# STORMWATER AUDIT (STAGE 1)

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| JBA Project Code | 2019s1541 |
| Contract | Residential Development Shanganagh Castle, Shankill, Co Dublin |
| Client | Punch Consulting |
| Day, Date and Time | 17th December 2019 |
| Author | Leanne Leonard |
| Subject | **Stormwater Audit - Stage 1 Report** |

## 1 Proposed Residential Development, Castle Park, Dalkey, Co Dublin.

### 1.1 Introduction

JBA Consulting have been contracted by Punch Consulting (Punch) to undertake a Stage 1 audit of the surface water drainage design for the proposed residential development at Shanganagh Castle, Shankill, Co Dublin. The surface water audit was undertaken in advance of a planning submission.

The audit has been completed in accordance with Dún Laoghaire Rathdown County Council's (DLRCC) Stormwater Audit Procedure (Rev 0, Jan 2012). The results of the audit are set out in the table below.

### 1.2 Stage 1 Audit

| Design Parameter | Audit Result |
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| Proposed Development | The subject site is located at Shanganagh Castle, Shankill, Co Dublin and is a greenfield development.<br><br>The proposed development will consist of:<br><br>• 598 nr residential units;<br>• Small commercial/café units;<br>• Crèche.<br><br>The total site area is stated to be 8.66 hectares (ha), however the net site area as drained for the proposed development is 6.07ha and will form the basis for greenfield runoff calculations.<br><br>The subject of this Stage 1 stormwater audit is to review the proposed surface water drainage design and sustainable urban drainage system proposals for the proposed development. |
| Relevant Studies/Documents | The following documents were considered as part of this surface water audit:<br>• Greater Dublin Strategic Drainage Strategy (GDSDS);<br>• Greater Dublin Regional Code of Practice for Drainage Works;<br>• The SUDs Manual (CIRIA C697). |
| Key Considerations & Benefits of SUDs | The key benefits and objectives of SUDs considered as part of this audit and listed below include:<br>• Reduction of run-off rates;<br>• Provision of volume storage;<br>• Volume treatment provided;<br>• Reduction in volume run-off;<br>• Water quality improvement;<br>• Biodiversity. |
| **Site Characteristics** | **Soil:**<br>Site infiltration tests undertaken by Causeway Geotech on 8nr soakaways have indicated that there is little or no permeability throughout the site.<br><br>Based on the WRAP classification scheme within the Institute of Hydrology Report No.126 together with results of the site investigation and topo survey, the SOIL class has been determined to be Class 4.<br><br>**Topography:**<br>There is a natural fall towards the southern boundary of the site.<br><br>**Greenfield Runoff Rate (basis of surface water attenuation design):**<br>The Greenfield Runoff Rate has been calculated by Punch using the Institute of Hydrology Report 124 (IH124) method for flood estimation on small catchments. |

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| | **Punch value** / **JBA value**<br>**Qbar:** **37.20 l/s** / **37.23 l/s**<br>**Q1 year:** **31.60l/s** / **31.65 l/s**<br>**2l/sec/ha:** **12.14l/s** / **12.14 l/s**<br><br>The above variations are within acceptable limits and likely to be due to rounding of figures.<br><br>Punch propose to discharge at Qbar for all rainfall up to and including the 1 in 100-year event.<br><br>**Calculations**<br><br>Attenuation is being provided by way of 2nr underground RC tank for the 1 in 100-year storm event + 20% climate change including for run-off from relevant green open spaces. This is sufficient storage for the developed area considering there are also green roofs, swales and permeable paving being provided. |
| SUDs Measures Considered | Punch confirmed the following SUDs measures were considered and conclusions reached: |

| SUDS Technology | Comments |
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| **Green Roofs** | Green roofs are provided to all apartment blocks and the crèche. |
| **Blue Roofs** | Not applicable. |
| **Swale/ Filter Drain / Infiltration trench** | Swales and rain gardens are proposed at select locations throughout the development. |
| **Permeable Paving** | Permeable paving is provided to all parking areas. |
| **Soakaways** | Ground conditions unsuitable, not applicable. |
| **Petrol Interceptor** | Not applicable. |
| **Surface Water Attenuation** | Attenuation will be provided by way of green roofs, proposed underground attenuation tanks together with permeable paving, swales etc. Full details to be agreed with the Local Authority. |
| **Site Run-off Rates** | The GDSDS requires that the discharge rate equals the 1-year greenfield run-off rate in the 1-year event and equals the 1 in 100 greenfield peak for the 1 in 100-year event.<br>Punch propose to limit discharge to Qbar for all storm events. |
| **Rainwater Harvesting** | Considered but not proposed due to continuous maintenance requirements. |
| **Detention Basins, Retention Ponds, Stormwater Wetlands** | There is an existing pond on site, and it is proposed to route some stormwater through same to enhance its ecological value/status. |

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| Surface Water Drainage Design | All surface water flows generated by the proposed development will be attenuated and discharged to the existing Shanganagh Park surface water drain. |
| SUDs Management Train | **Source Control** and **Site Control** are addressed by the use of green roofs, permeable paving, swales, rain gardens and tree pits (interception storage) and attenuation with outflow controlled by a Hydrobrake. Nominal infiltration through the proposed SuDS measures.<br><br>**Regional Control** does not apply at the level of this development. |

<table>
<tr><td></td><td>As recommended with the SUDs Manual (Table 3.3) assuming effective pre-treatment is in place the following number of treatment train components are recommended:<br><br>
<table>
<tr><th></th><th>No. of treatment train components recommended</th><th>Comment/Proposals</th></tr>
<tr><td>Roof areas</td><td>1</td><td>Green roof for all apartment blocks and crèche</td></tr>
<tr><td>Residential roads, parking areas, commercial zones</td><td>2</td><td>Pervious pavements, tree pits, swales, existing pond.</td></tr>
<tr><td>Refuse collection, industrial areas, loading bays, lorry parks and highways.</td><td>3</td><td>Not applicable.</td></tr>
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A Hydrobrake and associated storage structure is provided for the attenuation of storm flows prior to discharge off-site.<br><br>Generally, site proposals meet the treatment train recommendations within the SUDs Manual.</td></tr>
<tr><td>Climate Change</td><td>An allowance of 20% increase in flows has been included for climate change which is greater than the 10% requirement in the GDSDS. This adequately addresses Section 16.12 of the “Development Management – Thresholds Information Document”.</td></tr>
<tr><td>Discharge Rate / Flow Control</td><td>Limited to Qbar (37.2l/sec for all rainfall events)</td></tr>
<tr><td>Volume Storage</td><td>Punch have provided calculations for the proposed attenuation volume. 1,701m3 is available in tank #1 with an additional 873m3 provided in tank #2.</td></tr>
<tr><td>Volume Run-off</td><td>Greenfield run-off is currently conveyed to the southern boundary of the site and into the Shanganagh Park surface water drain.</td></tr>
<tr><td>Treatment Volume / Water Quality Improvement</td><td>As interception storage currently proposed, additional treatment volume not required.</td></tr>
<tr><td>Biodiversity</td><td>Biodiversity maximised by the extent of green roof and enhancement of the existing pond.</td></tr>
<tr><td>Return Period</td><td>A 100-year return period plus 20% for climate change has been used in the design for the attenuation systems. A model combining all elements of the surface water management systems is required at detailed design stage.</td></tr>
<tr><td>Health & Safety and Maintenance Issues</td><td>Optimum performance of the SUDs treatment train is subject to the frequency of maintenance provided. At detailed design stage, it is recommended that a maintenance regime be adopted.<br><br>Green roof discharge outlets are proposed to be checked quarterly and after significant storms prevent blockages.<br>Particular consideration is required at detailed design stage to the design, maintenance requirements and whole life plan (and replacement) of the SuDS system as a whole.<br><br>Regular maintenance of the hydrobrake will be required to remove any blockages, particularly in the wake of heavy rainfall events or local floods.</td></tr>
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| Design Review Process | Upon review of Punch initial drainage design, JBA Consulting provided feedback, resulting in some modifications, namely;<br>• Storm sewers have been modified to reduce surcharging/flooding;<br>• Interception of roads now provided;<br>• Re-routing of drainage to minimise depth of sewer.<br>A summary of comments and record of the audit trail are appended to this report.<br>Based on this being at preliminary design stage and a Stage 1 Surface Water Audit, JBA Consulting's comments have all been satisfactorily addressed or sufficient commitment provided that details will be confirmed at detailed design stage. |
| Summary of items to be considered at Detailed Design Stage | There are a number of items that require attention at detailed design stage. A summary of same are as follows:<br>• Maintenance regime for each of the SuDS components on site;<br>• Hydraulic model combining all elements of the surface water management system. |
| Audit Result | JBA Consulting considers that the surface water drainage design for the proposed development is acceptable and meets the requirements of the Stage 1 Stormwater Audit. |

Audit Report Prepared by: Leanne Leonard BEng
Engineer

Approved by: Declan White BE CEng MIEI IMaPS
Technical Director

***Note:***

*JBA Consulting Engineers & Scientists Ltd. role on this project is as an independent reviewer/auditor. JBA Consulting Engineers & Scientists hold no design responsibility on this project. All issues raised and comments made by JBA are for the consideration of the Design Engineer (Punch). Final design, construction supervision, with sign-off and/or commissioning of the surface water system so that the final product is fit for purpose with a suitable design, capacity and life-span, remains the responsibility of the Design Engineers.*

## Appendix A – Audit Trail Record

**JBA Consulting Stormwater Audit**

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| **Project:** | Residential Development at Shanganagh Castle, Shankill, Co Dublin |
| **Date:** | 27/11/2019 |
| **JBA Reviewers** | Leanne Leonard - Engineer |

| Item No. | JBA Review Comment | Comment/Clarification Request/Suggested Mitigation | Response from Client/Client Representative | Acceptable / Not Acceptable |
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| | **27/11/2019** | | | |
| | Documents Reviewed<br>- Punch Surface Water Drainage Strategy Report<br>- Drg No 182-134-002 Rev PR1<br>- Drg No 182-134-003 Rev PR0<br>- Drg No 182-134-004 Rev PR2<br>- Drg No 182-134-005 Rev PR2<br>- Drg No 182-134-007 Rev PR0<br>- AECOM Landscape Drawing | | | |
| **1** | Drg No 182-134-001<br>Section 2.1.3 of the Drainage Strategy Report refers to drawing nr 182-134-001, however, the said drawing is not provided for review. | Punch to advise. | **The drawing has been split into two separate drawings for easier viewing. Reference is outdated and should instead be to Drawings 181-234-002 and 182-134-003** | **Acceptable** |
| **2** | Existing Flows to the Pond<br>Section 2.2.11 of the Drainage Strategy Report notes an allowance of 2l/sec for additional flows not directly associated with the subject site has been allowed for. However, it is not clear how such a figure has been derived. | Punch to advise. | **A hydrogeological assessment of the site and existing site was commissioned and has been completed by BlueRock Environmental. The results of this assessment were unavailable when the Drainage strategy report was drafted. The figure of 2.0 l/s was used as an approximation based on intial advice received. We have received updated advice that a more accurate figure for the allowance is 0.2 l/s. Refer to report accompanying this feedback** | **Acceptable** |
| **3** | Existing Flows to the Pond<br>On Causeway Flow calculations, the additional inflow of 2l/sec has been inserted into the hydraulic model at node S10-7 in lieu of S12-0, although it is unlikely to change the size of upstream storm sewers unless the allowance has to be increased as per item 2 above. | Punch to review and advise. | **Reduced groundwater inflow of 0.2 l/s accounted for as per 2 above. Sufficient hydraulic capacity is available to accommodate this small additional flow.** | **Acceptable** |
| **4** | Simulation Calculations<br>12m3 of flooding indicated for node S10-7 which is the pond location. It is assumed that such flooding is contained within the existing pond profile | Punch to review and advise. | **The drainage network will be modified to remove the flooding mentioned.** | **Acceptable** |
| **5** | Attenuation Tank No. 2<br>Given the inflow of 2l/sec from external catchment to the existing pond, is the volume of attenuation tank no. 2 cognisant of same given the downstream limiting discharge of 37.2l/sec. | Punch to review and advise. | **Attenuation tank 2 has been sized allowing for runoff from the development as well as the additional (revised) groundwater inflow of 0.2 l/s** | **Acceptable** |
| **6** | Interception<br>Interception measures provided for most surfaces throughout the site with exception of some internal access roads. As no infiltration is deemed available throughout the site (from the site investigation) and given the limitations of Table 24.6 of the CIRIA SuDS Manual, interception of roads are to be addressed. | Punch to review and advise. | **Interception of runoff from roads and other hard pavement is to be provided via one of the following, subject to the specific location on site: runoff to lined pervious pavement; runoff to unlined tree pits, runoff to unlined swales; runoff drainage to existing pond. In all cases (except the pond), treatment volume will be provided by the voids within the proposed filter media (pavement buildup, tree soil or swale topsoil), and an appropriate thickness of media will be provided to suit the drained area. Note that some roofs are also intended to drain to the pond. A final calculation and explanation of all areas will be included in the final planning submission.** | **Acceptable** |
| **7** | Exceedance Flows<br>Proposed road levels are such that there is a fall towards the cul-de-sacs west of apartment blocks G and H. In times of exceedance rainfall coupled with potential blockage of local SuDS features and/or road gullies, there is the potential for storm flows to be conveyed across the southern boundary pending its treatment, thereby increasing the overall discharge rate from the site. | Punch to review and advise. | **The drainage system is designed for the exceedance requisite of 100 year + 20%. In the event of exceedance + blockage runoff will largely be contained within the road network where it will fall towards the south of the site. It will then flow drain back into the network over time through road gullies and excessive flows will runoff into the ditch system in the adjacent parklands - which is consistent with pre development situation. There is no GDSDS requirement to accommodate exceedance + blockage within the site area, but rather the scheme is designed to ensure that such events do not flood buildings.** | **Acceptable** |

| Item No. | JBA Review Comment | Comment/Clarification Request/Suggested Mitigation | Response from Client/Client Representative | Acceptable / Not Acceptable |
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| 8 | Routing of Existing Filter Drain to Northern Boundary<br>The routing of the existing filter drain from the northern boundary appears to traverse the underside of a semi detached house. The routing should be revised such that same is accommodated through the proposed 'pedestrian cut through' area immediately east and as referenced on the AECOM landscape drawing | Punch to review and advise. | There was a discrepancy between the architects and landscape architects layouts. The proposed route was chosen as this was shown as a green area. The sewer will be routed clear of proposed buildings. | Acceptable |
| 9 | Pipe Run S1.000<br>Not clear what the purpose of pipe run S1.000 is and if sufficient space exists given requirement for division wall between both properties. | Punch to review and advise. | Noted, Pipe S1.000 will be removed. | Acceptable |
| 10 | Pipe Run S1.008<br>With flow being throttled at manhole S1-8, the pass forward flow is 22l/sec. It is noted that the downstream storm sewer is 600mm diameter which is considered too large for the said flows and associated velocity of flow | Punch to review and advise. | The diameter of the drainage downstream of hydrobrake flow controls will be re-sized to suit the proposed discharge rate. | Acceptable |
| 11 | SuDS Strategy<br>Given the existing pond is being used to drain part of the subject site, was any consideration given to utilising it to provide the required attenuation volume in lieu of underground tanks which would enhance water quality further? | Punch to review and advise. | Consideration was given to using the existing pond for storage. However the pond is relatively shallow. Additionally the pond was observed to be heavily silted and as such undergound tanks were chosen to provide storage. The primary reason for routing through the pond was to maintain water level in the pond as the pond is of ecological value. It is intended for the pond to be used as a SUDS measure to provide a measure of surface water treatment and continued amenity feature, but not attenuation. | Acceptable |
| 12 | Other SuDS Considerations<br>For the apartment buildings, it is possible to provide rainwater harvesting for the flushing of toilets etc thereby reducing the volume of stormwater being discharged downstream. | Punch to review and advise. | Rainwater harvesting was considered for the the development. However the client has a preference for green roofs. Hence green roofs have been favoured over rainwater harvesting throughout the development. | Acceptable |
| 13 | Other SuDS Considerations<br>Tree pits are considered viable for interception of select isolated roads and parking areas with no current treatment mechanism | Punch to review and advise. | Tree pits are to be included as part of the proposed rain gardens. Rain gardens have been provided throughout the site where practical. | Acceptable |
| 14 | Green Roof Details<br>For the green roofs as shown on drawing nr 182-134-004, no cross-sectional details are available | Punch to review and advise. | The architect is to provide the proposed extensive green roof cross sectional details as part of planning pack. | Acceptable |
| 15 | Basement Drainage<br>No basement car-parking details provided but it is assumed that the drainaeg of same is pumped to the proosed foul sewer network | Punch to review and advise. | The proposed development does not have any basements. | Acceptable |
| 16 | Routing of Drainage<br>The routing of drainage along the northern boundary and in a western direction as shown on drawing nr 182-134-002 Rev PR1 is such that deep excavations are induced which is a health and safty concern for both construction and future operation and maintenance. | Punch to review and advise. | Drainage has been rerouted to minimise depths | Acceptable |