APPENDIX 5-3

INTEGRATED CONSTRUCTED WETLAND REPORT

VESI Environmental Ltd.

Tymon Park

Tallaght, Dublin

Integrated Constructed Wetland

Part X Planning Report

August 2019

Comhairle Contae
Átha Cliath Theas
South Dublin County Council

NICHOLAS O'DWYER

Document Control: 19333_3_Planning Report			
Prepared	**Checked**	**Revision**	**Date**
JC	AC	A	02 August 2019
JC/AC	AC	B	23 August 2019

VESI Environmental Ltd copyright 2019
This report and its contents must not be reproduced for any purpose without written permission.
It is only for the purpose for which it is prepared.

Table of Contents

List of Figures

List of Tables

List of Drawings

19333_3_00 Cover Page
19333_3_01 Existing Site Layout
19333_3_02 Proposed Site Layout
19333_3_03 Indicative Cross Section

1.0 INTRODUCTION

1.1 Background

Nicholas O'Dwyer have retained VESI Environmental Ltd. (VESI) to complete a preliminary design strategy for an Integrated Constructed Wetland (ICW) as part of a proposed flood alleviation Scheme for the River Poddle. The ICW is proposed for Tymon Park, Tallaght, Dublin 24. VESI have prepared the necessary documentation required for the ICW which forms part of the planning application under Part X, Sections 175 and 177AE of the Planning and Development Act 2000 as amended for the flood alleviation scheme. The documentation includes this Planning Report and accompanying planning drawings listed below and appended hereto.

- Drg. 19333_3_00 COVER PAGE
- Drg. 19333_3_01 EXISTING SITE LAYOUT
- Drg. 19333_3_02 PROPOSED SITE LAYOUT
- Drg. 19333_3_03 CROSS SECTIONS

Tymon Park (the 'Park') is a public amenity park owned and maintained by South Dublin County Council. The Park has two lakes on site, which are fed and connected by the River Poddle. The river begins as Tymon River, which originates in Cookstown in Tallaght and flows east through Tymon North before ultimately discharging into the River Liffey via a network of downstream culverts.

The River Poddle flows through a heavily urbanised area and is considered "At Risk" by the Environmental Protection Agency's River Waterbodies Risk website (accessed 01-July-2019). Water quality monitoring data obtained from South Dublin County Council shows at times elevated nutrients levels over the period 2009-2018 (see Table 1 in S3.1).

This document has been prepared to support a proposed nature-based, in-stream water treatment system through an Integrated Constructed Wetland (ICW) for the River Poddle at Tymon Park. The aim of the project is to improve water quality downstream of the Park, enhance biodiversity, increase amenity value, and further attenuate flows.

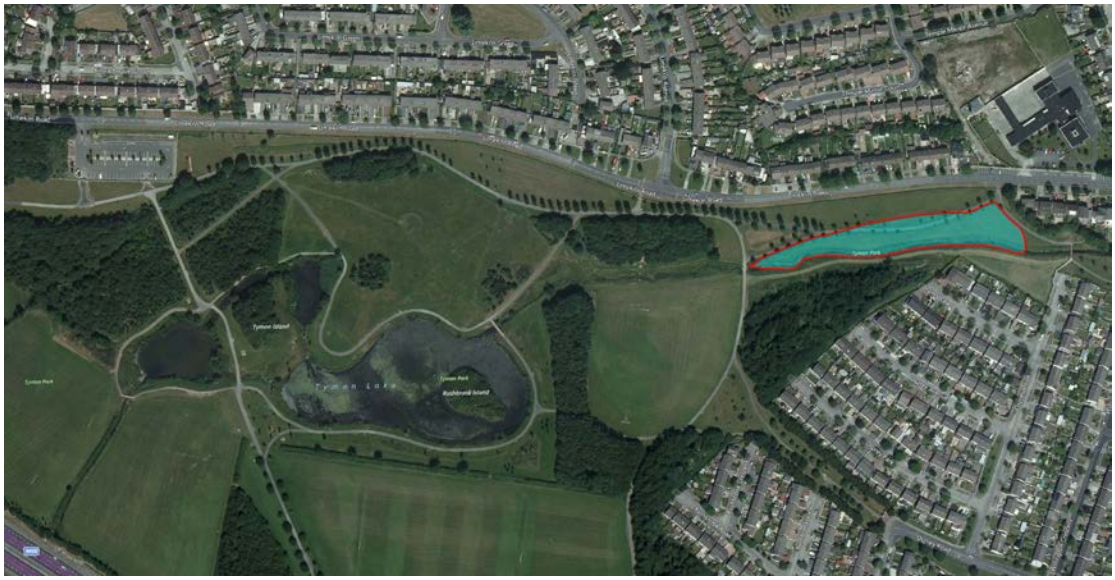

Figure 1: Proposed ICW location

South Dublin County Council, working in partnership with Dublin City Council and the Office of Public Works (OPW) are in the process of completing plans for flood attenuation works upstream in Tymon Park, and downstream along the river, as part of the River Poddle Flood Alleviation Scheme. Development of the proposed ICW is included as part of the overall project objectives.

1.2 Integrated Constructed Wetlands

ICWs are shallow, multi-celled, surface-flow, helophyte-vegetated wetlands that mimic the biological functions of naturally occurring wetlands dominated by reeds sedges and rushes. These vegetated wetland ecosystems are extremely effective at intercepting and treating nutrient/pollutant-contaminated water. Their helophytic (emergent) vegetation have species of high leaf-area indices and stem number densities. They have the capacity to treat a wide range of contaminants and impede through-flows. The treatment processes involved are together physical, chemical, and biological. Each ICW design is site-specific – bespoke to meet water treatment needs and site/landscape. ICWs differ from other constructed wetlands in that they are foremost, ecologically designed to facilitate the widest possible conditions typically found in the natural wetlands that they emulate. ICW designs strive to achieve an aesthetical landscape-fit and facilitate habitat reanimation and biodiversity. The larger area requirements of ICWs compared to other constructed wetlands, enhances hydraulic residence time which results in optimal treatment and mass pollutant removal. The larger area also results in better environmental outcomes, requires less maintenance, and avoids deep waters whilst coping with extreme weather events.

The ICW concept strives to optimise the complexes of biological, chemical and physical processes associated with water management in such ways that are compatible with local infrastructure and its existing ecosystem. ICWs and the underlying principles supporting them are based upon mimicking the multitude of treatment processes that occur in natural helophyte-dominant wetlands. The ICW concept effectively integrates the following four objectives:

1. The containment and treatment of influents within emergent vegetated areas using wherever possible local soil-material.
2. Slow release of flows and provision of temporary water storage during high rainfall events.
3. The aesthetic placement of the containing wetland structure into the local landscape towards enhancing a site's amenity values.
4. Enhanced habitat diversity and nature management.

The emphasis on explicit integration facilitates processing synergies, robustness, and sustainability that are not generally available in other constructed wetland designs. The benefits of ICWs are primarily due to larger scaling patterns and their greater biological complexity. ICW systems have been successfully applied to a range of effluent types in different situations, following a process of assessment, design and construction. Existing similar projects include:

- Annestown stream - Integrated constructed wetlands and stream reprofiling
- Kilbogget Park - Johnstown instream reprofiling and wetland area
- Tolka Valley Park – Integrated constructed wetland for instream water quality management
- Dunhill ICW – Village wastewater and storm/road runoff management

The ICW design approach has the following critical criteria:

- Site assessment and site-specific design;
- Containment and cleansing of contaminated water on site, thus removing consequential environmental costs;
- A fully integrated infrastructure for containment and cleansing;
- The appropriate building materials used in the construction are, ideally, found locally or on site;
- Robust system able to withstand extreme load variations, should they occur;
- Sustainable design and construction to ensure long life (50-100 years);
- Minimal management and capacity for self-regulation;
- The site is not irrevocably lost and is ideally enhanced;

- Appropriate plant species and distribution are used;
- Opportunities are provided for habitat development and biological diversification;
- Legislative context - Water Framework Directive, Nitrates Directive, Convention on Biodiversity; and
- An ecological approach rather than solely environmental engineering approach is taken.

2.0 SITE SUITABILITY AND SITE ASSESSMENT

Effluent quality and quantity of water, location, landscape, geology, hydrology, soils, and economics are all essential considerations necessary in the design of ICWs. These factors determine whether and how the ICW concept can be applied. Influent composition, hydraulic retention time, and site characteristics are fundamental in calculating the area and form of the ICW.

A section of the River Poddle to the east of Tymon Lake within Tymon Park has been determined as the location for the construction and operation of an ICW. It is proposed that the ICW be located within and adjacent to the existing river channel. The ICW will comprise a treatment cell through which all flows in the river will pass without augmenting the existing flow route.

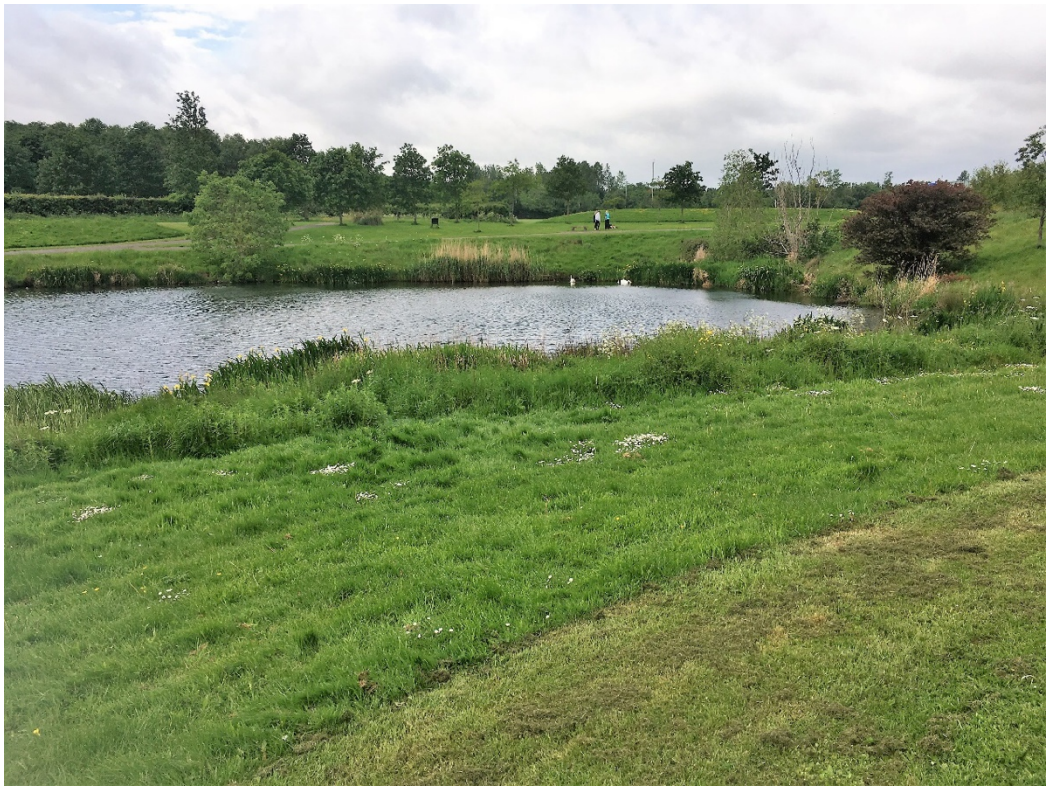

Figure 2: Tymon Park

2.1 Desk Study

In addition to an examination of published data on the site, the River Poddle Flood Risk Alleviation Scheme, Environmental Impact Assessment Report – working draft (Nicholas O' Dwyer, May 2019) was also reviewed.

2.1.1 Hydrogeological setting

The Geological Survey Ireland's Spatial Resources website indicates that the aquifer beneath the proposed ICW site is classified as *Locally Important Aquifer – Bedrock which is Moderately Productive only in Local Zones*. The groundwater vulnerability for the site is classified *Low*.

2.1.2 Groundwater

The groundwater response for the proposed site is classified by the Department of Environment, Heritage and Local Government (Integrated Constructed Wetlands: Guidance Document for Farmyard Soiled Water & Domestic Wastewater Applications) as being **R1.** There are no groundwater wells on site. The Groundwater Quality Status 2010-2015 is good for the groundwater table in the area and it is classified as being "not at risk" of deteriorating quality in the future by the Ground Waterbodies Risk classification.

2.1.3 Geology and subsoils

The soils and subsoils in the proposed area is described as *till derived chiefly from limestone*. There is no evidence of rock outcrops or of karst features within the site. Bed is recorded as *Palaeozoic, Carboniferous, and Mississippian*.

2.1.4 Natural and Cultural Heritage

The proposed location is not on any recorded protected sites, i.e. Natural Heritage Area, Special Protection Area, or Proposed Natural Heritage Area. The nearest record is *Proposed Natural Heritage Area: Dodder Valley* located 1.7km south of the site.

2.1.5 Proximity of human activities and housing

The existing site forms part of Tymon Park, which is open to the public for recreational use. The nearest domicile is approximately 20m at the nearest point to the Cell 2 (see drawing 19333_3_01 for location).

2.1.6 Utilities

ESB Networks and Gas Networks Ireland were contacted for services in the area. Returned information has been reproduced on drawing 19333_3_01. The proposed ICW site is not impacted by existing gas services, however a gas line crosses the river upstream between the ICW and Tymon lake. A buried low voltage/medium voltage power located to the east of the site crosses in a northeast-to-southwest direction. Further investigation will be required for delineating the buried power line. It is not expected that the buried powerline will be impacted during the ICW development as the final design levels remain at the current riverbed levels. However, appropriate agreements/notifications are to be arranged with ESB Networks prior to construction works.

2.2 Comments from the desk study

The information gathered during the desk study and previous site visits indicate that the site is suitable for an ICW subject to a detailed site investigation. This has been determined from:

- the availability of land area;
- the availability of suitable soil for the construction and operation of an ICW; and
- the topography of the land which allows for gravity flow through the ICW.

Appropriate mitigation measures are to be employed during construction to reduce negative environmental impacts to the river. The planned site investigations will inform on subsurface conditions, utilities on site, and site access provisions prior to detailed design stage.

3.0 INTEGRATED CONSTRUCTED WETLAND DESIGN

ICWs can and have been demonstrated to achieve very high treatment efficiency for a range of water borne pollutant types and concentrations, including those reported in the River Poddle. The design of the ICW is in accordance with the Department of Environment, Community and Local Government Guidelines on Integrated Constructed Wetlands, 2010.

3.1 ICW Design

3.1.1 ICW sizing requirements

The main factors taken into consideration when sizing an ICW include:

- Hydraulic loading;
- Concentration of contaminants (see Table 1);
- Average annual rainfall;
- Topography;
- Ground conditions; and
- Receiving water capacity.

The design of the ICW is based on a flow rate of 15 litres per second and water quality monitoring data received from South Dublin County Council (see Table 1 below). The existing land use as a public park has also been considered in the design process.

Table 1: Average water quality for River Poddle (2009-2018)*

Parameter	Measure ($\bar{x}$)
Ammonia	0.04mg/L(±0.0393)
BOD_5	0.735mg/L(±0.473)
Nitrate	1.0243mg/L(±0.7441)
Phosphorus	0.0506mg/L(±0.0330)
Suspended Solids	4.114mg/L(±3.0742)

*Data received from South Dublin County Council. Where values reported as below limits of detection, half the value was used for calculation purposes.

Table 2 below provides the Surface Water Regulation values for "Good" water status (S.I. 272/2009) for comparative purposes.

Table 2: Surface water regulations (Good water quality, S.I 272/2019)

Parameter	Measure
Ammonia	≤0.065mg/L
BOD_5	≤1.5mg/L
Nitrate	≤0.0375mg/L
Phosphorus	≤0.04mg/L

Common pollutants entering the River Poddle include anthropogenic sources, such as misconnections from nearby residences and leaks. Additionally, surface runoff from surrounding lands can also have an impact on surface water quality.

The ICW concept is tailored towards the treatment of a wide range of common parameters, particularly that of nutrients (Ammonia-N, Phosphorus, Nitrate, etc) as well as additional parameters such as Suspended Solids, Biochemical Oxygen Demand and a variety of metals. The removal mechanisms for these are primarily absorption, adsorption, precipitation, sedimentation and sequestration.

3.1.2 ICW location and area requirement

The proposed ICW location is approximately 240m east of Tymon Lake along the River Poddle channel. This location provides the required area and suitable ground conditions for ICW development and operation.

The area of land will be optimised for the treatment of river water while remaining sympathetic to park use. An area of 2,500m^2 was allocated in the Park for the ICW development, however, a functional treatment area of 2,600m^2 has been achieved on site to provide the required treatment area based on river flow data (15 litres per second). This functional treatment area also provides additional robustness capable of delivering increased treatment performance during periods of lower flows. The flow to the ICW, through the treatment area, and final outflow will be achieved by gravity, thereby eliminating any maintenance costs associated with pumping or flow control measures.

3.1.3 ICW performance

The wetland emergent plant species selected for this project have a high pollutant tolerance and a natural capacity for cleansing water. It is expected that given the current receiving water quality and flows the proposed ICW will reduce pollutant concentrations to align more with Surface Water Regulations 'Good status' (Ammonia $\bar{x} \leq 0.065$mg/l, BOD $\bar{x} \leq 1.5$mg/l, and Molybdate Reactive Phosphorus $\bar{x} \leq 0.035$mg/l). This is based on previous ICW project performances.

Waters flowing through the ICW undergo a tortuous journey through dense vegetation resulting in extended residence times compared to that of open water ponds and lakes. As the water progresses through the ICW it is exposed to biological, chemical, and physical processes that reduce the concentrations of pollutants within. These pollutants remain within the wetland area where many are broken down to become a source of nutrients to the resident biological communities. Other dissolved contaminants such as heavy metals which are not utilised become embedded in the underlying sediment by adsorption processes and thereby do not enter river water.

Water leaving the ICW area will be of a higher quality characterised by a lower pollutant profile and increased oxygen levels.

It is noted that a stormwater pipe will discharge to the ICW approximately three-quarters through the cell (proximal to the buried powerline – see 19333_3_02 for location). Influent from this stormwater pipe has the potential to add flow and pollutant load at a location that may limit the area of treatment to which this additional volume is exposed. Depending on loading rates from this stormwater pipe, final discharge water quality measurements from the ICW may be influenced as a result. However, with improved water quality of the stream as it passes through the ICW and treatment of additional flows from stormwater pipes water quality will overall be improved. ICWs when appropriately constructed and landscaped generally take 12 months to establish however improvements can be generally be seen following construction and planting.

3.1.4 ICW layout

Details of the proposed ICW layout, features, and landscaping is provided in the drawing 19333_3_03. While the treatment area of the ICW is 2,600m^2, the total development area is 6,100m^2, which includes embankment slopes. The design of the treatment area will see the existing route of the River Poddle maintained but widened northwards to create the ICW. The treatment area and slopes will be planted with a mixture of native plant species (further details on planting is provided in S4.2). The base of the ICW will be level throughout to maximise water dispersion over the treatment area. Steppingstones/baffles will be installed at the upstream end of the ICW to reduce river velocity as necessary and to further encourage water dispersion on entering the ICW.

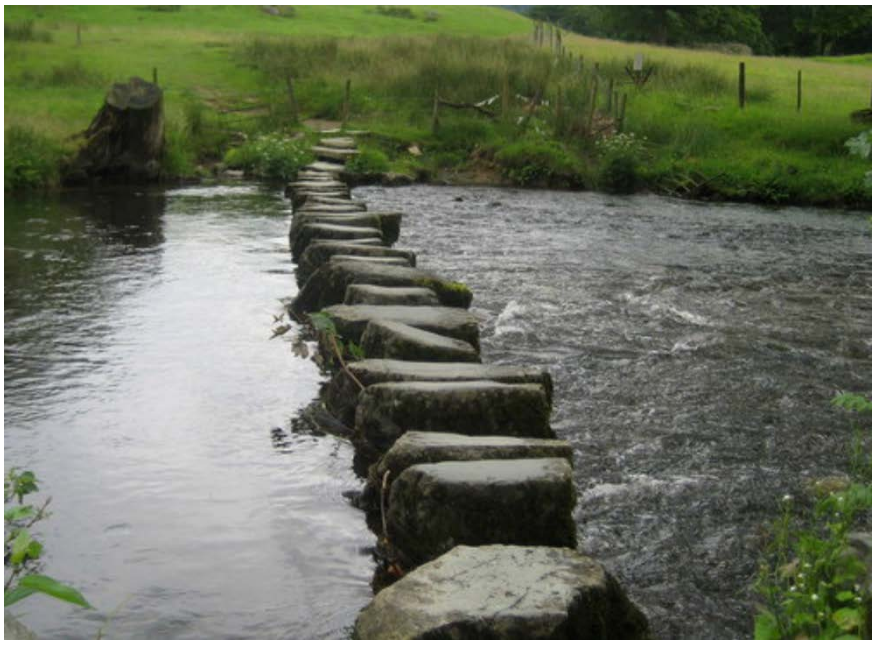

Figure 3: Example of proposed stepping stones

The southern bank of the river will remain unaltered. The northern bank from the edge of the ICW to existing ground will extend 10m with a 4:1 slope minimum (varying) and will include a 1m wide safety edge. Existing trees in this area will need to be removed to accommodate the ICW and pathway realigned. Trees removed to accommodate the ICW will be replaced with twice the number of trees as part of the landscaping works.

A weir constructed of natural stone will be included at the outflow of the cell for the management of water levels. This will also contribute to the project's objectives with regards to flood alleviation, provided by the ICW cells surface area and containing embankment. The velocity of the surface waters reduces over the wider channel area. An added benefit of the weir is increasing dissolved oxygen, which will benefit downstream biota. The operational water depth within the ICW treatment cell is typically between 150mm and 200mm, with capacity to allow for increased water depth during high rainfall events.

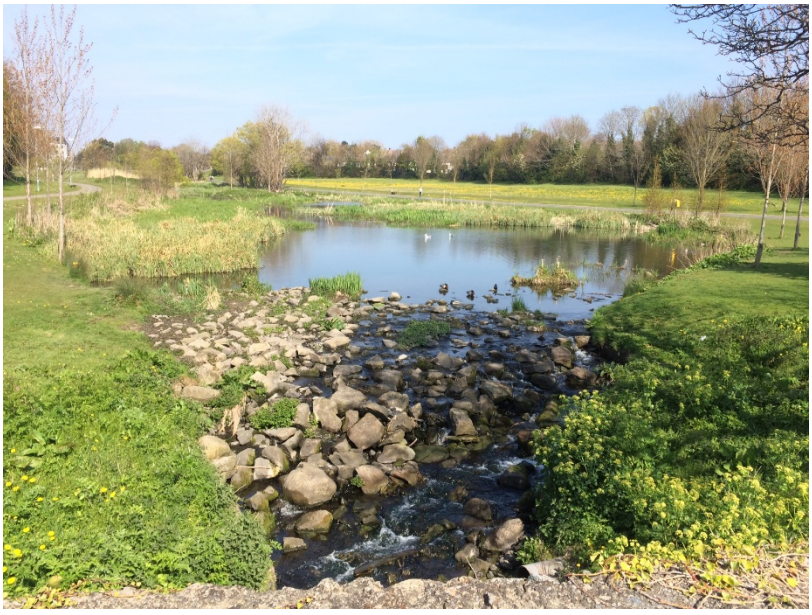

Figure 4: Example of proposed weir

To ensure safe access, gravel access paths will be provided at the upstream and downstream points of the ICW for monitoring and maintenance activities.

3.1.5 Landscape fit

While the primary objective of the ICW is for in-stream water treatment, the development itself facilitates the conservation of wetland-dependent wildlife through reanimating this declining ecosystem and can function as a significant educational and amenity resource. The layout, structure, and composition of the ICW is landscaped to be compatible with all aspects of its

surroundings, even taking into account the visual amenity and wildlife habitats of the Park. Given that wetlands provide a much-diminished important suite of habitats for invertebrates, marginal and aquatic vegetation, amphibians, fish and a range of breeding and wintering wildfowl, the ICW will contribute most significantly to the surrounding area by acting as a habitat and wildlife corridor in the area.

4.0 CONSTRUCTION AND LANDSCAPING OF ICW

The following section is provided as a preliminary plan of construction works. Further information will be prepared and refined at the detailed design stage. A site investigation on subsurface conditions at the proposed location will be conducted prior to commencement of construction works. An exclusion zone will be established around the development area prior to and during all site investigation and construction works in the interest of public safety.

4.1 Construction works

The main earthworks activities involved in the development of the ICW are levelling, excavation, and placement of soils for integration with existing topography. An estimated 5,000m^3 of material is to be excavated and reused elsewhere on site or locally. The main earthworks are not expected to take longer than 4-5 weeks to complete, however the overall works could take up to 2 months. The machinery used would include at least tracked excavators. Other machinery may include tractor & trailer, dumper, bulldozer, and/or roller. The main construction works are briefly summarised below Table 3 below.

Planting of the ICW treatment area will be undertaken on completion of the earthworks. Consideration to the scheduling of planting with regards to season will allow for reduced commissioning times.

A temporary river water management system will need to be established during the earthworks. To reduce the impact of construction works on the river flow the ICW will first be constructed outside of the river channel and erecting temporary bunds along the existing river route to contain and maintain river flows.

The stone baffles and stone weir and are to be installed at the inlet point and outlet points respectively. Weir and stone baffles are to be constructed from material acquired from site where suitable and available, otherwise locally sourced natural stone can be used.

On completion of construction and planting, the river will be diverted into the ICW and temporary bunds removed. The ICW can then be finished off with remaining levelling and planting where required. Careful timing with regards to weather conditions and silt mitigation methods will need consideration prior to construction stage scheduling. All in-stream works should ideally be carried out between July to September period, unless otherwise agreed. This period also occurs when flows are expected to be reduced compared to winter months.

The excavation of the cell and the formation of the cell slopes will be undertaken from material excavated from site. There should be no requirement to import or export material to or from the site, however this will need to be confirmed during site investigation. Indicative levels are provided in the ICW layout (19333_3_02) however these are subject to change if necessary and final levels to be confirmed prior to construction on site. The base of the ICW cell will be completely level to promote dispersal across the entire treatment area. The slope gradient will vary depending on landscaping requirements but will be at 4:1 minimum.

There may be slight variations to the layout and level of the ICW during construction, as required, so as to work within the confines of the site conditions and to utilise the characteristics of the site.

Appropriate access will be provided around the ICW site to allow for future monitoring and maintenance works. Access to the site will be via existing park roads.

Table 3: Main stages of ICW construction works	
Stage 1	Establish construction exclusion zones and health and safety preparations.
Stage 2	Delineate and establish temporary river bunds to maintain channel and flow.
Stage 3	Stripping of topsoil from the ICW area and retain for later use.
Stage 4	Excavation of sub-soil and tie-in slopes to existing ground. Install stone weirs.
Stage 5	Levelling and compaction of soil base. Installation of flow baffle rocks at inlets points.
Stage 6	Creation of tie-in slopes with variable gradients as required by landscaping works. Reinstate access path around ICW.
Stage 7	Re-distribution of top-soil and organic material over the base of cell.
Stage 8	Planting cell with emergent vegetation – Cell planted with 2-3 plants/m^2.
Stage 9	Divert river into ICW, remove temporary bunds, and finalise planting. Complete river integration.
Sage 10	Post-construction commissioning. Establish temporary bird control measures.

*Detailed method statement to be prepared and agreed with all stakeholders prior to construction.

4.2 Wetland planting and landscaping

Landscaping of the ICW will include planting emergent species within the treatment cell and a variety of native species on slopes to create ecotones. Existing wetland plants in the construction area (e.g. Flowering Rush *Butomus umbellatus*) will be temporarily removed and replanted during site restoration and landscape planting works.

4.2.1 Wetland cell planting

The planting of the wetland and cell areas with marginal, aquatic, and emergent plants provides the following functions:

- Treatment of influent waters;
- Mitigate potential odours;
- Slow hydraulic flows;
- Reinforcement of wetland soils;

- Oxygenation of the soil substrate to help the breakdown of organic pollutants;
- Enhance the amenity and aesthetic value of the area;
- Create and enhance the biodiversity of the area;
- Reduce maintenance; and
- Deter access.

The treatment area of 2,600m^2 will be planted with a mix of wetland emergent plant species, such as *Carex riparia, Glyceria maxima*, *Typha latifolia, Scirpus lacustris,* and *Iris pseudacorus* (see Table 4 for a sample of plants). Plant mix selection and density will be confirmed at detailed design stage however the goal is to establish a natural appearance with ecotones between wetland and parkland areas. Plant density within the ICW will increase over time, which will deter entry from park visitors. Furthermore, signs will be erected on the top of cell slopes to warn the public of the risks associated with entering water.

Table 4: Example wetland species

						
Glyceria maxima	*Carex riparia*	*Typha latifolia*	*Iris pseudacorus*	*Typha angustafolia*	*Ranunculus lingua*	*Lythrum salicaria*

4.2.2 Landscape planting

Additional landscaping may be included around the ICW site using native shrubs and grasses. Shrubs should not be planted near monitoring points where access could be restricted. Native species will be selected, subject to approval by South Dublin County Council Parks, in accordance with landscape and planting plan, will be in keeping with the existing vegetation of the site.

The design of an ICW ensures that its structure will 'fit' well into the landscape; e.g. by making the enclosing slopes curvilinear and fitting them to the site's topography appropriate to the site's setting. The slopes are designed as such to allow for ease and safe access for landscape maintenance activities (e.g. mowing) or otherwise vegetation to grow naturally.

Vegetation development within the wetland and surrounding area further enhances the visual natural appearance of the system.

4.3 Mitigation measures during construction & landscaping

Risk mitigation measures should be employed during the construction of the proposed integrated constructed wetland to limit the impact on adjacent surface water and groundwater environments through proper management and supervision.

Mitigation measures include:

- No construction will be undertaken at night or during very wet weather;
- One or more temporary earth bunds will be constructed to contain surface water run-off, to provide settlement, and to prevent the escape of silty water to the surface water during construction of the ICW;
- A detailed construction method statement will be prepared and will be followed by the contractor;
- All construction will be supervised;
- The re-fuelling of plant or machinery will not be permitted in the Park but either offsite or at a purpose use only point;
- All planting will also be supervised, and only native species from reputable sources will be used;
- No soil will be imported for landscaping purposes, and all plants brought to the site for use in the wetland will be checked for the possible presence of invasive species.

5.0 AFTERCARE AND MANAGEMENT OF ICW

Continual, while not onerous, monitoring and maintenance will be required following the construction and commissioning of the ICW. Activities associated with the post-commissioning monitoring and maintenance are to ensure ongoing function of the ICW to enhance river water quality and contribute to flood attenuation.

A comprehensive Operations, Monitoring and Maintenance Plan will be developed following the commissioning stage that will include a task list and schedule for the following items:

Surface water flow and quality monitoring upstream and downstream of ICW.

- To generate time-based treatment performance data and inform on issues relating to inflow and outflow water quality. Water quality parameters as per S3.1.1 of the current document or as agreed with South Dublin County Council.
- Regular visual checks will provide information on downstream effects.
- Provide data for future projects.
- Flow monitoring to account for all flows.

Vegetation monitoring and maintenance within the cell and around the site.

- Plant health and distribution monitoring provides insight into ICW health.
- Changes in colour and composition are key indicators for any issues.
- Ongoing monitoring will provide information on occurrences of invasive species.
- Vegetation management will also ensure the area is maintained in a tidy manner and not to become overgrown with noxious plant species and thereby decreasing the aesthetic value.

Weir monitoring for blockages and maintenance as required.

- Continuous flow through the ICW is critical to preventing upstream flooding. Any debris on the weirs is to be removed so as not to impede flow.

Maintenance of monitoring access paths for safe access for monitoring activities.

- Selected points for conducting monitoring activities are to be accessed on dedicated paths, which are to be kept in good order for health and safety reasons.
- Pedestrian path maintenance around ICW to be undertaken as per caretaker's regular park duties.

Sediment monitoring and management where necessary.

- Increases in ICW base levels influences the flow regime. While sediment buildup is a relatively slow process occurring over years it should nonetheless be monitored regularly.

Reporting

- All activities associated with ICW monitoring and maintenance are to be documented thereby generating a historical record of site performance.

A suitably qualified person with experience in ICWs shall supervise the monitoring and maintenance of the ICW. Regular external supervision will inform on ICW health and provide guidance on actions for maintenance and improvement as required.

Over time there may be an accumulation of sediments in the ICW that will need to be removed (accumulation of dead plant matter). The timeframe for this is typically not less than 10 years based on previous projects, however it is dependent on the sediment and solid accumulation, which may be confined to the upstream section of the ICW. Prior to removal an assessment of

sediment depth is to be undertaken to ensure the soil layer beneath the sediment is not disturbed. A temporary river diversion will need to be established during the sediment removal work. On completion the requirement for additional topsoil and replanting is to be assessed.

Safety considerations for both humans and animals are required and incorporated into the design of the ICW. Operational water depth is generally shallow (typically 150mm – 200mm deep) in ICWs. Landscaping works, plant density in the cell, and warning signs will aid in deterring entry into the ICW.

Training will be provided for the on-site operator/park caretaker to give guidance and ensure that the adequate procedures for the ICW system are implemented on an on-going basis.

6.0 SUMMARY

An Integrated Constructed Wetland system has been designed for Tymon Park as part of the River Poddle Flood Alleviation Scheme. The design of the ICW is in accordance with the Department of Environment, Community and Local Government Guidelines on Integrated Constructed Wetlands. ICW systems have been successfully applied to a range of water quality types in various situations when appropriately assessed, designed, and constructed.

The ICW at Tymon Park receives all inflowing river water where it will be reduced of its various dissolved and particulate constituents. Outflow water quality from the ICW is expected to align with good status once the ICW system is fully established, generally one year from construction and planting with respect to the Surface Water Regulations (SI 272 of 2009). Flow volumes to and from the ICW are naturally variable and will follow the changing seasons and weather events.

The ICW will provide additional benefits through appropriate landscaping, so that its structure 'fits' into the local environment thereby enhancing the Parks' aesthetic and amenity values while also increasing the biodiversity capacity of the site. Due to the nature of the ICW system, including its ability to provide high water quality treatment, enhance and create habitats, as well as a host of ecosystem services, the ICW should be viewed as a positive addition to the Park and the local environment.