
Carboniferous Surface Water Gleys derived from carboniferous drift and Peaty Gleys and Podsolised Gleys with less than 20cm of peat remaining	Mound on slopes less than 5 degrees. Mole Plough on slopes greater than 5 degrees
Peaty Gleys, Podsolised Gleys and Peaty Podsols with more than 20cm peat	Mound
Peaty podsols, peat depth less than 20cm	Rip
Surface water gleys with adequate slope	Mole Mound
Old red sandstone	Mound
Brown Earths and other free draining mineral soils with indicated iron pan	Rip
Brown Earths and other free draining mineral soils	Rip Scarify Double furrow agricultural plough where ground permits
Suitable soil types and site conditions	Mechanical planting is considered

9.9.2 Mounding

Mound Drains

- Mound drains should be dug using a V-shaped bucket
- Recommended Bucket Specification - conventional winged mounding bucket may be used for collector drains
- On sites with slopes greater than 4° (1 in 15) the mound drains should run in the direction of max slope and should be fed into collector drains spaced 50 - 80 m apart and aligned at a max slope of 2° (1 in 30). This ensures the slow removal of water from the site avoiding erosion
- Depth of mound drains is dependant on soil quality for mounding and should not be more than 45cm in depth in mineral soils and 60cm in peat soils
- Mound drains should normally be spaced 8m apart and to an adequate depth to serve the drainage over the life of the crop
- In exceptional circumstances drainage spacing may be greater where soil depth permits and natural drainage is not a problem.

- Collector drains should be excavated to a depth and size capable of collecting water from mound drains (normally 40 - 60 cm deep).
- Design drain gradients so that erosion during storms is avoided i.e. avoid long runs and use collector drains and sediment traps (see figures 1 and 2).
- Separate site and road drainage systems, where possible.
- Use buffer zones between drain ends and watercourses.

Mounds

- Mound rows at 2 metre spacing except where otherwise stated by the Forest Service. Spacing to be adjusted within rows rather than between rows.
- Mound size should be a minimum of 45cm x 45cm x 15cm high to a maximum of 60cm x 60cm x 20cm high and clearly identifiable.
- Mounds should be placed at a minimum of 50 cms from the drain edge.
- An intimate mix of soil should be used from top to bottom to ensure good planting medium for each mound.
- Avoid excessive subsoil, particularly on limestone derived soils.
- Inverted scrap mounds should be considered on steep slopes and free draining soils to avoid erosion.
- A period of settlement after cultivation is required before planting.
- On shallow soils where mound material is limited supplement mounds should be taken from the drain with scrap mounds taken from the side of the drains.

9.9.3 Ripping

- Rip at 2m spacings to 45cm depth using twin ripper tines.
- The tines should have wings fitted at bottom to ensure maximum disruption.
- In exceptional circumstances deeper ripping may be necessary in order to break up consolidated soil layers or deep pans.
- Site collector drains should be excavated at a spacing of 50m in order to collect water running in rips and to prevent risk of erosion and /or flooding of headland or adjacent land. In easily erodable sites e.g. Old red sandstone areas, closer drain spacing should be considered and be aligned at a slope of 2° (1 in 30).
- Depth of collector drains should be 55-60 cm.

9.9.4 Moling

- Mole at 2m spacing
- Install mole drains at a depth of 45 cm
- Use collector drain with sloped side walls spaced 50-80 cm apart and to a depth of 55-60 cm.
- Mole plough type - moling units are directly mounted on low ground pressure machines.
- Where a ball and chain is used for mole drains the size of the ball should be approximately 10 cm diameter.

9.9.5 Double Mould Board (D.M.B.) Ploughing

- Past experiences of windblow following, or as a result of, ploughing should be considered before a proposal is made to D.M.B. plough

- Plough furrows 4m apart with the edges of ribbons placed 30cm from edge of furrow
- Plough to a maximum depth of 25cm
- Collector drains (60cm deep) should be 50 - 80m apart and should be in natural depressions in line of fall
- Where possible, align ploughing in a South West - North East direction to improve crop stability.

9.9.6 Scarifying

- Scarifying should not be considered in shallow soils
- Scarify to a depth of 10 to 20cm.
- Collector drains to be installed as required. On sites with slopes greater than 4° (1 in 15), especially in ORS derived soils, space collector drains at 50m apart and align at a slope of 2° (1 in 30).
- Planting area to be cleared of vegetation for an average width of 60cm.

9.9.7 Agricultural Ploughing (double furrow)

- Agricultural ploughing should only be carried out on free draining agricultural soils with no compaction layer.
- Plough using a double furrow plough to a depth of 20 cm at 2 m apart
- Plough using a double furrow plough with a rip attachment has been shown to be effective
- Planting area (double furrow) to be vegetation free for a width of 80 cm.
- Plant on the sod furthest from the furrow or between the two sods, ensuring no air pockets
- Install collector drains as required at 80 m apart on slopes greater than 4° (1 in 15), especially on easily erodable soils.

9.9.8 Planting Machines

- Suitable for good free draining agricultural land
- Tine designed to ensure that there is appropriate disruption of the soil profile
- Care should be exercised to ensure that the slit opened by the planting machine is closed properly

9.10 Stocking and Spacing

Table 12 represents the minimum spacing and stocking requirements for all species at initial planting stage. Only sites that are planted at these stocking levels or greater should be submitted for 1st installment payment.

Table 12. Minimum stocking and spacing for conifers and broadleaves

Species	Spacing	Stocking/ha
LP pure	1.8m X 1.8m	3,100
All other Conifers	2.0m X 2.0m	2,500
Oak pure	2.0 m X 0.75m	6,600
Oak/conifer mix	Alternate lines - oak 2.0m X 0.75m - conifer 2.0m X 2.0m	 3,300 + 1,250
Beech pure	2.0 m X 0.75m	6,600
Beech/conifer mix	2 lines beech 1 line conifer - beech 2m X 0.75m - conifer 2.0m X 2.0m	 4,400 + 833
Other broadleaves e.g. ash, sycamore	2.0m X 1.5m	3,300

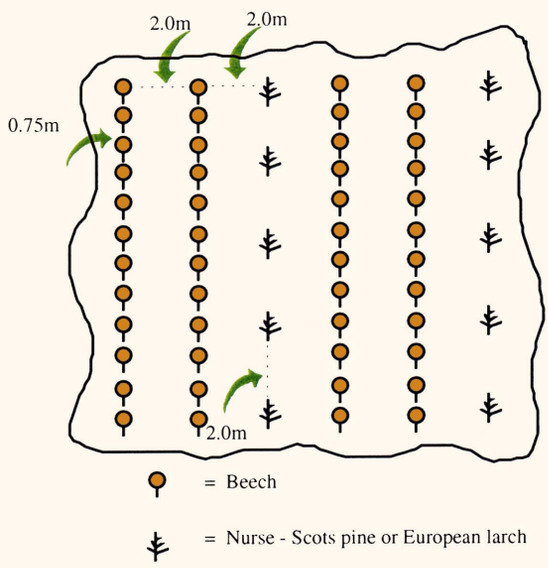


Figure 3. Beech/conifer mix

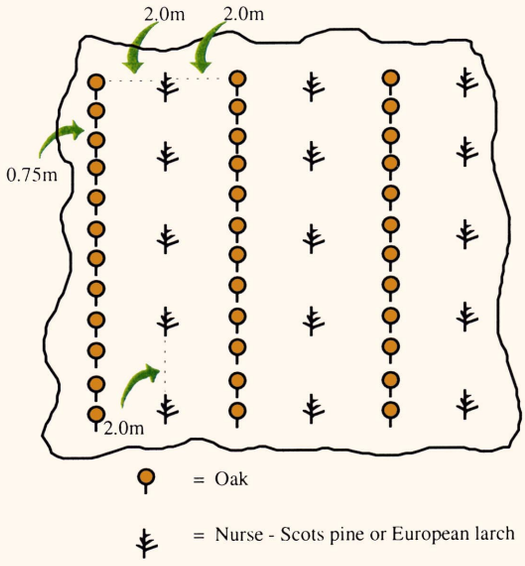


Figure 4. Oak/conifer mix

9.11 Plant Quality

Transplants (planting stock) must have the following quality characteristics:-
(a) A straight stem with a definite leader.
(b) A well balanced foliage with a good fibrous root system.
(c) A specified height to provide for size above ground when planted.
(d) A specified root collar diameter to provide for hardiness.
(e) Age must not exceed a specified maximum.

Transplants should be within the quality limits set out in Table 13 and 14 below.

Table 13. Broadleaves - Quality limits for transplants

Species	Max. age (Yrs)	Min. Collar Diameter (mm)	Stem Height (cm)
Ash	3	7	50-75
	4	12	60-90
Oak/Spanish chestnut/Beech	4	6	45 75
	4	7	55-70
	5	9	70-85
Sycamore	3	7	45-75
Alder	3	4	30-60
Other broadleaves	5	4	40-75

Table 14. Conifers - Quality limits for transplants

Species	Max. age (Yrs)	Min. Collar Diameter (mm)	Stem Height (cm)
Sitka spruce	4	6 (4*)	31-65 (20-30*)
Norway spruce	4	6 (4*)	31-50 (20-30*)
Lodgepole pine	2	3	10-20
Scots pine	3	4	20-40
Corsican pine	3	3	10-30
Japanese larch	3	5 (4*)	36-60 (25-35*)
European/Hybrid larch	3	5	35-60
Douglas fir	4	8	40-60
Western red cedar Western hemlock Other conifers	4	4	25-45

(*) These are Size 2 Category Plants and apply only to SS, NS and JL. They are suitable for sites without the potential for the vigorous growth of competing vegetation, provided the site is not liable to frost.

9.12 Plant Handling

Good plant handling is as important as plant quality. The following should be observed.

9.12.1 General Plant Handling Issues

- Co-ordination and timing of plant deliveries from nursery to planting site is essential to ensure that the health of the plants is maintained.
- Non bagged plants and plants removed from bags should be trenched in on the planting site as soon as possible.
- Plants should not be left with roots exposed and should be stored/trenched in the shade.
- Cold storage plants should be planted within two weeks of removal from cold store.
- Containerised plants should not be allowed to dry out on site.

9.12.2 Using Co-extruded plastic bags

- Bagged plants should be bagged in nurseries using co-extruded bags. The trees should be bagged in dry conditions free of excess soil.
- The date of lifting in the nursery should be known. The week in which the plants are lifted is usually indicated on the labels attached to the bags.
- Plants in co-extruded bags should be stored in the shade.
- Plants should not normally remain in bags for longer than 4 weeks after lifting in the nursery, but this period should be reduced to 2 weeks for those lifted early or late in the season.
- Plant condition should be checked 2 weeks after receipt on the planting site. This period should be reduced to a week during the early and late parts of the lifting season. If there is evidence of heating, plant immediately. Leave bags slightly open to allow cooling without excessive drying.
- Bags showing evidence of damage should be repaired with heavy duty tape or placed inside another new bag.

Litter warning

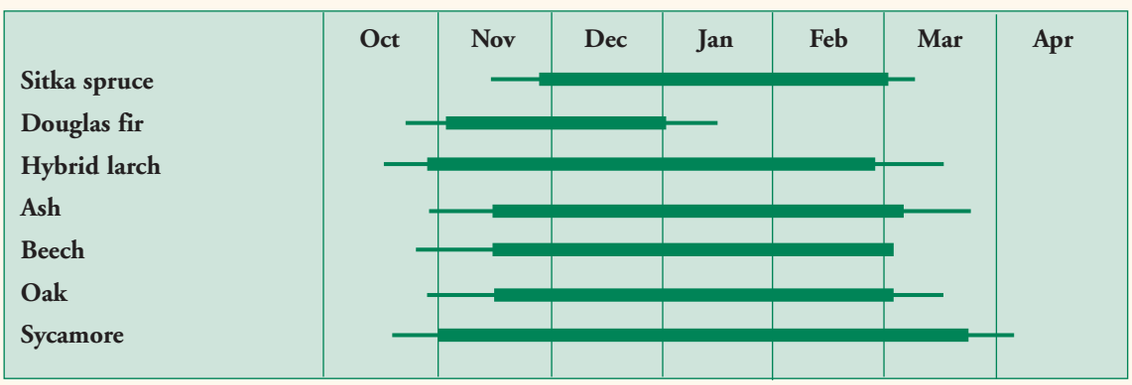
It is against the law to litter. Do not submit an application for payment until all packaging including planting bags, fertiliser bags herbicide containers etc. are removed from the site and disposed of in an environmentally responsible manner. Burning of plastic containers and bags is not acceptable. Note Forest Service penalty for dumping (Chapter 12).

9.13 Lifting and Planting Dates

Provided that the handling guidelines listed above are adhered to and morphological quality and size is acceptable the planting stock should be in good condition at time of planting. In addition to the risk of plant mortality, shoot dieback is a common response to poor handling/planting practices. Recommended periods of planting for several species are given in Figure 5.

The success of transplants after planting depends on plant quality and post planting environmental conditions. During the period of 'Less certainty' (see Figure 5 below) the likelihood of success will vary with plant dormancy level at the time of lifting and post planting conditions. Planting should be carried out soon after the plants arrive on the site to minimise these effects.

Figure 5. Optimal dates for planting freshly lifted stock



9.13.1 Cold Store Plants

Plants from cold storage can be used to extend the planting season to late April / early May. Planting cold stored plants late in the planting season can be risky as the risk of drought increases. Results have shown that where cold stored plants have been planted late in the planting season the height increment is reduced, especially for larch.

9.14 Fertiliser Application

9.14.1 General

- Apply fertiliser manually after cultivation to afforestation sites avoiding drains, buffer zones, areas within 20 metres of aquatic zones and waterlogged areas.
- Fertiliser should not be applied during or immediately after periods of heavy rainfall. It is best applied in early summer and not outside the period April to August.
- Subsequent application of fertiliser should be undertaken following a prescription resulting from an analysis of foliar samples. Observe the Forestry and Water Quality Guidelines, in particular the section on Fertiliser Application and Storage (Page 7) and Forestry and Aerial Fertiliser Guidelines (where applicable).
- All fertiliser should be applied broadcast and evenly distributed.
- Correct time of application - April to August inclusive.
- Apply after planting.
- Do not apply fertiliser to waterlogged soil.
- Do not apply during or after heavy rainfall

9.14.2 Phosphate

Phosphorus applications in forestry must ensure that, while trees have sufficient phosphorus for sustainable growth, water quality or habitats are not damaged by phosphorus eutrophication. Forests are sometimes located in areas where naturally nutrient poor water bodies are vulnerable to enrichment if even small amounts of nutrients are discharged into them. Forest owners, foresters, managers and contractors must ensure that enrichment of waters does not result from their actions. Correct phosphorus management in forestry entails correct fertiliser application in terms of rate and timing and prevention of sedimentation of aquatic zones.

The following sets out phosphorous requirements for Sitka spruce at establishment time and should not be exceeded during the establishment of that species. It is a guide for other species.

Table 15. Phosphate Requirements

Site Type	Rate of Application of Granulated Rock Phosphate (11% to 16% P)
Enclosed/Improved fields recently farmed	None
Former agricultural land not recently worked	250 kg./ha.
Unenclosed land	350 kg./ha. (on very poor sites, two applications may be necessary, 350 kg/ha. at establishment and a second application of 250 kg/ha. as required.)

Rock phosphate is most effective in acid soils. For soils with a pH of 6 or greater it is advisable to use other forms such as super phosphate. Potato fertiliser (7:6:17) has been beneficial on broadleaf sites.

Phosphorus application on peat soils should be kept to a minimum in any single application and careful consideration should be given to splitting the application on these soils.
Fertiliser type(s) and rate(s) should be described in plans attached to applications for approval for afforestation, woodland improvement, reforestation and aerial fertilisation.

9.14.3 Potassium

Midland fen peats normally under grass often require potassium for successful tree growth (the midlands in this context corresponds roughly with the area of the central plain). Potassium deficiency can occur in Western counties. Potassium is supplied as muriate of potash (50% K) at 250 kg per ha.

9.14.4 Broadleaves

On enriched peats and other sites where broadleaves may not grow to their full potential an application of a compound fertiliser (such as 10.10.20, 18.6.12 or 7.6.17 sulphate of potash) is recommended at year 2 or year 3. Ideal broadleaf sites seldom require fertiliser. There may be situations where phosphate and/or potassium are required but it is very questionable if broadleaves are suited to a site where nitrogen is deficient. If a nutrient deficiency is suspected at any stage a foliar analysis should be carried out. See Appendix 18 for foliar sampling procedure. This will determine the type and rate of fertiliser required

9.14.5 Sites 'in check'

Often on infertile sites, even those that are correctly fertilised at planting, trees begin to lose vigour. This may happen a number of years after planting. To remedy the situation it is necessary to determine the nutrient status of the crop 'in check'. Foliar analysis will be required to establish their nutrient status and determine the type and rate of fertiliser required. See Appendix 18 for foliage sampling procedure.

9.14.6 Prevention of sedimentation of aquatic zones

Mineral soil particles contain varying amounts of phosphorous which may be released slowly into the aquatic environment. The amount varies with soil type and with past fertiliser applications.
Podsols and some peats are very erodable and are more so than brown earths which are in turn more erodable than gleys. The greater the slope the more a soil is liable to erosion. Periods of heavy rain make all locations vulnerable to sediment loss.

Sediment must be prevented from entering aquatic zones. This is achieved by adherence to the Forestry and Water Quality Guidelines and the Forest Harvesting and the Environment Guidelines and the appropriate sections of this manual.

Table 16. Fertiliser Exclusion zones

	Width of Exclusion Zone by Method of Application		
Feature	**Manual***	**Mechanical***	**Aerial****
Aquatic Zone	20 metres or width of Buffer Zone whichever is the greater	50 metres	50 metres
Reservoirs & points of abstraction of drinking water	As above	As above	100 metres
Heritage areas	Consultation will take place with DoEHLG (fomerly Dúchas) re applications for approval for grant aided projects.	Consultation will take place with DoEHLG (fomerly Dúchas) re applications for approval for grant aided projects.	30 metres. Consultation will take place with DoEHLG (fomerly Dúchas) re aerial fertiliser application.
Unforested lands	Nil	Nil	30 metres
Dwellings	30 to 60 metres at afforestation. Existing setback for later application.	30 to 60 metres at afforestation. Existing setback for later application.	30 metres
Roads, archaeology and old buildings	Exclusion zones as per Forestry and Archaeology Guidelines and as per road setback	Exclusion zones as per Forestry and Archaeology Guidelines and as per road setback	15 metres

*See Forestry and Water Quality Guidelines
**See Forestry and Aerial Fertilisation Guidelines
Fertiliser should not be discharged into a free flowing drain nor into a sediment trap.

9.14.7 Storage of Fertiliser

Fertiliser should be placed under shelter on a dry elevated site at least 50 metres from the nearest aquatic zone. (The requirement for shelter refers to long term storage.)

9.14.8 Aerial Fertilisation

The Forest Service has introduced a new approval procedure for aerial fertilisation. This approval procedure, the consultation process and the operational requirements are described in the FORESTRY AND AERIAL FERTILISATION GUIDELINES and are available from the Forest Service.

Aerial fertilisation may be considered (a) for later fertiliser application on sites with a dense ground vegetation or branch growth where branches of adjoining trees are within 1 metre of touching each other or, (b) for initial fertilisation of mineral sites which have no cultivation drains. Prior approval must be obtained from the Forest Service for aerial fertilisation.