Pond creation and management guidelines for farm-scale water quality enhancement

Georgina Mooney[1], Féidhlim Harty[2], Mary Kelly-Quinn[1], Marcin Penk[1]

[1]School of Biology and Environmental Science, University College Dublin, Dublin, Ireland

[2]FH Wetland Systems, Lahinch, Ireland

Summary

Construction

- Ponds over 1 m deep require planning permission.
- Ponds over 0.2 ha (2,000m^2) in area are considered ineligible features under BISS (Basic Income Support for Sustainability Scheme).
- Include silt traps at inlet if the pond is directly fed from river/ditch or in direct flow path, at least 20% of the total pond area.
- Maximise shallow water areas (<20 cm) if the incoming water quality is poor, to allow for a range of tolerant plant species to colonise.
- No more that 20% of the pond area should be considered 'open water', unvegetated areas within the basin that are 50-90cm deep.
- Focus on the edge habitat and maximise the extent of the drawdown by including ridges and hollows to maximise habitat diversity.
- Adding earth banks and bumps under the waterline will also provide additional habitat to aquatic plants, allowing for a diverse range of species to colonise.
- Slope gently, where possible.

Planting

- Bulrush, water mint, and yellow flag iris are ideal for silt trap areas.
- The rest of the pond can be left unplanted to colonise with local plants, if a suitable seed source is available nearby.

- If planting, plants should be locally sourced and native.
- To avoid one species taking over a large area (such as bulrush) plant the inlet silt trap in blocks of single species, preferably across the full width of the inlet area.

Management

- Plant management to provide species diversity – a thick stand of bulrush is not as beneficial as a mosaic of numerous different species.
- The partial removal of patches of taller plants such as bulrush, bent grasses, etc. in some areas of the pond to provide 'bare soil' habitat can also be beneficial for increasing plant diversity.
- Plant management may also include removal of selected overhanging trees/shrubs on a 3-5 year basis, to prevent infilling of the pond.
- Dredging may be required when sediment load is high, on a 3-5 year basis, especially in silt trap.

Introduction to pond creation

The creation of wildlife ponds is a well-documented practice that has become increasingly popular over the recent past (e.g., Biggs and Williams, 2024). The creation of larger scale settling ponds for sediment and nutrient removal from polluted water, such as those in wastewater treatment facilities, is also well recorded in the literature (Headley and Tanner, 2012; Kochi *et al.,* 2020; Troitsky *et al.,* 2019)

While settlement ponds and constructed wetlands for farmyard run-off do occur, these often require planning permissions and specific licences where they are being used specifically for effluent treatment purposes. Small scale ponds such as those covered by the Farming for Water European Innovation Partnership (Farming for Water EIP) and the Agric-Climate Rural Environment Scheme (ACRES) do not require planning permission, but are **not** suitable to capture silage effluent, slurry, dairy washings, and other materials required by Good Agricultural Practice (GAP) regulations to manage (Farming for Water European Innovation Partnership, 2024). Ponds over 0.2 ha (2,000 m^2) area are ineligible features under BISS (Basic Income Support for Sustainability Scheme) (Farming for Water European Innovation Partnership, 2024).

The creation of small-scale ponds for both farmyard biodiversity and nutrient and sediment accumulation is highly encouraged by many agricultural schemes, with ‘pond manuals’ often suggesting the creation of new ponds (e.g., Mackenzie and McIlwraith, 2013; Harty, 2024; O’Rourke and Loughran 2024), the provision of clear, objective data regarding pond size, depth, and water source is often more difficult to ascertain. While a site specific pre-installation survey should always be undertaken before works commence, having a broad outline of ‘best practice’ may aid in minimising confusion surrounding pond installation.

- The aims of the Biodiversity Strategy for 2030 (Biodiversity Strategy, 2030) require that better efforts are made to restore freshwater ecosystems to favourable conservation status for species and habitats protected by the EU Habitats Directive Habitats Directive, 1992, the EU Birds Directive (Birds Directive, 2009), and the Water Framework Directive (Water Framework Directive, 2000). In general, this strategy aims to ensure that the biodiversity in Europe will be on the path to recovery “for the benefit of people, the planet, the climate and our economy.” (European Commission, 2024).
- The EU Strategy on Adaptation to Climate Change encourages the use of Nature Based Solutions (NbS), i.e., solutions that use natural processes to manage and mitigate human issues, where possible (European Commission, 2021). Pond installation in farm systems counts as a NbS system, e.g., nutrient loads from farming activities being mitigated using plant and microbial uptake (European Commission, 2021).
- The installation of ponds introduces high diversity features on agricultural lands which may provide numerous ecosystem services such as climate and water regulation, water quality enhancement, flood mitigation, pollination services, nutrient cycling, carbon sequestration, habitat creation, and aesthetic value.

Site selection

If EU protected habitats (Natura 2000 sites) are within the proximity of the site, or are hydrologically connected downstream, extreme care must be taken before a pond location is chosen. Existing features such as other ponds, lakes, marshes, bogs, fens, sedge and rush flushes, wet woodland, or any other wetland habitat must not be interfered with. If works are to occur within or adjacent to an SAC or SPA, the NPWS must be contacted for permission. Working within an existing stream or river will also require consultation with Inland Fisheries Ireland (O'Rourke and Loughran, 2024).

Ponds ideally should be dug **near**, not on, permanently waterlogged areas, which may include small areas of wetland habitat. Locating a pond near these habitats, i.e., within 10-20 m, may allow the rapid colonisation of the new pond by wetland species that otherwise may be destroyed if the pond is dug over the wet area. If there are areas on site that regularly hold water in heavy rains, these should be preferred for pond locations, as runoff is already being collected in that area (Harty, 2024).

When ponds are constructed to improve water quality in nearby rivers, such as those covered by the Farming for Water EIP, they also should not be installed in floodplains of rivers (Farming for Water European Innovation Partnership, 2024). This is done in order to prevent possible flooding of the pond, and rapid remobilisation of trapped sediments into the river, potentially causing a reduction in water quality.

Construction

- Ponds over 1 m deep require planning permission (Local Government (Planning and Development) Act 1963).
- Ponds over 0.2 ha (2,000m^2) in area are considered ineligible features under BISS (Basic Income Support for Sustainability Scheme (Farming for Water European Innovation Partnership, 2024).

Pond construction can be undertaken at any point in the year, however, likely will be easiest during drier months when the ground is most firm, and machinery can be more easily manoeuvred. If a constructed pond is to be fed directly from a ditch/river, or is in a known direct rainwater flow path from a farmyard or field, a silt trapping area should be implemented within the pond at the inflow/suspected inflow point (Biggs *et al.,* 2024; Harty, 2024; Mackenzie and McIlwraith, 2013).

While it might seem adequate to dig a large pit to allow sediments and nutrients to settle, a more efficient method involves the inflow first flowing through a shallow area (Biggs and Williams, 2024), approx. 20-30 cm deep (with an added 30-40 cm of substrate if pond is lined) (Kochi *et al.,* 2020). This will allow the growth of emergent plant species, i.e. plants that have their roots in the water and rest of the plant above the water, e.g. bulrush (*Typha latifolia*). These plants can aid in nutrient removal from the water, and slow down the flow rate to allow for solids in the water to settle out, additionally stabilising sediments with the roots and rhizomes (Headley and Tanner, 2012; The Department of the Environment Heritage and Local Government, 2010).

Sediment rich in organic matter forms on the pond basin, which is oxygenated by the roots of the plants, promoting additional digestion of organic material by microorganisms. The plants also provide a physical structure for the microorganisms to attach to (Headley and Tanner, 2012). This silt trap should account for at least 20% of the overall pond area (Biggs and Williams, 2024; Biggs *et al.,* 2024; Mackenzie and McIlwraith, 2013).

If the water quality is known or assumed to be poor, maximising the shallow silt trap areas will allow a greater number of tolerant plant species to establish, which can aid in nutrient and sediment removal. Minimising the amount of nutrients that reach the main pond basin is the goal, as this will reduce the risk of toxic algal blooms to occur, which can severely impact pond life and water quality.

Deep water in a pond technically includes anything deeper than 30 cm (O'Rourke and Loughran, 2024). Deeper areas (30 cm to less than 1 m) within the pond are important for sediment settling and water collection (Mackenzie and McIlwraith, 2013). However, deep open water should be less than 20% of the pond area (O'Rourke and Loughran, 2024); open water is important only for very specialist species that require very clean water to survive. In general, pond animals require plant cover to feed, hide, and reproduce, and most pond plants can't thrive in deeper water. To combat this, including hummocks and ridges within the pond basin can provide suitable habitat for some fully submerged plants (e.g. pondweed, *Potamogeton* spp.), or plants with floating leaves (e.g. yellow water lily, *Nuphar lutea*) to colonise the deeper areas of the pond without having to compete with the emergent plants along the pond edges (Biggs and Williams, 2024; Biggs *et al.,* 2024; Mackenzie and McIlwraith, 2013; O'Rourke and Loughran, 2024). Deeper ponds also can present a safety hazard if unfenced. Shallower ponds should be preferred, where possible.

In general, the more variety of plant species that are present within a pond, the better the nutrient control a pond can provide. Maximising the distance between the inlet and the outlet of a pond will also allow for the sediment storage capacity of the pond basin to be increased (Harty, 2024; Mackenzie and McIlwraith, 2013)

While people often believe that the water level within a pond should be consistently stable, the changing water level is actually an essential part of a pond life cycle (O'Rourke and Loughran, 2024). The drawdown of a pond is the change from the higher winter water level and the reduced summer water level. Pond creation should pay special attention to the edge habitat and maximise the extent of the drawdown by gently sloping the banks in most areas (O'Rourke and Loughran, 2024). Banks should be at least on a 1:4 gradient, or, inclining 25 cm every 1 m in distance. Bank slopes for wildlife are generally encouraged to be on a 1:10 to a 1:20 gradient (Koren *et al.,* 2023; Million Ponds Project, 2021; O'Rourke and Loughran, 2024) which may not be practical in an agricultural context.

Including ridges and hollows within the drawdown, as seen in Figure 1, will maximise habitat diversity in this area for a wider variety of plants. Areas of steeper banks can also be present, as these will somewhat restrict the growth of emergent plants from surrounding the entire pond edges, but these should account for less than half the pond bank (Million Ponds Project, 2021; O'Rourke and Loughran, 2024).

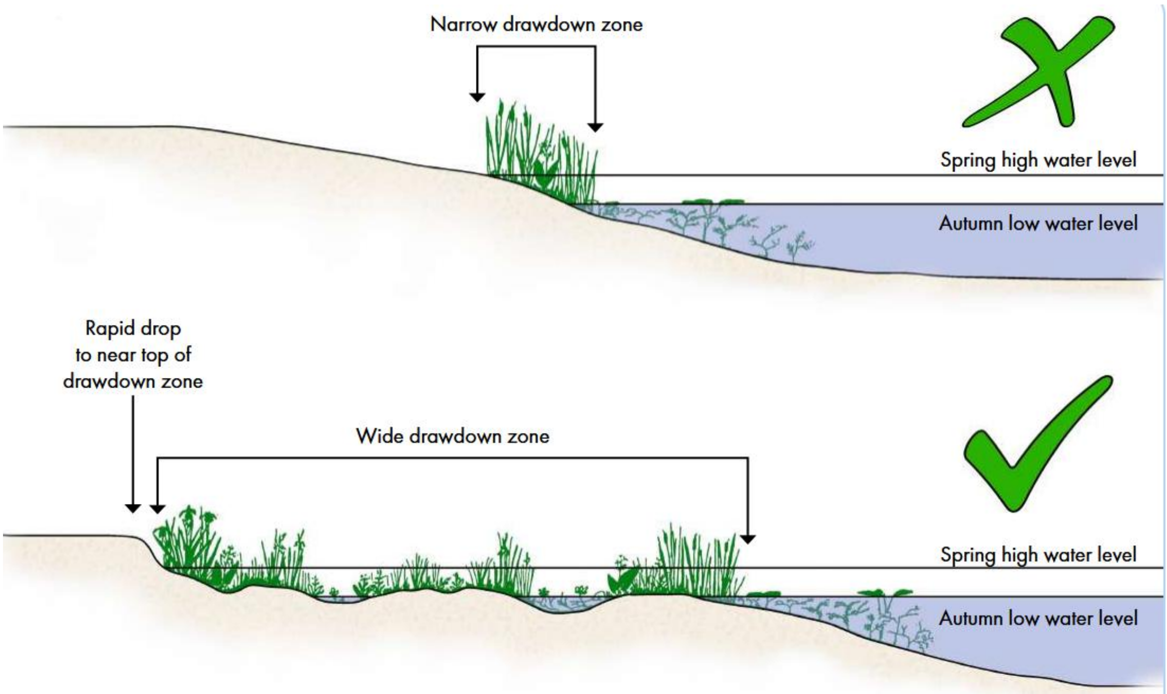

Figure 1. A wider drawdown area will allow for a wider range of plants to colonise the pond edges, providing increased biodiversity and nutrient uptake (O'Rourke and Loughran, 2024)

If water retention is a goal of the pond, consider asymmetric ponds (Figure 2), with very shallow water and gentle slopes on one end and a steeper bank beside deeper water areas to the far side of the pond (Million Ponds Project, 2021)

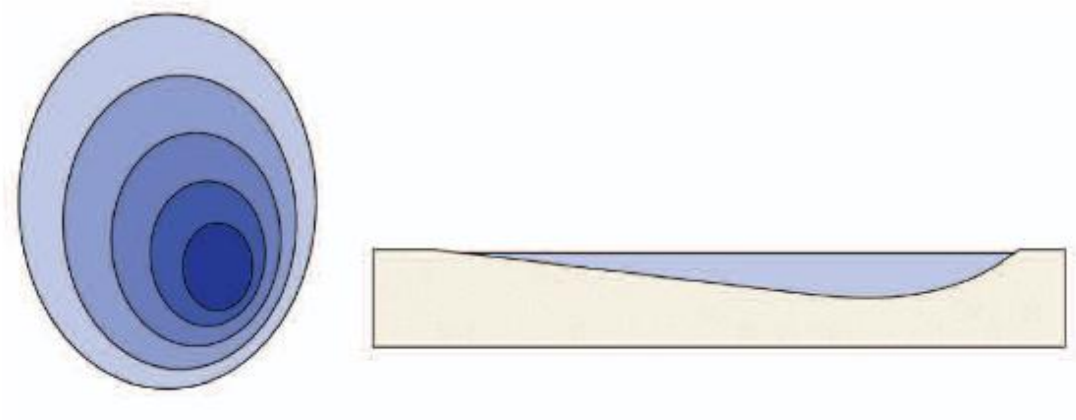

Figure 2. Asymmetric pond design for water retention, with deeper areas within one area of the pond, and a gentle gradient into shallow areas (Million Ponds Project, 2021)

The pond ideally should be a mosaic of shelf/step features (Figure 3), with many ridges and bumps providing a variety of underwater habitats at differing depths (O'Rourke and Loughran, 2024). Table 1 provides a summary of overall pond layout, with the majority of the pond basin consisting of mosaic habitat, with emphasis on shallower areas.

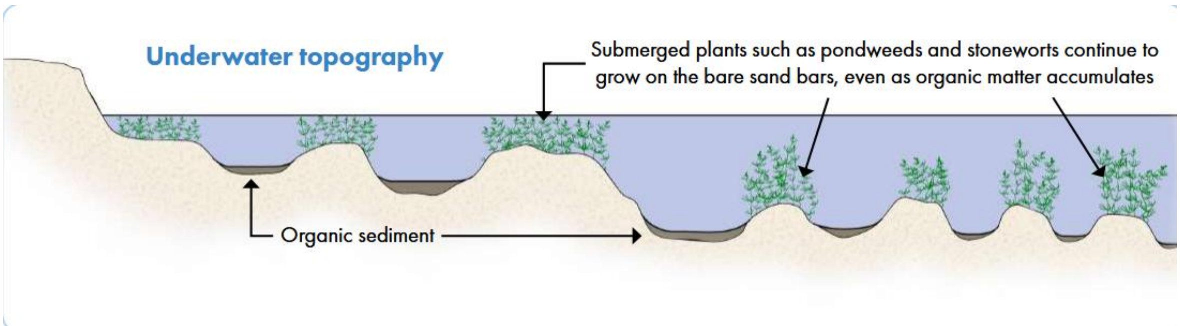

Figure 3. Underwater complex of ridges allowing submerged plants to grow, and sediments to settle in hollows (O'Rourke and Loughran, 2024).

Pond guidance often encourages a two-stage construction timeline, with partial installation occurring in one year, with approximate pond size and shape installed. This allows for flow paths to establish and be identified, and, where possible, for the water table changes to be observed over a summer/winter timescale. The rest of the digging then can occur over at least one more year (O'Rourke and Loughran 2024). While potentially not practical, there is no major concern if a pond system does need to be altered, e.g., installing a bigger silt trap, including more hummocks in the basin, widening or shaping the bankside, etc., after installation, as this may increase pond longevity, and increase biodiversity and water quality changes in the long run.

Table 1. Summary of areas within a pond, with ideal depths and overall extent and location within the pond basin (Adapted from O'Rourke and Loughran, 2024)

Pond area	Water depth	Pond area extent	Location in pond
Silt trap area	20-30cm	20% or more	At inlet
Mosaic of shelf/steps (max. shallows)	1-50cm	Approx. 60%	Throughout
Deeper open water	50-90cm	20% or less	Throughout

The inclusion of semi-permanent 'islands' within the pond basin that are submerged in winter and exposed in summer can also provide unique habitat for low-growing plants and resting spots for insects and amphibians, while also adding visual interest (Biggs *et al.,* 2024; Harty, 2024). Permanent islands are also very beneficial to wildlife, but may be inaccessible for management, and may become a future problem if woody shrubs or trees are present. These measures will allow for a wide diversity of plants to establish, providing the maximum nutrient removal from the water, and stabilising the sediments within the pond with the root systems (Biggs *et al.,* 2024; Million Ponds Project, 2021).

The overall pond shape should be relatively complex, with a wavy or scalloped 'natural' boundary as opposed to a more uniform, circular one (O'Rourke and Loughran, 2024). This will provide additional areas of different habitat for plants and insects, and will also provide areas of shade (from taller emergent plants) both over the water and along the banks at different points of the day and year (Biggs *et al.,* 2024; Million Ponds Project, 2021). This may be difficult to achieve without careful adherence to pond design.

Lining a pond may be considered when soil on site has high infiltration rates. Loamy mineral soils will typically require the addition of impermeable clay or man-made plastic liners that will provide the water retention required for a pond but will also increase costs of installation and may impact plant growth (Harty, 2024; O'Rourke and Loughran, 2024). Therefore, lining only the centre most areas of the pond basin, or lining an off-set area, can reduce costs, while allowing for the partial drying out of the pond seasonally, which can also benefit biodiversity (Harty, 2024). If the centre is to be lined, the edges of the liner still need to be raised from the ground, i.e., line partway up the pond banks rather than all the way up to the pond edges. Additionally, care must be taken that in ponds that are partially lined, the liner is unable to trap air bubbles underneath, which will cause to liner to float (Figure 4; Harty, 2024).

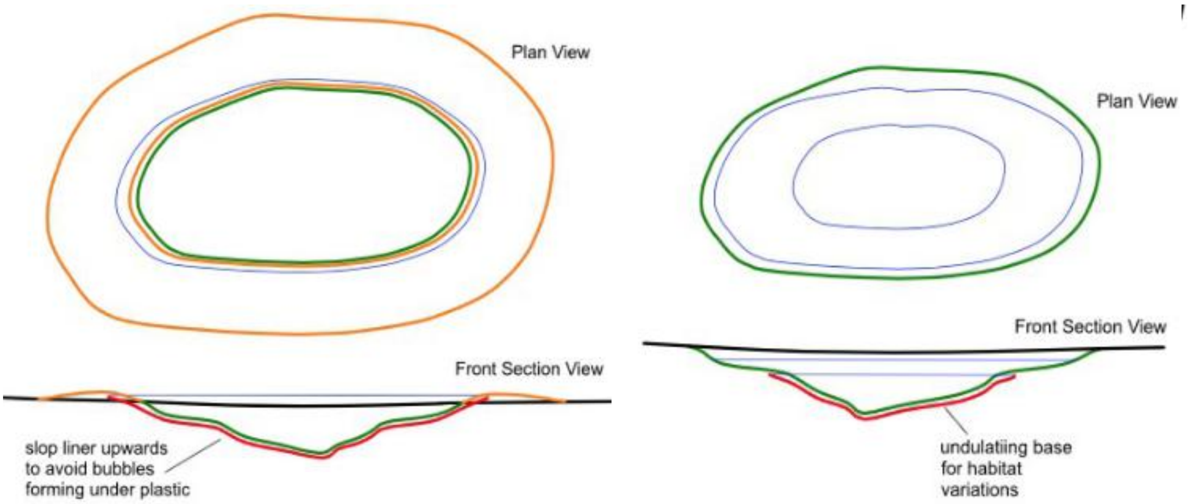

Figure 4. A fully lined pond (left, liner in orange) and a partially lined pond (right), with the liner sloping up the pond banks to prevent trapped bubbles lifting the liner (Harty, 2024)

"Treatment trains" are a highly efficient method of pond design used regularly for treatment of stormwater runoff and in wastewater treatment facilities (Figure 5). These pond systems involve a number of shallow ponds linked in series, where the outflow of one pond flows directly into another pond, and so on. The implementation of this type of pond requires careful planning (Jayasooriya *et al*., 2016), but provides many benefits, including longer time for the water to go through the entire system, allowing for more sediment to settle and nutrients to be mineralised. Additionally, the installation of multiple ponds provides the system some protection against total system failure if one pond were to become unsuitable or stop working (Jayasooriya *et al*., 2016). Typically, these ponds are linear, and arranged side by side, which allows for rapid colonisation by plants, and reduces overall land take when uses in large scale applications. The ponds are shallow, up to 30cm deep, which significantly reduces their water retention potential, and should be planted throughout with a range of species (Li *et al.,* 2021).

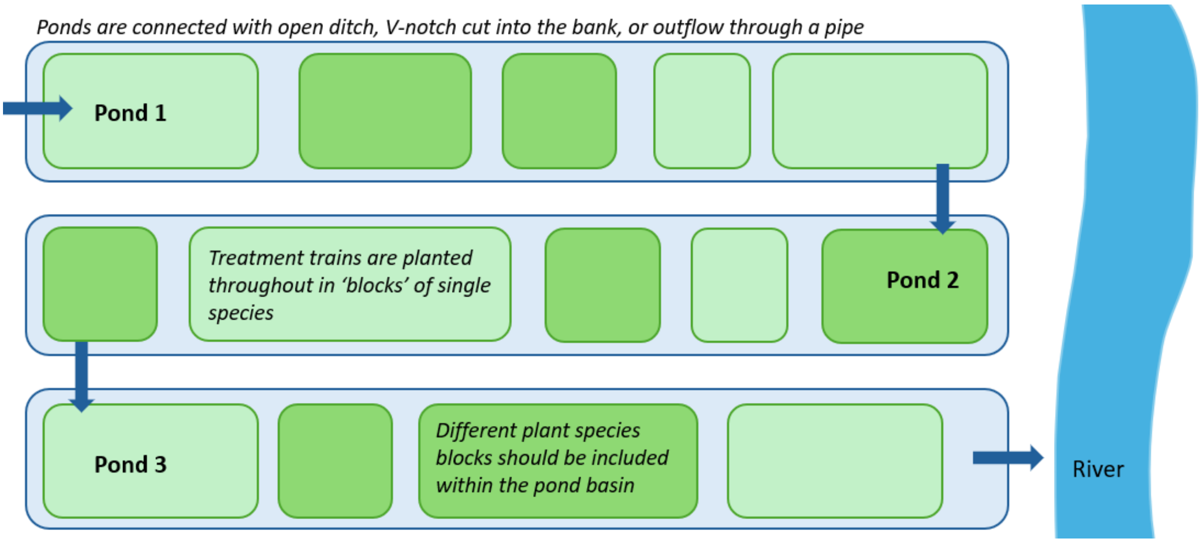

Figure 5. Treatment train style pond system, with three ponds linked in series, flowing one to the other before flowing into an adjacent river.

Planting

While there are arguments for and against planting a new pond, planting a silt trap area is essential for the nutrient and sediment removal processes to establish as soon as possible. It is recommended to plant in 'blocks' of a single species, with multiple blocks of different plant species within a silt trap area. This is additional protection for the system if one species fails to establish or colonise sufficiently in the first year, another may be able to grow successfully. In treatment train style pond, the entire system should be treated like a silt trap, and planting should occur throughout the entire system (Figure 6).

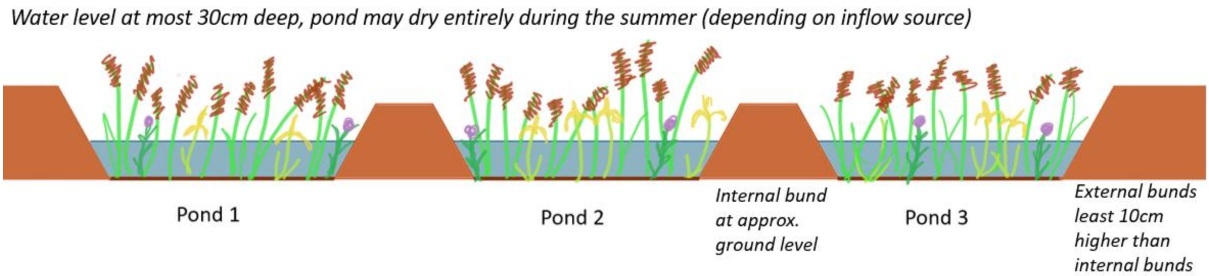

Figure 6. Cross section of treatment train style pond system, with internal and external bunds, and planting throughout the basins

In general, however, it is acceptable to not plant a new pond (Biggs et al, 2024; Harty, 2024; O'Rourke and Loughran, 2024), other than the silt trap, and to allow natural colonisation of local species to occur over time, especially if the pond is relatively close to another established waterbody such as a river or lake, or even to wet ditches and drains. Where planting does occur, plants should be locally sourced and **native.** There are numerous highly invasive aquatic species that are present in Ireland, the deliberate and known planting of which may be illegal, and, in many cases, that are available for sale by nursery suppliers.

Common reed (*Phragmites australis*) and bulrush (*Typha latifolia*) are very tolerant to a wide range in water quality, pH, and nutrient load (Harty, 2017; The Department of the Environment Heritage and Local Government, 2010). Common reed, which has an extensive root system and extremely vigorous growth, has been proved to be highly successful in controlling nutrients in silt trap areas, however, can rapidly out-compete other plant species and will likely spread out from the silt trap area (Harty, 2017; The Department of the Environment Heritage and Local Government, 2010). Due to this it is advised against using common reed in silt traps, and other plants, such as bulrush (Figure 7), should instead be utilised (The Department of the Environment Heritage and Local Government, 2010).

Planting yellow flag iris (*Iris pseudacorus*) (Figure 7) will also benefit nutrient removal while also providing a visually attractive flower during the late spring and early summer months. This plant will tolerate from permanently damp edges of the pond to being partially submerged and will grow among bulrush. Horsetails are similarly efficient in nutrient removal (Matovell *et al*, 2024) and are often already present along wet margins of field boundaries. Typically present in waterlogged areas is water horsetail: *Equisetum fluviatile*, but also greater horsetail: *E. telmateia,* and marsh horsetail: *E. palustre*. Avoid, where possible, removing these plants, as they may naturally colonise the margins of the pond basin and aid in nutrient removal. Water mint (*Mentha aquatica*) (Harty, 2017; Sangeetha *et al.,* 2023) should also be planted along the boundary or perimeter of the silt trap area and the rest of the pond to aid in nutrient removal while also being slightly out of the direct flow path of the more nutrient and sediment laden water (Kochi *et al*, 2020; Sangeetha *et al.,* 2023; The Department of the Environment Heritage and Local Government, 2010).

Figure 7. Bulrush (left) and Flag Iris (right) (www.wildflowersofireland.net)

Plants are essential in the nurient removal proccess provided by a pond. The plant itself will not only uptake nutrients such as nitrogen and phosphorus from the water for its own growth, but will also provide a physical strucutre for highly specalised microorganisms to colonise. The microorganismes are important in nutrient uptake and mineralisation, further benefiting water quality in the pond system (Headley and Tanner, 2012; Li *et al.,* 2021).

Table 2 provides a summary of plants that could be utilised in a pond system, and the location of where they would provide the most benefit to improving water quality. Plants in bold are known to be very effective in water treatment systems, and should be utilised in silt traps of ponds (Harty, 2017; Headley and Tanner, 2021; Mackenzie and McIlwraith, 2013; The Department of the Environment Heritage and Local Government, 2010). The remainder of the plants are beneficial within the pond, and will also provide water quality improvements, and add visual interest (Harty, 2017; The Department of the Environment Heritage and Local Government, 2010). While constructed wetlands often tend to focus on just water quality improvements, having a range of different plant species will also help enhance biodiversity in an area by providing a variety of food, nesting, and breeding materials for insects, mammals, birds, and amphibians, and can aid in establishing new habitat types in the area, potentially encouraging new species to colonies, further increasing overall biodiversity value of the pond over time (Mackenzie and McIlwraith, 2013).

Table 2. Na tive plants that can be utilised in a pond system for water quality improvements, and where they should be implemented within the system. Plants in bold are known to be very effective in water treatment systems (Adapted from DEHLG, 2010).

Common name	Scientific name	Location
Bulrush	***Typha latifolia***	**Silt trap**
Branched burr reed	*Sparganium erectum*	Silt trap
Yellow flag iris	***Iris pseudacorus***	**Edge of silt trap, margins**
Fool's cress	*Apium nodiflorum*	Edge of silt trap, margins
Watercress	*Nasturtium officinale*	Edge of silt trap, margins
Water mint	***Mentha aquatica***	**Edge of silt trap, margins**
Reed Sweet-grass	*Glyceria maxima*	Shallows, banks, margins
Marsh marigold	*Caltha palustris*	Shallows, banks, margins
Reed Canary-grass	*Phalaris arundinacea*	Banks, margins
Common Spike-rush	*Eleocharis palustris*	Banks, margins
Common Club-rush	*Schoenoplectus lacustris*	Shallows
Bottle Sedge	*Carex rostrata*	Shallows
Pondweed species	*Potamogeton* spp	Deeper sections
White water lily	*Nymphaea alba*	Deeper sections
Starwort	*Callitriche stagnalis*	Deeper sections

If the pond is unplanted other than the silt trap, there is a chance that the bulrush may spread out from the silt trap into the bare areas and dominate the edges of the pond (The Department of the Environment Heritage and Local Government, 2010). This is why including a range of water depths is highly important, as seen in Figure 3, as these plants will not be able to immediately spread into deeper areas, and other plants will be able to colonise the pond without competing with the bulrush.

Management

Pond management is a required element of pond construction. Without adequate management practices, the effectiveness of the pond as a water quality mitigation measure may be severely impacted due to infilling of the pond from sediments and from organic materials from the surrounding environment, such as leaf litter from adjacent trees. Additionally, the longevity may also be impacted, due to this infilling of the pond, eventually shifting the system from a pond into an area of wet ground (Biggs and Williams, 2024). Unfortunately, due to the diversity of pond systems, there is no one ‘one size fits all’ method for pond management (Biggs and Williams, 2024). Management must be balanced between the purpose of the pond, i.e., water quality improvements, sediment retention, nutrient mineralisation, and overall benefit to the pond system.

Similar to construction, there is no ideal time of year to undertake pond management. Water levels will typically be lowest in summer, and the ground firm, but insect and plant activity are high. Water levels are highest in winter when insect and plant activity is lower, but the ground may be very soft, and management difficult. Additionally, there may be hibernating frogs present in the mud and vegetation in and surrounding the pond in autumn and winter, and frogspawn present within the pond in spring. Management should be undertaken when it is easiest for the landowner, and that likely will be during the mid-summer when the ground surrounding the pond is most firm (Biggs et al, 2024; Mackenzie and McIlwraith, 2013; O’Rourke and Loughran, 2024).

Removal or thinning of floating and emergent aquatic vegetation in mid-autumn may reduce the build-up of nutrients in the pond at the end of the growing season, especially in nutrient ‘dense’ ponds associated with agriculture. By removing the plant before it dies, the nutrients that would have been released through decomposition are removed from the system. Floating plants can be removed with a net, algae by using a stick to twist and drag a clump out in one go, and emergent plants can simply be removed by hand. It is recommended that removed aquatic vegetation is left overnight on the bank of the pond to ensure any aquatic invertebrates are able to return back to the water (Biggs *et al.,* 2024; Koren *et al.,* 2023; Sayer and Greaves, 2020). Floating plants and algae should be removed when over 70% of the pond surface is covered, and no more than 30% of the cover should be removed in one year. Plants can then be composted at a location that won't contribute leachate or nutrient runoff back to the pond.

Historically, on wildlife ponds, having a very gentle grazing regime along a pond for a short period of time in the year may help uncommon, low growing plant species to flourish, increasing biodiversity (O’Rourke and Loughran, 2024). In this case, to avoid additional nutrient inputs to the pond by livestock, the partial removal of patches of taller plants such as bulrush in summer (i.e., when the ground is firm) in some select areas of the pond can also provide the ‘bare soil’ habitat that is required for low growing species. This ideally should be done by hand to minimise risk of stirring up the sediments in the water (Biggs et al, 2024, Koren *et al.,* 2023; Sayer and Greaves, 2020).

Dredging may be required if sediment loading is particularly high (O’Rourke and Loughran, 2024; Sayer and Greaves, 2020), particularly in silt trap areas. Dredging should occur on a 3-5 year cycle if required. If the whole pond is to be dredged, rather than dredging the pond in one go, dredge only 1/3 of the pond in one year, to avoid significantly impacting the pond system and increasing overall time to recovery (Biggs et al, 2024). Dredged pond sediments are typically high in nutrients, and can be used as fertiliser, outside the flow-path to the pond. During dredging, it may be necessary to redirect the flow of water into the pond, especially if the silt trap is being dredged. Because of this, it is recommended to undertake this management when waterflow is already low, i.e., during the summer period. It can also be beneficial to block the outflow of the pond with a bale of straw before dredging, in order to capture any released sediments before they reach the river. When the works are complete, the bale should be removed. Dredging can be undertaken with diggers, however, care must be taken that the pond is not inadvertently deepened during the dredge.

Overhanging vegetation from trees/hedgerow may also have to be removed on a 3-5 year cycle if over 70% of the pond has become consistently shaded. Having some areas shaded and some exposed to the sun is important in providing different habitat for plants with variation in shade tolerance, but overshading the pond entirely is not ideal. Cutting trees back will also prevent infilling of the pond by organic matter from leaves, and will aid in the longevity of the pond system (Biggs and Williams, 2024; Million Ponds Project, 2021; O’Rourke and Loughran, 2024). If branches do have to be cut, and shading is not severe, where possible remove only some of the overhanging branches to provide dappled light to the pond; and leave some long low branches that may be suitable for use as kingfisher perches. Avoid entirely removing large, mature native trees unless wind throw is likely to destabilise them. Always consider bird nesting season limitations when managing trees and hedgerows (O’Rourke and Loughran, 2024).

Providing deadwood, such as the cut branches or a large log into the pond can additionally provide biodiversity value and can be an additional support for microorganisms. It can also aid in slowing the flow of the water if the pond is connected to a ditch/river. Additionally, consider leaving some deadwood near the pond edges to prove additional habitat for frogs, birds and insects (Million Ponds Project, 2021; O’Rourke and Loughran, 2024). Tall standing deadwood can be created by ringbarking a mature tree that may otherwise suffer from wind-throw in a storm event.

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