# STORMWATER AUDIT (STAGE 1)

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| JBA Project Code | 2022s0368 |
| Contract | SHD Priorsland, Cherrywood SDZ, Co. Dublin |
| Client | 1 Carrickmines Land Ltd. |
| Date | 31st March 2022 |
| Author | Chris Wason |
| Subject | **Stormwater Audit - Stage 1 Report** |

## 1 Proposed Residential and Retail Development, Priorsland, Cherrywood, Co. Dublin.

### 1.1 Introduction

JBA Consulting have been contracted by 1 Carrickmines Land Limited to undertake a Stage 1 audit of the surface water drainage design completed by Punch Engineering for the proposed SHD at Priorsland, Cherrywood SDZ, Co. Dublin 18. 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).

***Stage 1 – Pre-Planning Stage:*** *A Stage 1 audit shall be carried out of the Stormwater Impact Assessment (SIA) prepared by the applicant. The audit will focus on the SUDS management train and whether the applicant has carefully considered all known SUDS techniques and applied the most appropriate type(s) for the site that will ensure improved water quality, biodiversity and volume control. The audit shall be forwarded to DLRCC prior to lodging the planning application. All recommendations shall be complied with, unless agreed in writing otherwise with DLRCC.*

The results of the audit are set out in the table below.

Any queries raised are populated in the Feedback Form in Appendix A to be responded to be the design engineer. When an 'Acceptable' status on all queries has been reached the audit is deemed completed and should be issued to DLRCC.

### 1.2 Stage 1 Audit

| Design Parameter | Audit Result |
|---|---|
| Proposed Development | The subject site is located at Priorsland within the Cherrywood Strategic Development Zone. It is outlined in red hereunder and is currently a greenfield site, with low intensity agricultural use. |

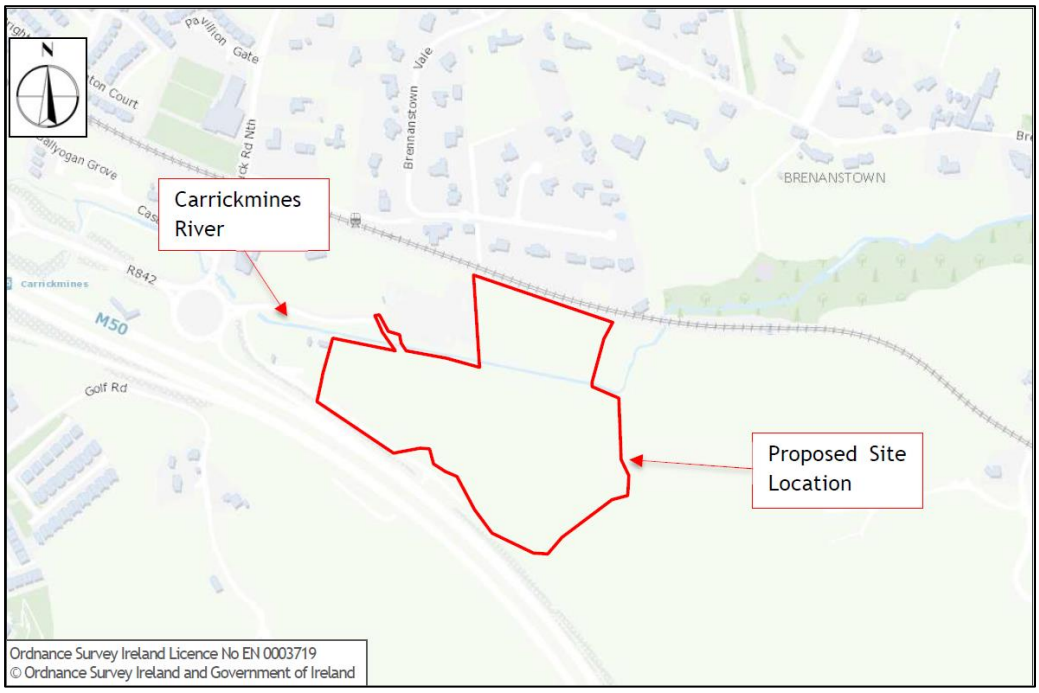


*Figure 1 Site Location Plan*

The development will comprise a mixed-use village centre and residential development

| Design Parameter | Audit Result |
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| | of 443 no. units comprising 6 no. blocks (A-F) of apartments (up to 5 storeys with basement/undercroft parking) providing 402 no. apartments units (146 no. 1-beds; 218 no. 2-beds and 38 no. 3-beds), and 41 no. houses (19 no.3-beds and 22 no. 4-beds). All apartments provided with private balconies/terraces. Provision of indoor residential facilities to serve apartment residents. The Village Centre and non-residential elements will comprise a supermarket, local retail/retail service units, non-retail commercial units, creche, gym, community space, and offices (High Intensity Employment) use.<br><br>Provision of the first phase of Priorsland Park (on lands within the applicant's ownership) and other public and communal open spaces. Construction of Castle Street through the subject lands and two road bridges across the Carrickmines<br><br>Stream, one to serve the future school site/ park, the second to provide pedestrian and cyclist access to the Carrickmines Luas station and future Transport Interchange to the north. Provision of an additional pedestrian bridge to the park. Provision of an acoustic barrier along the southern/western edge of the site.<br><br>All associated site development works, landscaping, boundary treatments and services provision.<br><br>The total site area is stated to be 8.751 hectares (ha). The proposal outlined in this planning application is for the development of approximately 6.8 hectares. |
| 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 C753).<br>• DLR Green Roof Guidance Document (September 2011)<br>• Cherrywood Planning Scheme (in particular Chapter 4 Section 4.1.2)<br><br>The audit is based on the following data provided by Punch on 14 March 2022;<br>• 182-186-010 PL0.pdf<br>• 182-186-011 PL0.pdf<br>• 182-186-012 PL0.pdf<br>• 182-186-013 PL0.pdf<br>• 182-186-020b PL0.pdf<br>• 182-186-021 PL0.pdf<br>• 182-186-021b PL0.pdf<br>• 182-186-022 PL0.pdf<br>• 182-186-022b PL0.pdf<br>• 182186 IGSL - Priorsland SHD - Site Investigations Report.pdf<br>• 182186 PUNCH - Priorsland SHD - Engineering Planning Report.pdf<br><br>Subsequent to the Feedback Form being issued the following additional information was provided by Punch on 29 March 2022;<br>• 182-186-028 PL0.pdf<br>• 182-186-029 PL0.pdf<br>• 182-186-071 PL0.pdf<br>• 182-186-072 PL0.pdf<br>• 182-186-073 PL0.pdf<br>• 182-186-074 PL0.pdf<br>• 182-186-075 PL0.pdf<br>• 182-186-077 PL0.pdf |

| Design Parameter | Audit Result |
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| | |
| 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>The Soil at the site has been indicated as being Soil type 3 (Soil Index 0.37) which was confirmed by geotechnical investigation works carried out in November 2018. A total of 5 No. infiltration tests were carried out in accordance with BRE Digest 365 as part of the geotechnical investigation works at this time. Infiltration rates between 0.00017m/min (2.83x10-6m/s) and 0.00097m/min (1.6x10-5 m/s) were encountered in 4 No. of the tests. In one instance an infiltration rate of 0m/min was observed due to high rock in the location of the test. SuDS systems were deemed suitable for this site. Groundwater was noted within 0.6m of existing GL but levels will be raised by 1-2m to reduce risk of flooding so GW should not be an issue<br>The default value from the UKSuDS web site is SOIL type 1, indicating a highly permeable soil. The value of 3 used in this study is taken from actual soil investigations and is considered to be more appropriate.<br><br>**Rainfall (basis for surface water pipeline network design):**<br>Rainfall parameters can be estimated using Met Eireann data, using the Flood Studies Report (FSR) values or the values in the GDSDS. The Met Eireann method can be more representative of a site if selected correctly.<br><br>**PUNCH value** — **JBA Value**<br>Rainfall model: Met Éireann — Met Éireann<br>M5-60 (mm): 16.9mm — 16.9mm<br>Ratio R: 0.272 — 0.273<br><br>The values in the Met Éireann depth duration frequency table provided by PUNCH correspond for the most part with the values in the table obtained by JBA from Met Eireann. The slight variations in certain values are within acceptable limits.<br><br>**The basis for surface water attenuation is stipulated in the Cherrywood Planning Scheme Chapter 4 Section 4.1.2.**<br><br>PI 8 states "*It is an objective to ensure that SuDS measures shall be fully implemented on all sites to 1 litre per second per hectare runoff rates, unless otherwise agreed with Dún Laoghaire Rathdown County Council.*"<br><br>PUNCH propose to discharge from the final attenuation basin to the Ticknick Stream at a discharge rate of 1 l/s/ha for all storm events as per the requirements of the Cherrywood Planning Scheme and is considered acceptable.<br><br>The subject site is in Development Area 3:Priorsland as detailed in Ch 6.3 of the CPS. The stipulated stormwater requirements are;<br>• Flood containment zone<br>• Diversion of Ticknick stream<br>• Flood flow bypass culvert parallel to Carrickmines river<br>• Detention basins and swales as shown on map 4.2<br><br>An extract from Map 4.2 is provided below |

| Design Parameter | Audit Result |
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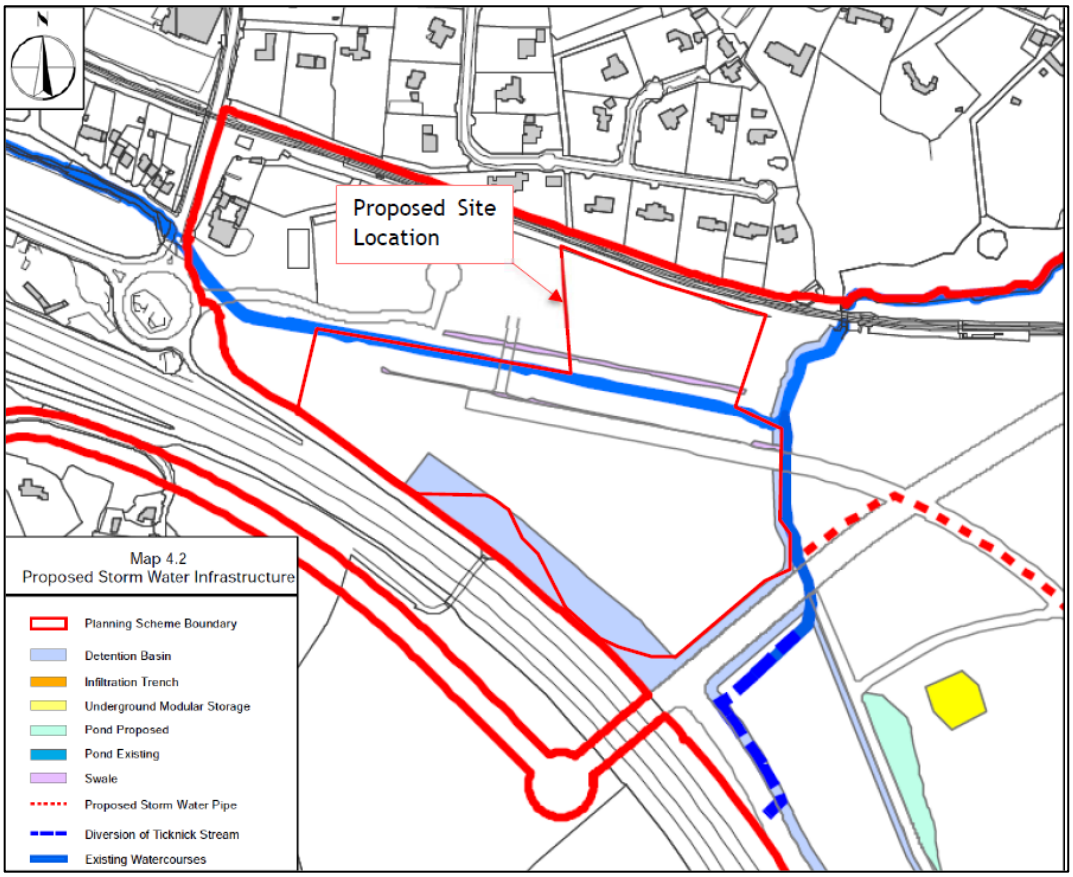


SuDs Measures Considered

Punch state in the report that pre-planning discussions have been held with DLRCC but there are no records of the outcome. Punch have given due consideration to the SuDS measures most applicable for this site and have provided a detailed SuDS management train. Measures include;

| SUDS Technology | Comments |
|---|---|
| **Green / Blue Roofs** | Intensive/Extensive green roofs have been proposed to all apartment blocks and at podium level on blocks A/B, C & E. Coverage is in excess of 60% of the total roof area for each of the blocks.<br>Overflow from the green roofs will be collected via internal RWPs at roof level, and discharge into the drainage network beneath the basement podium soffit slab via gravity.<br>Remaining roof areas will discharge to green areas at podium level which will provided for interception of run off |
| **Swale/ Filter Drain / Infiltration trench** | Infiltration trenches are provided in the public road areas and will provide interception of 5mm runoff.<br>Swales are provided along the main pipe run to the south of the development, prior to discharge to act as detention basins, in line with the CPS |
| **Permeable Paving** | Permeable/pervious paving has been proposed to all surface access roads and parking areas. They will provide for interception and storage of flow, and facilitate exfiltration where ground conditions are suitable |

| Design Parameter | Audit Result |
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| | **Soakaways** — Soakaways have not been specifically included but all infiltration/filter drains etc. will be unlined and allowed to infiltrate to ground where possible. *It is intended to raise the existing ground by 1-2m to mitigate against flooding. No details of the proposed engineered fill are provided but it should allow for filtration of runoff and details would need to be approved prior to construction* |
| | **Petrol Interceptor** — It is proposed to include an oil separator and pump to take storm runoff in the underground car park. Discharge will be to the foul network which is acceptable. |
| | **Other Sediment Management** — n/a |
| | **Surface Water Attenuation** — Attenuation will be provided by way<br>A. Green roofs<br>B. Permeable paving<br>C. Infiltration trenches<br>D. Swales<br>E. Stormtech Underground Attenuation Structure<br>It is expected that infiltration to ground will take place although this has not been designed for specifically. Storage is based on assuming runoff from the site controlled by hydrobrake flow controls.<br><br>The site runoff has been limited to 5 l/s although individual flow controls may limit flow to as low as 0.6 l/s which could raise operational/management concerns if orifices are <50mm |
| | **Site Run-off Rates** — Limited to 1 l/s/ha as required by the CPS |
| | **Rainwater Harvesting** — RWH has not been proposed within the development. Water butts are proposed |
| | **Detention Basins, Retention Ponds, Stormwater Wetlands** — Detention basins/regional ponds are proposed within the developers ownership and located commensurate with the CPS stormwater management proposals. |
| | **Tree Root Structural Cell Systems, Bio-retention, rain garden** — Tree Root Structural Cell Systems are proposed on Castle Street and typically one road gully is connected to the tree, which is the recommendation of the CIRIA C753 |
| Surface Water Drainage Design | It is proposed that all storm runoff from the development will be attenuated and discharged to the existing watercourse (Ticknick Stream) to the northeast of the site.<br>FLOW has been used for network design and simulation runs. JBA have the following comments;<br>1. A return period of 5 years has been used for network design which is acceptable.<br>2. Cv value is set at the default of 0.75<br>3. Cumulative Imp Area =2.755ha<br>4. Additional contributing area for basement tanks = 1.994ha<br>5. Total Imp Area = 2.755+1.994 = 4.749ha. which compares reasonably with that in the report of 4.83ha.<br>6. Additional Inflow has been input at a number of nodes to represent the basement tanks<br>7. The simulation output reports 10% CC.<br>8. Min velocity is set at 0.8m/s for Network design. GDSDS recommends (table 6.4) that velocity should be 1.0m/s at pipe full flow. This can be redesigned at detailed design stage, but it should make little difference to the preliminary design. These should be rechecked at detailed design stage.<br>9. Long sections of pipe runs provided and storage/SuDs facilities typical details shown<br>10. Some CL are given as 63.95m in the basement tank design but shown differently on drgs 011,012 and 013. These can be updated at detailed design stage but should make little difference.<br>11. Basement tanks Design Settings are set to 'England and Wales' and should be amended to 'Scotland & NI' at detailed design stage.<br>12. Basement tanks are modelled separately and input as add inflow to the SW network design. One has a pumped outfall so is not an issue but the other have hydrobrake controls and should be |

| Design Parameter | Audit Result |
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| | interconnect to the main model so full interaction can take place in the simulation runs. This can be done at detailed design stage as it is not likely to have any major impacts.<br>13. Swales appear to be modelled as pipe equivalent structures. Typical details of the swales are provided |
| SUDs Management Train | **Source Control** and **Site Control** are addressed by the use of SuDS devices (interception storage) and attenuation with controlled outflows.<br>A flow control device will be installed on the outlet from each of the storage structures is provided for the attenuation of storm flows prior to discharge off-site.<br>Generally, site proposals meet the treatment train recommendations within the SuDS Manual. |
| Climate Change | An allowance of 10% increase in flows has been included for climate change to the rainfall intensities for the purposes of sizing the attenuation storage. |
| Discharge Rate / Flow Control | Risk of blockage of the flow control device needs careful consideration at detailed design stage and must be managed through an appropriate maintenance plan. Some control points have very small orifice sizes (<50mm)<br>Final outflow from the site is limited to 5l/s. |
| Volume Storage | A number of storage units with pump or hydrobrake flow controls are located throughout the development.<br><br>No details are provided but it is assumed that those under basements on drgs 011,012,013 are concrete tanks which are not preferred. Punch in their Feedback Form response have confirmed and justified the use of RC tanks. |
| Treatment Volume / Water Quality Improvement | Interception storage of 5mm is currently proposed by way of green roofs, permeable paving, swales, water butts and tree root systems and interception trenches comprising 30% porosity stone. A suitable treatment train is also in place. Table 5 in the report lists the methods of interception proposed and appears to be incompliance with Table 24.6 of CIRIA 753. The total area noted is 5.027ha. which is 100% of the impermeable area but in actual fact the GDSDS allows a reduction to 80% for interception so that provided is conservative.<br>However, it is not clear on drg 011, 012, 013 how car park drainage is to be intercepted. Are these areas to be permeable paving? The Suds Management train diagram in the report indicated that they will discharge to engineered swales but this is not as shown on drawings if they discharge to a concrete tank and then to the regional detention pond. Car park runoff should be intercepted at source where possible. Punch have provided some additional typical detail in their Feedback From response. Traditional gullies etc are used as collection systems as required in the CPS but these are only in case of failure of permeable/porous paving which should allow runoff to percolate and then be directed to the collection system as required. Suitable stone build up should allow for this. Details should be provided at detailed design stage.<br><br>The CPS states that *runoff from all sites must pass through at least one level of treatment…. prior to the final level of treatment in the public realm areas*.<br><br>Generally, this has required that 5mm is intercepted in the private development and 10mm in the public realm areas, in this case, in the detention pond proposed. However, there are no calculations or details to show how the detention pond sizing has been arrived at. Typical details of the ponds are provided. Punch should provide details of the detention pond proposal and clarity if these are to be become part of the public realm. |
| Biodiversity | Inclusion of extensive green roofs. Site and landscape site plan to consider same in more detail at detail design stage. |
| Return Period | A 100-year return period plus 10% for climate change has been used in the design for the attenuation systems. A model review combining all elements of the surface water management systems is required at detailed design stage.<br>No flooding is predicted for the 100 year return period - ok |
| Exceedance flows | Have been considered in Table 4 but no flow details provided which should be provided at detailed design stage. |
| Health & Safety | The proposed drainage system comprises SuDS devices, traditional gullies, manholes, attenuation |

| Design Parameter | Audit Result |
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| and Maintenance Issues | systems, and underground pipes. These elements are considered acceptable from a Health & Safety perspective once supplier/manufacturers guides are followed and complied with during the detailed design, construction and operation.<br><br>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>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 flow control device will be required to remove any blockages, particularly in the wake of heavy rainfall events or local floods.<br><br>Regular maintenance and cleaning of the isolator row will be required to remove any sediments, particularly in the wake of heavy rainfall events or local floods. |
| Summary & Compliance with CPS | Punch have made comment against each PI identified in the CPS and the intent is to apply SuDS techniques to the development. Generally, JBA would be happy with the intent shown and the proposal delivers compliance with the CPS requirements and GDSDS recommendations.<br><br>The design will need to be fully developed for detailed design stage and details of all proposals provided on drawings for approval.<br><br>See audit trail for queries raised and response provided by Punch comments which are relatively minor in nature. It is considered that the majority can be delivered at detailed design stage for approval. |
| 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: Chris Wason BEng CEng MICE CEng
Principal Engineer

Approved by: Michael O'Donoghue BEng (Hons) MIEI
Associate 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. 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 Stage 1 | |
|---|---|
| **Project:** | 2022s0368 - SHD at Priorsland, Cherrywood SDZ, Dublin 18 |
| **Date:** | 25/03/2022 |
| **JBA Reviewers** | Chris Wason |
| BMI | HWI-JBAI-XX-XX-AU-C-0002-S3-P02.01-St_1_SWA_Feedback_Form |

| Item No. | JBA Review Comment | Comment/Clarification Request/Suggested Mitigation | Response from Client/Client Representative | Acceptable / Not Acceptable |
|---|---|---|---|---|
| | 25/03/2022 | 25/03/2022 | | 30/03/2022 |
| | **General** | | | |
| | | | | |
| 1 | It is assumed that basement tanks are to be RC units which are not preferred | Punch to clarify and if RC units justify their use. | The design of the proposed attenuation tanks sited below basements/buildings have been considered following *Chapter 21 Attenuation Storage Tanks* of the *CIRIA SuDS Manual 2015.*<br><br>The attenuation tanks below basements/buildings are proposed as RC tanks for the following reasons:<br><br>1) RC tanks with waterproofing solutions will result in waterproof tanks, derisking water ingress into the storm drainage system from ground water. It is more straightforward to address waterproofing issues with an RC tank then a modular tank underneath a building should any issues during construction arise. Where tanks are located in open ground, excavations are possible and therefore modular tanks are proposed in those instances.<br><br>2) RC tanks reduce risk of larger maintenance issues in 5+ years which is a significant consideration where the tanks are located below basements/buildings. It will not be feasible or safe to dig to the tanks once the buildings overhead are constructed.<br><br>3) RC tanks reduce risk of damage to the tanks during construction, which is a significant consideration as temporary works and permanent buildings will be constructed above the tanks and the tanks will be overrun by construction plant. | **Accepted** |
| 2 | Details of public realm detention ponds for treatment of 10mm of runoff not provided | Punch should provide details of the detention pond storage to capture 10mm of runoff. This could be provided at detailed design stage if acceptable to DLRCC | Please refer to drawing 182186-071 now provided for typical detail. This will be developed further at detailed design stage. There are two ponds shown on the drainage layout at the south east of the site, as agreed with DLRCC. The first pond will act as a forebay for capturing sediments with a secondary level of treatment provided in the second pond. | **Accepted**<br>**No calculations are provided and these will have to be provided at detailed design stage for proper sizing if acceptable to DLRCC** |
| 3 | Details of storage facilities, swales are not provided. | more details of the proposed attenuation and treatment facilities should be provided at detailed design stage for approval.<br>Additional calculations should be provided as required. | Details now provided. These will be developed further at detailed design stage. | **Accepted** |

| Item No. | JBA Review Comment | Comment/Clarification Request/Suggested Mitigation | Response from Client/Client Representative | Acceptable / Not Acceptable |
|---|---|---|---|---|
| 4 | FLOW Model<br>1 -Basement tanks are input into the model as add inflow. One tank has a pumped discharge, others are gravity and could be connected to the sw network so that the full effects of simulation can be inspected.<br><br>2 - min velocity set at 0.8m/s.<br><br>3 - no long section of pipe runs is provided<br><br>4 - some basement model CL are given as 63.95m but are different on drgs 011,012 and 013.<br><br>5 - Basement tank design setting are set to 'England and Wales' but should be set to 'Scotland and NI'<br><br>6 - Swales are included in the model as equivalent pipes but no details are provided | 1 - It is recommended that the gravity outfall from basement tanks is bult into the model so are considered fully in simulation runs. Unless Punch can provide an alternative rationale this should be done at detailed design stage.<br>2 - 1.0m/s is recommended in the GDSDS<br>3 - long sections to be provided at detailed design stage<br>4 - QA checks to ensure compatibility between model and drawings to be completed at detailed design stage<br>5 - settings should b changed for final runs<br>6 - details of swales should be provided at detailed design stage | 1) The Causeway Flow model will be updated and submitted to DLRCC at detailed design stage (and for the Stage 2 Stormwater Audit) with basement tanks included in place of added inflows in the site drainage model. Note, the added inflows are running continuously at the full allowable discharge rates in the site model which was a conservative assumption, as full flow rates are dependant on the head of water in each attenuation tank and lower flows would be expected over time.<br><br>2) Flow controls required to achieve 1l/s/ha will reduce actual velocities in the model below 1.0m/s and therefore an amended design will be of little benefit in this instance. Thermoplastic Structured Wall Pipes are proposed which have a ks value estimated to be as low as 0.06 which will increase actual velocities. A maintenance regime will be actioned in the development for cleaning the drainage lines.<br><br>3) Long-section drawings 182186-028 and 182186-029 now provided.<br><br>4) Noted, model/drawings to be updated.<br><br>5) Noted, models updated, change to 'Scotland and NI' did not affect results.<br><br>6) Standard swale detail provided on drawing 182186-072. This will be developd further at detailed design stage. | **Accepted** |
| 5 | Interception of 5mm of runoff seems to be accommodated and in compliance with Table 24.6 of the CIRIA C753. 100% of impermeable areas has been considered which is conservative as the GDSDS allows for 80%.<br>However, it is not clear on drg 011, 012, 013 how car park drainage is to be intercepted. Are these areas to be permeable paving? The Suds Management train diagram in the report indicated that they will discharge to engineered swales but this is not as shown on drawings if they discharge to a concrete tank and then to the regional detention pond. Car park runoff should be intercepted at source where possible.<br>The CPS states that *runoff from all sites must pass through at least one level of treatment…. prior to the final level of treatment in the public realm areas.* | Punch to clarify | These areas will have a permeable aspalt buildup. | **Accepted**<br>**Details of how the flow is to be captured below the surface for pervious and permeable pavements will need to be provided at detailed design stage. Pavement build up may need to be reviewed to allow for water to percolate and some units may need to be lined** |
| 6 | Exceedance flows are discussed in Table 4 of the report but no drawings are provided. | Punch to provide drawings at detailed design stage if acceptable to DLRCC | Exceedance flow drawing being prepared for planning stage. | **Accepted** |