

**MINIMUM SPECIFICATION FOR INTEGRATED CONSTRUCTED WETLANDS,  
AND ANCILLARY WORKS**

This is a minimum specification. Where the word “SHALL” is used, then that standard (at least) **must** be followed in all Integrated Constructed Wetlands (ICW) whether covered by grant-aid schemes (REPS, etc), or not. Where a procedure is “RECOMMENDED”, this is advice only on good practice.

Note that all references to other Department Specifications are to the current edition of that specification [available on the Department of Agriculture, Fisheries and Food Website ([www.agriculture.gov.ie](http://www.agriculture.gov.ie)) under Farm buildings]. Similarly, references to Standards are to the current edition of the Irish, British or European Standard, as appropriate.

This specification shall be read in conjunction with the guidance document referred to in clause A.1.

## **A. Introduction**

Constructed wetlands are a recognized form of wastewater treatment that have been used to treat varying types of polluted water including those of industrial, domestic, and agricultural origin (Kadlec & Knight 1996). Constructed wetlands consist of 3 basic forms:

- Horizontal surface flow (or free water surface) wetland
- Horizontal sub-surface flow wetland
- Vertical flow wetland

Integrated Constructed Wetlands (ICW) are a form of horizontal surface flow wetlands providing a joined-up approach to environmental and conservation management.

ICWs are distinguished from most other constructed wetland approaches, as they are designed to facilitate the widest possible range of structures and processes found in natural wetland systems, including those of soil, water, animal, and plant ecology.

**All Integrated Constructed Wetlands require planning permission and discharge licence.**

**Only Farmyard soiled water, as defined in the Nitrates Regulations, shall be allowed into an ICW.** Prior to the construction of an ICW full storage capacity (as required under the Nitrates Regulations) shall be provided for all slurry and effluents produced, and required to be stored, on the farmyard.

**All on farm ICWs shall be constructed in strict compliance with this specification as required under SI 610 of 2010 (nitrates regulations).**

Because an ICW depends entirely on subsoil to minimise leaks, such a store shall only be built after a “Site Assessment Report” has been completed by a Local Authority approved site assessment expert. A planning application is then prepared and, together with the completed and signed site assessment report, is sent to the Local Authority for application for full planning permission. After planning permission has been obtained, a discharge licence is

then applied for prior to the commencement of construction. Application for the discharge licence is made to the Local Authority, and construction should not commence until after the licence has been obtained.

ICWs require careful expert construction by a competent contractor, whose complete work shall be overseen by the Construction Supervisor (Clause A.7.2). If the work is to Specification, they will then sign a "Certificate of Compliance". All works shall be completed in compliance with the planning permission.

Some locations will be unsuitable for ICWs, by virtue of the presence of close underlying rock; the presence of unsuitable subsoils such as sand or gravel; high water tables; or other adverse conditions. Trying to remedy these faults may prove to be expensive or impractical. A conventional Dirty water handling system may be a better and more economic choice. However, the suitability of a site will ultimately be determined by the on-site tests and investigations.

### ***A.1 Guidance Document: "The Design, Siting, and Safe Operation of Integrated Constructed Wetlands"***

A Guidance Document has been prepared which gives further and more detailed information on the design, site assessment, and safe operation of ICWs. It is extremely important that this Guidance Document is read by Local Authority Planners, Site Assessors, Construction Supervisors, Agricultural Consultants, and Farm Advisors.

This guidance document has been prepared by the Department of the Environment, Heritage and Local Government and is titled: Integrated Constructed Wetlands: Guidance Document for Farmyard Soiled Water and Domestic Wastewater Applications.

The Guidance Document is available on the website of the Department of the Environment, Heritage and Local Government ([www.environ.ie](http://www.environ.ie)) under: Publications/Environment/Water/Integrated Constructed Wetlands.

Where there are any differences between the documents, the more onerous requirement shall be followed.

## **A.2 Safety.**

### **A.2.1 Responsibility for Safety**

Farmers are reminded that they have a duty under the Safety, Health, and Welfare at Work Act 2005 to provide a safe working environment on the farm, including farm buildings, for all people who may work on or enter that farm. There is a further duty to ensure that any contractor, or person hired to do building work, provides and/or works in a safe environment during construction.

### **A.2.2 Safety during Construction**

**Farmer Responsibility:** Please note that neither the Minister nor any official of the Department shall be in any way liable for any damage, loss or injury to persons, animals or property in the event of any occurrence related to the development and the farmer shall fully indemnify the Minister or any official of the Minister in relation to any such damage, loss or injury howsoever occurring during the development works.

**Dangers:** Where the farmer is undertaking any part of the above work, it is his/her responsibility to seek competent advice and to undertake all temporary work required to ensure the stability of excavations and to avoid any other foreseeable risk. It is also his/her responsibility to ensure that any drains, springs or surface water are diverted away from the works.

**Power lines:** An ICW shall not be constructed within 10m of an overhead power supply. If advice is required, or if power lines need to be diverted, it is the applicant's responsibility to contact, in writing, ESB Networks before construction commences and then to follow the conditions set out by ESB Networks.

**Danger to children:** It is the farmers responsibility to prevent children from playing or spending time in the vicinity of any construction work.

### **A.2.3 Safety Notices**

Where deep ponds are included in the system warning signs shall be erected at the entrance to the ICW, stating "**DEEP WATER: DANGER OF DROWNING**".

It is also recommended that a waterproof list of emergency contact personnel and service phone numbers be fixed securely to the ICW fence. Details of emergency rescue and resuscitation procedures should also be displayed.

### **A.3 Sizing.**

All ICWs shall be sized as specified in the Guidance Document for Integrated Constructed Wetlands (see clause A.1). This requires that the pond area (excluding banks) of the wetland shall be at least twice the size of the intercept area.

### **A.4 Minimum Design Requirements**

All ICWs shall be underlain by at least 1.0m of moderate or low permeability subsoil, with the upper 0.5m having a permeability of less than  $1 \times 10^{-8} \text{ ms}^{-1}$ .

Where a regionally important aquifer is present the total thickness shall be at least 1.0m, with the upper 0.75m having a permeability of less than  $1 \times 10^{-8} \text{ ms}^{-1}$ .

Where high permeability sand and gravel or fractured bedrock is encountered and is in hydraulic continuity with the water table the ICW can only be constructed if 1.0m of low permeability material can be provided over the sand and gravel or fractured bedrock, with the upper 0.5m (0.75m over regionally important aquifers) enhanced if necessary to achieve a permeability of  $1 \times 10^{-8} \text{ ms}^{-1}$ .

Where there is a risk of catastrophic hydraulic leakage, for example in some areas of karst geology or areas liable to collapse or subsidence (mined areas), an increased depth of subsoil to 1.5 m is required or alternatively, declining the site as being inappropriate for an ICW.

The required permeability in the upper 0.5m or 0.75m, will be achieved by the construction of a compacted liner as described in Clause C.6.

In cases where the site assessment indicates that the insitu subsoil has a clay content greater than or equal to 13%, is impervious, free from preferential flow paths and that the required depth of subsoil (1.0m minimum) is present, then the excavated portion of the ICW will require one layer of compacted subsoil (4 passes) and plastering with remoulded subsoil.

In cases where suitable depths or types of subsoil are not present a geo-membrane liner may be used to line the ponds. All geomembrane-lined ICW ponds shall be underlain by at least 150 mm of subsoil, the upper 50 mm of which may be a protective fine sand layer depending on the requirements of the lining contractor. The geomembrane shall be overlain by subsoil with a minimum thickness of 200 mm of low to moderate permeability and plastered with remoulded subsoil.

ICWs shall only take farmyard soiled water, as defined in the Nitrates Regulations. Prior to the construction of an ICW full storage capacity (as required under the Nitrates Regulations) shall be provided for all slurry and effluents produced and required to be stored on the farmyard.

Where an ICW is proposed to be constructed on a site that is liable to flooding, embankments shall be constructed around the ICW to such a height that when the area is flooded, the floodwaters cannot cover the ICW or enter the ICW itself. Under no circumstances may an ICW be allowed to waterlog.

All ICWs shall be designed, set out and constructed such that they have the smallest possible impact on the landscape.

The area, number of ponds, pond aspects, relative size of ponds, depth of ponds, and plant selection shall at least meet the requirements set out in table 1.

<b>Key Design Criteria</b>	<b>Guidance</b>	<b>Comment</b>
ICW area relative to intercepted area	2:1 minimum ratio	Effective wetland cell area does not include bank area
Number of wetland cells	Minimum of 4 cells required	There may be additional cells, such as monitoring ponds.
Length/width ratio for cells (aspect)	2:1 or less optimal recommended, 4:1 maximum. Otherwise additional area needed	Long narrow channels should be avoided, as this increases velocity and can lead to lower phosphorus retention and to scouring/flushing during high flows.
Relative size of individual cells	Cells should be of similar size with the first cell ideally 20% to 25% of overall ICW area to facilitate P capture.	All cells should be of relatively similar size to allow water to flow at as slow a velocity as possible to facilitate P capture and retention
Depth	100 to 300 mm.	Shallow water levels are necessary to facilitate emergent plant growth and nitrification/denitrification processes and for safety.
Plant Selection	Variety of species, and planting density	Role of plants is multifunctional.

**Table 1: Summary of ICW Design Recommendations**

### **A.5 Planning Permission**

In every case planning permission shall be obtained for an ICW. It shall be clearly stated in the application for permission to the Planning Authority, that the proposed structure is to be an Integrated Constructed Wetland. When applying for planning permission the site assessment report form, incorporating the trial hole report forms, shall be supplied to the Planning Authority along with all other required documentation.

## **A.6 Discharge Licence**

In every case a discharge licence shall be obtained for an ICW. There is no case where an ICW does not require a discharge licence. It shall be clearly stated in the application for permission to the Planning Authority, that the proposed structure is to be an Integrated Constructed Wetland. When applying for the discharge licence the site assessment report form, incorporating the trial hole report forms, shall be supplied to the Planning Authority along with all other required documentation.

The discharge licence shall be renewed on an annual basis, and all conditions of the licence complied with.

Note: the discharge licence will require regular monitoring of the discharge from the ICW.

## **A.7 Responsibilities for Project**

It is recommended that the farmer draw up a contract with either the Construction Supervisor and/or the Contractor (who may be one and the same) to assume overall responsibility for the management of the project.

### **A.7.1 Site Assessor**

The person undertaking the site assessment, shall have an appropriate training and shall be approved by the relevant Planning Authority.

### **A.7.2 Construction Supervisor**

The Construction Supervisor shall be an appropriate Chartered Construction Professional, or a person who has successfully completed a specialised training course that has been approved for this purpose by both the Department of Agriculture and Food and the Department of Environment, Heritage and Local Government. The Construction Supervisor shall be required to certify that the works have been designed and completed to the standards required in this specification and shall ensure that any additional conditions of planning permission and the discharge licence are complied with. A sample certificate is included in appendix A.

### **A.7.3 The Contractor**

The full construction of the ICW shall be carried out directly by the Contractor, including the construction of the banks, liner, influent/effluent points and planting. In all cases the construction shall at least meet all of the requirements of this specification.

## **B. Site Assessment**

### ***B.1 INTRODUCTION***

This section details the approach that shall be used to assess site suitability with the objective of collecting sufficient information to:

- Determine if an ICW can be developed on the site, without creating a negative impact on the environment.
- Provide adequate data to enable the optimal design to be achieved.

The approach is termed Site Assessment. Site assessment combines various assessments including desk study, visual assessment and site tests, to satisfy the objectives. The site assessment is the basis of the ICW design and the data collected shall be used to optimise the construction of the proposed ICW. A site assessment form has been developed, for the collation of data and shall act as a check list, and aid in the process of decision making. A copy of this form is included in section D and this form shall be fully completed as part of the site assessment process. Full details on how to complete the Site Assessment are given in the Department of Environment, Heritage and Local Government Guidance Document (DEHLG Guidance Document).

#### **B.1.1 Site Restrictions**

There are a number of restrictions which shall be satisfied before embarking on the construction of an ICW subject to Local Authority Planning Requirements. A proposed ICW shall not be considered for:

- Sites where the minimum design requirements (Clause A.4) cannot be achieved.
- Sites within 60m up-gradient of any well or spring used for potable water.
- Sites within the inner protection zone of a public groundwater supply source, where the vulnerability rating is classified as extreme.
- Sites within 300m up-gradient of a public supply (>10m<sup>3</sup>/day or >50 persons) borehole, where an inner protection zone has not been identified.
- Sites where construction of the ICW may negatively impact a site of natural heritage value without carrying out an appropriate assessment as required by the Habitats Regulations.
- Sites where construction of the ICW may negatively impact a site of cultural heritage value.
- Sites within 25m of a dwelling.
- Sites within the crown area of mature tree root systems
- Sites underlain by karst Limestone, where the possibility of collapse cannot be ruled out.
- Sites where adequate land area is not available
- Sites within 15m of a karst feature

- Sites in close proximity to a watercourse (no less than 10m from the initial and second ponds and no less than 5 m for subsequent ponds).
- Sites that cannot be adequately protected from flood damage.
- Where neither surface water discharge nor exfiltration is possible in situations where an adequate receiving water is not available.

### **B.1.2 Steps in the site assessment**

The following steps shall be undertaken:

- A. Collation of background information
- B. Visual Assessment
- C. Site Tests
- D. Decision process, and preparation of recommendations

The site assessment shall be completed with detailed reference to the Guidance Document.

## **B.2 Collation of Background Information**

A desk study involves the assessment of available data pertaining to the site and adjoining area that may determine whether the site has any restrictions to the development of an ICW. Detailed information on the requirements is given in the DEHLG Guidance Document.

### **B.2.1 Collation of Relevant Environmental Data**

The following information shall be collated and sections D1 and D2 of the site assessment form shall be completed in full.

#### **B.2.1.1 Topography**

The grid reference for the site shall be determined.

#### **B.2.1.2 Climate**

Basic data on annual rainfall shall be determined.

#### **B.2.1.3 Surface Water**

The location of the nearest surface waters, their distance from the proposed site and the designation (under National Regulations) of these waters shall be determined. Additionally, the receiving water flow shall be determined along with the expected outflow from the ICW.

#### **B.2.1.4 Groundwater**

The existing source of water on the farm shall be established, whether mains, private or a group scheme.

Available information on the subsoil type and underlying bedrock shall be determined.

The aquifer category shall be determined for the site. Where available the groundwater vulnerability rating, source protection zone, resource protection zone and groundwater protection zone shall be determined (these are available free of charge on the GSI website at [www.gsi.ie](http://www.gsi.ie)).

### ***B.2.1.5 Natural & Cultural Heritage***

Any protected or listed structures shall be identified and, it shall be determined if the proposed site is in a designated NHA, SPA, or a candidate SAC.

### ***B.2.1.6 Public Utilities***

The Planning Authority shall be consulted with regard to the location of public water supplies and water mains in the area. Locations of gas lines, electricity cables, and communications networks shall be established in consultation with the relevant utilities.

The status of these shall be assessed at this stage, and the need for further investigation highlighted if necessary.

### ***B.2.1.7 General Planning***

The county development plan shall be consulted to establish if there are any restrictions to developments of this sort. This will be available for consultation at the Planning Authority offices. The development plan may indicate set back distances that have been decided by the Local Authority.

### ***B.2.1.8 Discharge Licence***

The assimilative capacity of the receiving water body shall be determined and all other required information for either the surface water discharge licence or groundwater discharge licence shall be determined. (Clause 4.6 of DEHLG guidance document)

## **B.2.2 Interpreting the Background Information**

At this stage any potential difficulties and sensitive receptors that have been discovered shall be highlighted so that the developer of the site can determine if they want to progress with the site assessment.

## **B.3 VISUAL ASSESSMENT**

The visual assessment of the site is undertaken to verify the background information, evaluate the sensitivity of the identified receptors and finalise the selection of the preferred location.

### **B.3.1 Visual assessment**

Section D3 of the site assessment form shall be completed in full. Detailed information on the requirements is given in the DEHLG Guidance Document.

A general overview of topography, density of dwellings, surface water ponding, waterbodies, drainage, vegetation (including trees), rock outcrops and condition of the ground shall be made, and the relative distances of potential receptors (e.g. wells, karst features) from the ICW shall be established. A Topographical survey shall be commissioned to survey the farmyard and the proposed ICW area. The landscape position reflects the location of the site in the landscape, e.g crest of hill, valley, slope of hill. Ideally the site shall be down slope of the interception (farmyard) area to allow gravity flow. A 1metre minimum drop is required from the yard outlet to the base of the first proposed ICW segment, to allow for build up of sediment.



### ***B.3.1.1 Interpreting the results of the Visual Assessment***

The site restrictions that shall be referenced in the visual assessment are set out in clause B.1.1. If any of the restrictions exist then the ICW shall not be developed on the proposed site.

## **B.4 TRIAL HOLE**

To avoid any accidental damage, a trial hole assessment shall not be undertaken in areas, which are at or adjacent to significant sites (e.g. NHAs, SACs, SPAs, and/or Archaeological etc.), without prior advice from The Department of Environment, Heritage and Local Government or the relevant Local Authority.

### **B.4.1 General**

The purposes of the trial hole are to determine:

- The depth to the water table
- The depth to bedrock
- The soil and subsoil characteristics

Section D4 of the site assessment form shall be completed in full.

### **B.4.2 Excavating and recording the trial hole results**

The trial holes shall be dug to at least 2m below the proposed floor level of the ICW. The number of trial holes shall be as given in table B1. (Excavation shall take account of all Health and Safety requirements for deep excavations.)

**Table B1: Minimum number of trial holes for different sized ICWs.**

Size of ICW	Min. No. of Trial Holes
> 0.5Ha	3
> 0.5Ha to < 1.0Ha	4
1.0Ha to < 1.5Ha	5
1.5Ha to < 2.0Ha	6
> 2.0Ha	7

They should be spaced well apart to give a representative sample of the site's soil and subsoil conditions.

Groundwater conditions shall be described, and if necessary the holes should be left open for 48 hours (and securely protected), or fitted with a standpipe to enable groundwater levels to be established.

The thickness and nature of topsoil shall be recorded.

An accurate description of all subsoils encountered shall be provided. The subsoils shall be described in a professional manner in accordance with BS 5930 standard description method.

Representative samples shall be taken from this horizon for laboratory testing at an approved laboratory, and the following tests on the samples shall be undertaken to BS1377: Clay

content. The results of these tests shall be put into Section D5. At least one sample shall be taken from each trial hole.

### **B.4.3 Interpretation of Trial Hole Results**

The results of testing shall meet the following requirements (see table B2) and the actual values entered in Section D5.

**Table B2: Minimum subsoil requirements.**

Liner Type	Minimum Acceptable Criteria	Subsoil Thickness Required
Compacted Liner	10% Clay or greater	Min. 1.0 m required in all cases
Insitu liner	13% Clay or greater	Min. 1.0 m required in all cases

A particle size distribution test (PSDT) provides data that can indicate the likely permeability of subsoil. For the required permeability of  $1 \times 10^{-8}$  m/s, the clay content should be greater than 13% (where the particle size distribution is adjusted by excluding materials larger than 20mm). In circumstances where clay content is greater than 13% clay but there is evidence from the visual assessment and/or Trial Hole tests that the permeability of the subsoil is more than  $1 \times 10^{-8}$  m/s (for example, the area is free draining or the BS5930 description of the subsoil is SILT), it shall be assumed that the  $1 \times 10^{-8}$  m/s requirement is not met in these circumstances, and that enhancement at the construction stage shall be required to achieve this level.

Where clay content is less than 13% but more than 10% the sub-soil shall be enhanced to achieve a permeability of  $1 \times 10^{-8}$  m/s.

### **B.5 Conclusions and recommendations**

The Certificate of Site Assessment shall be completed in full. It is the site assessors responsibility to state if the site is suitable for the construction of an ICW. The site assessor shall also give details on depth to bedrock, thickness of liner required, type of liner (insitu or compacted liner) that is required, depth to suitable layer of subsoil for liner, thickness of suitable layer of subsoil for liner, depth to suitable layers of subsoil for embankment construction and any other special conditions for the site.

## **C. Construction**

Land forming of the ICW structure requires a level of sensitivity by the contractor to ensure that the final structure fits into the landscape. The ICW design layout will have indicated basic shape and configuration, however the contractor will in large measure be influential in interpreting the designer's plan, and the quality of what is finally achieved on site.

### **C.1 Working conditions**

All works shall be carried out in dry weather conditions. Subsoil for the liner shall not be left exposed and allowed to dry out unnecessarily. The subsoil moisture content shall be kept within the recommended plasticity range for optimum compaction of the subsoil liner.

### **C.2 Site Preparation**

On all sites, the topsoil within the ICW footprint shall be removed and used only as a final cover for the planting medium for the vegetation, the grassed top and outer bank surfaces. All topsoil and any other unsuitable layers (as indicated in the site assessment report) shall be removed completely from the surface leaving only suitable subsoil for ICW construction. All trees within 10m of the outer toe of the bank of the ICW shall be removed.

The use of topography in minimising cut and fill shall be reflected in the construction approach. This is emphasized in the design and the final fitting of the ICW into the landscape.

### **C.3 Removal of old drains**

All existing drains, percolation systems' pipe-work and associated backfill aggregate encountered during excavation shall be completely removed to, at least, 7 metres beyond the outside of the bank boundary and all exposed vacant channels shall be thoroughly filled and compacted with plastic subsoil.

**Note:** Old farmyards even in naturally dry soils may have generations of land-drain and percolation pipelines beneath the surface.

### **C.4 Lowering of water table**

The water table shall be lowered if it is deemed necessary in the site assessment report.

The water table shall be lowered to at least 500 mm below the lowest compacted subsoil floor layer. This shall be undertaken by the installation of deep cut-off drains 7 m outside the lowest part of the banks and extending at least 600 mm and preferably 750 mm below the lowest compacted subsoil floor level of the tank. At least 150mm land drainage pipes shall be used in this system. The land drainage pipe shall then be covered by at least 300 mm of clean stones (minimum 20mm diameter).

### **C.5 Bank Stability and Construction**

The banks shall be constructed so that they, at least, meet the minimum loading requirement set out in BS5502 part 50. The banks shall be excavated to a gradient that will maintain stability in the prevailing ground conditions and with regard to the soil type. The gradient of the bank shall not be less than 1 in 2. Corner and junction areas shall be sufficiently wide to allow for easy turning of vehicles.

The banks of the ICW shall be not less than 300mm high above ground level and be well-compacted. The banks shall be wide enough on top (min 3 m but preferably 4 m) to allow for a permanent stability factor of safety of the bank and for safe access. The excavated and/or made-up ground shall be finished uniform and smooth and free of any sharp protuberances.

The banks shall be constructed of suitable excavated material as assessed by the Construction Supervisor. The Construction Supervisor for each individual store shall determine the required gradient and degree of compaction for the banks. In sloping ground extreme care shall be taken to ensure bank stability and strength is achieved.

No loose stone, gravel, sand, topsoil, peat or debris of any sort shall be used to construct the inner banks or floor of the ICW. Only plastic subsoil shall be used.

### **C.6 Construction of Liner for ponds of 300mm deep and less**

Constructed liners shall have, on completion, a permeability of less than  $1 \times 10^{-8} \text{ m.s}^{-1}$  and shall be at least 0.50m thick, over at least 0.5m undisturbed subsoil. Where the proposed site is over a regionally important aquifer, the liner shall be constructed at least 0.75m thick over at least 0.25m undisturbed subsoil.

The liner on the banks and floor shall be constructed of suitable excavated dense plastic subsoil material only. The site assessment report gives details of the suitable layers of subsoil and only this material shall be used for the construction of the liner. If there is not enough suitable material present in tank area, additional suitable sub-soil material may be brought on to the site. However, this material shall first have been assessed, by the same person who completed the initial soil assessment, to be suitable for the construction of the liner. It is imperative that the liner subsoil in the floor of the tank, the inner bank surfaces and the core of the banks are thoroughly compacted.

The liner on the floor and banks shall be built in layers/lifts of 150 mm and each layer/lift compacted until the desired permeability has been achieved. The excavator shall make a minimum of 4 passes per lift (two each in cross directions) over the liner soil so as to compact the material. Each layer comprising the compacted subsoil liner shall be fully compacted prior to placement of the next layer.

Once the full depth of liner has been constructed the inside floor and bank slopes shall be smoothed off and compacted (plastered) with the track machine using a remoulded subsoil. This is particularly necessary when the pond is constructed in dry conditions.

Compaction shall be effected by means of a hydraulic excavator with a minimum weight of 20 tonne capable of exerting a ground pressure of at least 40 kPa ( $40 \text{ kN.m}^{-2}$ ) (e.g. a 20 tonne excavator with tumbler length 3.7 m and track width 0.6 m shall exert a ground pressure of 44.17 kPa). Alternative suitable compaction plant may be used if it can be demonstrated that, at least, equivalent compaction can be effected.

Insitu liners may be used in cases where the site assessment indicates that the insitu subsoil has a clay content greater than or equal to 13%, is impervious, free from preferential flow paths and that the required depth of subsoil is present, then the excavated portion of the tank requires the construction of one layer (4 passes with excavator, as above) of compacted subsoil and plastering with remoulded subsoil. In these cases, the topsoil shall be removed as per clause C2 and the banks shall be constructed as per clause C5. Additionally, at least, a 0.5m liner shall be constructed over the banks as described above.

Topsoil gathered at the site shall be redistributed in preparation for planting/seeding. The use of puddling where topsoil is mixed with water to make a self-leveling slurry is an alternative

method. The use of water, ideally available at this phase, will considerably facilitate final leveling and provide an optimal condition for planting/seeding of the emergent plant species to be established.

### **C.7 Construction of Liner for ponds greater than 300mm deep**

All ponds greater than 300mm deep shall be constructed to the standards set out in Department of Agriculture and Food Specifications S.126: Minimum specification for the construction of geomembrane lined slurry/effluent stores or S.131: Minimum specification for the construction of earth-lined slurry effluent stores.

### **C.8 Inlet and Outlet Points**

The inlet to the first pond shall be, at least 500mm above the water level. The inlet shall be by means of 150mm diameter plastic pipe. The pipe shall extend out from the surface of the bank for such a distance that the end of the pipe extends, at least, 300mm over the liquid in the pond. An 'elbow' section shall be fitted to the end of the pipe so that dirty water flow into the pond may be prevented if necessary.

The outlet from each pond shall be by a 150mm plastic pipe. The pipe shall extend at least 300mm into the pond. An 'elbow' section shall be fitted to the end of the pipe so that if necessary it will be possible to prevent liquid leaving the pond. The pipe shall be positioned so that the lowest point of the end of the pipe is no higher than 250mm above the bottom of the pond.

The inlet to the second and subsequent ponds shall be as for the first pond, except that the inlet shall be no more than 200mm above the liquid level in the pond.

When the inlets and outlets are being constructed, great care shall be taken to ensure that there is a complete seal formed around the pipes.

### **C.9 Establishment of Vegetation**

Various methods for establishing vegetation are effective. Success depends upon conditions and management of the wetland during the establishment period.

The use of bare-rooted planting stock usually requires a period of settling-in. They should ideally be planted in Spring or Summer, when the settling in period is approximately 2 weeks to 1 month. They are normally planted at 1-2 plants per m<sup>2</sup>, and with the wetland initially operating at minimum depth of approximately 100mm, can be used soon after construction.

Pot-grown plants are the quickest to establish, and allow for minimal time loss before operation. The physiological status of pot-grown plants is important and if immature seedlings or plants have too little vegetative emergence above water they may fail. Juvenile plants are more vulnerable to pollution. An integral mixture of plant species gives added robustness to the overall system.

Direct seeding of appropriate species will require minimal water depth and turbidity, allowing seedlings to germinate and develop to a physiologically mature state, in order to withstand the influents in each wetland segment. They also require that competition from residual vegetation/seed bank in the topsoil be minimised. Setting seeds during the Winter period ensures good germination in the following Spring/Summer. Seed sources should ideally be collected locally

### **C.10 External bank finish**

Outer surfaces and the top of the bank shall be covered with topsoil. Excess topsoil may be placed against the outer toe of the banks. The banks should be sown with native plant species. Trees shall not be planted within 10m of the toe of the banks. (See Department of Agriculture minimum Specification for Screening belts etc—S. 135).

### **C.11 Fencing**

Fences should be erected to the required standards to control the access of people and livestock, where necessary, and required under any Planning Conditions. The shallow depth of the ICW and the surround of any deeper water such as the monitoring pond, provides an inherent degree of built-in safety. Electric fencing has in the main been adequate but more closed or robust physical fencing may be necessary in certain situations especially near habitation. Where a deep balancing pond is constructed, it shall be surrounded by a 1.8m safety fence as described in Department of Agriculture and Food Specifications S.126 and S.131. Tractor access, where required, shall be through a gated opening in the surrounding fence, at least 1.8m high and normally 3.6m wide. Fencing to keep livestock out shall be constructed in accordance with Department of Agriculture, Fisheries and Food specification S.148 – Minimum Specification for Farm Fencing.

### **C.12 Maintenance**

The banks shall be maintained with a short grass mat to promote maximum tiller density and ground cover thus minimising soil erosion potential and maximising bank stability. Non-pasture species such as bushes, scrub or invasive weeds (e.g. nettles) shall be allowed to develop on the banks.

**Note:** ICWs need careful and constant management to ensure correct operation.

### **C.13 Certification**

The following Certificates shall be provided to the farmer for his retention.

1. Site Assessment report
2. Planning Permission
3. Certificate of completion of Integrated Constructed Wetland

## D. SITE ASSESSMENT FORM

To avoid any accidental damage, a trial hole assessment should not be undertaken in areas, which are at or adjacent to significant sites (e.g. NHAs, SACs, SPAs, and/or Archaeological etc.), without prior advice from The Department of Environment, Heritage and Local Government, or the relevant Local Authority.

### D.1 GENERAL DETAILS

<b>APPLICANT NAME:</b>					
<b>ADDRESS</b>					
<b>SITE LOCATION AND TOWNLAND:</b>					
<b>TELEPHONE NO:</b>		<b>FAX NO:</b>		<b>E-MAIL:</b>	
<b>Remarks following Preliminary Consultation</b>					
<i>Approx Area of Farmyard</i>					
_____					
<i>Estimated Preliminary ICW Area</i>					
_____					
<i>Other Remarks</i>					
_____					
_____					
_____					

## D.2 DESK STUDY

### D.2.1 TOPOGRAPHICAL DETAILS

<b>GRID REFERENCE</b>					
<b>MAPS</b>					
<b>1:50000</b>		<b>1:10,000</b>		<b>1:2500</b>	
Preliminary Assessment of Topography					

### D.2.2 CLIMATE

<b>Rainfall mm</b>	<b>Evaporation mm</b>	<b>Wind Direction</b>

### D.2.3 SURFACE WATER

<b>Surface Water Features</b>	<b>1</b>	<b>Comment</b>
<b>Name:</b>		
<b>Catchment Area (Ha)</b>		
<b>Mean Flow Estimate</b>		
<b>Available Dilution</b>		
<b>Water Quality "Q"</b>		
<b>Water Quality: Other</b>		



## D.2.4 GROUNDWATER

<b>Source of Water</b> (Tick as Appropriate)	<b>Mains</b>	<b>Private</b>	<b>Group</b>		
<b>Aquifer Category and Description</b>					
<b>Is there a Groundwater Protection Scheme ?</b>					
<b>Vulnerability Class</b> (Tick as Appropriate)	<b>Extreme</b>		<b>High</b>	<b>Moderate</b>	<b>Low</b>
	<b>Outcrop/ shallow rock</b>	<b>1 to 3m</b>			
<b>Subsoil Type and Thickness</b>					
<b>Groundwater Response</b> (Refer to Appendix A)					
<b>Incidence of Karst, describe</b> (Show location on Map)					
<b>Public Supply Boreholes</b> (Show location on Map, and indicate distance from proposed ICW site)					
<b>Domestic Boreholes</b> (Show locations on Map, and indicate distance from proposed ICW site)					

## D.2.5 CULTURAL SIGNIFICANCE

<b>Presence of Significant Sites</b> (archaeological, natural):	
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## D.2.6 DRAINAGE

<p><b>Land Drainage</b></p> <ul style="list-style-type: none"> <li>- Maps</li> </ul>	
<ul style="list-style-type: none"> <li>- Local Knowledge</li> </ul>	

## D.2.7 UTILITIES

UTILITIES	Knowledge	Safety	Needs Further investigation
<p><b>Power Lines</b></p> <ul style="list-style-type: none"> <li>- above ground</li> <li>- below ground</li> </ul>			
<b>Gas mains:</b>			
<b>Sewerage:</b>			
<b>Water Mains:</b>			

## D.2.8 OVERALL DESK STUDY ASSESSMENT

### Comments arising from Desk Study Assessment

*(Integrate the information above in order to comment on: the potential suitability of the site, potential targets at risk, and/or any potential site restrictions)*

### **D.3 VISUAL ASSESSMENT**

#### **D.3.1 ON-SITE HAZARD ASSESSMENT**

<b>Farm Type</b>	<b>Area of Farm Utilised (Ha)</b>	<b>Number of Animals</b>
<b>Dairy</b>		
<b>Dry Stock</b>		
<b>Suckler</b>		
<b>Sheep</b>		
<b>Pigs</b>		
<b>Poultry</b>		
<b>Tillage</b>		
<b>Totals</b>		
<b>Farmyard</b>	<b>Size m<sup>2</sup></b>	<b>Comment</b>
<b>Open Yards</b>		
<b>Housing</b>		
<b>Slurry pits</b>		
<b>Silage clamps</b>		
<b>Manure Pits</b>		
<b>Dungsteads</b>		
<b>Other buildings</b>		
<b>Other Sources of Effluent</b>		
<b>Wash Water</b>		
<b>Milking parlour</b>		

## D.3.2 VISUAL ASSESSMENT OF RECEPTORS

### D.3.2.1 Topography / Landscape Position

General Comments:

Ground Slope

Steep (>1:5 )

Shallow (1:5 -1:20)

Flat (<1:20)

Difference in Level between Farmyard and  
Proposed base of ICW 1<sup>st</sup> Pond

### D.3.2.2 Surface Water

General Description of  
Proposed Receiving Water

Channel Width

Channel Depth

Water Depth

Evidence of Greater  
Depth

Estimate of Flow

**D.3.2.3 Groundwater**

**Give Descriptions of the Following:**

<b>Rock Outcrops</b>	
<b>Springs</b>	
<b>Wells</b>	
<b>Soil Cuttings</b>	

**D.3.2.4 Utilities**

<b>Description of other utilities not identified in Desk Study</b>	
<b>Verification of Desk Study Findings</b>	

**D.3.2.5 Heritage**

<b>Description of Flora</b>	
<b>Description of Cultural Heritage</b>	

### **D.3.2.6 Human**

<b>Existing Land Use</b>	
<b>Distance in m. to Nearest House (where relevant)</b>	
<b>Distance in m. to Nearest School (where relevant)</b>	
<b>Distance in m. to Nearest Gathering place (e.g. Church, Community Centre - where relevant)</b>	
<b>Site Boundaries: (distance in m. to nearest)</b>	
<b>Road: (distance in m.)</b>	
<b>Evidence of Prevailing Climatic Conditions (<i>particularly wind</i>)</b>	

### **D.3.2.7 Drainage Systems**

<b>Drainage Systems:</b>	
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### **D.3.2.8 Interpreting Results of Visual Assessment**

*(Integrate the information above in order to comment on:*

- *The potential suitability of the site for an ICW,*
- *Potential targets at risk,*
- *The location of the proposed ICW system within the site).*

### D.3.3 TRIAL HOLE

The Trial Hole shall be excavated to a minimum depth of 2m below the base of the proposed wetland.

Trial Hole No.	Depth of Trial Hole (m):	Date and Time of Excavation:	Date and Time of Examination	
Depth from Ground Surface to Bedrock (m) <i>(if present)</i> :				
Depth from Ground Surface to Water Table (m) <i>(if present)</i> :				
Depth and Description of Topsoil				
	Soil/Subsoil Texture & Classification (Include Plasticity/Dilatancy Results)	Density/ Compac tness	Colour	Preferential Flowpaths
0.2m				
0.4m				
0.6m				
0.8m				
1.0m				
1.2m				
1.4m				
1.6m				
1.8m				
2.0m				
2.2m				
2.4m				
2.6m				
2.8m				
3.0m				
3.2m				
3.4m				
3.6m				
3.8m				
4.0m				

**Other Information** (*where relevant*):

**Depth of Water Ingress:**

**Rock Type** (*if present*):

**D.3.4 PARTICLE SIZE DISTRIBUTION TESTS (BS 1377)**

<u>PSAT Test Number</u>	<u>% Clay Content</u>	<u>% Fines Content</u>
1		
2		
3		
4		
5		
6		
7		

**EVALUATION of Trail Hole and PSAT Results:**

**(Include discussion here of significance of results)**



**Sketch of site showing**

- **measurement to Trial Hole and PSAT locations,**
- **wells and direction of groundwater flow (if known),**
- **adjacent houses, watercourses, significant sites and other relevant features.**
- **North point should always be included.**

**[A copy of the site layout drawing should be used if available]**

#### **D.4 CONCLUSION of SITE CHARACTERISATION**

(Integrate the information from the desk study and on-site assessment (i.e. visual assessment, trial hole and percolation tests) above and conclude whether it is feasible to construct the ICW)

<b>Is a Permeability of <math>10^{-8}</math> m/s achievable?</b>	
<b>How? What specific works are required?</b>	
<b>Is the assimilative capacity available for surface water discharge?</b>	
<b>Are there any specific features to avoid?</b>	
<b>Are there any specific features to include?</b>	
<b>How? What specific works are required?</b>	
<b>Other:</b>	

#### **D.5 Site Assessor Details**

**Signed:**

**Address:**

**Qualifications/Experience:**

**Date of Report:**

**Phone:**

**Fax:**

**Email:**

[Certificate to be typed on Site Assessor's headed paper]

## Certificate of completion of site assessment for Integrated Constructed Wetland

Name of Owner: \_\_\_\_\_

Address of Owner: \_\_\_\_\_

Address of site: \_\_\_\_\_

Is the site suitable to construct an ICW: YES NO

Depth to bedrock: \_\_\_\_\_ m

Thickness of liner required: \_\_\_\_\_ m

Depth to suitable layer \_\_\_\_\_ m

Thickness of suitable layer \_\_\_\_\_ m

Method of construction (insitu or compacted liner) \_\_\_\_\_

Special Conditions (if any) \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

Name of Site Assessor: \_\_\_\_\_

Address of Site Assessor: \_\_\_\_\_

\_\_\_\_\_

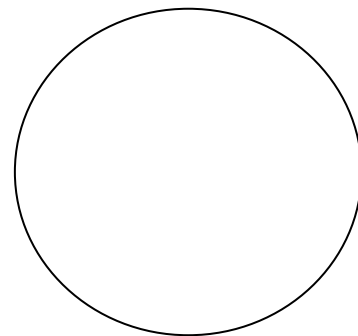
**Site Assessor's signature:** \_\_\_\_\_

Phone: \_\_\_\_\_

Fax: \_\_\_\_\_

Company Stamp:

Date: \_\_\_\_\_



[Certificate to be typed on Construction Supervisor's headed paper]

## Certificate of completion of Integrated Constructed Wetland

Name of Owner: \_\_\_\_\_

PPS No. of Owner: \_\_\_\_\_

Herd No. of Owner: \_\_\_\_\_

Address of Owner: \_\_\_\_\_

Address of site: \_\_\_\_\_

Name of contractor: \_\_\_\_\_

Address of contractor: \_\_\_\_\_

I certify that the subsoil-lined slurry/effluent store has been constructed in strict compliance with Department of Agriculture and Food Specification S. 132 and that all requirements of the site assessment report and all planning conditions have been fully adhered to. Furthermore, I certify that I oversaw the construction of the subsoil liner, and certify that the banks of the store are in compliance with BS5502 part 50 and that the ICW is of suitable construction to remain in a leak tight nature for a minimum of 20 years.

Planning Ref: \_\_\_\_\_

Name of Construction Supervisor: \_\_\_\_\_

Address of Construction Supervisor: \_\_\_\_\_

Professional Body Membership No. (if applicable): \_\_\_\_\_

### Construction Supervisor's signature:

\_\_\_\_\_

Phone: \_\_\_\_\_

Fax: \_\_\_\_\_

Company Stamp:

Date: \_\_\_\_\_

