Scottish Natural Heritage
Dualchas Nàdair na h-Alba

Peatland ACTION
Restoring Scotland's Peatlands
Ath-stèidheachadh talamh mònach na h-Alba

Peatland ACTION
Guidance for land managers

Dam Installation techniques –
Peat and Plastic dams

Updated March 2019

Section 1 - Installing peat dams

Please see Annex 1 for legislative requirements in relation to ditch-blocking.

Peat dams should be considered the default technique to block ditches or moor grips. Blocking erosion gullies may also benefit the peatland, but this usually requires other techniques to be used. They are much cheaper to install than dams made of other materials, especially where a large number of dams are required. The results blend in with the landscape and the excavator can be used to profile dams and ditches to prevent deep, steep-sided pools being left behind after ditch blocking that might be a hazard to stock. The aim of the dams is not only to hold back water in the ditches, but also to direct water away from the ditch line and back onto the bog.

Circumstances where peat dams do not work

1. Drains on shallow peat

In order to effectively key-in a peat dam, sufficient depth of good quality peat (see peat condition below) is required at the base of the drain. Peat dams are generally unsuitable where the depth of solid peat at the base of the drain is ≤50cm.

2. Sloping ditches or grips

Peat dams are usually only effective on a shallow slope (<12° gradient), although the method can be adapted to steeper slopes e.g. in high flow ditches on slopes, turves should be placed on top of dams at a 45° angle to the flow of water to help prevent erosion. However, if the gradient is too steep, the water flow can cause erosion over the top or round the sides of dams of the dam, resulting in failure and/or increasing the risk of peat slide. Where dams need to be installed on the sloping edges of lowland bogs, we advise that plastic piling is used.

3. On wide drains/ditches

Hand built peat dams can only be made in ditches no larger than 70cm wide and 60cm deep. Machine built dams can be in ditches no larger than 150cm wide and 120cm deep, depending on the peat composition. Above these dimensions, the peat dam structure can become unstable particularly if flow rates are high.

A good site for peat dams

Peat condition

The peat used for damming must be saturated, but not sloppy, and should have a darker appearance with a putty-like consistency. Peat that has been dried and exposed to air will not form a watertight dam. Only peat taken from the bottom and wet sides of the ditch (or nearby borrow pits) should be used. The original ditch spoil is not suitable; as with other dried peat, its structure and water holding properties will have been damaged by exposure to air and weathering.

Availability of suitable machinery

Smaller low ground pressure excavators are capable of constructing peat dams on drier firmer peats, but wetter peats will require wider tracks. Low ground pressure excavators used to be hard to obtain away from peat extraction sites (mostly in the Central Belt and Aberdeenshire). Many more contractors now have wide tracked excavators as part of their fleet, due to their use in wind farm construction.

Selecting locations of dams

- It is advisable to check aerial photographs for linear changes in vegetation that may indicate hidden ditches before going on site. Ditches are not always apparent on the ground. Vegetation may grow across the top of a narrow ditch, whilst water actively flows underneath.

- Ensure there is sufficient depth of solid peat at the base of the drain (≥50cm) to create an effective key for each dam.

- It is advisable to walk the line of each drain in advance, and probe the base of each drain at regular intervals in order to determine the depth of available peat, and suitability for peat dam installation.

- The intensity of damming required depends on the flow of water in the ditch, and the amount of water held back by individual dams.
- Generally dams are installed at 7.5 metre to 20 metre intervals on flat ground, however, dam frequency should increase to between 5 metre and 7 metre intervals on steeper, sloping ground. It is expected that the final water level from the lower dam will rise half way up the next upstream dam. The final water level should be at the peat surface or no more than 20cm below the surface.
- Appropriate locations for peat dams can be marked using bamboo canes with plastic marker tape or cut up carrier bags attached to the tops. Select a location where the ditch narrows to form a pinch point. This provides a firmer footing for the dam and uses less material.
- Check for small depressions and channels at the edges of the ditch that could effectively divert or restrict the amount of water contained by the dam.

- Cracks running parallel to the ditch may need blocking as well.
- Where ditches are running parallel, stagger the dam positions, to increase the wetting effect on the surrounding peat. The wetting influence of each dam will extend sideways into the peat for up to 15 metres.

Where not to site dams

- Avoid undercut banks, tree roots and thick grass tussocks. If unavoidable and with care, tree roots and grass tussocks can be cut with a chainsaw.
- Avoid dry peat banks that will slump when wetted up.
- Avoid peat pipes, cracks and fissures where water may suddenly disappear
- Avoid dams in the dry edge of the moss as these will inevitably leak due to cracks in the peat. Trench bunding may work better in these places.
- Ensure that the dam location is not too close to the junctions with tributary drains, as these points have unstable peat. Two to three metres downstream of these junctions is ideal, as the peat is firm, but there is the added benefit that two ditches are blocked by one dam.
- Ensure dams are clear of timber/brash previously placed in the ditch. Even small amounts of timber/brash can make it difficult to install the dam properly.

Method

Installing peat dams using an excavator

Careful planning is important for a machine operation, including planning locations for delivery, access and re-fuelling of machines. Machines that work on bogs need to be low ground pressure and excavators will require a moderate bucket reach to reduce movements. It is important that operators are experienced at working on deep peat and are made aware of the specific risks you may have on your site. It is a good idea for the operator to walk the site before bringing the machine on. On wet parts of the bog, the excavator may need to travel on bog mats.

Method (also see methodology for hand-built peat dams below)

Where possible, use consolidated peat from an in-ditch borrow pit located upstream to create the dam. Avoid leaving deep, steep-sided borrow pits as these can be dangerous to stock. Where the quality of in-ditch peat is unsuitable for creating a solid peat dam, use peat with the right degree of plasticity from a nearby borrow-pit, located near to but not too close to the ditch, and upstream/upslope of the dam.

1. Remove the vegetated turfs from the surface of the borrow pit and the dam location, ensuring that the root structure remains intact, and place to the side.

2. Clean out/push away from dam location the unconsolidated peat and debris.

3. Create a key for the dam into each side of the ditch, with a 0.5 to 1 metre notch on both sides. Carry out a visual inspection of the peat in the vicinity of the key, checking for any obvious cracks or pipes that could compromise the efficacy of the dam. If either is present, select another location within 2 metres and repeat steps 1-3.

4. Roll the back of the machine bucket along the key to compact the peat and remove any cracks or voids.

5. On sloping ground, shallow swales that extend out (or on one side) from behind the dam can be added to re-direct water from the ditch line. Wider dams can also be useful on slopes to help encourage water out of the ditch-line and allow it to shed across a wider area downslope.

6. Regularly compact the peat in the dam with the back of the excavator bucket to ensure an effective watertight seal.

7. Reprofile the sides of the drain behind the dam to a shallow slope, to enable animals to enter and exit the pool created by the dam.

8. When the dam is 50cm above ground level place the vegetated turfs across the top of the dam (and in swale if present), ensuring that the top and face of the peat dam is covered to prevent oxidation of the bare peat. Use the machine bucket to tamp down the turfs to ensure good contact with the peat. Vegetated turfs obtained from a nearby borrow-pit can also be used to ‘dress’ the dam.

For further guidance also see the SNH ditch-blocking demonstration video[1]

[1] https://www.youtube.com/watch?v=Gmoji9SYheE&list=PLSTn6yg6zH__XM-Mw7fKNoGsVYo31B5VH&index=9

Creating successful peat dams

- Creating good peat dams requires a skilled machine operator who understands what result is required. If possible, get supervision for the creation of the first few dams by someone who has seen then made before.

- Dam thickness will depend on the ditch width and will increase as the ditch widens to counter the increased water pressure.

- Make sure that access can be gained whilst maintaining stock proof fences and any public access points.

- Care should be taken to avoid creating deep open water pools where stock might drown when obtaining peat from in-ditch borrow pits. The sides of the borrow pit should be sloped to allow animals to climb out.

- Any borrow pits created beside the ditch should be restored by reprofiling the sides to a shallow slope and reinstating turfs and/or stretching the surrounding vegetation to cover up any bare, exposed peat where turfs have been removed.

- Borrow pits located beside the ditch should be staggered and should not be selected in a systematic manner, to avoid creating a line of depressions that could form a new drain line.

- The excavated material should be flattened down to almost level with the overall bog surface (allowing for the peat to slump/settle slightly). Large hummocks of spoil should not be left, as they are a prime location for invasive scrub to germinate, particularly on lowland bogs. Instead, the spoil should be placed back into the channel upstream of the newly installed dam.

- Get the contractor to distinguish between time spent on site and time spent transporting machinery when quoting.

- It can be difficult for machine operators to get their bearings and interpret maps on unfamiliar open ground.

- Double-bunded cells should be used for storing fuel. Refuelling points should be located off the wetland site and at least 50m from any watercourse.

- Sharp or stationary turns should be avoided as they churn up the peat and dislodge surface vegetation. If this occurs, replace the turves in their original position.

If dislodged by turning, replace turves in original position

An alternative method for slopes and wider ditches: re-profiling ditches

On sloping sites or where ditches are wider, better results may be obtained by damming and re-profiling the ditch. This is done by installing peat dams close together, e.g. every 5-7 metres, then using the machine bucket to roll back vegetated turves on either side of the drain in consecutive strips. The sides of the ditch are then re-profiled to a shallower gradient by pulling down peat from the banks and compacting. Water can be directed away from the ditch line using swales behind each dam. The turves are then rolled back over the re-profiled sides and compacted using the bucket. The swales and any remaining areas of bare peat need to be carefully patched with turves, so that the vegetation recovers and peat is protected from erosion. Re-profiling drains also helps make them safer for livestock and other wildlife as it results in a much shallower channel with less severe banks, thereby offering a better chance of escape should anything fall in. Re-profiling requires training and/or experienced supervision to achieve a good result.

Questions that you should ask potential contractors are:

Where will the excavator be delivered and unloaded?

Excavators are transported on large low loader lorries that will require good roads on which to drive and turn.

Where will the re-fuelling point be?

This should usually be off the peatland and the contractor should be prepared with a spill kit, should a spillage occur.

Will the excavator fit through our existing gates?

Often bog excavators have extra wide tracks that mean they will not always fit through standard gates.

What route will the excavator take onto across and off the site?

Work should start at the furthest point and work back to the exit. If this is not done the excavator could become trapped by the rising water levels it is creating by damming. The route should minimise ditch crossing points and very wet areas.

How will machines access the site if further work or maintenance of dams is necessary?

Hand-built peat dams

Generally we do not recommend building peat dams by hand, although they can be worthwhile where machine access is not possible. Building dams by hand is exhausting and it is difficult to achieve a good, long-lasting result without the level of compaction offered by an excavator bucket. It is also more difficult to successfully reinstate smaller hand-cut turfs compared to larger machine-cut turfs. Modern low-ground pressure machines can be taken onto most sites without causing any long-term harm.

A two person team with two spades or a rutter and a spade can successfully make small dams. Each dam can take two people up to 2 hours to complete. In addition, two grabs, that are basically four-pronged forks with the tines bent at right angles, are required to move the cut block of peat. Blocks of wet peat are cut to an approximate size of 20cm x 30cm x 20cm.

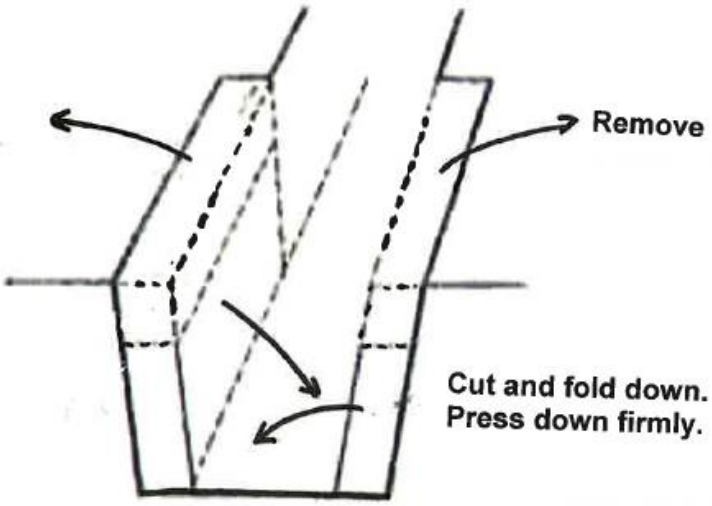
The principle of the exercise is to create a notch to ensure the dam is keyed into the surrounding vegetation. Then to create the dam using peat from a borrow pit located in the ditch upstream of the dam.

1. Remove all unconsolidated peat and debris from where the dam is to be constructed

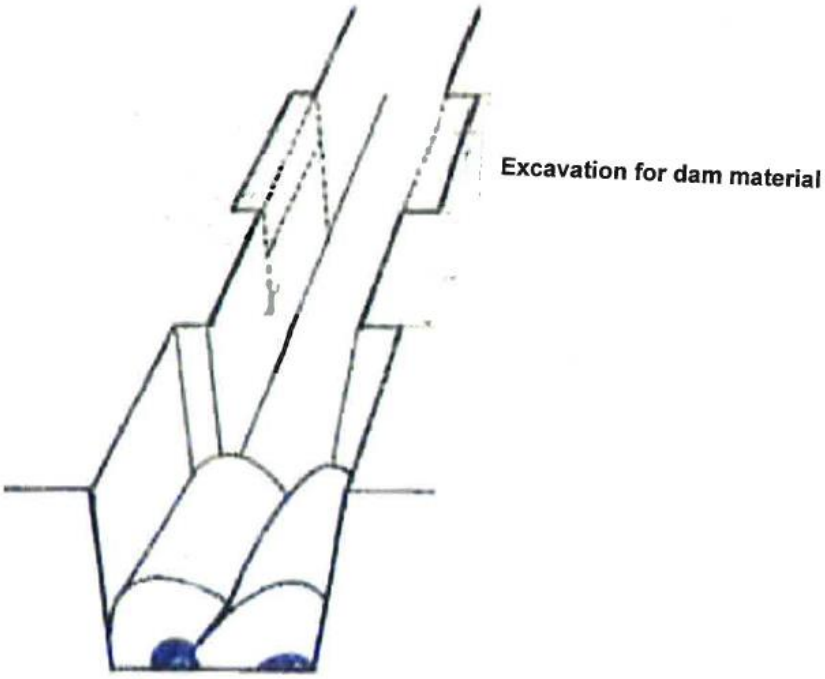
2. Place any turfs to one side for later use.

3. Cut a notch on both sides of the ditch 1 metre wide, 20cm thick and 20cm deep. Remove the sod.

4. Continue cutting down the back of the sod, and fold into the ditch leaving a hinge at the bottom of the sod. Press and compact each sod with your feet.

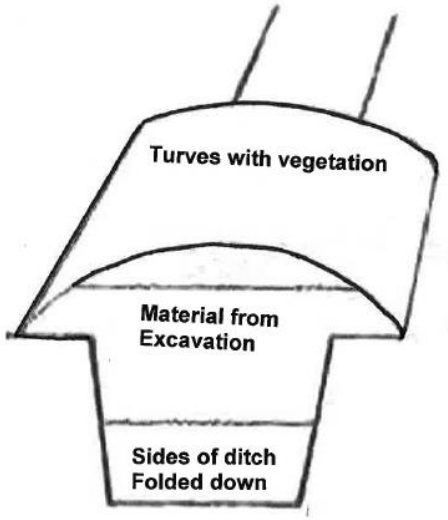


5. Move upstream, leaving a gap of 1 metre between the dam notch. Remove the surface vegetation at this point. Cut further sods from the wet peat from the sides and base of the ditch. Avoid leaving steep sided or deep holes behind the dam, as these can be dangerous to stock.



6. Place these sods on top of the folded sods and compact. Continue this process until the peat is just above the top of the ditch; this allows for further settlement and shrinkage.

7. Place growing vegetation/turfs on the top of the dam to assist rapid regrowth and dam stability.



Installation of peat dams - Points to remember

- Peat dams alone may not be suitable on very large active drains. Machine built peat dams should only be used in ditches ≤150cm wide and ≤120cm deep.

- Peat dams are unsuitable on drains (or sections of drain) that are incised/eroded down to the mineral layer.

- The type of dam required may vary across a site, or even along the length of a drain, depending on the drain depth/width, flow rate, and/or peat depth at the bottom of the drain.

- Even small, seemingly infilled, drains can still be very active so dams should always be made well and spaced adequately in order to ensure their efficacy.

- Damming a drain can result in large volumes of water being held back. Drains should be blocked up their entire length where possible to reduce the amount of water being held back by any one dam.

- Behind the dam, water needs to be encouraged to seep laterally across the bog on flatter ground, and to shed out of the drain and down the slope on steeper ground. It is not desirable to create large pools of water behind dams.

- The use of swales and/or wider dams can be useful on sloping ground to help encourage water out of the ditch-line and allow it to shed across a wider area downslope.

- On sloping sites or where ditches are wider, better results may be obtained by a combination of damming and re-profiling the ditch.

- When working on slopes, drains should be blocked first at the top of the slope then progressively working downstream.

- When working on flatter ground, e.g. lowland raised bogs, drains should be blocked first near the centre then progressively working outwards.

- Water flow can vary significantly under different conditions. Where possible the "winter flow" should be planned for.

- Where possible, install peat dams at "pinch points" in the drain.

- The frequency of dam spacing should be between 7.5m and 20m on flatter ground, however, this should increase to between 5m and 7m on steeper, sloping ground. Dam spacing may also depend on drain size or if dams are supplemented with other material in the channel e.g. stone, bales, brash, felled woody material/debris.

- Take good care to tamp down the dam with the excavator bucket to ensure that the peat used to create the dam is well compacted and consolidated.

- If turf or peat is required from a new borrow pit adjacent to the ditch, the borrow pit should be located upstream /upslope of the dam, taking care not to create a new drain line via a systematic, linear series of pits.

- It is essential that there is a minimum 50cm depth of solid peat at the base of the ditch in order to effectively key-in a peat dam and ensure a good watertight seal.

- Hand dug peat dams can be worthwhile on smaller drains (no larger than 70cm wide and 60cm deep) and where machine access is not possible, however, they can be time-consuming and less robust compared to dams installed by machine.

Appropriate Machinery

- Using low ground pressure excavator

- The optimal size of machine bucket used will depend on the size of drain and size of dam required (e.g. if a wider dam is desirable for a stock crossing point). However, a 4-foot wide, toothed, general purpose bucket tends to offer the most practical option for this technique.

Section 2 - Installation of plastic piling dams

Please see Annex 1 for legislative requirements in relation to ditch-blocking.

This section of the guidance is intended for contractors and land managers who wish to install plastic piling dams on ditches less than 1.5m wide. Plastic piling is light, versatile and slots together on site. If properly installed, plastic piling dams can form a good watertight seal that will last for decades. They are not usually feasible on large, remote upland sites, due to the cost and difficulties of transporting piling and moving it around site.

Plastic piling dams are useful in the following situations:

- Where only a small number of dams are required and it is not cost effective to get an excavator on site to make peat dams.
- On ground that is too soft and/or unstable to allow safe machine access.
- On small, extremely remote sites that are inaccessible by machine.
- On active drains that are partially infilled with vegetation, yet hold too much water to allow effective installation of peat dams.

Selecting locations of dams

- It is advisable to check aerial photographs for linear changes in vegetation that may indicate hidden ditches before going on site. Ditches are not always apparent on the ground. Vegetation may grow across the top of a narrow ditch, whilst water actively flows underneath.
- The intensity of damming required depends on the flow of water in the ditch, and the amount of water held back by individual dams.
- Generally dams are placed at between 10 and 20 metre intervals on flat ground, but would need to be closer where there is a slope. It is expected that the final water level from the lower dam will rise half way up the upstream dam. The final water level should be at the peat surface or no more than 20cm below the surface.
- Select a location where the ditch narrows to form a pinch point. This provides a firmer footing for the dam and uses less material.
- Check for small depressions and channels at the edges of the ditch that could effectively divert or restrict the amount of water contained by the dam.
- Cracks running parallel to the ditch may need blocking as well.
- Where ditches are running parallel, stagger the dam positions, to increase the wetting effect on the surrounding peat. The wetting influence of each dam will extend sideways into the peat for up to15 metres.
- Mark the estimated dam locations using bamboo canes with plastic marker tape or cut up carrier bags attached to the tops.
- Dams in ditches with constant water flows, like that of a small burn, will require additional support, for example the inclusion of wooden bracing (see Section 3 below).

Where not to site dams

- Avoid undercut banks, tree roots and thick grass tussocks. If unavoidable, tree roots and grass tussocks can be cut with a chainsaw.
- Avoid dry peat banks that will slump when wetted up.
- Avoid peat pipes, cracks and fissures where water may suddenly disappear
- Avoid dams in the dry edge of the moss as these will inevitably leak due to cracks in the peat.
- Ensure that the dam location is not too close to the junctions with tributary drains, as these points have unstable peat. Two to three metres downstream of these junctions is ideal, as the peat is firm but there is the added benefit that two ditches are blocked by one dam.
- Ensure dams are clear of timber/brash previously placed in the ditch. Even small amounts of timber/brash can make it difficult to install the dam properly.

Site access

Bogs are a sensitive habitat and are vulnerable to damage from excessive passage of inappropriate machines. To avoid time consuming journeys to collect materials, identify a drop off point, adjacent to a firm road but close to the site. In identifying a drop off site, check that overhead power-lines will not foul delivery lorries. In areas where vandalism and theft are a problem it may be necessary to hire a steel shipping container in which to store materials, tools and machines. Shipping container delivery lorries require a firm road and base for stabilising rams either side of the vehicle. Most tracks close to peat bogs only have bottoming confined to the width of the track. It is therefore necessary to provide two firm bases for the lorry stabilisers, either side of the track, in the form of concrete blocks, timber or steel sheet.

Mark out a transit route prior to starting work on wetland to avoid becoming cut off by ditches. Where necessary damming materials can be used to bridge ditches at regular crossing points. Vehicles used for transporting materials across the moss should have a maximum ground pressure of 5psi and are inevitably tracked or multi wheeled. Tracked vehicles can be hired from various sources. Quad bikes can be used on very dry sites, but often become bogged when crossing even small ditches.

Site meeting

We recommend a site meeting with contractors (if employed) before the contact commences to ensure a good understanding of the work required, site constraints and health and safety aspects.

Prepare a map of the site with hazards, major ditches and the damming areas or individual dams marked.

Materials

Estimation of amount of materials required

As a guide only one third of the dam will be visible on completion. The total quantity of plastic piling required will be approximately twice the cross-section area of the ditch, although this can increase to 3 times for dams wider than 3 metres.

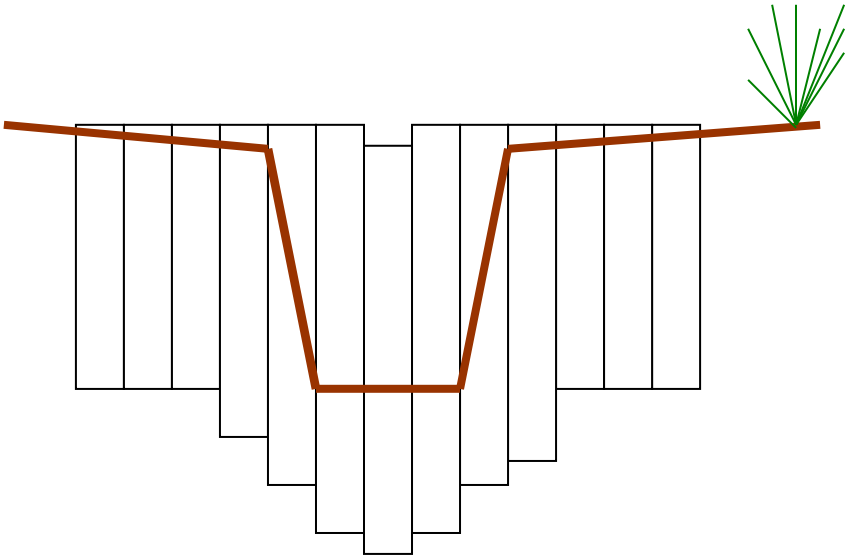


Fig 1: Cross-section of ditch with piling inserted

Plastic Piling

Plastic piling can be used in two configurations, box section and Z-ribbed, depending on the width of the dam required. Box-section is the most robust, stable format and is used for dams more than 2 metres wide. The Z-ribbed section is used for small dams and extension wings into the ditch banks on larger dams.

Piling in box format

Piling in ‘Z’ format

Tools

- A sharp spade for cutting though the vegetation
- A fencing mel to knock the pile in
- Timber batten to protect top of pile (piece of 50mm x 150mm)
- Platform to allow easier access

Dam construction

Hammer piles in starting from the centre of the ditch

- Position the longest pile in the deepest part of the drain. Use a sharp spade to pre-cut the outline of each pile in the surface vegetation. Push the pile into the peat using your own weight.

- Ensure that the piles remain vertical as it will become increasingly difficult to insert piles if they lean in any direction. Using a mel, drive further and when firm guide adjacent piles into their cams, repeating the process. Continue until all piles are firm in the peat.
- Piling will only create a good seal if driven into at least 75cm of solid peat, usually found below the 50 cm of soft peat in the base of the ditch.
- The top edge of the pile may require shielding from the metal of the mel. Several methods are used but the most effective is a timber batten resting on the pile.
- Shape the dam to form a gently curving upstream ‘C’ shape at the ends. This shape assists dam strength and increases the amount of water retained. The dam must extend well into the banks of the ditch. A rule of thumb is the extensions into the bank on each side, equal the width of the ditch. On slopes, the wings of the dam can be angled down the slope to re-distribute water over the site and reduce pressure behind the dam.
- Continue driving the piles starting at the centre, until all piles are approximately 30cm above bank level. Leave the dam to fill with water, as the last firming is best done with water behind the dam to lubricate the piles. Finally, hammer the piles until they sit no more than 10cm above the ground surface. The dams should not be visible above the vegetation. If they are too high after installation, then the tops of the piling should be trimmed off to make sure that the dams blend in with the landscape. Do not hammer the piles below the ground level, as this reduces the amount of water held and spread across the adjacent peatland.

The overflow

It is not always necessary to create an overflow. It is usually better to allow the water to spread around the sides of the dam, wetting the surrounding vegetation. Only install overflows where a strong flow would cause erosion around the sides of the dam.

- To create an overflow, drive in two piles in the centre of the dam about 5 to10cm lower than the adjacent piles. This is usually done when the dam has filled with water as it is easier to determine the correct height of water when the dams are full.
- If there is a strong flow of water around the sides of the dam, add extra piling where the water is flowing round until the water level reaches the overflow.
- If there is likely to be a lot of water coming over the overflow, place branches, heather sods or tree trunks in the flow to stop undercutting of the dam. This is particularly important for the lowest dam in the ditch, as there is no water below the dam.

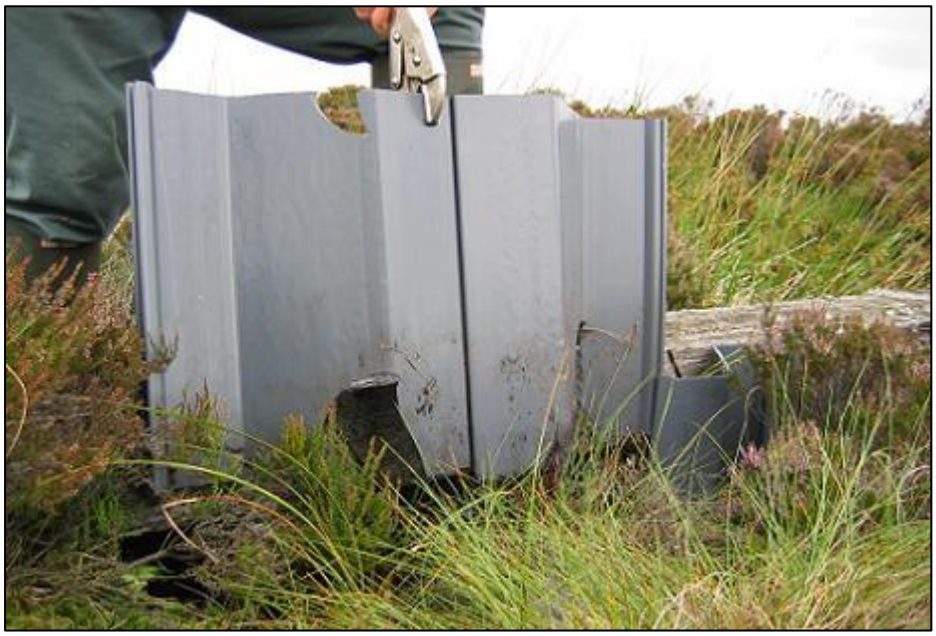
Checking installation of dams

Each dam should be checked (approximately 1 month after installation) to ensure that it is working properly.

What to look for on one month check?

- Are the dams functioning and holding water? Note that, if there is no water, this does not necessarily mean that the dam is poorly installed. In dry weather and in certain locations, dams can take several weeks to fill up. Conversely, a pool of water behind the finished dam does not necessarily mean the dam is installed properly. A dam can quickly fill and hold water for a few weeks and then suddenly fail due to poor installation.

- Piles that are not driven firmly. This will be evident by the fact that the piles can be shaken, pulled out by hand or with mole grips and have very little burring on the top of the pile. The burring indicates that the plastic was correctly hammered into the ground below the peat.



Short and broken piles being removed from a poorly constructed dam

- Short piles. To check, push a stick into the base of the dam, this will show the depth of piling used at that particular point. If the piles are too short you will find the base of the pile with the stick.
- Make sure that off cuts were cleared from the site.
- Cracks that occurred during installation should be repaired.
- Rough or shattered pile tops should be cut level with a hand saw.
- Cams (links between sheets) that have come adrift should be patched.

Monitoring and repairs

Monitoring of the dams is minimal and includes the following points:

- Check the overflow is not blocked with floating material
- Are the dams holding some water? If so, how far below the edge of the ditch is the water table? Bear in mind that during dry periods water levels can fall dramatically even when dams are installed and relatively effective.
- Problems can occur following prolonged periods of drought, as the peat contracts leaving a gap between the peat and plastic dam. Heavy rainfall that follows drought rushes through these gaps, causing erosion before the peat can expand.
- Check whether water is going around the sides of the dam or underneath it.

Minor leaks will occur between the piles. These will stop after a few weeks as they become filled with peat and heather debris. This process can be enhanced by stirring up the peaty water upstream of the dam.

Major leaks are caused by:

- Splitting of the piling, due to unprotected or overzealous hammering or obstructions in the peat as the pile is being hammered into position.
- Cams that link each pile coming adrift.
- Water diverting around the sides of the dam.
- Water going under the piles

How to repair dams

- Splitting and shattering of the piling. Plastic piling is a recycled product with a certain amount of variability in the material. If the piling splits, it is sometimes possible to saw off the shattered edge and continue driving. Piling will shatter more frequently in frosty conditions.
- Cams between the piles can come adrift, usually because the piles are not being driven vertically. If the driving process is not advanced, pull the whole dam out and start again. If the split occurs towards the end of piling, hammer a patch of 4 piles on the upper side of the dam, back-filling the space between the patch and dam with peat.

Split cam

- Water is flowing around the dam. Add additional 1m piles to the wings of the dam, curving their route upstream.

- Water going under the piles. This is caused by insufficient length of pile being driven into the peat. For minor problems drive the piles deeper; it is often sufficient to push down by standing on each pile. For major undershoot, pull the whole dam out and start again in a slightly different place, as repairs in disturbed peat will not hold water.

Repair on ‘Z’ format

Repair on box section format

Best Practice

- Piling will only create a good seal if driven into at least 75 centimetres of solid peat. Solid peat is usually found below the 50 centimetres of soft peat in the base of the ditch.

- The dam must extend well into the banks of the ditch. As a rule of thumb the width of each one of these extensions into the bank should equal the width of the ditch.

- If there is likely to be a lot of water coming over the overflow, place branches, heather sods or tree trunks in the flow to stop undercutting of the dam.

- Reinforced plastic piling dams can be installed at the end of long runs of peat dams where the water pressure is greatest.

Appropriate Machinery

- Can be done by hand

- An excavator can be useful to drive in plastic piling

- Consider machinery being used to transport materials to site (tracked vehicles can cause less damage)

When most likely to succeed

- On flatter sites but also effective on steeper slopes

- When only a few dams are required but on larger runs reinforcement may be appropriate

When most prone to failure

- If they are not reinforced

- If seal is not sufficient (often sides and base not properly keyed in)

- When installed in drains with very shallow or no peat in base

- On previously afforested sites. Roots make it very difficult to sink the plastic piling and get a good seal.

Why Use This Technique?

- If it is not cost effective to get an excavator on site to make peat dams

- On ground that is too soft and/or unstable to allow safe machine access.

- On small, extremely remote sites that are inaccessible by machine.

- On drains that are partially infilled (occluded) and/or vegetated yet are still very active.
- Peat dams may fail under weight of water on wider ditches
- Use on key exit points of raised bogs.
- Act as good terminal dams at the end of a run of peat dams on sloping ground.

Points to Remember

- Visual impact
- Expensive
- Environmental sustainability
- How to get material to site. How to get excess material offsite.
- Plastic piling dams will need reinforcement on steeper slopes and where ditches are wider than 1.5m.
- Consider using different profiles based on flow/dam width.
- Dam must extend sufficiently into bank either side
- Land managers and owners may not want to use plastic on their bog
- Can be very effective and are capable of holding back a lot of water.
- Difficult on previously afforested sites – have to cut through tree roots.
- Can catch fire! Can be damaged easily. Can't cross them (other dams could be crossing point). Could use timber bracing for crossing.
- Chemicals from plastic

Section 3 - Large dam and reinforcement guidance

Please see Annex 1 for legislative requirements in relation to ditch-blocking.

For the purposes of this guidance, a large dam refers to those where the ditch width is greater than 1.5 metres. Reinforced plastic piling dams are useful on steeper gradients or for wider ditches where the weight of water could cause peat dams or unreinforced piling dams to fail. In addition, at the end of a long run of dams particularly peat dams (i.e. 20 dams or more) it is advisable to reinforce the last two dams to act as extra insurance should any dams fail.

The overall method of construction with plastic piling is similar to that shown in Section 2 of this guidance.

Reinforcement

Reinforcement takes the form of timber or metal piles such as road barriers. In general, timber reinforcement is adequate. Reinforcement usually entails the use of timber immediately behind the dam with diagonal timbers linked to the ditch bank (see Fig 2 below). Reinforcement is reserved for the end of a large dam run and usually on the last two dams at the lower end.

Support

Support consists of timber immediately behind the dam and fixed to the ground by stobs at either end. This is used where the dam face exposed to water is greater than 2 metres. The purpose of the support is to reduce bowing of the dam structure.

Choice of timber

Treated: generally the timber used for reinforcement is treated. In the past, there have been reservations about using treated timber on wildlife sites as the treatments contained arsenic. However, the new generation of treatment involves impregnation with a copper trizole based preservative. The impregnation process fixes the chemical into the timber to prevent it leaching out. Similar chemicals are approved for use on crops and so this type of treated

timber is considered safe for sensitive sites. As a precaution, it is suggested that after treatment, the timber is left to dry properly, to ensure the preservative is completely fixed to the timber and surface residue is taken up.

Untreated: suitable untreated timbers include oak, elm and European larch. The two former hardwoods are heavy to handle, expensive and difficult to secure in appropriate dimensions. European larch, although easier to source, can be problematic because Japanese larch and hybrid larch (which rot very easily) are sold as generic 'Larch'; therefore it is difficult to ensure that the timber is European larch.

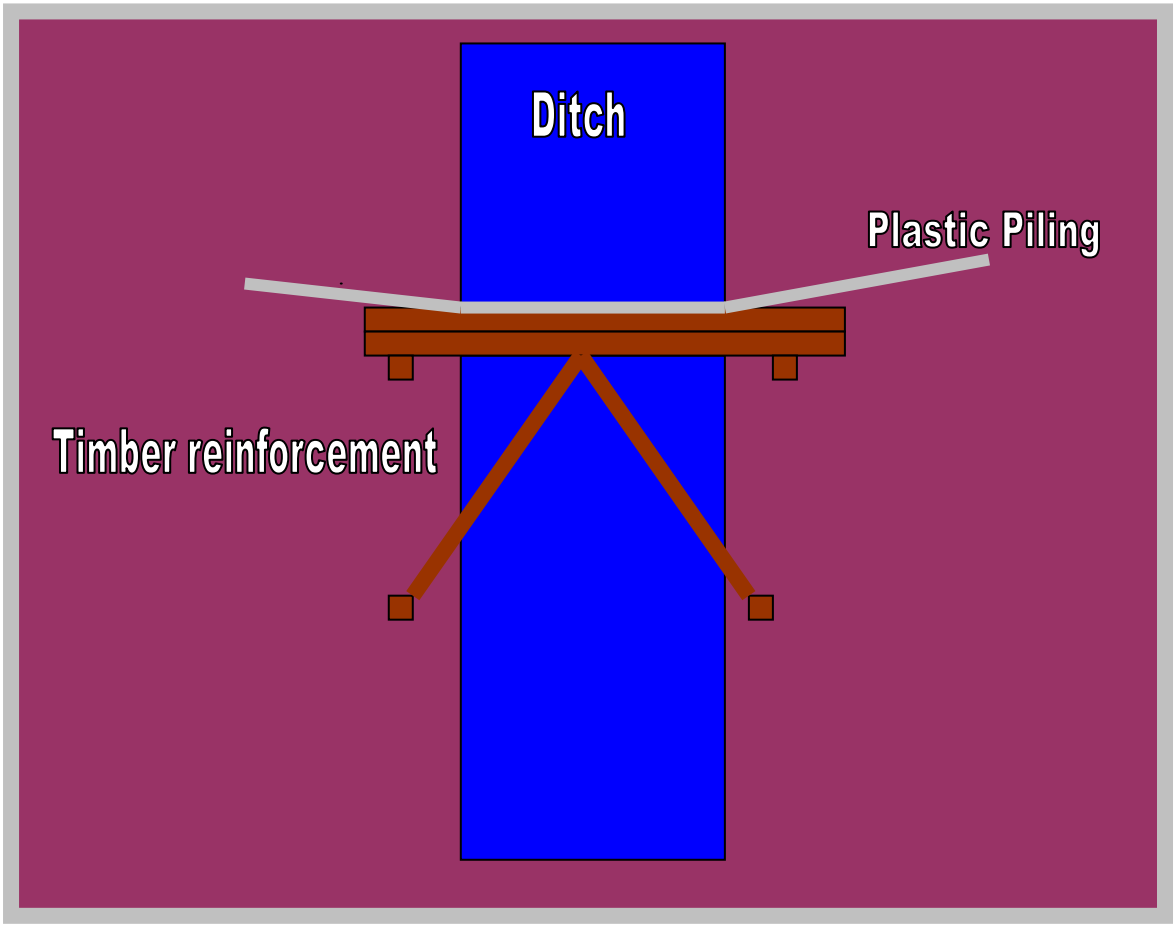


Fig 2: Timber reinforcement

Dam reinforcement

In most cases it is sufficient just to use two 4x4 posts bolted together, supported by two 4"x 4" stobs at either end. By bolting the two pieces of timber together with grain in opposing directions the combined structure will be much stronger than a single piece of wood of similar dimensions. The last two dams at the end of the run should have the diagonal supports inserted which are held in place by stobs, in the manner shown in Figure 2.

The maximum length of 4"x 4" timber is usually 3.6 metres. If wider dams are proposed, stagger the length to ensure the timber joints are not opposite each other and so weakening the structure.

Good Practice in Pictures

Dam showing full reinforcement

Dam showing support: note that the support is sunk into the ground to enhance stability.

Where the public can easily access the damming sites, cover the timber with mesh stapled to the timber so that they are not slippery. In addition, warning signs may be helpful.

Poor practice in pictures

Timber dimensions too small (3”x 3”) and no diagonal struts. In addition, the piles should be hammered deeper. The result: the dam does not hold water.

Insufficient pile length; even at the wings of the dam, these short piles are a waste of time.

Annex 1

Legislative Requirements - CAR licensing

Before carrying out any ditch-blocking activities, the potential requirement for a SEPA CAR (controlled activities regulations) license must be considered. SEPA will **not** normally require authorisation for the creation of an impoundment designed to raise the water levels to restore a degraded wetland or peatland where:

a) The activity is carried out in artificial drainage channels or eroded channels.
b) The activity is not associated with an abstraction.
c) The impoundment is created in a watercourse where the 'normal' (baseline) width of water within the active channel is <1m.
d) The affected watercourse does not appear on a 1:50000 scale OS map.

In any other case a CAR licence is required. Further information on the licensing process can be found at: https://www.sepa.org.uk/media/34761/car_a_practical_guide.pdf