

Clandeboyne Rainwater Garden

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Background

NI Water's involvement with Clandeboyne Primary school commenced with the construction of a new WwPS within the school grounds to facilitate the closure of 3 combined storm overflows. The WwPS overflow discharges to the Clandeboyne Stream which flows through the school ground in an adopted DfI Rivers Agency culvert. The WwPS works included a new access road linking the WwPS site to a neighbouring cul-de-sac. The proposed discharge location for storm water run-off from the access road and the WwPS hardstanding was the also Clandeboyne stream. From discussions with DfI Rivers Agency it became apparent that the culvert had limited spare capacity during heavy rainfall. In addition the primary school had issues with its own surface runoff, which flooded a downstream cul-de-sac during heavy rainfall and had been issued a statutory notice by the local roads authority (DfI Roads) to resolve. The raingarden was proposed to resolve both issues.

In parallel to the surface water issues in the area, NIW and its parent department, the Department for Infrastructure (DfI) were keen to promote and demonstrate SuDs within the urban environment, particularly "soft SuDs", as a sustainable tool to manage surface water and reduce the risk of flooding. NIW applied to the department and were successful in securing funding from the DfI Ministers Special Fund set aside for SuDs demonstration projects. The proposal's align with the NIW Long Term Water Strategy 2014-39 (LTWS) as well as a number of interdepartmental strategies including the Sustainable Development Implementation Plan 2011-14 (OFMDFM) and the 2010 Education (School Development Plans) Regulations.

The garden's location, situated within the grounds of a primary school which included two nursery schools, added significant challenge in the acceptance of the proposals by all stakeholders. Key to acceptance was support by the School Principal and Board of Governors who could envisage how the project could not only help control surface water, but also provide an additional educational resource, visual amenity and improvement and element of play and fun into the school grounds.

Drainage Strategy

The drainage strategy involves the interception of overland flows from hardstanding areas around the school and attenuation of these flows before discharging into the Clandeboyne Stream. The total area of hardstanding is 2702m² which for a 1 in 100 year storm return period results in a maximum inflow to the ponds of 70l/s. Maximum outflow is limited to 13.7 l/s which results in a total storage requirement of 54m³.

The hardstanding area can be divided into 3 area each of which have a different SuDs management train. The design rationale for the project was to select SuDs components that met the objectives for quantity of water storage, quality of water, amenity and biodiversity.

Area	Source Control	Conveyance	Site Control
Area A: Car park & access path 261m ²	Surface water is collected by 3 gullies which have been redirected to a 12.5 m ³ ACO StormBrixx geo-cellular tank.	Storm flows are released from the geocellular tank via a valve or high level overflow. The flows discharge into a 38m long rill which in turn discharges into pond A and pond B.	Pond A and Pond B provide 36.5m ³ attenuation storage before discharging to Clandeboye stream via a high level overflow.
Area B: Playground 2097m ²	Surface water gravitates to bog garden which acts as a broad filter trench providing 12m ³ of attenuation storage	The bog garden conveys flows through the substrate to pond and pond B	Pond A and Pond B provide 36.5m ³ attenuation storage before discharging to Clandeboye stream via a high level overflow
Area C: WwPS access road 344m ²	Surface water gravitates to swale	Swale conveys flows to Clandeboye Stream	Swale provides filtration and some infiltration as it conveys flows

Table 1: SuDs management train

The geo-cellular tank was selected as source control for Area A runoff to retain the required volume at the top of a natural slope water quality is addressed through the provision of sumps on the gullies discharging to the tank. The tank is designed so that flows can be released via a valve which has been incorporated into a turtle sculpture to allow the water to discharge from the turtle's mouth into a rill running down the slope. The design of the conveyance system was focused on providing amenity value to the school children by creating play feature where duck races can take place. The bog garden collects the runoff from Area B and allows flows to slowly percolate down the natural slope into Pond A. This process filters the runoff removing sediment while also providing 12m³ of storage in the voids contained in the substrate. The planting, logs and rocks that form the bog garden contribute to the biodiversity to the scheme.

Pond A and Pond B collect the flows from bog garden and those discharged from the geo-cellular tank. The ponds are designed to have a permanent water depth of 150mm for aesthetic and biodiversity reasons and a maximum water level of 450mm for safety reasons. A low level overflow is provided to allow attenuated water to slowly drain down to this 150mm depth. A high level weir ensures that the maximum depth of water in the ponds does not exceed 450mm. The ponds are planted with a mix of aquatic plants to form a boundary to the pond margins. The planting has been selected to ensure that views to the ponds are not obstructed in the event of a child entering the ponds. A dipping platform has been provided to allow children safe access to the edge of the pond in supervised conditions.

A swale was selected as the most suitable SuDs component for collecting the access road drainage as it can follow the horizontal alignment of the road and collect flows along its length. The swale

provides filtration of the runoff and a small level of infiltration as it conveys flows to the Clandeboye Stream. The mix of planting in the swale allows it to contribute to the biodiversity of the scheme.

Safety considerations

With the Rainwater Garden being located in a school environment safety was at the forefront of every design consideration. In addition to designers risk assessments and discussions with the key stakeholders the project team engaged ROSPA to complete a risk assessment of the design. This review resulted in an overall risk rating of low with some recommendations which were implemented where possible. A further review was undertaken once construction works were completed.

Consideration has been given to the rill and its operation and location in terms of safety. Water from the harvesting tank is source controlled using a valve under supervision only, so will not have open water running unless at planned play times. In summary, the rill is shallow and will be dry except when in use under supervised conditions. Safety features installed in the 'sink hole' at the end of the rill omit deep water with the void space being filled with large boulders so that water in this feature is also shallow.

The early response to open water features in the landscape was to deny access through fencing. Although physical barrier may be suitable where risks are high, barriers can obstruct visual observance of the water body and provision of help in an emergency. The ponds at Clandeboye have been designed to have a 'dry bench' beside the water line to provide a level surface and all slopes not greater than 1:3 to allow unaided movement for maintenance and vegetation clearance. The ponds also have a clear identification of the water edge using planting / rocks. This reduces the risk of accidental falls into the ponds. Purposeful access to the water is discouraged through appropriate use of shallow, muddy, planted margins. Reeds and shrubs will be selected to not obstruct visibility to the area. The planted SuDs ponds have a design water depth of 150mm, with a maximum of 450mm at times of heavy rainfall. Where it is considered that unsupervised young children could gain access to the water, then a toddler-proof fence 600-700mm high should be provided to prevent toddlers getting to the water but allow adult entry to step across if necessary. Although any young children accessing the school site via the entrance path (accompanying a parent and school age child for example) would not be considered unsupervised, a 700mm barrier has been proposed to deter any errant / accidental access to the area. This barrier has been temporarily extended around the entirety of the scheme to provide adequate segregation until the vegetation has been established.

The swale has been designed with shallow gradients and no standing water to allow for safe and easy access by pedestrians. A clearly defined road edge and suitable width of access road ensured the swale did not prove a hazard to vehicular traffic.

Educational benefits

The Rain garden and rill is part of the Eco school programme with Clandeboye Primary School and will be used to illustrate some of the major topics of the Eco school programme for example - Water,

Waste, School Grounds, Biodiversity, and climate change. Within that specific topics can be discussed from Wildlife - Flora and Fauna, water cycle, flooding, pollution, flood mitigation, bioremediation, biodiversity etc

Benefits and Achievements

Following successful launch of the project, a change in thinking has occurred as to the nature of surface water management, the associated risks and benefits and its place within the grounds of a primary school evidenced by the public statement from the Education Authority's Deputy Director of Development welcoming similar schemes across Northern Ireland. Further statements by local elected representatives including the local MP Lady Silvia Hermon, MLA's and local councillor's further support the philosophy and benefit provided by the SuDs project. Various articles in the local media outlets have went further in promoting the benefits and acceptance of surface water management features within the local environment.

Sustainable water management, reducing the risk of flooding and enhancing the local environment by adding biodiversity friendly habitats are well known, positive outcomes of a project of this nature and expected post construction. What wasn't anticipated by the delivery team to such an extent, was the added value in terms of educational resource, and secondary benefits of creating a safe play environment for the pupils of Clandeboye Primary School. Some of the added benefits included a lowering of the schools accident rate, as play was more focused on the features of the garden and away from the traditional games of "chasing" on hard, knee unfriendly playground surfaces, and a noticeable reduction in playground disagreement's, "he said she said" was observed by staff. Further work by the school has included a designed outdoor classroom including a mud kitchen and sandpits and included within the learning curriculum. Clandeboye Primary is hosting other schools within the area to tour the feature and demonstrate the added value provided by the Raingarden to the school curriculum.

Challenges / Lessons learned

Key challenges to the project came mainly from the legal profession representing the interests of the Education Authority in terms of risk to both pupils of the school, children in general who may attend and the wider risk of legal action taken against the board as a direct result of permitting the raingarden to be constructed within the school grounds. The importance of SuDs evangelism not only to the immediate sector but to a broader church of decision makers including the legal profession, Chief Executive & Director forums, accountancy profession and central government departments cannot be overstressed to aid early acceptance, limit resistance and generally educate society as to the necessity of SuDs solutions where applicable.

This opposition and challenge was welcomed by the development team as a chance to influence at a strategic level within the Education Authority, also serving as a detailed check to our design. The input of ROSPA was valuable as an independent and trusted advisor.