

*Bord na Móna
Energy Ltd.*

**Integrated Pollution Control
Licence Application**

ATTACHMENT No. 8

*OPERATIONAL INFORMATION
REQUIREMENTS*

8.1 GENERAL OVERVIEW

Areas where peat accumulates are called peatlands, bogs or mires. In Ireland peatland originally covered 16.2% or 1.34 million hectares of the land area. Ireland has the third largest percentage peatland coverage in the world after Canada and Finland respectively. However, since the onset of mechanical extraction of peat and with more efficient and large scale drainage of peatlands for agriculture and forestry, the level of intact peatland has been dramatically reduced to 8% of the original amount of raised bog and 18% of blanket bog in the Republic of Ireland.

Peat is a biogenic deposit consisting of partly decomposed plant remains accumulating in an area where surface features cause water retention. In these wet conditions, which are characterised by low levels of oxygen, complete microbial aerobic decomposition of plants and other sources of organic matter cannot occur. The dead partially decomposed organic remains accumulate as an organic carbon source, i.e. peat. A combination of climatic and geomorphological factors has combined to make peatland formation particularly favourable in Ireland.

There are three major types of peatland in Ireland.

- Fen Peat
- Raised Bog
- Blanket Peat

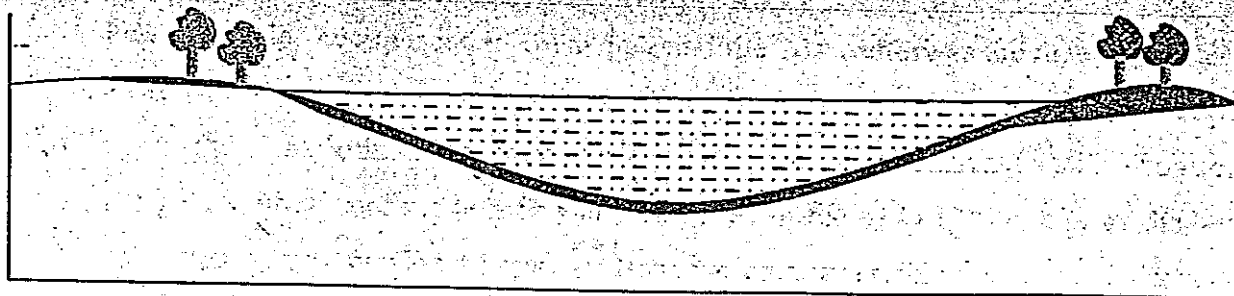
These peat types can be classified according to their water source. Raised and blanket bogs are ombrogenous, that is, they receive their nutrients and moisture from atmospheric precipitation. Conversely fens are topogenous as their development is controlled by topography and groundwater. The formation of the various peat types is discussed briefly here.

8.1.1 FORMATION OF PEATLANDS

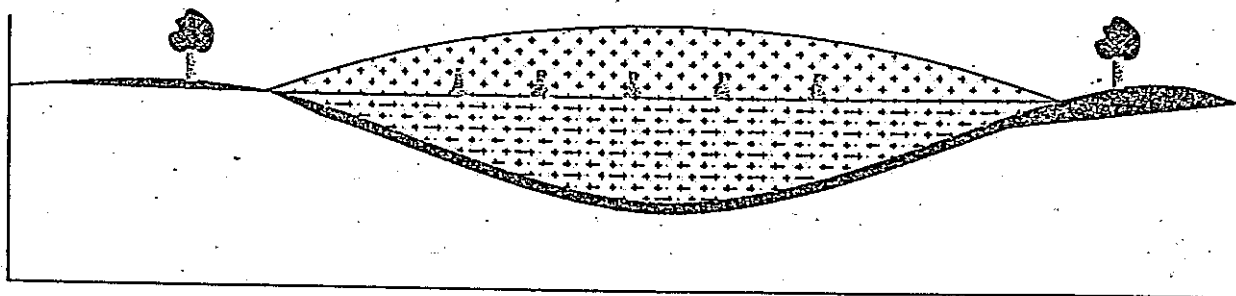
(i) Fens

When the last ice age ended about 10,000 years ago water accumulated in river valleys and poorly drained hollows. At the edges of these newly formed lakes, beds of reeds developed first, followed by rushes, sedges, grasses and herbs. As the vegetation grew the lake gradually became infilled and became a fen (Figure 8.1). The vegetation growing on a fen receives nutrients from the groundwater underneath,

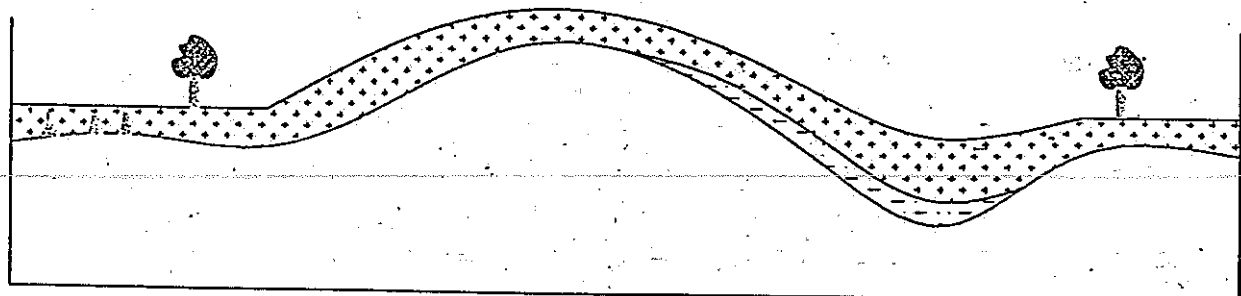
FEN



RAISED BOG



BLANKET BOG



BOG PEAT



FEN PEAT



FOSSIL TREE
STUMPS

FIGURE 8.1:

PEATLAND TYPES

but as plants die their dead remains accumulate on the fen surface and make it more difficult for roots of growing vegetation to reach groundwater. At this point an important development takes place as certain species of Sphagnum mosses able to survive on rain water which contains few nutrients, colonise the fen. As this happens the fen plants are gradually replaced by species which can survive in the much poorer, acidic conditions and a raised bog is formed (Figure 8.1).

(ii) Raised Bogs

Raised bogs have developed from fens as already discussed above and as the peat continues to accumulate it forms a flattened dome slightly higher than the surrounding countryside hence the name (Figure 8.1). They may be 9 – 12 m in thickness in their undrained state. Sphagnum mosses are the main component of raised bogs. Some form hummocks which may be up to a metre high capped by heathers and different mosses, while others are found in hollows and pools which occur beside the hummocks. The hummocks and hollows together with the variation in colour of Sphagnum mosses give raised bogs their characteristic appearance.

(iii) Blanket Peat

Moving from the raised bogs in the central plain of Ireland to the west the characteristics of the peatland change due to the high relief and increased rainfall. In general, when the rainfall exceeds 1,200 mm and falls on more than 250 days per year a blanket bog forms. In these conditions, commonly found on the west coast, the climate is so wet that peat may form directly on mineral soil without the initial formation of topogenic fen peat (Figure 8.1). Consequently, the entire landscape, except for very steep slopes with good drainage, is covered with peat.

Blanket bog can be divided into two categories.

- An Atlantic or lowland sub-type
- A Montane or mountain sub-type

Along the west coast of Ireland the division between the two types is made at the 150 m contour based on different plant species debris found contributing to the growth of the peat above and below this level.

8.2 **PEAT PRODUCTION**

A detailed description of the processes and operational procedures involved in peat extraction within the Derrygreenagh Group are presented in Figures 8.2 and 8.3.

8.2.1 **DRAINAGE**

In its virgin state, a peat bog ranges in moisture content from 95% near the surface to 90% in the deepest layer. The sphagnum mosses and other plants at the surface will only survive in these very wet conditions, depending, as they do, on rainfall alone for their nutrients.

Because of the high moisture content, a bog will not support heavy machinery. Efforts at reclamation or peat removal subsequently worked progressively from the edges as drainage was carried inwards. For large scale industrial production it was necessary to drain the whole bog systematically. Bogs are, therefore, drained in order to reduce the water content of the surface and increase bearing capacity. This permits the use of larger and, therefore, more economical machines in the production process and also substantially reduces the amount of water that has to be removed from peat during the drying process. Reducing the water content of the surface of a bog from 95% to 80% removes more than 75% of the water from the surface layer.

TABLE 8.1: MILLED PEAT PRODUCTION DRAINAGE (DITCHING) PROCESS - EMISSIONS & WASTE GENERATED		
IN Materials Used	OUT Emissions	Waste/Disposal
Peat	Major - Discharge of peat particles to silt ponds via surface water drainage network Minor - Noise	None

In order to drain the bogs special tracked machines were designed with very low ground bearing pressure (< 2 psi). The drainage plan typically involves a network of parallel open drains 15 m apart (the strip of bog between two drains is called a field). Drains are first opened by towing a plough which cuts a drain 50 cm deep, simply by turning the sod over. The surface water is subsequently removed and the bearing pressure improves over time. After a year it is possible to deepen the drains further using a disk ditcher (Plate 8.1) or wheel ditcher (Plate 8.2) which scatters the spoil over 10 to 12 m of the adjacent ground. The drains are progressively deepened in this way over a period of 5 – 7 years until a stable drain 1.5 m deep is established and the

Figure 8.2: Milled Peat Production

Operating Period

September to March

April to May

May

June onwards to September

←← **Bog Drainage**

Ditching resinking outfalls,
cleaning railways, drains and
boundary drains

←← **Bog Preparation**

Prepare turning grounds, screw
levelling of production fields
every 3rd cycle

←← **Milling**

Offset mill all production areas
and continue the off setting after
every 3rd harvest

Full Production

Peat production operates on a 3 to
4 day cycle

←← **Harrowing**

Harrow each crop twice during
drying process

←← **Ridging**

←← **Harvesting**

←← **Milling**

←← **Pile Rolling**

This operation is carried out after
every 5th harvest to protect stock
during bad weather conditions

←← **Stock Pile Covering**

←← **Transport**

- Fugitive Dust
- Emissions to Water
- Air
- Noise
- Solid Waste Generation

Figure 8.3: Sod Peat Production - German Bagger

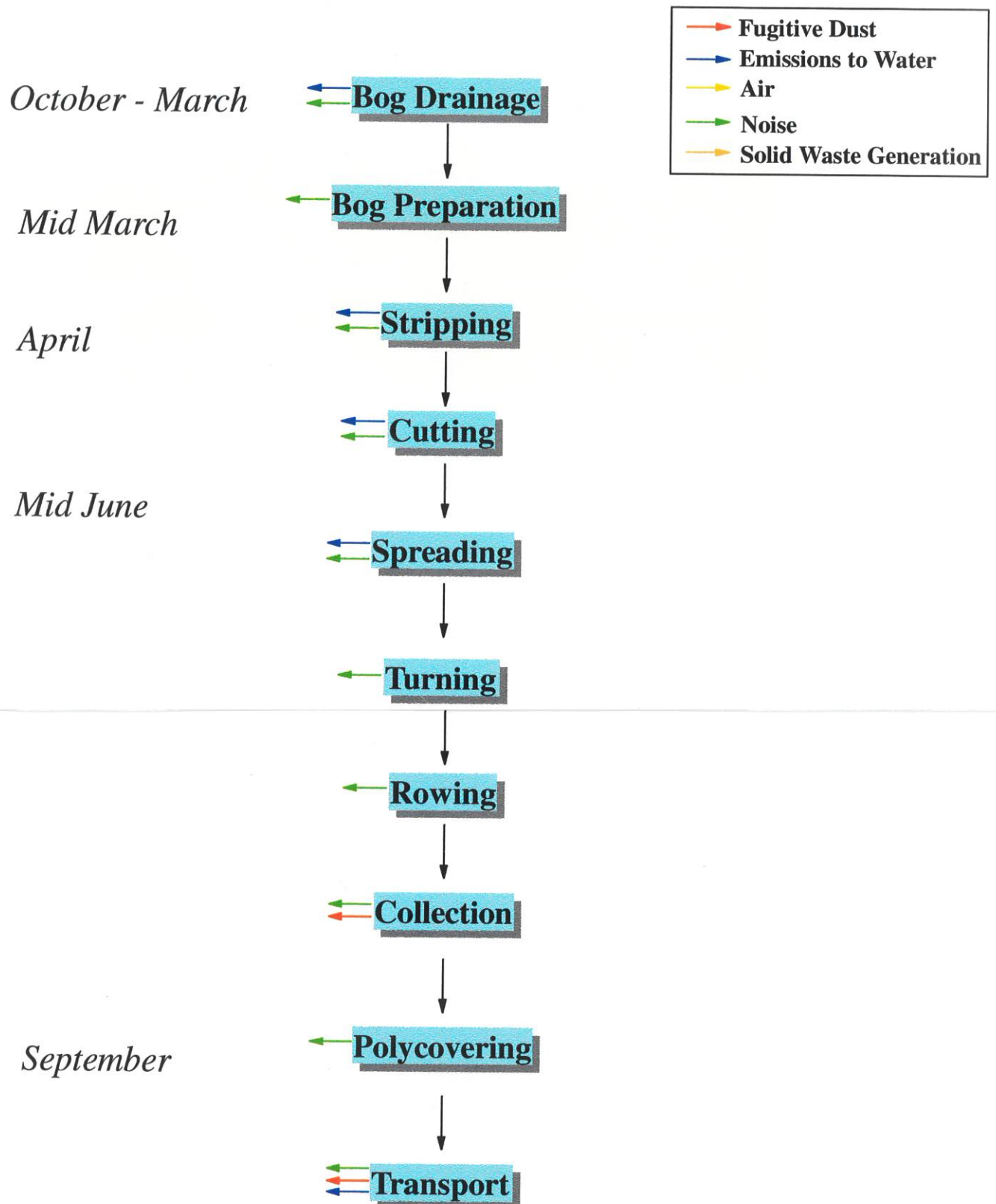




Plate 8.1: Disc Ditcher



Plate 8.2: Wheel Ditcher

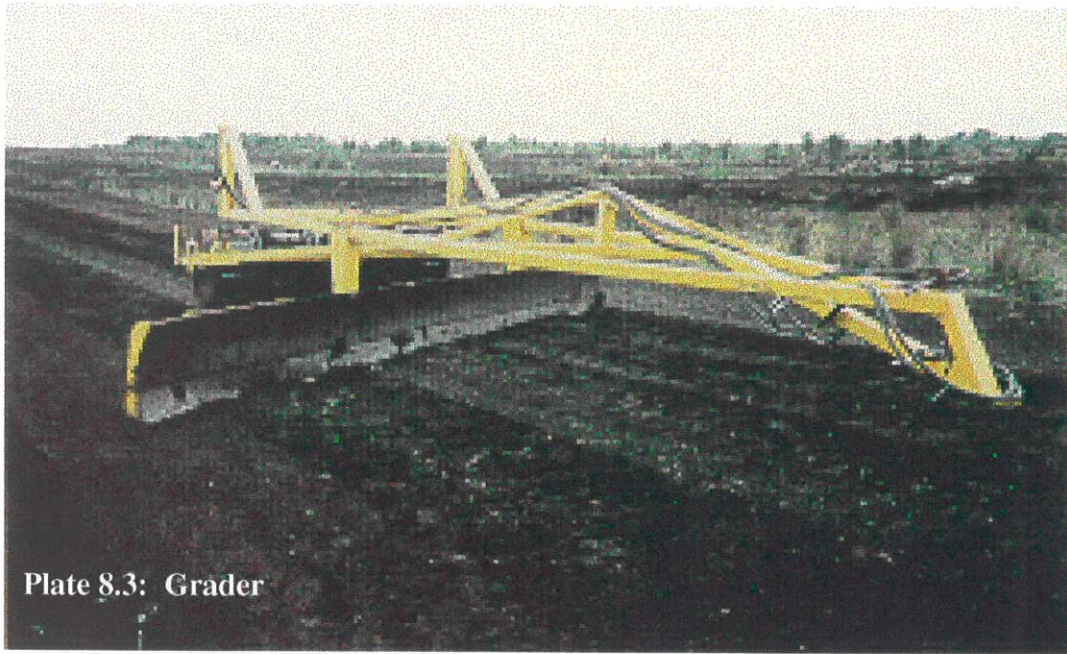


Plate 8.3: Grader



Plate 8.4:
Ditch Edge Miller



Plate 8.5: Light Miller



Plate 8.6: Harrow



Plate 8.7: Trailed Ridger



Plate 8.8: Trailed Brush Ridger



Plate 8.9: Harvester



Plate 8.10: Polycover



Plate 8.11: Loader



Plate 8.12: Locomotive



Plate 8.13: Tippler

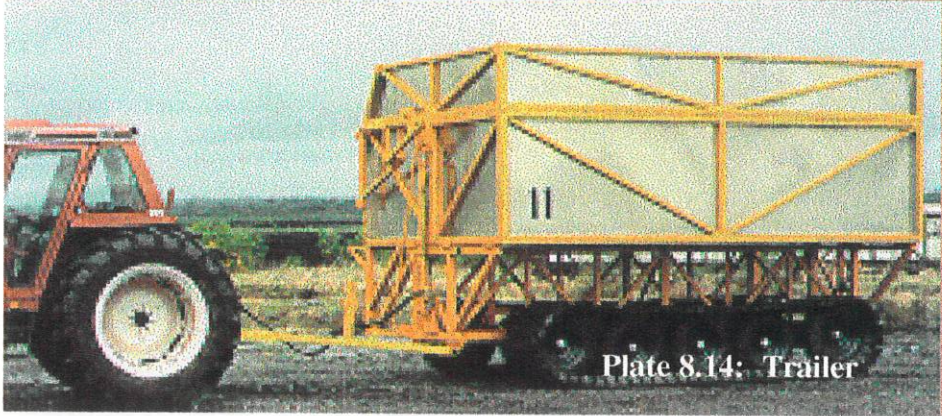


Plate 8.14: Trailer



Plate 8.15: Raillayer

bearing pressure of the bog surface allows the use of heavier machines for levelling and subsequent peat production. The smothering of the vegetation by the spoil combined with the drainage prevents any further growth and the 'field' i.e. the 15 m or so between drains can be levelled and cambered in order to facilitate rainwater run off from the bog surface.

Depressions in the bog, which are identified during survey work, are also drained and piped to provide an outlet for the drainage water. Outfalls from the bog are developed and deepened along existing inadequate channels connecting the drainage to the river system.

Drainage of water by gravity is not always possible in some of the low lying peatlands. For sod peat operation where deep excavation is an intrinsic part of the process, pumps had to be installed to effect drainage. Archimedean screw pumps powered by electric motors were used, lifting the water up to 6 m. Power supply was available from the network installed to supply the electrically driven bagger excavator. Many bogs historically formed in lakes below the present river levels and pumping is necessary for drainage. In recent times, the Archimedean screw pump has been replaced by modern submersible pumps. Because of the remote bog locations power supply is expensive, therefore, the use of wind power is currently undergoing consideration. Historically this was not economical but the rapid advances in wind power technology may make it possible in the future.

For sod peat production trenches were initially machine dug at 250 yard centres with smaller drains (subs) at 125 yard centres. The trenches were typically dug to 1.5 - 2.0 m depth. Cross drains were also dug and piped to drain trenches. It should be noted that this drainage step is a once off process step carried out to drain the bog prior to sod peat production.

TABLE 8.2: SOD PEAT PRODUCTION DRAINAGE PROCESS - EMISSIONS & WASTE GENERATED		
IN Materials Used	OUT Emissions	Waste/Disposal
Peat	Minor - Emissions to surface water Minor - Noise	None

8.2.2 BOG PREPARATION

Screw levelling operations of bog areas are carried out approximately every three years. Selected bog sections are screw levelled annually in order to maintain the camber on the production fields. This operation is carried out using a screw leveller or grader (Plate 8.3). This is a spiral type machine unit, towed and powered by a tractor, which screws out the raw bog from the edge of the field drain to the centre of the field. Levelling turning grounds is effected by a bulldozer. Railway drains (which run each side of permanent rail lines) and boundary drains (which are around the edge of production bogs) are opened and cleaned by hydraulic digger.

TABLE 8.3: MILLED PEAT PRODUCTION BOG PREPARATION - EMISSIONS & WASTE GENERATED		
IN Materials Used	OUT Emissions	Waste/Disposal
Peat	Major - Discharge of peat particles to silt ponds via surface water drainage network Minor - Noise	None

Bog preparation for sod peat production simply involves the levelling of the spreading ground, prior to the cutting process, using a bulldozer unit.

TABLE 8.4: SOD PEAT PRODUCTION BOG PREPARATION - EMISSIONS & WASTE GENERATED		
IN Materials Used	OUT Emissions	Waste/Disposal
Peat	Minor - Noise	None

8.2.3 PEAT PRODUCTION AND PROCESSING

8.2.3.1 Milled Peat Production

The product milled peat is the term used to describe peat in a powder or crumb form. It has a mean particle size of about 6.0 mm in diameter ranging from about 15.0 mm to fine dust. Milled Peat is generally used for electricity generation, and also as the raw material for the production of peat briquettes. While the production system is basically the same milled moss is the term used to describe peat which is used in the horticultural industry (peat of larger particle size). Milled moss is used as the raw material for a wide variety of products which require further processing.

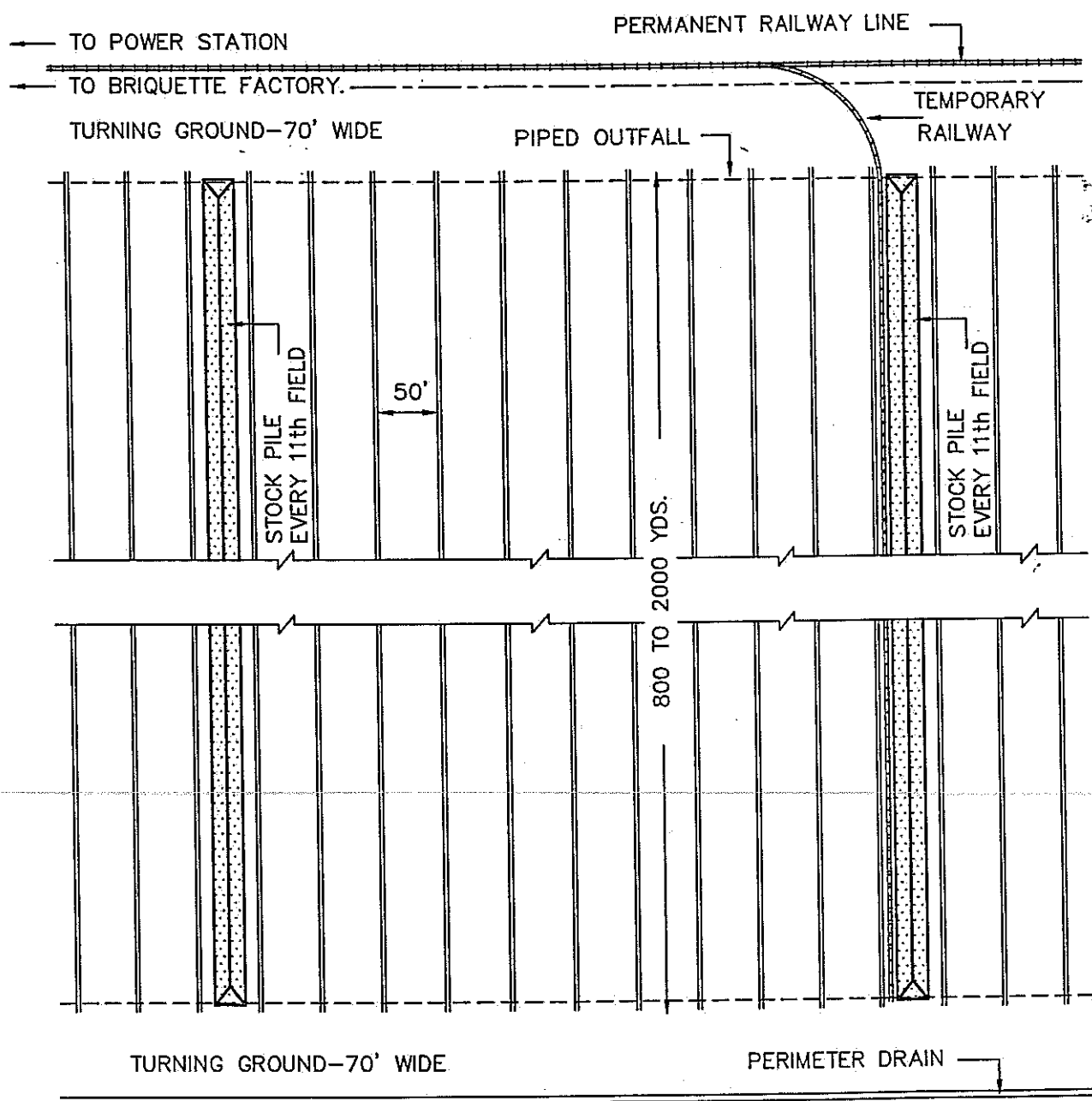


FIGURE 8.4:

BOG LAYOUT FOR MILLED PEAT PRODUCTION

Most milled peat has a loose bulk density of between 120 and 400 kg/m³ or an average of 270 kg/m³, (depending on the degree of decomposition of the peat). In general for fuel peat the higher density is preferred, but for binding and suitable ash content, peat of e.g. humification H⁶ to H⁸ on the "Von Post" scale, is preferred for briquetting and electricity generation (~ 270 kg/m³). It is desirable that anhydrous ash content should not exceed 5%. Anhydrous milled peat has an average calorific value of 21.95 MJ/kg.

(i) Peco System

Milled peat is a very economical system of peat production, but very dependant on weather conditions. What is known as the "Peco System" is used by the Bord na Móna. The bog layout for this system is shown on Figure 8.4. The Peco System harvest cycle is based on 2 to 3 consecutive days of solar drying which gives an average of 12 harvests per year, yielding 185 tonnes per net production hectare at an average of 50% moisture content.

For the purpose of the Peco production system the production area is divided into units of eleven fields, comprising a central stockpile field with five production fields on either side. The stockpile field can accommodate up to 20 harvests of milled peat.

The production operations for the Peco system i.e. ditch edge milling, milling, harrowing, ridging, harvesting, stockpile protection, loading and transportation are described.

Ditch Edge Milling

Before production begins the fields are cambered along the drain edges by a machine known as the Ditch Edge Miller (Plate 8.4), which consists of a pinned roller mounted on the three point linkage of a 140 hp tractor. The power driven roller is set at an angle of 60° to the drain edge, so that the peat which is removed from the drain edge is directed towards the centre of the production field, and undergoes the remaining production processes.

The purpose of offset milling is to ensure that the fields are cambered towards the drains to provide effective run-off for rainfall.

Light Pin Milling

Milling is the operation which cuts a thin layer about 12 mm (1/2") of peat from the surface of the production field by means of a power driven pinned roller (Plate 8.5). The miller unit is powered and towed by a 140 H.P. tractor, and has a cutting (milling) width of 7.0 m. thus requiring two runs of the attachment for each production field. The attachment is supported on ground rollers and has a hydraulically operated depth control.

TABLE 8.5: MILLED PEAT PRODUCTION MILLING PROCESS - EMISSIONS & WASTE GENERATED		
IN Materials Used	OUT Emissions	Waste/Disposal
Peat	Major - Discharge of peat particles to silt ponds via surface water drainage network Minor - Dust (emission is minor given the high moisture content of the peat) Minor - Noise	None

Harrowing

In order to speed up the solar drying process on the open peat surface, a spoon harrow (Plate 8.6) spanning the full width of the production field and towed by a 65 H.P. tractor, is used to turn over the milled peat a number of times. The effect of this process step is to increase the area of the peat layer exposed to the drying elements and therefore increase the rate of drying. The correct result can only be achieved if the harrow unit is travelling at the correct speed. In dry anticyclonic weather conditions the number of harrowings per crop will vary from two to five depending on drainage conditions and the rate of evaporation. The harrow consists of 88 No. steel spoons mounted uniformly over the total width. The main objective of the harrowing process is to reduce the moisture content of the peat from 68% to 72% after the milling process to an acceptable 45% - 50% moisture content.

TABLE 8.6: MILLED PEAT PRODUCTION HARROWING PROCESS - EMISSIONS & WASTE GENERATED		
IN Materials Used	OUT Emissions	Waste/Disposal
Peat	Major - Dust Major - Discharge of peat particles to silt ponds via surface water drainage network Minor - Noise	None

Ridging

When the moisture content of the peat has been reduced to between 45% and 50%, the peat is moulded into triangular shape ridges in the centre of each production field. The operation is performed by a ridger unit (Plates 8.7 and 8.8), towed by a 140 H.P. tractor. The ridger unit has two blades supported on a tracked frame. The blades form a V-shape in plan behind the tractor, and are set at an angle of 30° to direction of travel. The blades are made of aluminium with stainless steel sole-plates which are constructed in hinged sections to facilitate the surface contours of the production field. The two blades span the full width of the production field, and are hydraulically operated.

TABLE 8.7: MILLED PEAT PRODUCTION RIDGING PROCESS - EMISSIONS & WASTE GENERATED		
IN Materials Used	OUT Emissions	Waste/Disposal
Peat	Major - Dust Major - Discharge of peat particles to silt ponds via surface water drainage network Minor - Noise	None

Harvesting

A harvesting unit (Plate 8.9) towed by a 140 H.P tractor, sometimes fitted with half-track, follows the ridger to pick up the milled peat ridge in the centre of the field and transfer it to the centre of the adjacent field. The harvester picks up the peat by means of a potato chain pick up system, and delivers it onto the jib-belt which transfers it to the centre of the next field. This process is then repeated, field by field, until the peat on the five fields each side of the designated stockpile field are transferred onto the stockpile. Because harvesters are designed with the jib positioned on the left hand side you have a one-way anti-clockwise harvesting cycle around the stockpile. The potato chain pick up unit is hydraulically operated and can be raised to facilitate idle travel of the harvester unit.

TABLE 8.8: MILLED PEAT PRODUCTION HARVESTING PROCESS - EMISSIONS & WASTE GENERATED		
IN Materials Used	OUT Emissions	Waste/Disposal
Peat	Major - Dust Minor - Discharge of peat particles to silt ponds via surface water drainage network Minor - Noise	None

This operation completes the production cycle, which is repeated continuously with the commencement of the milling operation in favourable weather conditions.

Stockpile Protection

The stockpiles are compacted, on either side, by large rollers drawn by 65 H.P. tractors. This counteracts high winds and heavy rainfall and aids in the exclusion of air. The roller assembly is articulated so that the rolling unit can follow the profile of the stockpile. This operation is usually carried out every third harvest which also reduces the actual size of the stockpile.

TABLE 8.9: MILLED PEAT PRODUCTION STOCKPILE PROTECTION - EMISSIONS & WASTE GENERATED		
IN Materials Used	OUT Emissions	Waste/Disposal
None	Minor - Discharge of peat particles to silt ponds via surface water drainage network Minor - Dust, Noise	None

Polythene Covering of Stockpiles

At the end of the production, selected stockpiles are covered with polythene film (250 - 350 gauge sheets ranging in width from 7.0 m to 12.0 m x 100.0 m long). The polythene sheets are rolled out over the stockpiles and secured in position by spreading evenly over it a layer of high moisture content milled peat (Plate 8.10).

TABLE 8.10: MILLED PEAT PRODUCTION POLYTHENE COVERING OF STOCKPILES - EMISSIONS & WASTE GENERATED		
IN Materials Used	OUT Emissions	Waste/Disposal
Peat Polythene	Minor - Discharge of peat particles to silt ponds via surface water drainage network Minor - Dust (emissions may occur on placement of milled peat on the polythene cover) Minor - Noise	None

The purpose of polythene covering is to keep stock dry, to protect it against wind erosion, and to inhibit spontaneous combustion in certain types of peat by the exclusion of as much air as possible.

Stock Survey and Quality Control

Immediately after the end of the production season, a stock pile survey is conducted. Samples are taken at pre-determined locations for moisture content, density, and ash content. Samples of the peat are extracted by a steel tube specially designed for this purpose and laboratory analysed. From this data, charts are prepared of each production area showing the stockpile peat quality, i.e. moisture, density, ash. This information is essential for quality control when drawing up a dispatch programme.

(ii) Haku Production System

In the late 1980's the "Haku" production system was introduced in some areas, especially where peat shallows were appearing, i.e. subsoil appearing on the field surface, and the normal "eleven field production system" could not continue.

The primary difference between the "Haku" and "Peco" system is the method by which the peat is harvested and stockpiled.

In the Peco system the peat ridges are moved laterally from field to field by self-loading harvesters until it eventually reaches the stockpiles, which run parallel to the production fields. These stockpiles are normally 3 to 4 m high x 1000 to 3000 m long. Using the Haku system the dried peat (40% - 50% moisture content) is lifted from the single ridges into 18 m³ sidetipping tracked trailers (Plate 8.14) and towed by 110 H.P tractors to large stockpiles convenient to road or rail transport. These stockpiles can be as high as 15.0 m and containing >10,000 tonnes of milled peat.

8.2.3.2 Sod Peat Production

Manual Production: Manual hand cutting of peat was the traditional method of producing peat (turf) for domestic fuel over the centuries in Ireland, and it is still continued in some areas. It is very labour intensive, as all operations involved in cutting and saving the turf are carried out by hand.

Machine Production: Attempts to mechanise sod peat production in Ireland date back to the middle of the last century, but it was not until the acquisition of a German turf cutting machine by the Turraun Peat Works in 1924 that machine turf production became a real possibility. Following the establishment of Bord na Móna in 1946, a large scale sod peat production programme was adopted. After carrying out many modifications and re-design work the German machine called a "Bagger" was capable of

coping with the varying peatland conditions and operational problems associated with the Irish Midland Peat Reserves. At peak sod peat production in the mid 1970's the Board operated 42. No. Standard Baggers and 6 No. Lilliput Baggers to produce 900,000 tonnes of dried sod peat per annum.

Figure 8.5 shows the bog layout for standard Bagger sod peat production. The output from these Baggers yields 12 to 16 tonnes per hour of sod peat at about 35% moisture content and an annual output of 20,000 tonnes per machine. The drying process is aided by other specialised machines which turn the sods and arrange them into rows ready for transfer to stockpiles.

(i) German Bagger

The production operations for Bagger sod peat production i.e. stripping, cutting and spreading, harvesting/windrowing, turning, collecting and stockpile/protection; are outlined.

Stripping

Stripping involves the removal of the overburden of mossy peat from the surface of the cutting trench. The stripping machine designed for this purpose travels on tracks powered by a 45 H.P diesel engine.

TABLE 8.11: SOD PEAT PRODUCTION STRIPPING PROCESS - EMISSIONS & WASTE GENERATED		
IN Materials Used	OUT Emissions	Waste/Disposal
Peat	Minor - Discharge of peat particles to surface water drainage trenches Minor - Noise	None

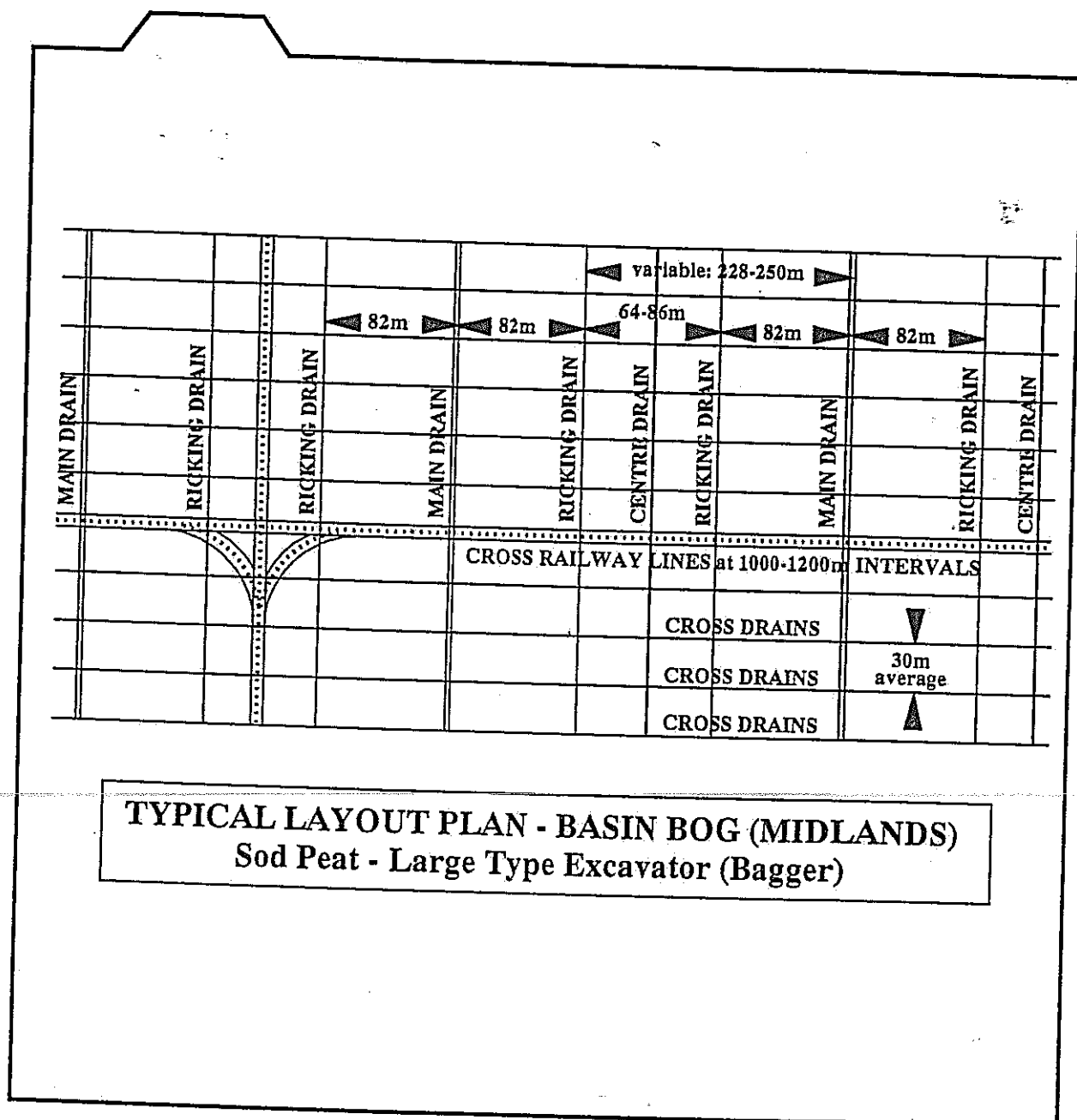


FIGURE 8.5:

BOG LAYOUT FOR GERMAN BAGGER SOD PEAT
 PRODUCTION

Cutting and Spreading

The "Bagger" is a fully automatic excavator cutting a two metre wide face 3 - 4 m deep. It is a full track machine, weighs 45 tonnes, with a ground bearing pressure of 2 lbs/inch². It is electrically driven, the supply being brought to the machine by means of a flexible trailing cable coupled to a 3 phase overhead power line system operating at 3.3 K.V.

TABLE 8.12: SOD PEAT PRODUCTION CUTTING & SPREADING PROCESS - EMISSIONS & WASTE GENERATED		
IN Materials Used	OUT Emissions	Waste/Disposal
Peat	Minor - Discharge of peat particles to surface water drainage trenches Minor - Noise	None

The macerator is the kernel of the Bagger. It consists of a casing which houses twin counter shafts revolving at 182 R.P.M., each carrying an assembly of transport screws and mixed blades made of special design to mix, macerate and extrude the peat onto the spreader arm.

Harvesting/Windrowing

The development which made the most significant contribution to increasing productivity in the sod peat industry was the mechanisation of harvesting operations. In 1952 Heseper Torfwerk carried out successful trials in Germany with a windrowing machine. This machine was adopted by the Board. It is fully automatic, operated by one person, and has an output of 20 tonnes of dry turf/hour.

TABLE 8.13: SOD PEAT PRODUCTION HARVESTING/WINDROWING PROCESS - EMISSIONS & WASTE GENERATED		
IN Materials Used	OUT Emissions	Waste/Disposal
Peat	Minor - Noise	None

Turning Machine (not carried out under normal drying conditions)

Hesepher Torfwerk also designed and built a turning machine to work in conjunction with the windrower. This machine has an output of 20 tonnes of dry turf/hour. Bord na Móna Engineers re-designed this machine which increased its output to 40 Tonnes/hour.

Collecting

With the advent of windrowing and turning machines the sod collector was re-designed and fitted with pick up elevators along the collecting conveyor. The elevators pick up the sods which have been placed in rows by the turning machine. The automatic collector has an output of 40 tonnes per hour, and operates with a crew of two people, compared with a crew of 21 people on the previously used hand fed collector.

TABLE 8.14: SOD PEAT PRODUCTION COLLECTING PROCESS - EMISSIONS & WASTE GENERATED		
IN Materials Used	OUT Emissions	Waste/Disposal
Peat	Minor - Dust (only occurs during extremely dry weather conditions) Minor - Noise	None

Stockpile Protection

Sod peat is stored in stockpiles on the bogs, and must be protected from the weather during the winter months and early spring in order to control the moisture content. The stockpiles are covered with 350 gauge clear polythene, secured by a cord and peg system. A polypropylene cord (with a 275 lb breaking load) is used. The pegs securing the cord measure 3 cm x 3 cm x 75 cm.

TABLE 8.15: SOD PEAT PRODUCTION STOCKPILE PROTECTION - EMISSIONS & WASTE GENERATED		
IN Materials Used	OUT Emissions	Waste/Disposal
Peat Polythene Polypropylene cord	Minor - Noise	None

(ii) Small Sod Peat Production Machines

Small sod peat production machines with outputs of 3000 to 6000 tonnes per annum of air dried peat (at about 35% moisture content) became available in the mid 1980's. These machines can be powered by standard large agricultural tractors 60 - 80 H.P. and are very suitable for small production operations. Some of the various types available are: Chainsaw Type, Surface Machine and Field Press Machine.

Chainsaw Type

This machine has a digging blade 1.0 M to 1.7 M long, with spoons attached, which carries the peat into the macerator/extrusion chamber. The peat is then extruded through, up to 10 No x 10 cm diameter square outlets with outputs of about 5.0 tonnes per hour of air dried turf.

Surface Machine

This machine has a combined horizontal feeding screw and a vertical cutting disc. Peat extraction is from the top 10 cm to 30 cm of the bog. Output is from 3 to 4 tonnes per hour of air dried peat. The peat quality is normally low density and rather poor turf.

Field Press Machine

This is a self propelled or tractor drawn extrusion machine, which is fed by an excavator operating from a face bank. The "Field Press" mixes, macerates and extrudes the peat in continuous sod form on an adjacent spread area. Output is 3 to 4 tonnes per hour of air dried turf.

8.2.4 PEAT LOADING, TRANSFER & UNLOADING OPERATIONS

In accordance with the dispatch programme, and in order to maintain a proper blend and continuity of supply to the customer, loading and haulage are carried out from a number of stockpiles at any given time. Loading to wagons is carried out by a hydraulic excavator (Plate 8.11). This peat is subsequently transported by rail (Plate 8.12) into the transport yard where the peat is unloaded by rotary tippler (Plate 8.13) into the power station/briquette factory/horticulture works peat bunker. The peat is then taken to the power station/factory unit by conveyor belt.

TABLE 8.16: MILLED PEAT PRODUCTION PEAT LOADING, TRANSFER & UNLOADING OPERATIONS - EMISSIONS & WASTE GENERATED		
IN Materials Used	OUT Emissions	Waste/Disposal
Peat	Major - Discharge of peat particles during loading operations to silt ponds via surface water drainage network Major - Dust (during loading & transfer operations on the bog and during unloading operations at the tippler area) Minor - Noise	Polythene (removed from peat stockpiles during loading operations at the bog)

TABLE 8.17: SOD PEAT PRODUCTION TRANSFER OPERATIONS - EMISSIONS & WASTE GENERATED		
IN Materials Used	OUT Emissions	Waste/Disposal
Peat	Major - Dust (during loading operations on the bog and during unloading operations at the works yard area) Minor - Noise	Polythene (removed from sod stockpiles during loading operations at the bog)

8.2.4.1 Railways

All transportation of harvested peat from the surface of the bogs to the receiving facilities is by narrow gauge (0.90 m) railway. A typical milled peat train would consist of 15 to 20 wagons of 16 m³ capacity or 75 to 100 tonnes net weight of peat per train.

(i) Total Length of Track

The total length of Board track is now over 1300 km. of which about 800 km is permanently laid, the remaining 500 km of temporary track may be laid and lifted up to 12 times in a year to allow haulage of peat from about 3500 km of stockpiles.

(ii) Type of Rail

Most of the track is in 35 lbs/yd/B.S.R. Rail. i.e. 35 Lbs weight per linear yard of rail, British Standard revised type. A small amount of track is in 30 lbs/yd, and rail approaching receiving facilities is in 50 lbs/yd (older lines are 50 - 60 lbs/yd). The rail is laid on steel trough sleepers, using a rail layer (Plate 8.15), which is attached by steel rail-clips and clip-bolts. The rails are attached to each other longitudinally by steel fish-plates and 4 No. fishbolts per connection. Track is prepared in standard lengths of 30

feet and weights about 1200 lbs (545 kg). There are over 2000 No. turnouts or switches within the system, the turnout angle is generally $1/4$, but $1/3$ and $1/6$ is also in use. Rail switches are left hand or right hand, but occasionally two-way or three-way switching is required, i.e. left hand right hand and straight through, and also cross-overs are sometimes required.

(iii) Design of Rail System

Curves on permanent track are rarely less than 300 feet radius, and on temporary track usually 150 ft radius. Gradients on permanent track less than $1/150$ are not recommended. Gradient is a very important factor from haulage and safety viewpoints, since both traction and breaking are proportionate to hauling loco weight. Before the design and layout of any rail system commences, a detailed topographic survey is carried out. Where crossings of rivers, streams or roadways are involved then a detailed assessment of any future alterations or excavations is necessary, e.g. Local Authorities may have plans to re-align roadways or deepen inverts of rivers etc. There is almost always a drainage problem when crossing under a roadway by an underbridge, because the design rail level is usually 4.0 m below the roadway surface level, and at this level it is unlikely that gravity drainage is available except when the site is at an elevated roadway location.

(iv) Level Crossings

At locations where crossings by underbridges was not feasible due to ground topography, level crossing with gates were constructed. Level crossing gates were designed for each particular crossing, as the angle of crossing and foundation material always varied from one location to another. Standard level crossing lamps with light sensors that switches to light on when daylight fades are fitted to all crossing gates. Catch points are also fitted into the railway track on either side of level crossing gates. This is standard safety practice in order to de-rail any runaway trains before the reach the level crossing.

(v) Track Maintenance

Continuous inspection and maintenance of railway track and rail beds is essential in order to prevent de-railments and other accidents. Operating a rail system with a large volume of rolling stock requires constant supervision and safety precautions must always be to the forefront.

8.3 **DERRYGREENAGH GROUP**

The Derrygreenagh Group consists of the Derrygreenagh and Ballivor group of bogs and Rossan bog (Drawings 2.2, 8.1a - 8.1e). Refer to the attached report (K960-H5: A Preliminary Hydrogeological Classification of the Derrygreenagh Group) for a general description of the geological/hydrogeological setting of the Derrygreenagh Group.

8.3.1 **DERRYGREENAGH GROUP OF BOGS**

The Derrygreenagh group of bogs is located in North East Offaly and South East of County Westmeath. Development work in the second programme commenced in 1952. The original acquisition was 5,668 gross hectares and 3,238 net hectares were developed and production of milled peat began in 1958. The Derrygreenagh group of bogs has been the sole supplier to Rhode ESB Power station and Croghan briquette factory. In addition, the Derrygreenagh group of bogs supplied peat for the moss peat plants in Kilberry and Cúil na Móna when required. In the mid seventies approximately 1,214 net hectares was developed in the third programme, which is now assigned to Bord na Móna Allen Peat Limited as part of the Allen Group. Cutaway acreage at present (including Clonsast) is estimated at 2,833 hectares. The main river catchments to which peatlands within the the Derrygreenagh group of bogs drain are to the Boyne (North of the Grand Canal) and the Barrow (to the South).

Derrygreenagh Works

Operations that take place at Derrygreenagh works include fabrication (welding, cutting & grinding of metals, painting), repair, maintenance and routine fuelling of machinery.

DEVELOPMENT & PRODUCTION ACREAGE

The budget production targets for 1999 - 2000 for the Derrygreenagh Group are 243,104 tonnes from 1197 hectares. 398 hectares of peatlands is proposed for development during this time frame.

8.3.2 **BALLIVOR GROUP OF BOGS**

The Ballivor group of bogs is made up of the Ballivor (Area 14), Carranstown (Area 15) and Bracken West (Area 16) bog areas. Each of these bog areas are rail linked to the Ballivor horticultural factory and associated works which is situated midway between Ballivor and Raharnay villages. Drainage of these bog areas is to the Deel

and Stonyford rivers (tributaries of the Boyne). Production activities within the Ballivor group of bogs originally commenced in production in the mid 1980's following the development programme of the 1970's.

Ballivor Works

Operations that take place at Ballivor works include repair, maintenance and routine fuelling of machinery.

Ballivor Outloading Area

Horticultural peat is harvested into stockpiles located on the Ballivor group of bogs. The peat is then transported by rail from the stockpiles to tippler/outloading area at Ballivor works for transport to customers (professional and retail markets).

DEVELOPMENT, PRODUCTION & CUTAWAY ACREAGE

There is currently 304 hectares approximately of the Ballivor group of bogs (Ballivor, Carranstown and Bracken West bog areas) in milled moss production with an annual target of 52,000 tonnes. Adjacent to the Ballivor group of bogs areas is 971 hectares of cutaway bog (resulting from historical sod turf operations), 364 hectares of undeveloped fringe area and a further 809 hectares of bog under development. Sod turf is produced on Lisclogher bog (61 hectares) – annual production 5000 tonnes with 3000 tonnes transport to the tiphead at Ballivor for sale and 2000 tonnes sold direct to customers.

8.3.3 ROSSAN BOG

DEVELOPMENT, PRODUCTION & CUTAWAY ACREAGE

Rossan bog (324 hectares) is located one mile from Kinnegad on the Castlejordan road. There are currently 142 hectares in milled moss production with an annual target of 27,000 tonnes. A further 49 hectares is in development and 41 hectares is developed for further milled peat supplies with the remaining acres in fringe bog with some sod turf cutting operation carried out privately by locals.

Rossan Works

Operations that take place at Rossan works include repair, maintenance and routine fuelling of machinery.

8.3.4 DERRYGREENAGH GROUP - FUEL STORAGE, TRANSFER FACILITIES & OPERATIONS

Refer to Table 8.18 and Drawings 8.1a - 8.1e for locations of various fixed diesel/oil/petrol storage tanks used within the Derrygreenagh Group. 9 x 5000 litre and 3 x 2600 litre mobile diesel tanks are used within the Derrygreenagh Group.

TABLE 8.18: FIXED DIESEL, PETROL & OIL STORAGE TANKS IN THE DERRYGREENAGH GROUP							
Tank Location Reference	Diesel	Diesel Derv.	Petrol	Oil	Paraffin	Tank Capacity	Bunded (Yes/No)
1	Yes					3 x 315000 l ^{70k}	Yes
		Yes				1 x 6750 l ^{1.5k}	Yes
			Yes			1 x 4500 l ^{1k}	Yes
				Yes		2 x 45000 l ^{10k}	Yes
					Yes	1 x 1350 l ^{300l}	Yes
2	Yes					1 x 45000 l ^{10k}	Yes
3	Yes					1 x 90000 l ^{20k}	No
		Yes				1 x 23000 l ^{5k}	No
4	Yes					1 x 23000 l ^{5k}	No

Bog Transport Machines

Bog transport machines (loading machines, rail layers, dozers and machines attached to rail repair) are refuelled and serviced by a mobile (rail transport) fuelling/service units from individual workshops. The fuelling/service unit contains a fuel tanker which is mounted on a flat rail wagon with a diesel engine attached to operate a fuel delivery pump (pump may also be operated manually) with automatic shut off nozzles and an air compressor. The compressor is fitted for the purpose of blowing dust particles from the radiator and operation of a greasing unit. Oil drums are also mounted on the fuelling/service unit in order to facilitate oil changes for individual machines. Empty oil barrels are also carried on the fuelling/service unit to facilitate collection of waste oil that may be generated following an oil change of a machine unit. In a situation where a machine is not accessible by rail a mobile tractor fuelling/service unit is used. The mobile fuelling/service units are loaded at individual works.

Bog Development Machines, Silt Cleaning Machines & Production Machines

There are three different methods used for the fuelling of bog development/silt cleaning/production machines:

- Machines may be fuelled from a permanently fixed fuel tank located at the closest tea centre
- Machines may be fuelled and serviced from a mobile rail fuelling/service unit
- Machines may be fuelled and serviced from a mobile tractor fuelling/service unit

The mobile tractor and rail fuelling/service units are filled at individual works and at selected tea centres depending on which harvesting machines on a particular bog area requires fuelling/service.

Locomotives

A manned drive through service area is located at the transport centre adjacent to Rhode power station and Croghan briquette factory for the fuelling and servicing of locomotives used for the peat transfer operations. The locomotive service area is equipped with a fuel dispensing unit (fitted with an automatic cut off hand piece), an air operated greasing unit and an oil barrel storage area for replenishing oil levels.

Road Transport Vehicles

All road transport vehicles (cars, vans and trucks) are fuelled at a dedicated petrol/diesel dispensing area located at Derrygreenagh and Ballivor works.

DETAILS OF KNOWN HISTORICAL POLLUTION INCIDENTS

No major diesel, petrol or oil spillage's are known to have occurred within Rossan and the Ballivor group of bogs.

A diesel spillage occurred on 21st April 1999 at the transport centre at Rhode Power Station. On detection of a distinct diesel smell by an operative emergency procedures for diesel/oil/petrol spillages were immediately implemented. The valves from the pump house were closed in order to prevent possible back feed by gravity. Booms were deployed within the adjacent drainage channel (straw was also used to mop up the diesel collecting behind the booms). A 2 m trench was excavated between the embankment and the drainage channel in order to intercept diesel that was seeping

though the bank. A truck load of milled moss peat, which was obtained from Croghan Briquette Factory, was shovelled into the drainage channel upstream of the first boom to mop up the diesel. While this was occurring the pipeline from the storage tank to the locomotive diesel hut was unearthed in an attempt to locate the source of the diesel leak. This was dug back about 20 m, but the source of the leak was not found. Diesel that drained to the temporary interceptor trench was pumped into a tanker. Additional booms were subsequently deployed at various road crossings on the Yellow River. Representatives from Offaly County Council and the Fisheries Board inspected the site on the day after the spillage. The source of the leak was identified (crack in the pipeline) following a pressure test on the pipeline. It is proposed to replace this section of the pipe. Once repaired the system will be pressure tested prior to re-use of the storage tank.

A recent (February 1999) minor spillage (approximately 450 litres) of fuel oil was recorded from the oil storage tank located at Rossan works. The spillage, which was as a result of frost bursting a connection point, was contained and did not reach a surface water system.