McCloy Consulting

Flood Risk Assessment
Chestnuts Park, Haringey

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CLIENT CONTACT	Sam Neal (LBH)
PROJECT MANAGER	Phillip Duffy, Anthony McCloy
AUTHOR(S)	Iain Black, Michael Rea
BRANCH	BELFAST Mossley Mill, Lower Ground (West), Carnmoney Road North, Newtownabbey BT36 5QA T: +44 (0) 28 9084 8694 | W: www.mccloyconsulting.com

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1 INTRODUCTION

1.1 Terms of Reference

This Flood Risk Assessment was commissioned by London Borough of Haringey to support the introduction of a sustainable drainage system and detention basin in Chestnuts Park to improve biodiversity, clean surface water run-off which ultimately discharges to the River Lea and providing flood risk to surrounding residential areas.

The assessment will determine potential sources of flooding at the site and their associated risk to life and property. The assessment will determine the suitability of the site for development in relation to flood risk from various sources and propose appropriate design and mitigation measures where appropriate.

1.2 Statement of Authority

This report and assessment has been prepared and reviewed by qualified professional flood analysts specialising in the fields of hydrology, drainage and flood risk. The key staff members involved in this project are as follows:

- Iain Black MSc *BEng (Hons*) – Graduate Engineer with experience in the fields of flood risk and drainage and surface water management design.
- Michael Rea MEng *(Hons*) – Senior Project Engineer with experience in the fields of flood risk and drainage and surface water management design.
- Philip Duffy *BEng (Hons) CEng MIEI* – Associate and Senior Engineer with expertise in infrastructure engineering and drainage and wastewater design, green infrastructure, and environmental improvement schemes.
- Anthony McCloy BEng CEng FIEI - Director of McCloy Consulting and a Chartered civil and environmental engineer specialising in engineering hydrology; SuDS design and flood risk investigation and assessment.

1.3 Approach to the Assessment

Consideration has been given to the sources and extent of fluvial flooding at the site, as well as flooding of the site from pluvial sources, infrastructure failure, overland flow and ponding of localised rainfall within the site.

For the purposes of this study, the following have been considered:

- Site level information based on best available Environment Agency LiDAR data and a 3rd party survey;
- Underlying ground conditions at the site based on British Geological Society 1:50k datasets, and site investigation data.
- Available information on historical flooding in the area;
- Available online flood data published by the EA.
- Haringey Council Surface Water Management Plan (SWMP)
- Haringey Council Strategic Flood Risk Assessment (SFRA)
- North London Strategic Flood Risk Assessment (SFRA)
- Non-Statutory Technical Standards (NSTS) for SuDS
- Environment Agency Guidance on Climate Change
- National Planning Policy Framework, published March 2012 and updated June 2019.
- National Planning Practice Guidance (NPPG) for Flood Risk and Coastal Change, published March 2014

The purpose of the assessment is to demonstrate that the development meets the requirements of local and national standards and provide sufficient information to satisfy the requirements of the statutory authorities involved for the purposes of determining planning application.

2 SITE INFORMATION

2.1 Site Location

The proposed development is located within the north western corner of Chestnuts Park within the London Borough of Haringey at British National Grid reference (532479,188805).

The site context and location are shown on drawings submitted in support of the application.

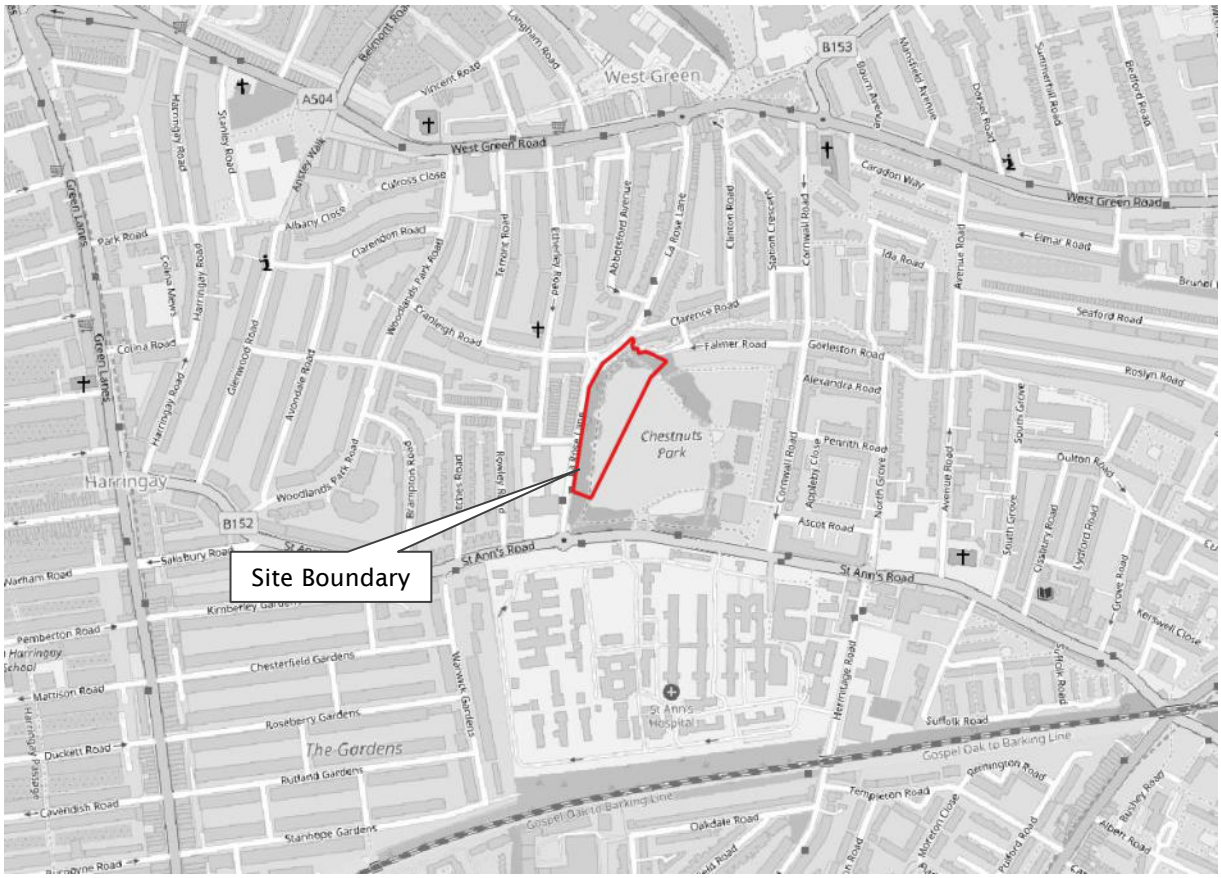

Figure 2-1 Site Location

2.2 Existing Land Use

The wider Chestnuts Park is a local greenspace containing a playground, café, tennis courts and community centre. Lands within the site boundary contains amenity greenspace with footpaths and established trees.

2.3 Proposed Development

The proposed scheme is a flood attenuation basin which incorporates a wetland feature and amenity space. A ramped access connecting to the existing pathway is proposed to provide access to the basin.

Existing	Proposed
	

Figure 2-2 Site A - Summary of Land Use Change

Figure 2-3 Proposed Basin Layout

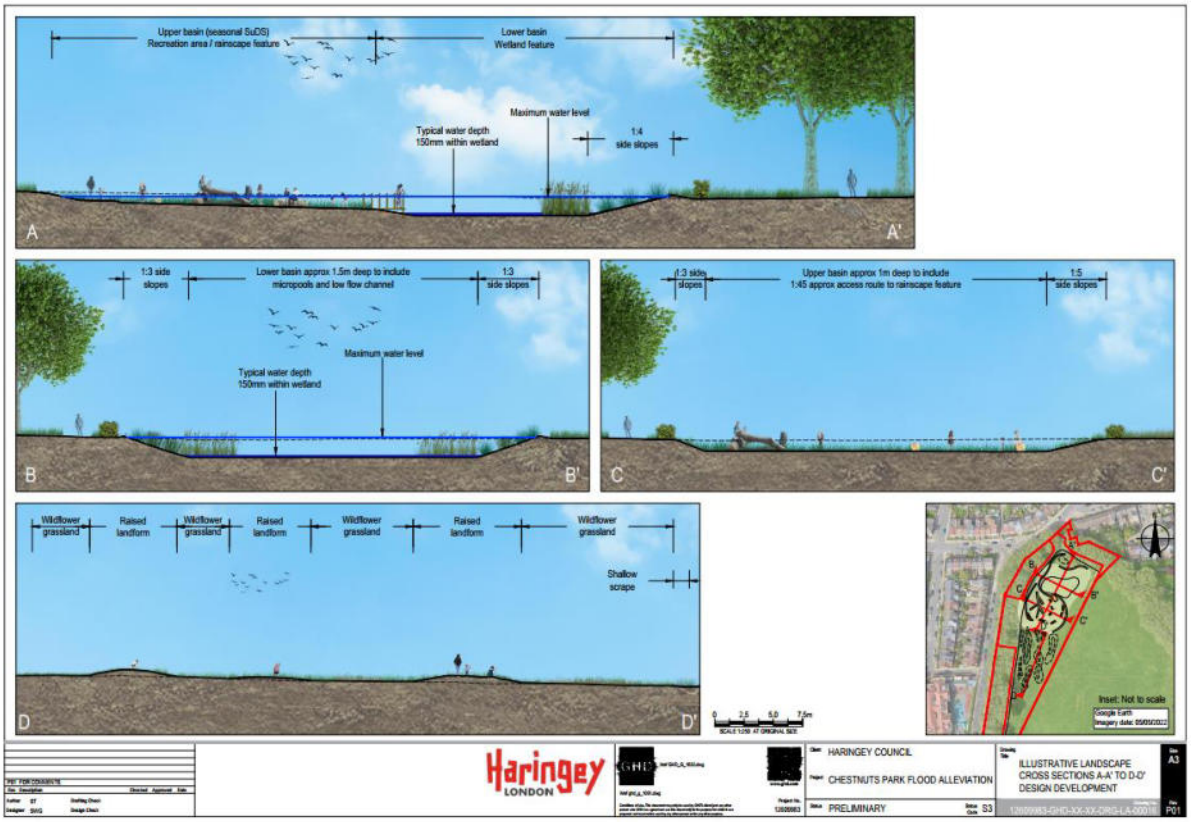

Figure 2-4 Proposed Basin Sections

2.4 Site Characteristics

2.4.1 Hydrology and Watercourses

A review of main watercourses designations indicates the nearest main watercourses are the culverted Moselle Brook located 0.8km north of the site, and the culverted Stonebridge Brook located 0.9km east of the site.

A review of ordinary watercourses was carried out. A large 1800mm diameter storm culvert coincides with the eastern boundary.

2.4.2 Topography

The site slopes to the north, with ground levels typically ranging between c. 16.1 – 12.9m AOD.

The site topographical setting and topography dictating the upgradient hydrological catchment to the site are shown in the following figure.

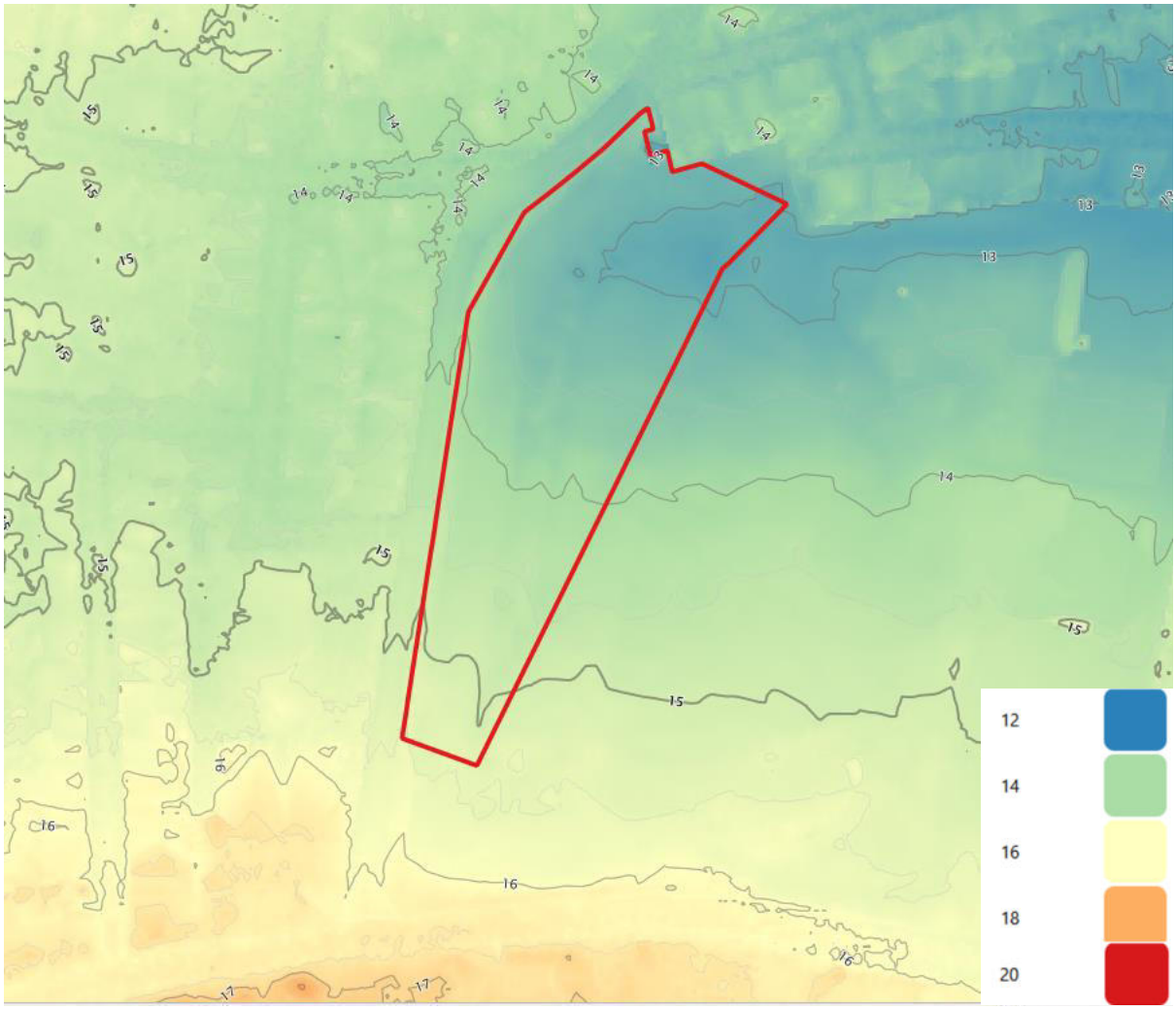

Figure 2-5 **Application Site Topography (Combined survey and 2m LiDAR)**

2.4.3 Ground Conditions

BGS Data

British Geological Survey online Geoindex Map Viewer was reviewed to determine the expected geology of the catchment. Findings as shown in British Geological Survey Mapping illustrate that no superficial geology is observed underlying the catchment, and that London Clay formation is the observed bedrock geology in the region. Furthermore, the hydrogeology map indicates that the bedrock is expected to have "essentially no groundwater" which would suggest that the medium is of low permeability.

Boreholes accessed from the British Geological Survey online Geoindex Map Viewer also provided data from nearby boreholes regarding the lithologies observed in the greater site area, which verified the information from the map viewer bedrock and superficial geology maps. The boreholes were undertaken in the St Ann's General Hospital site and a building located north of St Ann's Road and south of Ascot Road. The borehole data indicated that clay was generally encountered at depths of approximately 0.15m below existing ground level. The clay was observed to be overlain by made ground or topsoil when not encountered at ground level.

The clay can be broken into three forms in the boreholes; a stiff brown clay has been observed below made ground, of a depth of 2.13m. Beneath this is a Hard Brown Clay with sulphate crystals, this is 4.57m thick. A stiff hard blue clay with a little silt in places is observed to underly the rest of the layers, giving a maximum borehole depth of 18.29m.

Site Investigation Data

Trial pits were dug at the site in June 2022 for geotechnical analysis and waste acceptance criteria (WAC) testing. Trial pit observations confirm that ground at the site is silty clayey loam.

2.5 Urban Drainage

The site is surrounded by a separated sewerage network owned and maintained by Thames Water. Multiple storm sewers transverse the site boundary and the culverted Stonebridge Brook flows adjacent to the eastern site boundary.

Two Ø600mm dia. storm sewers traverse the site and discharge to the Ø1800mm conduit flowing adjacent to the eastern site boundary. A Ø450mm storm sewer traverses the north of the site.

A land drainage system within Chestnuts Park is noted, discharging to the Thames Water store system.

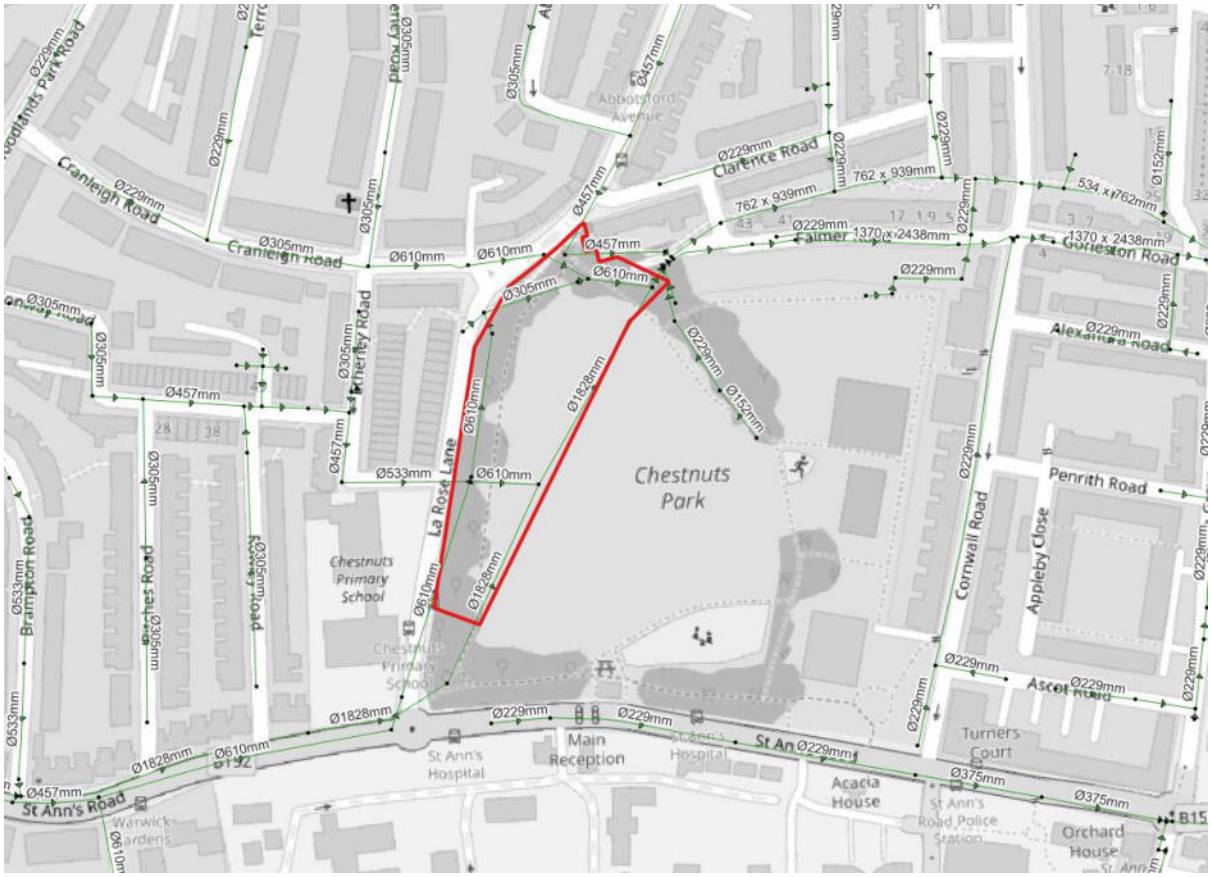

Figure 2-8 Urban Drainage

3 BACKGROUND INFORMATION REVIEW

As part of the study data collection phase, several available sources of information were investigated to develop an understanding of the potential risk of flooding to the site.

The following review highlights the key findings of the anecdotal evidence collection exercise.

3.1 Internet / Media / Background Search

A brief media search indicates that surface water flooding / ponding has historically been an issue within Chestnuts Park. A land drainage scheme was previously installed in 2000, however anecdotal reports of ponding within the park and within adjacent highways to the park have been reported.

3.2 Critical Drainage Areas

The London Borough of Hackney (LBH) Surface Water Management Plan was completed in 2011 as part of the Drain London Tier 2, several Critical Drainage Areas (CDAs) were identified at high risk from surface water flooding. The site lies within CDA 057.

3.3 North London Strategic Flood Risk Assessment

The Haringey Council Flood Management Strategy report was reviewed as part of this assessment. It highlights a number of flooding locations in the area but does not name any in proximity to the site. It concludes that Haringey was at risk from fluvial, sewer and pluvial flooding, but not groundwater or tidal flooding.

It concludes that fluvial flooding is the main source of flood risk to Haringey, particularly from the Lower Lee, Moselle Brook and Stonebridge Brook.

3.4 Haringey Council Strategic Flood Risk Assessment

Haringey Council SFRA was reviewed. No specific instants of flooding for the site or surrounding streets were identified.

Chestnuts Park was identified as being within Critical drainage Area 057 (Seven Sister Road, South Tottenham), with a drainage area of 3.03km^2, indicating the area is at risk of flooding for 1 in 100 year rainfall event.

The assessment recommends flood resilience and resistance measures to properties with a high flood risk within the area, as well as a community flood plan including St Ann's Hospital, located adjacent to Chestnuts Park.

3.5 Haringey Council Surface Water Management Plan

The report identified Chestnuts Recreation ground (Chestnuts Park) as a location to provide attenuation to improve conveyance for the critical drainage area (Group4_057).

The plan recommends flood resilience and resistance measures to properties with a high flood risk within the area, as well as a community flood plan including St Ann's Hospital, located adjacent to Chestnuts Park.

3.6 Environmental Agency Flood Mapping

For initial assessment, the location of the site was reviewed within the Environment Agency online flood mapping tool[12] and up to date EA surface water flooding data layers .Relevant extracts from the data are shown in Figures 3-1 overleaf and can be summarised as follows:

- The EA Flood Map for Planning (River and Sea) determines that the entirely of the site is situated within Flood Zone 1 and therefore not at risk from fluvial flooding.
- The EA Risk of Flooding from Surface Water Extent map indicates that the northern portion of the site coincides with an area of high flood risk (>3.3% AEP). Area of flood risk are also identified adjacent to the Falmer Road, corresponding to historical evidence.
- The EA Long Term flood risk maps show that there is no risk of flooding from reservoirs to the site.

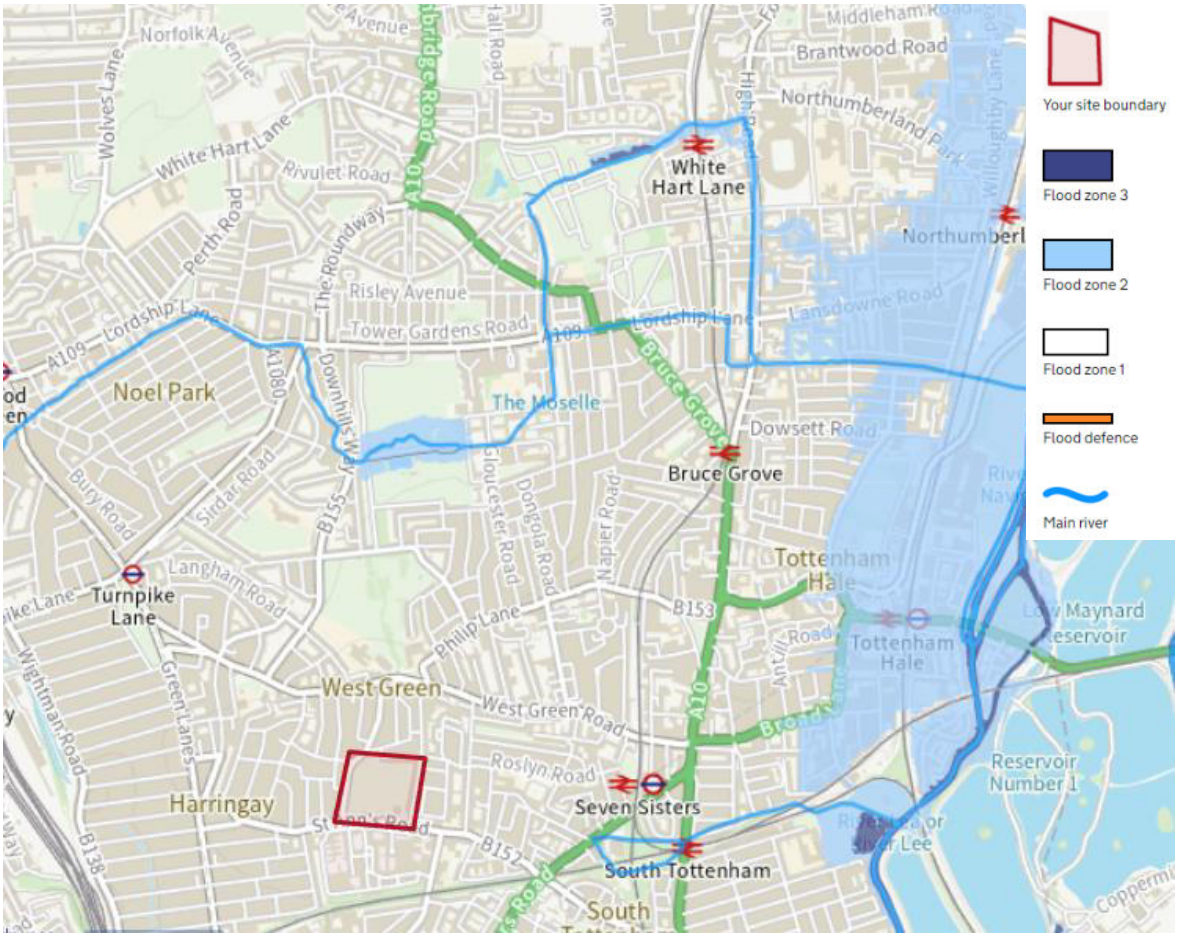

Figure 3-1 EA Flood Data- Flood Zone Mapping

1 EA (2022) Flood Map for Planning. Available at https://flood-map-for-planning.service.gov.uk/confirm-location. Accessed 05/07/2023

2 GOV.UK (2020) Long term flood risk information. Available at: https://flood-warning-information.service.gov.uk/long-term-flood-risk/map? easting=534240&northing=108428&map=SurfaceWater Accessed 05/07/2023

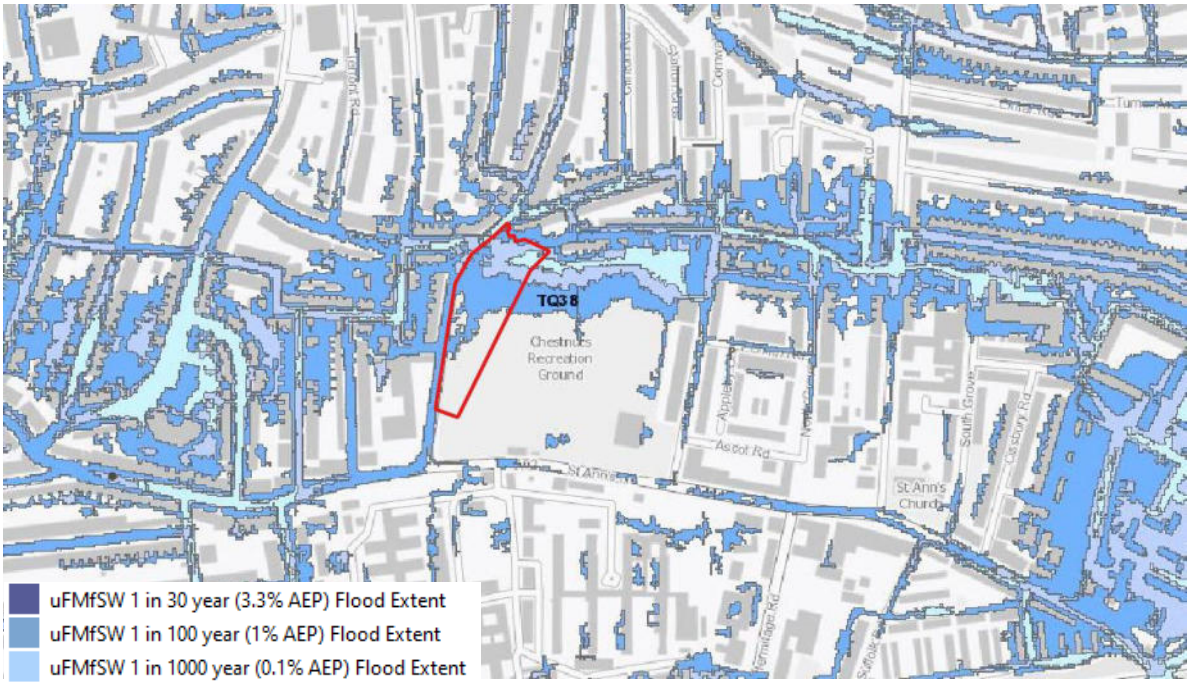

Figure 3-2 EA Flood Data- Risk of Flooding from Surface Water

3.7 Surface Water Flooding (Local Study)

EA RoFSW mapping indicates that the site may be partially affected by surface water flooding.

McCloy Consulting were previously involved in the development of an integrated Innovyze ICM 1D-2D model covering the Critical Drainage Area 057 that contains Chestnuts Park. That model was reviewed and adapted for use in this assessment and the development of the scheme. The 1D-2D model better defines the EA RoFSW flood mapping by representing underground drainage systems.

An extract of the 3.3% AEP flood mapping derived the model is shown in the following figure. Overland flow paths to the north west of Chestnuts Park are evident from St Anns Road to the south, La Rose Lane to the west and Cranleigh Road from the west.

Overland flows converge at the north west of the site before flowing easterly towards Falmer Road and Newsam Avenue.

Refer to the baseline flood maps within the technical note in Appendix A.

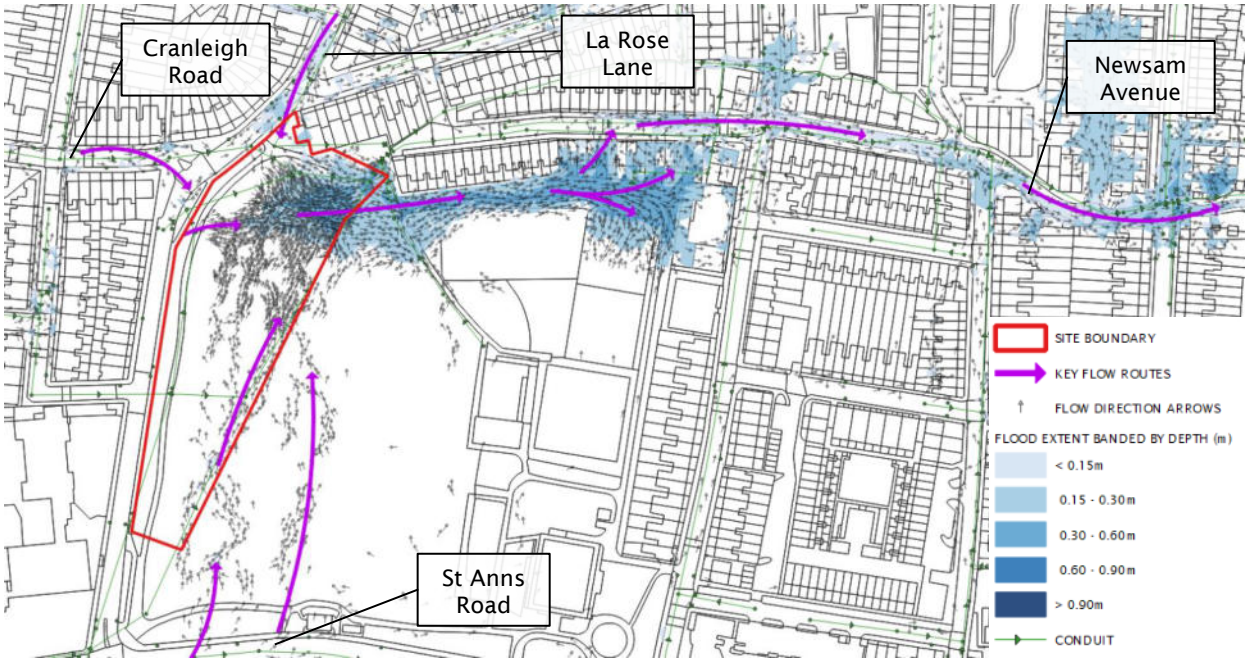

Figure 3-3: Primary Surface Flow Routes with 3.3%AEP Flood Extents

4 DEFINITION OF FLOOD HAZARD

4.1 Initial Assessment

The screening assessment is based upon the background information considered for the site in Section 2, summarised in the following table.

Table 4-1: Flood Hazard Screening

Source/Pathway	Significant/ Assess Further?	Comment/Reason
Fluvial (Rivers)	No	EA flood risk maps indicate that the entirely of the site lies within Flood Zone 1 There are no ordinary watercourses proximal to the site.
Coastal	No	N/A – inland elevated site.
Surface Water	Yes	EA surface water flood mapping indicates the site is partially affected by surface water flooding. It is noted that there is a history of surface water flooding in the area surrounding the site, Falmer Road, La Rose Lane and St Ann's Road.
Groundwater	No	Based on a review of the geological characteristics of site and a review of local flood risk documents, there is no significant risk of ground water flooding to the proposed site.
Urban drainage incapacity	Possible	Surface water flooding is likely linked with incapacity of sewers to receive surface water flow.
Reservoirs and Artificial Sources	No	No reservoirs or artificial sources located in the vicinity of the site.

Based on the information provided by the EA and other sources; the site is not affected by flooding from fluvial or groundwater sources. The risk of surface water flooding is assessed subsequently.

5 ASSESSMENT OF FLOOD RISK

5.1 NPPF Requirements

Paragraph 167 of the NPPF is considered applicable to the proposal which states:

> *When determining any planning applications, local planning authorities should ensure that flood risk is not increased elsewhere. Where appropriate, applications should be supported by a site-specific flood-risk assessment. Development should only be allowed in areas at risk of flooding where, in the light of this assessment (and the sequential and exception tests, as applicable).*

The following table details the NPFF specific requirements and how the proposed development satisfies requirements.

Table 5-1 NPPF Requirements - Responses

NPPF Requirement	Comment
Within the site, the most vulnerable development is located in areas of lowest flood risk, unless there are overriding reasons to prefer a different location.	The scheme is primarily intended to reduce flood risk for the benefit of downstream residents through making additional space for water within Chestnuts Park. The flood attenuation basin is therefore positioned in a location of surface water flood risk.
The development is appropriately flood resistant and resilient such that, in the event of a flood, it could be quickly brought back into use without significant refurbishment.	The lower tier of the basin is proposed as a wetland feature. It is anticipated that this area will receive a low baseflow for the majority of the year. Inflow to this area will increase in response to rainfall. Once the capacity of the lower tier of the basin is taken up, the upper basin will begin to inundate. This is discussed further in Section 6.2. Planting and play infrastructure within the basin is proposed to be flood resilient and quickly brought back into use without significant refurbishment.
It incorporates sustainable drainage systems, unless there is clear evidence that this would be inappropriate.	The flood attenuation basin scheme incorporates a low flow channel with wetland planting. The proposed flood alleviation scheme is nature based.
Any residual risk can be safely managed.	Refer to Section 6.3
Safe access and escape routes are included where appropriate, as part of an agreed emergency plan.	Refer to Section 6.4

5.2 NPPF Sequential Test

The NPPF outlines Government policy on development and flood risk. It aims to ensure that flood risk is considered throughout the planning process for any new development. Where there is a risk, this should be reduced through the strategic planning process, without increasing flood risk elsewhere.

The development is classified as water compatible and within Flood Zone 1. Based on Table 5-2, a Sequential Test and Exception Test is not required.

Table 5-2 Flood Risk Vulnerability and Flood Zone 'Compatibility'

Flood Zone	Flood Risk Vulnerability Classification				
	Essential Infrastructure	Highly Vulnerable	More Vulnerable	Less Vulnerable	Water Compatible
Zone 1	✓	✓	✓	✓	✓
Zone 2	✓	Exception Test Required	✓	✓	✓
Zone 3a	Exception Test Required	X	Exception Test Required	✓	✓
Zone 3b	Exception Test Required	X	X	X	✓

5.2.1 Climate Change

The National Planning Policy Framework (NPPF) sets out how the planning system should help minimise vulnerability and provide resilience to the impacts of climate change. Guidelines on climate change projections published in February 2016 (revised February 2017)[3] , set out revised guidelines for climate change for river flows and rainfall run off.

The site is located within Flood Zone 1, therefore climate change allowances on fluvial flooding is not relevant to the site.

The impact of climate change factor applied to rainfall intensity is dependent of the lifetime of the development. The EA 1% AEP 2070's upper end allowance for climate change is +40% within the London catchment.

5.3 Haringey Local Plan Flood Risk Policy Requirements

The Haringey Development Management DPD outlines Haringey's spatial strategy and the key objectives of the Strategic Policies Local Plan. The policies relevant to this assessment are:

Policy DM24: Managing and Reducing Flood Risk

- The Council will ensure that all proposals for new development avoid and reduce the risk of flooding to future occupants and do not increase the risk of flooding.
- All proposals for new development within Flood Zone 2 and 3a will be required to provide sufficient evidence for the Council to assess whether the requirements of the Sequential Test and Exception Test, where required, have been satisfied. Proposals must be informed by a site specific Flood Risk Assessment (FRA) taking account of all potential sources of flooding and should:
    - Demonstrate the application of a sequential approach for the development of individual sites to ensure that the most vulnerable land uses are located in areas of the site that are at lowest risk of flooding;
    - Preserve overland flood and flow routes and ensure there is no net loss of flood storage. Adequate flood storage and compensation should be provided on site, or if this is not possible, provided off site where circumstances allow;
    - Where appropriate, set out the mitigation measures that will be incorporated on site to manage residual flood risk including:
        - Finished floor levels set no lower than 300mm above the 1 in 100 chance in any given year, including an allowance for climate change, flood level; and
        - Ensure safe access and egress for future users of the development or an appropriate emergency evacuation plan.

    - Contribute to naturalising watercourses where opportunities arise.
- All proposals for new development will be required to:
    - Manage and reduce surface water run-off; and
    - Manage water and waste water discharges.
- With the exception of water compatible uses and essential infrastructure, development in areas designated in Haringey's Strategic Flood Risk Assessment as being within Flood Zone 3b will not be permitted.

Policy DM26: Critical Drainage Areas

- All proposals for new development within a Critical Drainage Area (CDA) will be required to incorporate measures to reduce the overall level of flood risk in the CDA
- Proposals for new development within Local Flood Risk Zones must include a statement describing how flood risk issues have been addressed. The Council may require a further site-specific Flood Risk Assessment to assess risk, particularly from surface water flooding.

In response to these policies;

- *DM24 and 26 are in line with the requirements set out in NPPF, which are responded to in Table 5.1.*
- *Proposals introduce additional flood storage, complying with DM24.*
- *This study demonstrates how the proposals reduce the overall level of flood risk as required by DM26.*

6 FLOOD RISK ALLEVIATION SCHEME – TECHNICAL ASSESSMENT

6.1 Proposed Flood Risk Alleviation Scheme

The scheme proposals will not result in an increase in run-off rates from the site. The proposals will intercept overland flow routes within the park that would naturally coalesce at the location of the proposed basin. Surface runoff from adjacent Thames Water storm sewers will be diverted into the basin, creating additional capacity within the Thames Water storm network.

The proposed development will attenuate run-off and promote natural losses, creating betterment in the wider catchment. The proposals have been hydraulically modelled (see Appendix A) to demonstrate the effect of the development.

Underlying ground conditions restrict potential for discharge of water to groundwater.

The Thames Water network within the catchment is a separated network. Thames Water sewers to be connected to the basin are storm sewers carrying flows from La Rose Lane, Cranleigh Road and St Ann's Road to the west of the site. Landscape proposals include a low flow channel and wetland system within the lower basin to improve water quality of grey water.

No further mitigation is required. A connection application to the Thames Water network will be required to permit a discharge from the basin. Figures overleaf show the design sketches for the site, and are enclosed within Appendix B.

6.2 Basin Operation

It is proposed to divert the Thames Water storm sewers into the lower portion of the basin. The lower portion of the basin forms a low flow channel which will carry day to day flows and a wetland. Water levels will rise in the lower basin following storm events and is anticipated to be contained within the lower basin for all events up to the 2 year (50% annual exceedance probability (AEP)) storm events.

The upper basin will start to fill following storm events of between a 2 and 5 year magnitude (i.e. between a 50% AEP and a 20% AEP). (It is note that the basin will not fill fully for these events and it is estimated that the top tier will fill up to 300mm depth for the 1 in 5 year rainfall event).

Modelling indicates it will take c. 40-50 minutes from the start of a rainfall event until water levels start to inundate the top basin for a short intense 60 minute duration event.

The bottom of the upper basin has a 1 in 40 slope towards the lower basin. Flooding of the upper basin will gradually encroach the basin floor until fully inundated. The slope of the upper basin will restrict ponding within the upper basin following drawdown of the lower basin.

Modelling indicates level drawdown from the basin will take c. 30-55 minutes to achieve 50% drawdown and c. 3 hours for full drawdown.

Properties removed from each flood risk band in line with Environment Agency GIA criteria is displayed on the following table.

Table 6-1 Environment Agency GIA Flood Risk Bandings

Flood Risk Band	Probability Band	Assumed likelihood	Properties Removed from Band
Very significant risk band	>=5%	1 in 20 or a 5% annual chance of flooding	98
Significant risk band	<5% to >2%	1 in 40 or a 2.5% annual chance of flooding	36

Flood Risk Band	Probability Band	Assumed likelihood	Properties Removed from Band
Intermediate risk band	2% to >1%	1 in 75 or a 1.33% annual chance of flooding	17
Moderate risk band	1% to >0.5%	1 in 150 or a 0.67% annual chance of flooding	9
Low risk band	<=0.5%	1 in 200 or a 0.5% annual chance of flooding	6

Refer to the hydraulic assessment technical note within Appendix A.

6.3 Designing for Exceedance

Outflows from the basin are controlled by a 300mm pipe. Any flows in exceedance of the basins capacity will follow similar flood mechanisms as per the present day baseline scenario, however the magnitude of the overland flow will be reduced.

The hydraulic model was updated with the proposed geometries to establish the effect of the proposals within and outside of the site. An extract of the proposed flood map for the 20 year event is shown on the following figure. Further mapping and analysis is contained within Appendix A.

Figure 6-1 20 Year (5% AEP) Proposed Flood Map Extract

6.4 Safe Access and Egress to the Basin

A ramp with slope 1:40 will provide access to the upper tier of the basin. Side slopes to the upper basin range between 1:4 and 1:3, reducing to 1:10 adjacent to the ramp. Side slopes from the lower basin are maximum 1:3, reducing to 1:6 to the upper basin and 1:5 to the north of the basin.

Levels have been sited to ensure gentle slopes out of the basin via the designated access ramp or from the other sides of the basin if required.

Egress from the basin at times of flood will be per route shown on the following figure. The route out of the basin has been conservatively estimated as a maximum 75m as shown. The egress route will take 94 seconds to complete based on a conservative walking speed of 0.8m/s representative of less able bodied persons. A person of typical walking speed of 1.4m/s would take 54 seconds to exit the basin.

Model simulation results have been reviewed and the time for inundation of the top tier of the basin is estimated from 40 minutes. Between 45 and 50 minutes from the 20yr event onward, depending on event severity.

This demonstrates that an able bodied person would have more that adequate time to egress from the basin should filling of the top tier of the basin be observed.

The likelihood of the top tier of the basin filling will be infrequent, but the basin will fill in response to significant rainfall. Signage indicating the functioning of the basin along with notification to vacate the basin should the top tier of basin storage start to fill will be provided.

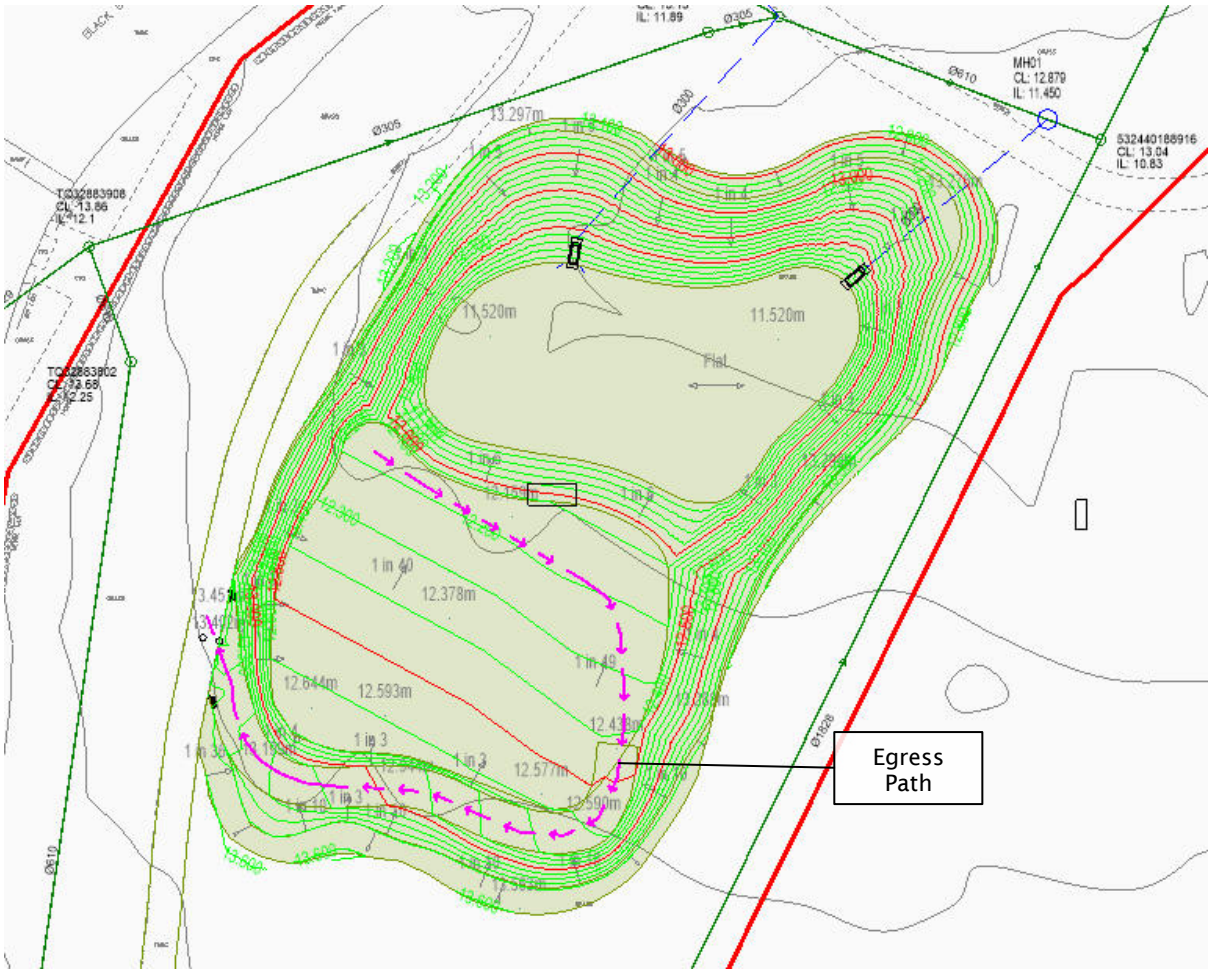

Figure 6-2 Egress Route from Basin

6.5 Maintenance Requirements

A management and maintenance plan has been developed by the Landscape Architects as part of the scheme, included within the Landscape Planning & Seeding Palette.

The plan details the maintenance required and the expected frequency of action. Maintenance visits are to be made on a regular monthly basis with the following tasks carried out:

- Litter collection.
- Removal and replacement of dead and vandalised plants.
- Watering of lawns, trees and shrubs as necessary.
- Weeding of beds and borders.
- Pruning of herbaceous, wetland planting and semi-native shrubs once a year.
- Pest and disease control.
- Topping-up of bark mulch as needed.
- Grass cutting and trimming of edges as set out in the grass cutting
- Removal of any wetland plant material/ debris within 1 m of the inlet and outlet features.
- Removal/ thinning of any wetland plant material may be required after the 3 year establishment period to maintain flow and function

Refer to the Landscape Planning & Seeding Palette for further information.

7 SUMMARY & CONCLUSION

The site is located within Flood Zone 1. The site is noted to be at risk of surface water flooding. The proposal is considered as "water compatible" and as such the principle of development within that Zone is permissible. Excavation for the proposed basin will intercept runoff from the adjacent lands. Thames Water storm sewers are proposed to be diverted to the basin.

Pre and post development has been assessed by a detailed 1D-2D integrated hydraulic model and the effect of the development has been assessed as net beneficial. In all return periods assessed, flood risk has been demonstrated to be reduced and no new receptors are at risk of flooding or existing receptors at risk of additional flooding.

Hydraulic model results demonstrate that the scheme reduces the overall flood risk within the catchment, particularly for lower return period events.

Time of filling an emptying of the basin has been assessed. The assessment outlined by this report demonstrates that the rate of inundation allows for safe egress. Time to empty assessment demonstrates that the basin will empty out relatively quickly allowing for the basin to be back in use within a relatively short timeframe.

The development is considered acceptable in relation to flood risk and in accordance with the relevant planning policies including the NPPF.

Appendix A

Hydraulic Modelling Technical Note

McCloy Consulting

Hydraulic Assessment

Chestnuts Park, Haringey

M01600-11_TN01 | July 2023

WATER & ENVIRONMENTAL CONSULTANTS

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CLIENT CONTACT	Sam Neal (LBH)
PROJECT MANAGER	Philip Duffy, Anthony McCloy
AUTHOR(S)	Michael Rea
BRANCH	BELFAST Mossley Mill, Lower Ground (West), Carnmoney Road North, Newtownabbey BT36 5QA T: +44 (0) 28 9084 8694 | W: www.mccloyconsulting.com

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DISTRIBUTION

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APPENDICES

Appendix A Stage One – Baseline Flood Mapping
Appendix B Stage Two – Conceptual Plan Flood Mapping

1 INTRODUCTION

1.1 Terms of Reference

This hydraulic assessment was commissioned by London Borough of Haringey and seeks to determine the effect of integrating flood management measures within Chestnuts Park and to what extent these will reduce the risk of flooding to properties in proximity to Chestnuts Park.

1.2 Introduction to the Assessment

Hydraulic modelling of the basin was carried out using a fully integrated 1D-2D model in Innovyze ICM v8.5 software. Chestnuts Park is located within Critical Drainage Area (CDA) 057, as such the surrounding area has been modelled in detail.

McCloy Consulting were previously involved in enhancements and the validation of CDA models throughout the borough on behalf of Haringey Council in 2018 as part of an Integrated Catchment Management Study.

The underlying validated model was utilised to assess the impact of the proposed basin at Chestnuts Park.

The assessment was conducted in two stages, namely;

- Reviewing and repurposing a baseline (present day) 1D-2D flood model using best available data to establish the properties at risk from flooding downslope of the site. The model was re-simulated for the 2, 5 year return periods as well as the 20, 30, 75, 150, and 200 year return periods in line with Flood and Coastal Erosion Risk Management (FCERM) funding requirements.
- The model was adapted to investigate the potential for reduction of flood risk of properties surrounding and downgradient of Chestnuts Park following introduction of the proposed basin.

2 STAGE ONE – BASELINE MODEL

2.1 Approach to the Assessment

A 1D-2D linked hydraulic model had been previously developed in Innovyze ICM V8.5 software for the entire Critical Drainage Area 057 containing Chestnuts Park as part of an Integrated Catchment Management Study (ICMS) carried out in 2018 by McCloy Consulting.

The key inputs to the 2018 ICMS are summarised as follows:

- OS MasterMapping was used to define physical areas within the hydraulic model, represented as roughness zones, porous polygons, infiltration zones etc.
- 1m LiDAR was used across the model to define the topographical catchment and form the ground model within the hydraulic model.
- Thames Water asset data was used to represent storm sewerage within the CDA. Thames Water data was updated with survey data were held as part of the ICMS model, particularly on the Stonebridge Improvement Culvert.
- Haringey gully data was included within the model to represent flows into and out of the 1D network from the 2D surface.
- Threshold levels for properties at risk of flooding were assumed based on 300mm above mean ground level.
- FEH rainfall data was applied directly to 1D subcatchments, draining to storm sewers.
- Infiltration losses from permeable surfaces were implemented using the New UK runoff model with a New UK depth value of 0.1. There is a low infiltration potential due to the shallow bedrock geology of London Clay.
- The model was simulated for the 3.3% AEP and 1% AEP events. The 60 minute (1 hour) duration event was assessed as the critical duration for the model.

The following summarises the changes applied to the 2018 ICMS model for its use as the baseline model within this project:

- All Thames Water sewers within Chestnuts Park was reviewed against survey information obtained.
- The ground model was replaced with a composite ground model, updating the existing LiDAR data with ground based topographical survey within Chestnuts Park where available.
- A mesh zone was placed over Chestnuts Park to increase model 2D mesh density and capture key flow routes within the park in greater detail.
- Rainfall was previous applied as 1D subcatchment to the 1D network and allowed to spill onto the 2D surface which has the potential to under represent overland flows within rural areas and large parks. Rainfall within Chestnuts Park was updated to be applied to the 2D surface, with remaining areas applied to 1D subcatchments per the ICMS model.
- Additional hydrological analysis was undertaken to include the following return periods for lower return period analysis and per Environment Agency funding requirements: 2 year (50% AEP), 5 year (20% AEP), 10 year (10% AEP), 20 year (5% AEP), 30 year (3.3% AEP), 75 year (1.3% AEP), 150 year (0.66% AEP), 200 year (0.5% AEP).

This methodology allows for an assessment of the baseline risk to properties at Chestnuts Park and establish the number of properties at risk of flooding.

2.2 1D Model Elements

2.2.1 Storm Conduits and Manholes

Thames Water asset data, supplemented by survey data where available forms the 1D representation of storm sewerage within the model. A typical Colebrook-White roughness value of 0.6 was used to represent the conduits. Where survey information was available, asset data was updated with surveyed invert, size and cover level.

2.2.2 Gullies

Gully data supplied by Haringey Council are used in the model to convey flows from the 2D surface to the 1D conduits. Gully invert levels are assumed to be at a depth of 0.3m below road level and are assumed to be connected to the storm network through the closest manhole via 100mm conduits.

2.2.3 1D Subcatchments

Thames Water 1D subcatchments were used within the model to generate flows to the 1D storm system. Subcatchments were previously generated by Thames Water and were reviewed as part of the 2018 ICMS study. Subcatchments convert rainfall applied to runoff based on areas of surface types (hardstanding, permeable, rooftop). Flows are conveyed directly to the 1D network.

Runoff routing parameters are used as follows:

- Roads / Hardstanding – Wallingford Routing Model – 0.75 fixed runoff coefficient.
- Rooftops – Wallingford Routing Model – 0.75 fixed runoff coefficient -0.05 ground slope (initial loss).
- Permeable – NewUK Runoff Volume Type – Initial Loss Value 0.002m – New UK Depth -0.1m.

Parameters were unchanged from the 2013 original CDA model, validated and reviewed as part of the 2018 ICMS update.

2.2.4 Foul Model Representation

The Thames Water network is separate within the CDA057 catchment which contains Chestnuts Park. As part of the previous ICMS study in 2018, the foul model network was run in parallel to the storm network. There are no modelled connections to the storm network, however some representation of storm flows to the foul network can be common in reality– e.g. on the rear rooftops of older and terrarced houses.

As part of the ICMS study, the foul network model was run in parallel to the storm network model and representation of spills from the foul network were made by applying out of network flows from the foul model to the storm model surface corresponding to the relevant surcharged foul manhole.

No spills from the foul network were noted within proximity to Chestnuts Park that would affect the proposal.

2.3 2D Model Elements

2.3.1 2D Zone

The terrain model was loaded into InfoWorks ICM as a ground model, and subsequently converted into 2D mesh elements (the surface used to simulate flows across the topography within the model). The 2D zone has a maximum triangle size of 25m^2, reducing to 7m^2 within Chestnuts Park and 2m^2 in the north west of the park corresponding to the location of the attenuation basin. Additional detail, such as kerb lines were delineated within the model mesh to ensure representation of key flow routes.

2.3.2 Boundary Conditions

A normal depth boundary condition was applied to all boundaries in the 2D zone. This boundary has been sited sufficiently downstream of the study area to limit the possibility of levels being artificially influenced by the boundary condition. The normal condition assumes that slope balances friction forces with flow depth and velocity remaining constant when water reaches the boundary, so water can flow out without energy losses.

2.3.3 Surface Roughness

A Manning's n Roughness value of 0.0125 has been applied to the whole 2D zone to represent the urban make up of the area over which water would flow, including roads, pathways and other hardstanding areas.

Grassed areas were represented using roughness zones to delineate areas from the base roughness with a typical roughness value of 0.04,

2.4 Model Simulations

2.4.1 Model Results

Rainfall durations of 60, 180, 360 minutes were tested to assess the model critical duration. The shorter 60 minute storm event was assessed as most critical rainfall event and adopted as the design duration.

Simulations for the design events were run with a 60 minute duration. Overland flow paths to the north west of Chestnuts Park are evident from St Anns Road to the south, La Rose Lane to the west and Cranleigh Road from the west.

Overland flows converge at the north west of the site before flowing easterly towards Falmer Road and Newsam Avenue.

An extract of the 3.3% AEP flood depth / extent mapping is shown on the following figure with key overland flow routes highlighted. Refer to Appendix A for flood mapping for all return periods simulated.

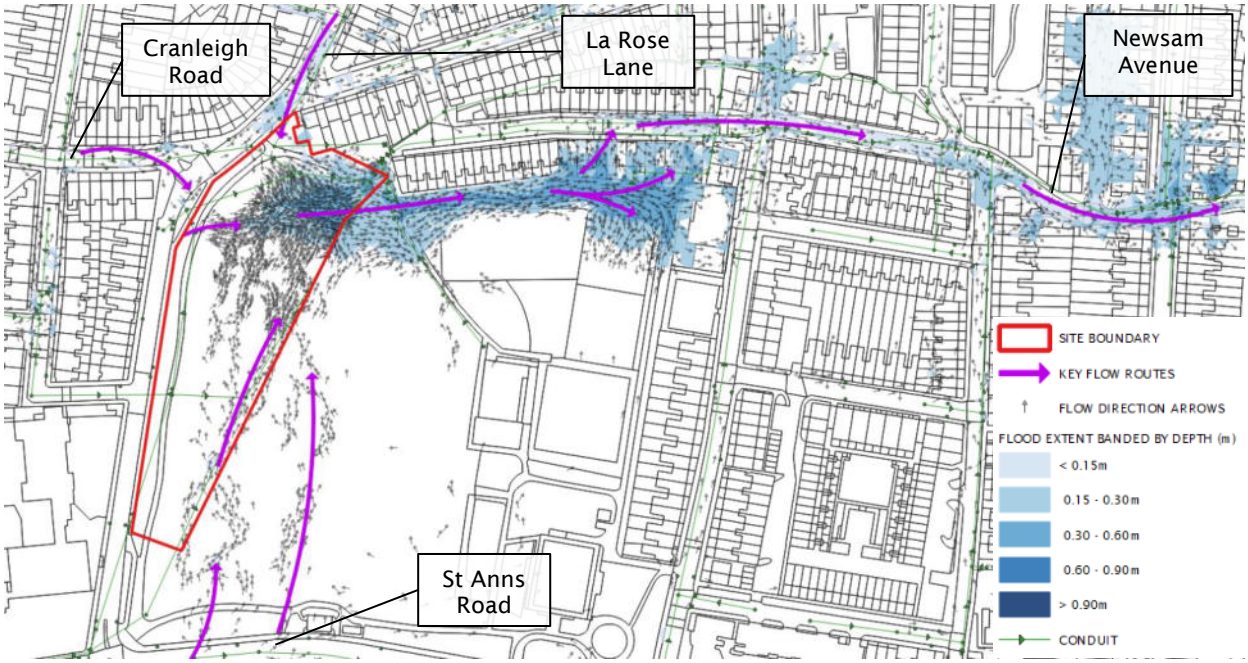


Figure 2-1: Flow Routes underlaid with 3.3% AEP Flood Extents

3 STAGE TWO – PROPOSED SCHEME MODEL

3.1 Approach to the Hydraulic Analysis

To ensure continuity between models, the stage one model was used as the base for the second stage model with key parameters and rainfall inputs remaining the same.

The following summarises the adaptations made to the model:

- The ground model was updated with proposed topographical changes (basin cuts, landscaping). The 2D mesh was retained and resampled to ensure comparability between baseline and proposed modelling.
- A Ø 300mm connection from MH TW32884905 to the new basin 2D outfall is created.
- A Ø 300mm connection from the basin to a new manhole on the Ø 600mm conduit between MH TW32884905 and MH 532440188916 on the large diameter Ø 1800mm Stonebridge Improvement Culvert. Flows are limited by the conduit pipe size.
- A Ø 450mm connection between MH TQ32883907 and MH TW32884905 permits flow from La Rose Lane to discharge to the basin.

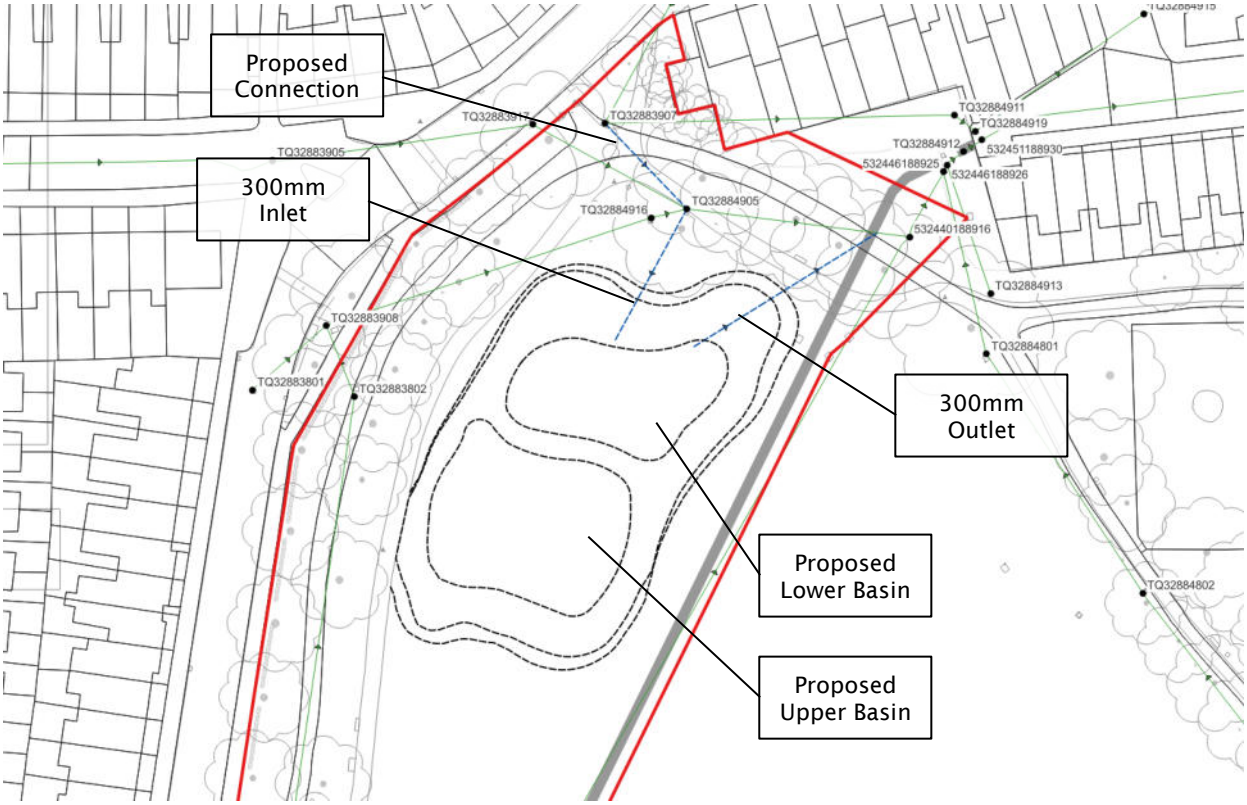


Figure 3-1 Proposed Geometry Changes (Indicative for Modelling)

3.2 Hydraulic Model Simulation Results

The configuration of the connection of the basin during model development was tested in multiple configurations to optimise the storage within the basin. Scenarios tested included:

- PR1 – No Control - unrestricted inflow / outflow to/from the basin. Flows diverted from the main line by a new 600mm pipe. A penstock is proposed downstream of diversion. Flows from basin outfall to via a 600mm pipe back to the system.
- PR2 – Outlet Controlled - Flows diverted from the storm system per PR1, however flows are restricted from the basin back to the storm system via a 300mm pipe.
- PR3 – Inlet Controlled - Flows into the basin are restricted by a 300mm pipe, flows from the basin outfall back to the storm system via a 600mm pipe.

- PR4 – Inlet + Outlet Controlled - Inflows to basin are controlled per PR3, outflows from basin are controlled per PR2.

Overall it was found that there is limited sensitivity between scenarios, inlet control with / without outlet control (PR3/PR4) tends to marginally outperform, particularly at lower return periods. Scenario "PR4" was taken forward as the preferred option with both the inlet and outlet to the basin controlled by a smaller diameter pipe.

The updated model was run with the same simulation settings and rainfall files as the baseline model to ensure direct comparability. Flood map outputs from the proposed model are enclosed within Appendix B. An extract of the 20 year (5% AEP) proposed flood extent is shown in the following figure.

Figure 3-2 20 Year (5% AEP) Proposed Flood Map Extract

The proposed basin provides additional volume within the Thames Water storm network which will reduce surcharging of manholes flows within the network. The basin will also attenuate and slow flows passing through the network to marginally reduce time to peak flows.

Approximately 7000 properties were sampled within proximity of Chestnuts Park, including properties on flow routes downstream of the park where benefits of the scheme are most likely to be realised.

The following table summarises the properties at risk of flooding for the respective storm events modelled of the sampled properties. The proposed scheme is shown to be most effective at lower return periods up to the 75 year return period.

Table 3-1 Properties Flood Risk Reduction (Predicted)

	M10-60	M20-60	M40-60	M75-60	M100-60	M150-60	M200-60
Baseline Properties Inundated	2602	3285	3758	4224	4488	4666	4806

	M10-60	M20-60	M40-60	M75-60	M100-60	M150-60	M200-60
Proposed Model Properties Inundated	2595	3191	3722	4207	4479	4657	4800
Properties Reduction in Flood Depth – (Unfiltered)	339	1064	1429	1998	2060	2242	2640
Reduction of Flood Depth >20mm	31	163	226	414	273	148	4
Properties removed from flooding	7	98	36	17	9	9	6

Properties removed from each flood risk band in line with Environment Agency GIA criteria is displayed on the following table.

Table 3-2 Environment Agency GIA Flood Risk Bandings

Flood Risk Band	Probability Band	Assumed likelihood	Properties Removed from Band
Very significant risk band	>=5%	1 in 20 or a 5% annual chance of flooding	98
Significant risk band	<5% to >2%	1 in 40 or a 2.5% annual chance of flooding	36
Intermediate risk band	2% to >1%	1 in 75 or a 1.33% annual chance of flooding	17
Moderate risk band	1% to >0.5%	1 in 150 or a 0.67% annual chance of flooding	9
Low risk band	<=0.5%	1 in 200 or a 0.5% annual chance of flooding	6

3.3 Basin Performance

Frequency of inundation and drawdown duration

The performance of the basin was assessed through modelling additional lower return periods to determine frequenting of flooding of the basin at lower return periods. The upper portion of the basin is predicted to fill from between a 2 and 5 year storm event, i.e. will have between a 50% and 20% probability each year of inundation of the upper basin, as detailed in the following table.

Table 3-3 Basin Water Levels

Return Period	Peak Water Level (mOD)	Max Lower Basin Water Depth (m)	Max Upper Basin Water Depth (m)	Time for Water Levels to Reach Upper Basin (mins)	50% Drawdown (mins)
2 (50% AEP)	12.01	0.49	0	N/A	30
5 (20% AEP)	12.26	0.74	0.10	50	30
20 (5% AEP)	13.07	1.55	0.91	45	45
30 (3.3% AEP)	13.17	1.65	1.01	40	55

Predicted drawdown from the basin is shown in the following figure. Full drawdown for storms will occur in c. 3 hours, increasing dependent on magnitude of the storm event, drawdown will be sensitive to storm duration, climatic conditions and antecedent conditions.

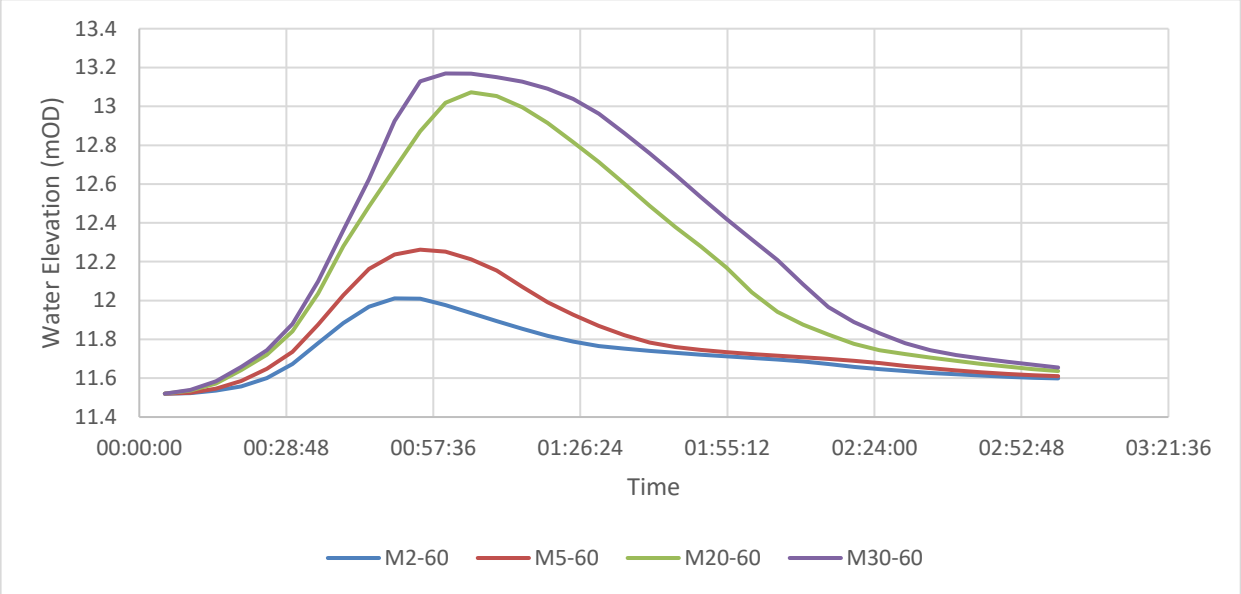


Figure 3-3 Basin Drawdown

Rate of Inundation

Water levels will rise in the lower basin following storm events and is anticipated to be contained within the lower basin for all events up to the 2 year (50% annual exceedance probability (AEP)) storm events.

The upper basin will fill following storm events of between a 2 and 5 year magnitude (i.e. between a 50% AEP and a 20% AEP). Modelling indicates it will take c. 40-50 minutes from the start of a rainfall event until water levels start to inundate the top basin (at 12.1mOD) for a short intense 60 minute duration event.

An estimate for the inundation of the top basin to a level of 12.4mOD, corresponding to a 300mm flood depth is between 45 and 50 minutes. It is noted that a 5 year event is not predicted to achieve a 300mm flood depth.

4 HYDRAULIC MODELLING ASSUMPTIONS

4.1 Modelling Assumptions

The representation of any complex system by a model requires a number of assumptions to be made. In the case of the hydraulic model developed for the purposes of the study it is assumed for both baseline and proposed model that:

- The terrain model (based on ground based topographic survey, supplemented with EA 1m LiDAR accurately represents the surface topography and associated flow paths.
- The design flows are an accurate representation of flows of a given return period.
- Ground roughness, represented by a Manning's 'n' value is an accurate reflection and does not vary with time. Roughness zones were introduced to delineate key changes in roughness from the urban land use at open parks, grassed areas etc.
- Property floor level is taken as 0.3m above mean underlying ground level at each individual dwelling.
- Thames Water subcatchments utilised to inform flows to the storm network are assumed to provide an accurate reflection of system inflows.
- Antecedent conditions are assumed as dry.
- The model does not represent any topographic features smaller than the minimum resolution of the underlying terrain model used for constructing the hydraulic model for the site.
- Modelled sewers are assumed to be in a good condition with no blockages.

The limitations of the modelling exercise are noted as:

- Due to the quantity of properties affected in the wider catchment a property threshold survey has not been undertaken. An assumption of property floor levels of 0.3m above mean underlying ground levels was adopted per best industry practice.
- Due to the iterative design process of the basin within the model and project timelines for delivery, the finalised shape of the basin has not been modelled. The updated design shape of the basin offers a marginally smaller volume of 1773m^3 vs 1790m^3 of volumetric storage modelled (<1% difference). The marginal difference is within error bounds of the model output.

5 SUMMARY

This assessment indicates that the proposed basin within Chestnuts Park has the potential to reduce predicted downstream flooding by providing headroom within the Thames Water storm network.

The assessment utilises an existing detailed 1D-2D integrated urban drainage model previously developed for the critical drainage area which has previously been validated, reviewed and sensitivity tested. The model was modified for use in a site specific setting.

FEH design rainfall was applied to the model across three rainfall durations, the 60 minute critical duration was determined as most critical and was adopted for the design analysis. The model was simulated with return periods of 2, 5, and 10 year as well as 20, 40, 75, 150 and 200 year return periods per the Flood and Coastal Erosion Risk Management (FCERM).

The proposed simulation design demonstrates there is a significant potential for flood risk reduction for properties downgradient, removing up to 98 properties from the very significant risk band.

Appendix A

Stage One – Baseline Flood Mapping

532400 532500 532600 532700 532800

189000

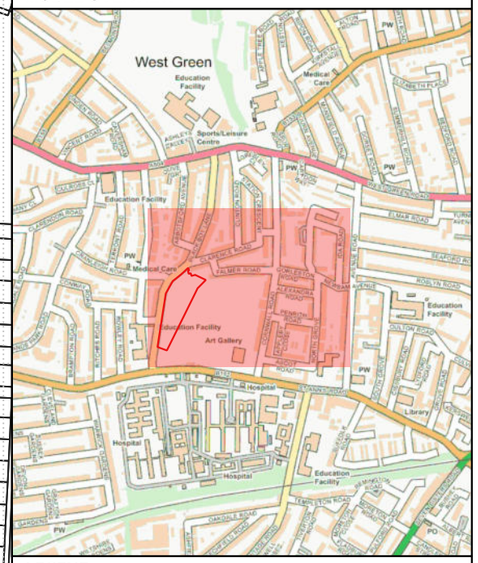
188900

188800

N

0 25 50 75 m

MODEL OVERVIEW



LEGEND

FLOOD EXTENT BANDED BY DEPTH (m)

- < 0.15m
- 0.15 - 0.30m
- 0.30 - 0.60m
- 0.60 - 0.90m
- > 0.90m
- CONDUIT

NOTES

1.FLOOD EXTENTS WITHIN CHESTNUTS PARK ARE PLOTTED ON GROUND BASED TOPOGRAPHIC SURVEY. FLOOD EXTENTS SHOWN OUTWITH THE PARK BOUNDARY ARE PLOTTED ON A COMBINATION OF GROUND BASED TOPOGRAPHIC SURVEY AND LIDAR AND AS SUCH ARE NOT SUITABLE FOR PROPERTY LEVEL ASSESSMENT.

2. BUILDING THRESHOLD LEVELS ARE NOT SURVEYED; INTENRAL FLOOD EXTENTS SHOWN ARE INDICATIVE ONLY.

3.ALL GRID COORDINATE INFORMATION IS TO BRITISH NATIONAL GRID.

4. FLOOD EXTENTS ARE FILTERED TO REMOVE AREAS OF LOW DEPTH (<0.02m) AND VERY LOW HAZARD (<0.575)

McCloy Consulting
Mossley Mill,
Lower Ground (West),
Carnmoney Road North,
Newtownabbey, BT36 5QA
T: 028 9084 8694
E: info@mccloyconsulting.com
W: www.mccloyconsulting.com

PROJECT CHESTNUTS PARK		**HYDROLOGY SCENARIO** PRESENT DAY	**SCALE** 1:1500	**ORIGINAL SIZE** A3
MAP TYPE FLOOD EXTENT / DEPTH MAPPING		**GEOMETRY SCENARIO** PRESENT DAY	**DRAWN BY** MR	**APPROVED BY** PD
SOURCE PLUVIAL	**FLOOD EVENT** 50% AEP (1 IN 2)	**FIGURE NUMBER** M01600-11_FL01	**REVISION** 02	**DATE** 21/07/2023

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189000

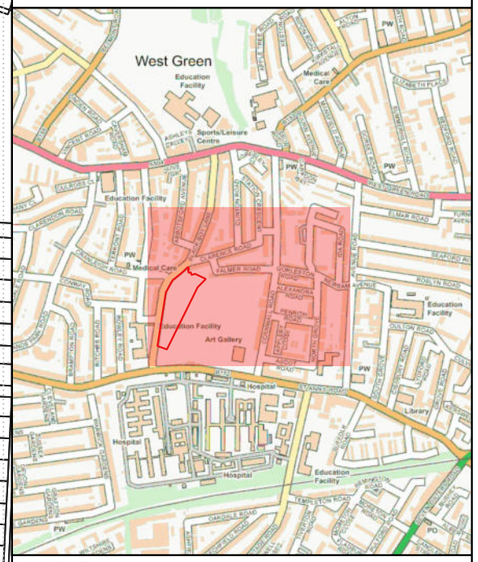
188900

188800

N

0 25 50 75 m

MODEL OVERVIEW



LEGEND

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- 0.15 - 0.30m
- 0.30 - 0.60m
- 0.60 - 0.90m
- > 0.90m
- CONDUIT

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McCloy Consulting
Mossley Mill,
Lower Ground (West),
Carnmoney Road North,
Newtownabbey, BT36 5QA
T: 028 9084 8694
E: info@mccloyconsulting.com
W: www.mccloyconsulting.com

PROJECT CHESTNUTS PARK		**HYDROLOGY SCENARIO** PRESENT DAY	**SCALE** 1:1500	**ORIGINAL SIZE** A3
MAP TYPE FLOOD EXTENT / DEPTH MAPPING		**GEOMETRY SCENARIO** PRESENT DAY	**DRAWN BY** MR	**APPROVED BY** PD
SOURCE PLUVIAL	**FLOOD EVENT** 20% AEP (1 IN 5)	**FIGURE NUMBER** M01600-11_FL02	**REVISION** 02	**DATE** 21/07/2023

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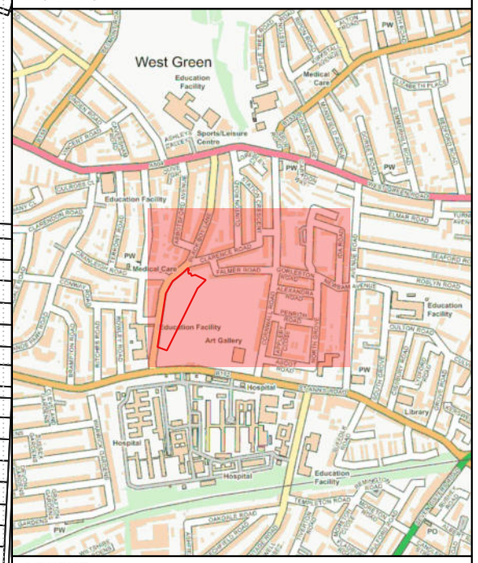
189000

188900

188800

0 25 50 75 m

MODEL OVERVIEW



LEGEND

FLOOD EXTENT BANDED BY DEPTH (m)

- < 0.15m
- 0.15 - 0.30m
- 0.30 - 0.60m
- 0.60 - 0.90m
- > 0.90m
- CONDUIT

NOTES

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McCloy Consulting
Mossley Mill,
Lower Ground (West),
Carnmoney Road North,
Newtownabbey, BT36 5QA
T: 028 9084 8694
E: info@mccloyconsulting.com
W: www.mccloyconsulting.com

PROJECT CHESTNUTS PARK		**HYDROLOGY SCENARIO** PRESENT DAY	**SCALE** 1:1500	**ORIGINAL SIZE** A3
MAP TYPE FLOOD EXTENT / DEPTH MAPPING		**GEOMETRY SCENARIO** PRESENT DAY	**DRAWN BY** MR	**APPROVED BY** PD
SOURCE PLUVIAL	**FLOOD EVENT** 10% AEP (1 IN 10)	**FIGURE NUMBER** M01600-11_FL03	**REVISION** 02	**DATE** 21/07/2023

532400 532500 532600 532700 532800

189000

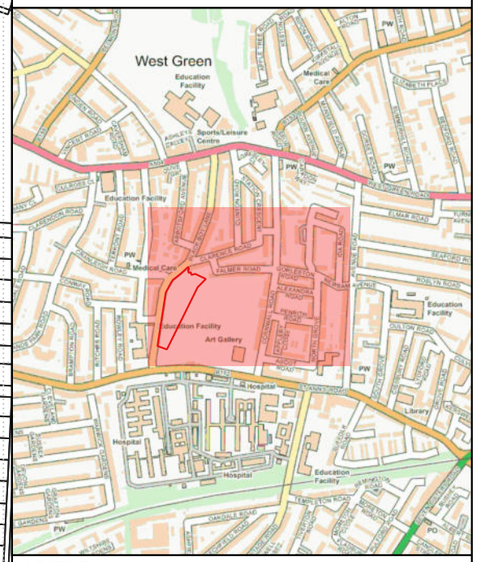
188900

188800

N

0 25 50 75 m

MODEL OVERVIEW



LEGEND

FLOOD EXTENT BANDED BY DEPTH (m)

- < 0.15m
- 0.15 - 0.30m
- 0.30 - 0.60m
- 0.60 - 0.90m
- > 0.90m
- CONDUIT

NOTES

1.FLOOD EXTENTS WITHIN CHESTNUTS PARK ARE PLOTTED ON GROUND BASED TOPOGRAPHIC SURVEY. FLOOD EXTENTS SHOWN OUTWITH THE PARK BOUNDARY ARE PLOTTED ON A COMBINATION OF GROUND BASED TOPOGRAPHIC SURVEY AND LIDAR AND AS SUCH ARE NOT SUITABLE FOR PROPERTY LEVEL ASSESSMENT.

2. BUILDING THRESHOLD LEVELS ARE NOT SURVEYED; INTENRAL FLOOD EXTENTS SHOWN ARE INDICATIVE ONLY.

3.ALL GRID COORDINATE INFORMATION IS TO BRITISH NATIONAL GRID.

4. FLOOD EXTENTS ARE FILTERED TO REMOVE AREAS OF LOW DEPTH (<0.02m) AND VERY LOW HAZARD (<0.575)

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PROJECT CHESTNUTS PARK		**HYDROLOGY SCENARIO** PRESENT DAY	**SCALE** 1:1500	**ORIGINAL SIZE** A3
MAP TYPE FLOOD EXTENT / DEPTH MAPPING		**GEOMETRY SCENARIO** PRESENT DAY	**DRAWN BY** MR	**APPROVED BY** PD
SOURCE PLUVIAL	**FLOOD EVENT** 5% AEP (1 IN 20)	**FIGURE NUMBER** M01600-11_FL04	**REVISION** 02	**DATE** 21/07/2023

532400 532500 532600 532700 532800

189000

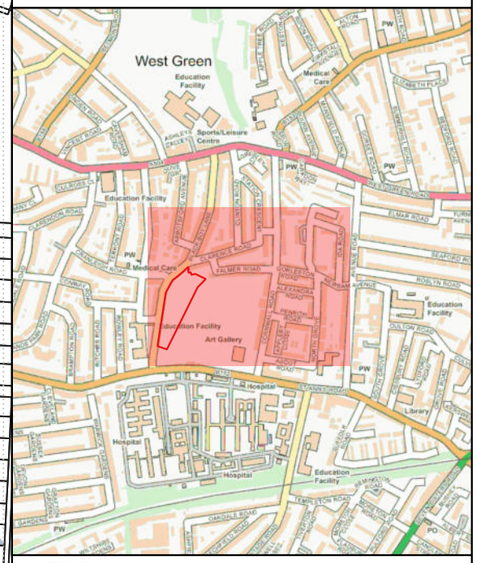
188900

188800

N

0 25 50 75 m

MODEL OVERVIEW



LEGEND

FLOOD EXTENT BANDED BY DEPTH (m)

- < 0.15m
- 0.15 - 0.30m
- 0.30 - 0.60m
- 0.60 - 0.90m
- > 0.90m
- CONDUIT

NOTES

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2. BUILDING THRESHOLD LEVELS ARE NOT SURVEYED; INTENRAL FLOOD EXTENTS SHOWN ARE INDICATIVE ONLY.

3.ALL GRID COORDINATE INFORMATION IS TO BRITISH NATIONAL GRID.

4. FLOOD EXTENTS ARE FILTERED TO REMOVE AREAS OF LOW DEPTH (<0.02m) AND VERY LOW HAZARD (<0.575)

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PROJECT CHESTNUTS PARK		**HYDROLOGY SCENARIO** PRESENT DAY	**SCALE** 1:1500	**ORIGINAL SIZE** A3
MAP TYPE FLOOD EXTENT / DEPTH MAPPING		**GEOMETRY SCENARIO** PRESENT DAY	**DRAWN BY** MR	**APPROVED BY** PD
SOURCE PLUVIAL	**FLOOD EVENT** 3.3% AEP (1 IN 30)	**FIGURE NUMBER** M01600-11_FL05	**REVISION** 02	**DATE** 21/07/2023

532400 532500 532600 532700 532800

189000

188900

188800

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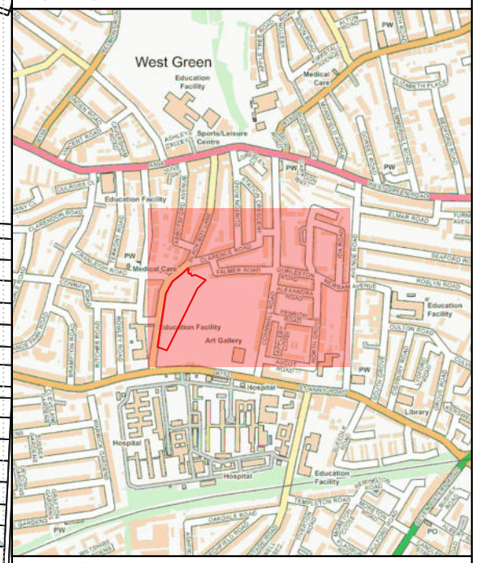
0 25 50 75 m

MODEL OVERVIEW



LEGEND

FLOOD EXTENT BANDED BY DEPTH (m)

- < 0.15m
- 0.15 - 0.30m
- 0.30 - 0.60m
- 0.60 - 0.90m
- > 0.90m
- CONDUIT

NOTES

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PROJECT CHESTNUTS PARK		**HYDROLOGY SCENARIO** PRESENT DAY	**SCALE** 1:1500	**ORIGINAL SIZE** A3
MAP TYPE FLOOD EXTENT / DEPTH MAPPING		**GEOMETRY SCENARIO** PRESENT DAY	**DRAWN BY** MR	**APPROVED BY** PD
SOURCE PLUVIAL	**FLOOD EVENT** 2.5% AEP (1 IN 40)	**FIGURE NUMBER** M01600-11_FL06	**REVISION** 02	**DATE** 21/07/2023

532400 532500 532600 532700 532800

189000

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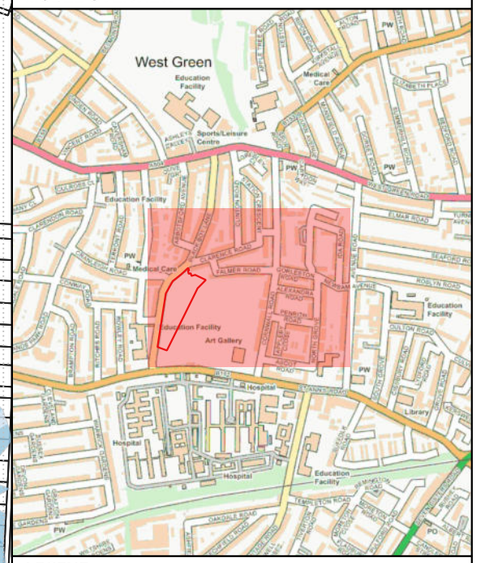
0 25 50 75 m

MODEL OVERVIEW



LEGEND

FLOOD EXTENT BANDED BY DEPTH (m)

- < 0.15m
- 0.15 - 0.30m
- 0.30 - 0.60m
- 0.60 - 0.90m
- > 0.90m
- CONDUIT

NOTES

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PROJECT CHESTNUTS PARK	**HYDROLOGY SCENARIO** PRESENT DAY	**SCALE** 1:1500	**ORIGINAL SIZE** A3
MAP TYPE FLOOD EXTENT / DEPTH MAPPING	**GEOMETRY SCENARIO** PRESENT DAY	**DRAWN BY** MR	**APPROVED BY** PD
SOURCE PLUVIAL / **FLOOD EVENT** 1.3% AEP (1 IN 75)	**FIGURE NUMBER** M01600-11_FL07	**REVISION** 02	**DATE** 21/07/2023

532400 532500 532600 532700 532800

189000

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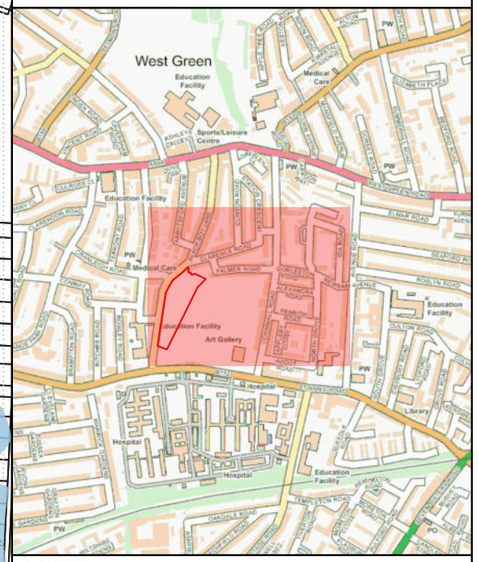
0 25 50 75 m

MODEL OVERVIEW



LEGEND

FLOOD EXTENT BANDED BY DEPTH (m)

- < 0.15m
- 0.15 - 0.30m
- 0.30 - 0.60m
- 0.60 - 0.90m
- > 0.90m
- CONDUIT

NOTES

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PROJECT CHESTNUTS PARK		**HYDROLOGY SCENARIO** PRESENT DAY	**SCALE** 1:1500	**ORIGINAL SIZE** A3
MAP TYPE FLOOD EXTENT / DEPTH MAPPING		**GEOMETRY SCENARIO** PRESENT DAY	**DRAWN BY** MR	**APPROVED BY** PD
SOURCE PLUVIAL	**FLOOD EVENT** 1% AEP (1 IN 100)	**FIGURE NUMBER** M01600-11_FL08	**REVISION** 02	**DATE** 21/07/2023

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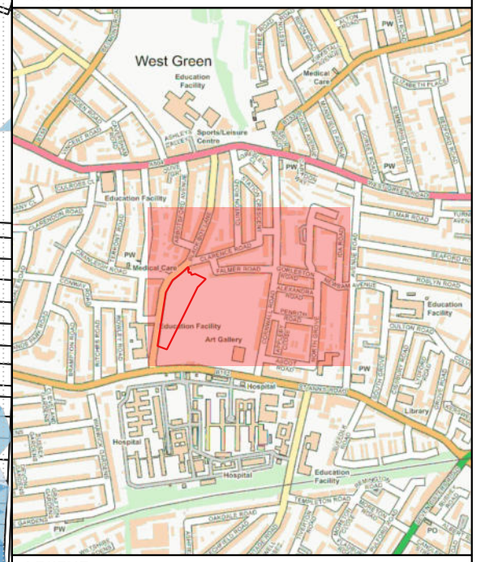
0 25 50 75 m

MODEL OVERVIEW



LEGEND

FLOOD EXTENT BANDED BY DEPTH (m)

- < 0.15m
- 0.15 - 0.30m
- 0.30 - 0.60m
- 0.60 - 0.90m
- > 0.90m

CONDUIT

NOTES

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PROJECT CHESTNUTS PARK	**HYDROLOGY SCENARIO** PRESENT DAY	**SCALE** 1:1500	**ORIGINAL SIZE** A3
MAP TYPE FLOOD EXTENT / DEPTH MAPPING	**GEOMETRY SCENARIO** PRESENT DAY	**DRAWN BY** MR	**APPROVED BY** PD
SOURCE PLUVIAL / **FLOOD EVENT** 0.67% AEP (1 IN 150)	**FIGURE NUMBER** M01600-11_FL09	**REVISION** 02	**DATE** 21/07/2023

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189000

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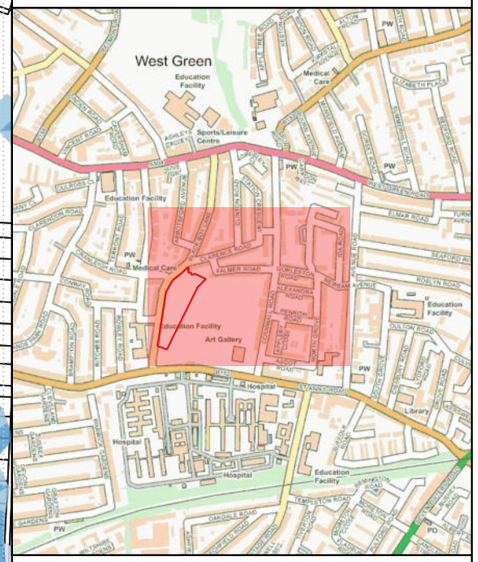
0 25 50 75 m

MODEL OVERVIEW



LEGEND

FLOOD EXTENT BANDED BY DEPTH (m)

- < 0.15m
- 0.15 - 0.30m
- 0.30 - 0.60m
- 0.60 - 0.90m
- > 0.90m
- CONDUIT

NOTES

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PROJECT CHESTNUTS PARK		**HYDROLOGY SCENARIO** PRESENT DAY	**SCALE** 1:1500	**ORIGINAL SIZE** A3
MAP TYPE FLOOD EXTENT / DEPTH MAPPING		**GEOMETRY SCENARIO** PRESENT DAY	**DRAWN BY** MR	**APPROVED BY** PD
SOURCE PLUVIAL	**FLOOD EVENT** 0.5% AEP (1 IN 200)	**FIGURE NUMBER** M01600-11_FL10	**REVISION** 02	**DATE** 21/07/2023

Appendix B

Stage Two – Conceptual Plan Flood Mapping

532400 532500 532600 532700 532800

189000

188900

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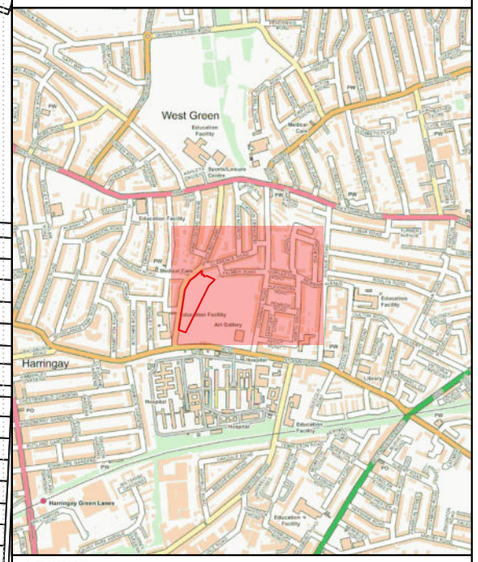
0 25 50 75 m

MODEL OVERVIEW



LEGEND

PROPOSED GEOMETRY OUTLINE

BASELINE FLOOD EXTENT

FLOOD EXTENT BANDED BY DEPTH (m)

- < 0.15m
- 0.15 - 0.30m
- 0.30 - 0.60m
- 0.60 - 0.90m
- > 0.90m

CONDUIT

NOTES

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PROJECT CHESTNUTS PARK		**HYDROLOGY SCENARIO** PRESENT DAY	**SCALE** 1:1500	**ORIGINAL SIZE** A3
MAP TYPE FLOOD EXTENT / DEPTH MAPPING		**GEOMETRY SCENARIO** PROPOSED	**DRAWN BY** MR	**APPROVED BY** PD
SOURCE PLUVIAL	**FLOOD EVENT** 50% AEP (1 IN 2)	**FIGURE NUMBER** M01600-11_FL101	**REVISION** 02	**DATE** 25/07/2023

532400
532500
532600
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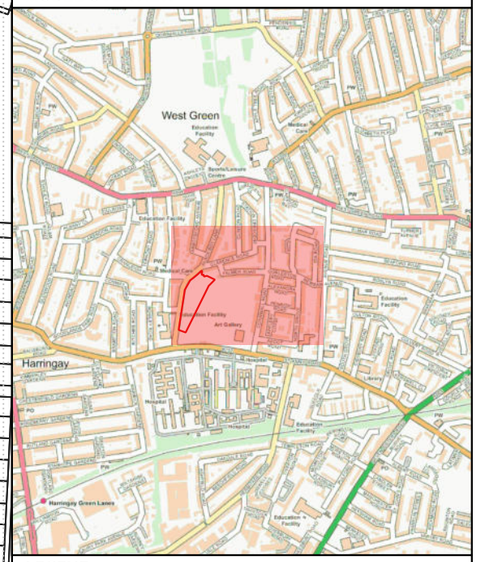
75 m

MODEL OVERVIEW



LEGEND

PROPOSED GEOMETRY OUTLINE

BASELINE FLOOD EXTENT

FLOOD EXTENT BANDED BY DEPTH (m)

- < 0.15m
- 0.15 - 0.30m
- 0.30 - 0.60m
- 0.60 - 0.90m
- > 0.90m

CONDUIT

NOTES

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PROJECT CHESTNUTS PARK		**HYDROLOGY SCENARIO** PRESENT DAY	**SCALE** 1:1500	**ORIGINAL SIZE** A3
MAP TYPE FLOOD EXTENT / DEPTH MAPPING		**GEOMETRY SCENARIO** PROPOSED	**DRAWN BY** MR	**APPROVED BY** PD
SOURCE PLUVIAL	**FLOOD EVENT** 20% AEP (1 IN 5)	**FIGURE NUMBER** M01600-11_FL102	**REVISION** 02	**DATE** 25/07/2023

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188900

188800

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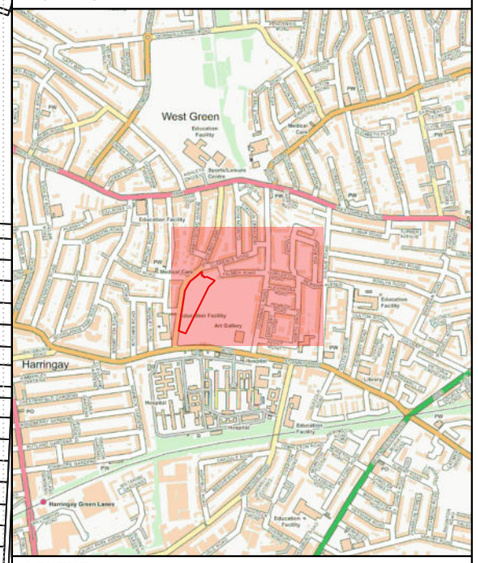
0 25 50 75 m

MODEL OVERVIEW



LEGEND

PROPOSED GEOMETRY OUTLINE

BASELINE FLOOD EXTENT

FLOOD EXTENT BANDED BY DEPTH (m)

- < 0.15m
- 0.15 - 0.30m
- 0.30 - 0.60m
- 0.60 - 0.90m
- > 0.90m

CONDUIT

NOTES

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PROJECT CHESTNUTS PARK		**HYDROLOGY SCENARIO** PRESENT DAY	**SCALE** 1:1500	**ORIGINAL SIZE** A3
MAP TYPE FLOOD EXTENT / DEPTH MAPPING		**GEOMETRY SCENARIO** PROPOSED	**DRAWN BY** MR	**APPROVED BY** PD
SOURCE PLUVIAL	**FLOOD EVENT** 10% AEP (1 IN 10)	**FIGURE NUMBER** M01600-11_FL103	**REVISION** 02	**DATE** 25/07/2023

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189000

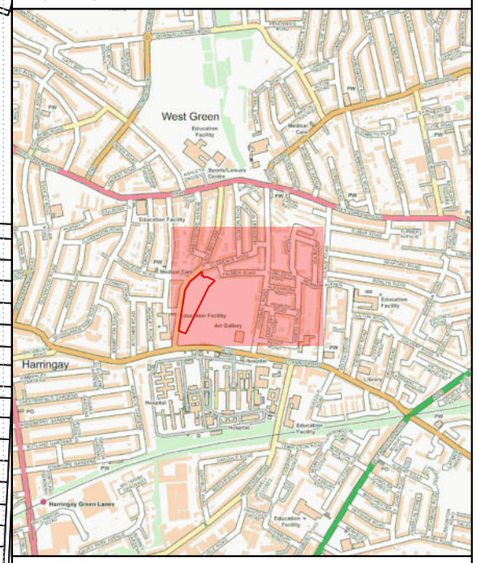
188900

188800

N

0 25 50 75 m

MODEL OVERVIEW



LEGEND

PROPOSED GEOMETRY OUTLINE

BASELINE FLOOD EXTENT

FLOOD EXTENT BANDED BY DEPTH (m)

- < 0.15m
- 0.15 - 0.30m
- 0.30 - 0.60m
- 0.60 - 0.90m
- > 0.90m

CONDUIT

NOTES

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PROJECT CHESTNUTS PARK		**HYDROLOGY SCENARIO** PRESENT DAY	**SCALE** 1:1500	**ORIGINAL SIZE** A3
MAP TYPE FLOOD EXTENT / DEPTH MAPPING		**GEOMETRY SCENARIO** PROPOSED	**DRAWN BY** MR	**APPROVED BY** PD
SOURCE PLUVIAL	**FLOOD EVENT** 5% AEP (1 IN 20)	**FIGURE NUMBER** M01600-11_FL104	**REVISION** 02	**DATE** 25/07/2023

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189000

188900

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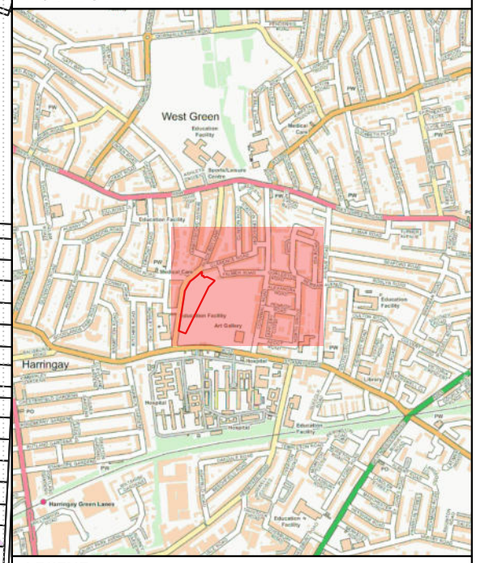
0 25 50 75 m

MODEL OVERVIEW



LEGEND

PROPOSED GEOMETRY OUTLINE

BASELINE FLOOD EXTENT

FLOOD EXTENT BANDED BY DEPTH (m)

- < 0.15m
- 0.15 - 0.30m
- 0.30 - 0.60m
- 0.60 - 0.90m
- > 0.90m

CONDUIT

NOTES

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2. BUILDING THRESHOLD LEVELS ARE NOT SURVEYED; INTENRAL FLOOD EXTENTS SHOWN ARE INDICATIVE ONLY.

3.ALL GRID COORDINATE INFORMATION IS TO BRITISH NATIONAL GRID.

4. FLOOD EXTENTS ARE FILTERED TO REMOVE AREAS OF LOW DEPTH (<0.02m) AND VERY LOW HAZARD (<0.575)

McCloy Consulting

Mossley Mill,
Lower Ground (West),
Carnmoney Road North,
Newtownabbey, BT36 5QA

T: 028 9084 8694
E: info@mccloyconsulting.com
W: www.mccloyconsulting.com

PROJECT CHESTNUTS PARK		**HYDROLOGY SCENARIO** PRESENT DAY	**SCALE** 1:1500	**ORIGINAL SIZE** A3
MAP TYPE FLOOD EXTENT / DEPTH MAPPING		**GEOMETRY SCENARIO** PROPOSED	**DRAWN BY** MR	**APPROVED BY** PD
SOURCE PLUVIAL	**FLOOD EVENT** 3.3% AEP (1 IN 30)	**FIGURE NUMBER** M01600-11_FL105	**REVISION** 02	**DATE** 25/07/2023

532400 532500 532600 532700 532800

189000

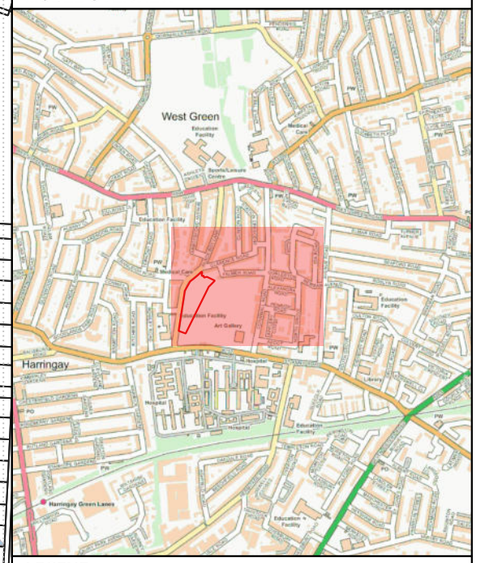
188900

188800

N

0 25 50 75 m

MODEL OVERVIEW



LEGEND

PROPOSED GEOMETRY OUTLINE

BASELINE FLOOD EXTENT

FLOOD EXTENT BANDED BY DEPTH (m)

- < 0.15m
- 0.15 - 0.30m
- 0.30 - 0.60m
- 0.60 - 0.90m
- > 0.90m

CONDUIT

NOTES

1.FLOOD EXTENTS WITHIN CHESTNUTS PARK ARE PLOTTED ON GROUND BASED TOPOGRAPHIC SURVEY. FLOOD EXTENTS SHOWN OUTWITH THE PARK BOUNDARY ARE PLOTTED ON A COMBINATION OF GROUND BASED TOPOGRAPHIC SURVEY AND LIDAR AND AS SUCH ARE NOT SUITABLE FOR PROPERTY LEVEL ASSESSMENT.

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PROJECT CHESTNUTS PARK		**HYDROLOGY SCENARIO** PRESENT DAY	**SCALE** 1:1500	**ORIGINAL SIZE** A3
MAP TYPE FLOOD EXTENT / DEPTH MAPPING		**GEOMETRY SCENARIO** PROPOSED	**DRAWN BY** MR	**APPROVED BY** PD
SOURCE PLUVIAL	**FLOOD EVENT** 2.5% AEP (1 IN 40)	**FIGURE NUMBER** M01600-11_FL106	**REVISION** 02	**DATE** 25/07/2023

532400 532500 532600 532700 532800

189000

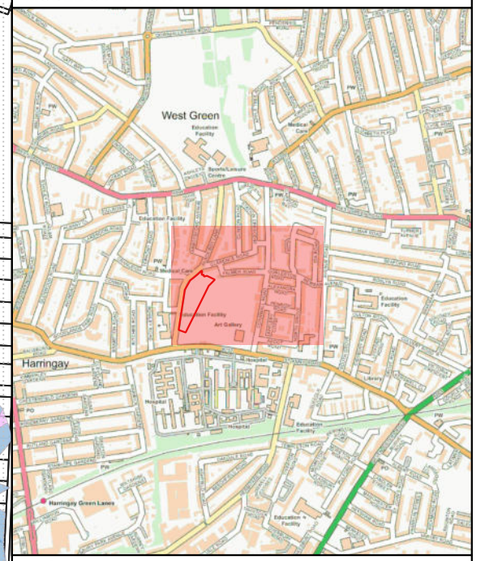
188900

188800

N

0 25 50 75 m

MODEL OVERVIEW



LEGEND

PROPOSED GEOMETRY OUTLINE

BASELINE FLOOD EXTENT

FLOOD EXTENT BANDED BY DEPTH (m)

- < 0.15m
- 0.15 - 0.30m
- 0.30 - 0.60m
- 0.60 - 0.90m
- > 0.90m

CONDUIT

NOTES

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E: info@mccloyconsulting.com
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PROJECT CHESTNUTS PARK	**HYDROLOGY SCENARIO** PRESENT DAY	**SCALE** 1:1500	**ORIGINAL SIZE** A3
MAP TYPE FLOOD EXTENT / DEPTH MAPPING	**GEOMETRY SCENARIO** PROPOSED	**DRAWN BY** MR	**APPROVED BY** PD
SOURCE PLUVIAL / **FLOOD EVENT** 1.3% AEP (1 IN 75)	**FIGURE NUMBER** M01600-11_FL107	**REVISION** 02	**DATE** 25/07/2023

532400 532500 532600 532700 532800

189000

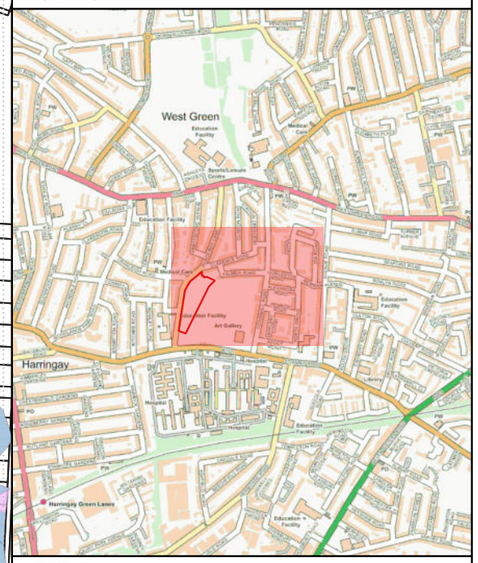
188900

188800

N

0 25 50 75 m

MODEL OVERVIEW



LEGEND

PROPOSED GEOMETRY OUTLINE

BASELINE FLOOD EXTENT

FLOOD EXTENT BANDED BY DEPTH (m)

- < 0.15m
- 0.15 - 0.30m
- 0.30 - 0.60m
- 0.60 - 0.90m
- > 0.90m

CONDUIT

NOTES

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PROJECT CHESTNUTS PARK		**HYDROLOGY SCENARIO** PRESENT DAY	**SCALE** 1:1500	**ORIGINAL SIZE** A3
MAP TYPE FLOOD EXTENT / DEPTH MAPPING		**GEOMETRY SCENARIO** PROPOSED	**DRAWN BY** MR	**APPROVED BY** PD
SOURCE PLUVIAL	**FLOOD EVENT** 1% AEP (1 IN 100)	**FIGURE NUMBER** M01600-11_FL108	**REVISION** 02	**DATE** 25/07/2023

532400 532500 532600 532700 532800

189000

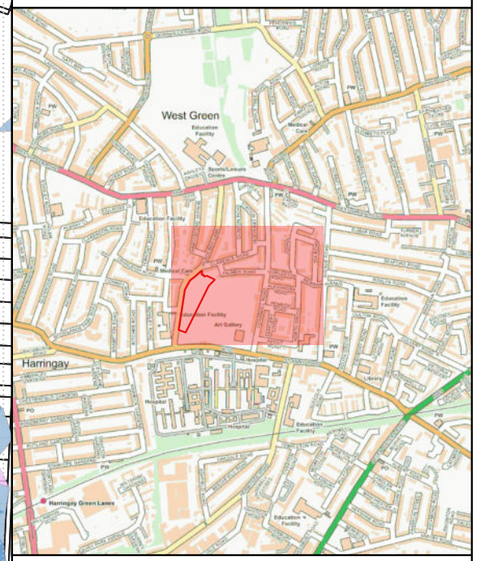
188900

188800

N

0 25 50 75 m

MODEL OVERVIEW



LEGEND

PROPOSED GEOMETRY OUTLINE

BASELINE FLOOD EXTENT

FLOOD EXTENT BANDED BY DEPTH (m)

- < 0.15m
- 0.15 - 0.30m
- 0.30 - 0.60m
- 0.60 - 0.90m
- > 0.90m

CONDUIT

NOTES

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PROJECT CHESTNUTS PARK		**HYDROLOGY SCENARIO** PRESENT DAY	**SCALE** 1:1500	**ORIGINAL SIZE** A3
MAP TYPE FLOOD EXTENT / DEPTH MAPPING		**GEOMETRY SCENARIO** PROPOSED	**DRAWN BY** MR	**APPROVED BY** PD
SOURCE PLUVIAL	**FLOOD EVENT** 0.67% AEP (1 IN 150)	**FIGURE NUMBER** M01600-11_FL109	**REVISION** 02	**DATE** 25/07/2023

532400 532500 532600 532700 532800

189000

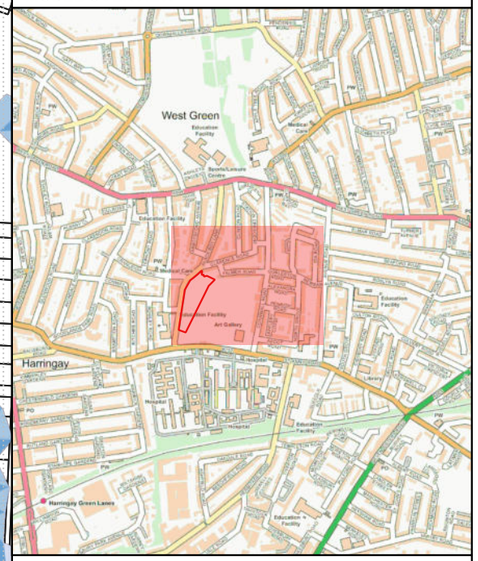
188900

188800

N

0 25 50 75 m

MODEL OVERVIEW



LEGEND

PROPOSED GEOMETRY OUTLINE

BASELINE FLOOD EXTENT

FLOOD EXTENT BANDED BY DEPTH (m)

- < 0.15m
- 0.15 - 0.30m
- 0.30 - 0.60m
- 0.60 - 0.90m
- > 0.90m

CONDUIT

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PROJECT CHESTNUTS PARK		**HYDROLOGY SCENARIO** PRESENT DAY	**SCALE** 1:1500	**ORIGINAL SIZE** A3
MAP TYPE FLOOD EXTENT / DEPTH MAPPING		**GEOMETRY SCENARIO** PROPOSED	**DRAWN BY** MR	**APPROVED BY** PD
SOURCE PLUVIAL	**FLOOD EVENT** 0.5% AEP (1 IN 200)	**FIGURE NUMBER** M01600-11_FL110	**REVISION** 02	**DATE** 25/07/2023

Appendix B

Drawings

INSET SCALE 1:500

Key

- Application boundary
- Existing drainage infrastructure culvert
- Existing trees to be retained / protected during works
- Wildflower conservation grassland
- Modified grassland
- Neutral grassland
- Wetland reedbed / sedge planting
- Wetland
- Low flow channel
- Shallow scrapes
- Native mixed hedgerow
- Information / interpretation board
- Play tree structure within wildflower meadow
- Viewing platform / area
- Log seating amphitheatre

NOTE:
Cross reference with drawing 00016 the Landscape Cross Sections and Landscape Seeding and Planting Palette within the DAS.

Rev	Description	Checked	Approved	Date
P02				
P01	FOR COMMENT	SWG	SWG	04/07/2023

Author ST | Drafting Check ST
Designer SWG | Design Check SWG

Haringey LONDON

GHD

Xref GHD_G_1032.dwg

Xref ghd_g_1031.dwg

www.ghd.com

Project No. 12609983

Client HARINGEY COUNCIL

Project CHESTNUTS PARK FLOOD ALLEVIATION

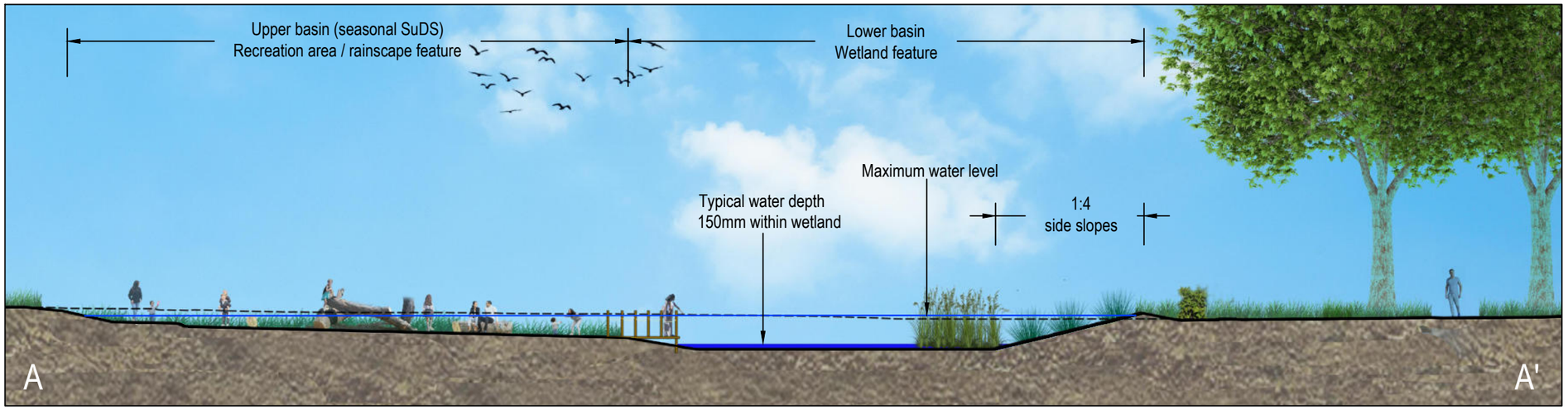
Status FOR COMMENT | Status Code S3

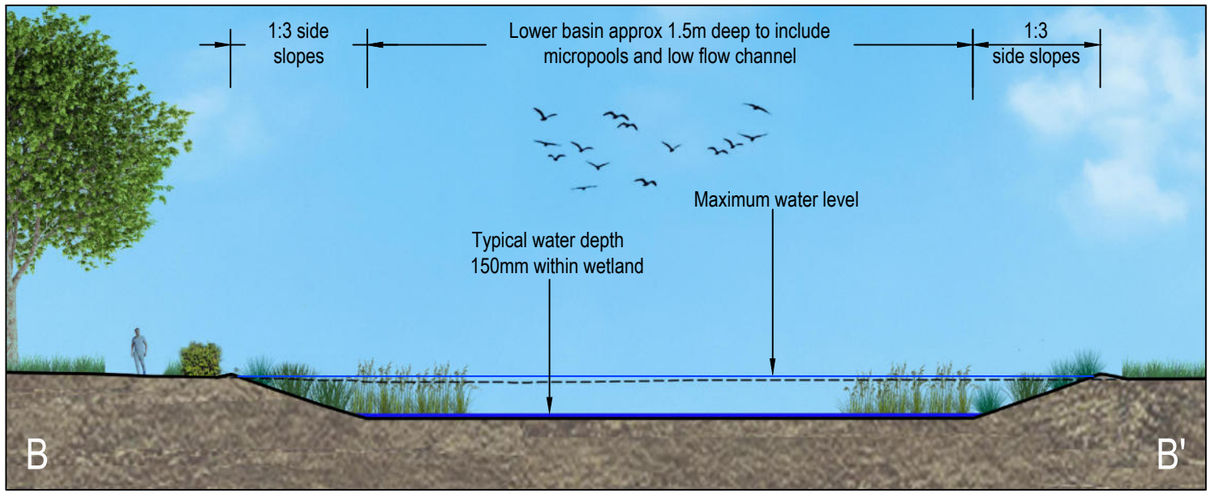
Drawing Title LANDSCAPE PROPOSALS PLAN

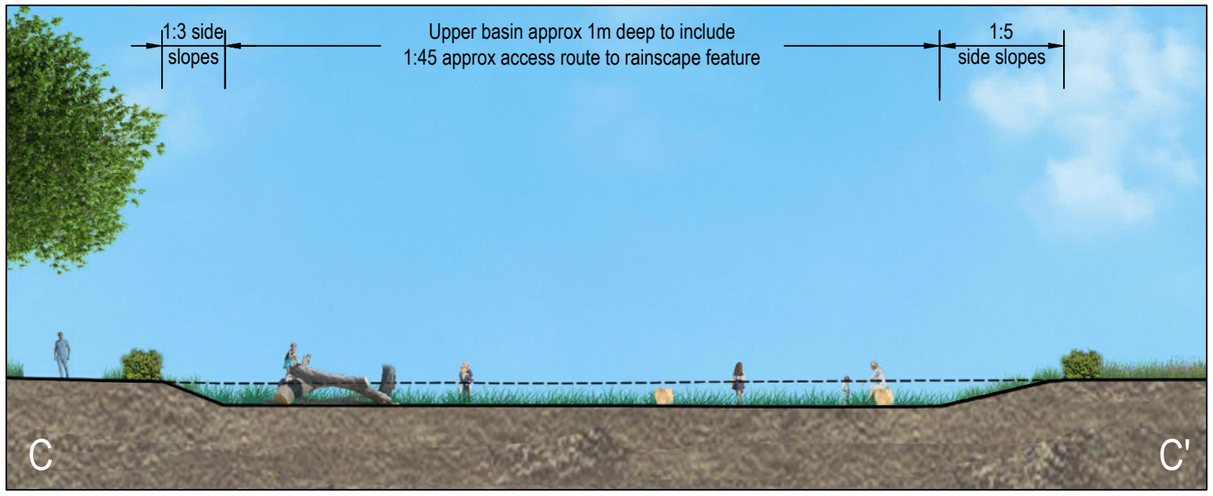
Size A3

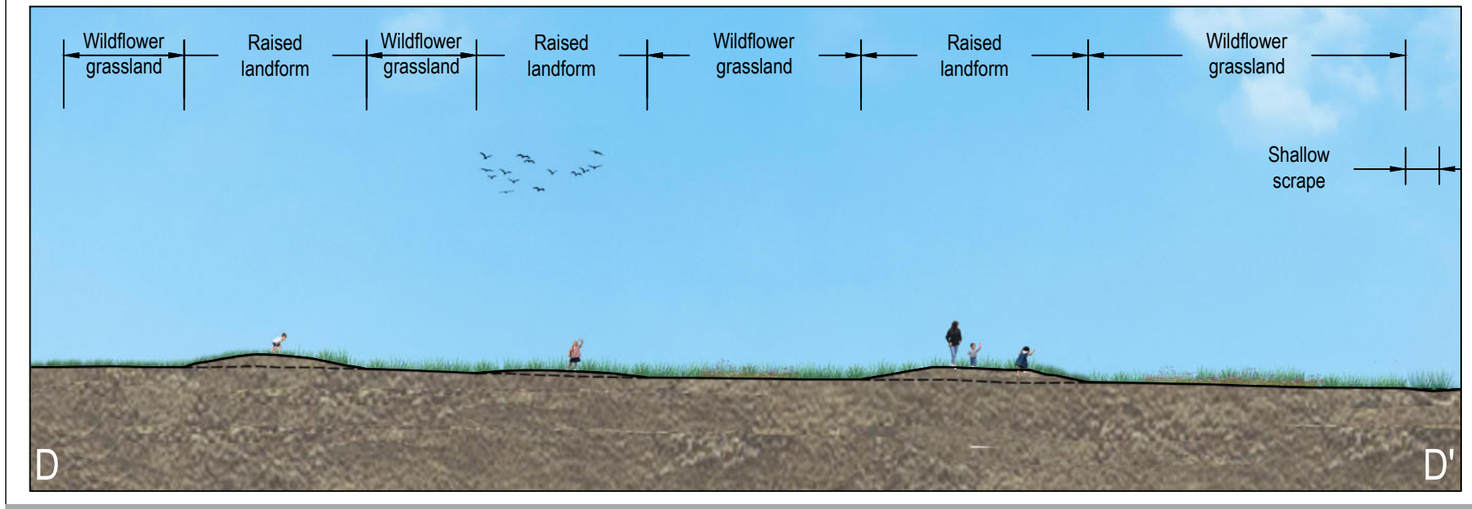
Drawing No. 12609983-GHD-XX-XX-DRG-LA-00014

Rev P02









0 2.5 5.0 7.5m
SCALE 1:250 AT ORIGINAL SIZE

Rev	Description	Checked	Approved	Date
P01	FOR COMMENTS			

Author ST Drafting Check
Designer SWG Design Check

Haringey LONDON

GHD

Xref GHD_G_1032.dwg
Xref ghd_g_1031.dwg

www.ghd.com

Project No. 12609983

Client HARINGEY COUNCIL

Project CHESTNUTS PARK FLOOD ALLEVIATION

Status PRELIMINARY Status Code S3

Drawing Title
ILLUSTRATIVE LANDSCAPE
CROSS SECTIONS A-A' TO D-D'
DESIGN DEVELOPMENT

Drawing No. 12609983-GHD-XX-XX-DRG-LA-00016

Size A3

Rev P01

mcc-fileserver\shared_Projects\M01600 London Borough of Haringey\11 Chestnuts Park\07 Drawings\M01600-01_SK100 - Basin Layout.dwg 21-Jul-23 Print As PDF.pc3

N

QUEENSBOROUGH ROAD

BLACK BOY LANE

TQ32883905
CL: 13.82
IL: 12.07

TQ32883917
CL: 13.58
IL: 11.94

TQ32883907
CL: 13.24
IL: 11.9

TQ32884911
CL: 13.38
IL: 11.7

532446188925
CL: 13.29
IL: 10.68

532451188930
CL: 13.4
IL: 10.65

TQ32884905
CL: 13.1
IL: 11.7

TQ32884916
CL: 13.15
IL: 11.89

MH01
CL: 12.879
IL: 11.450

532440188916
CL: 13.04
IL: 10.83

TQ32883908
CL: 13.86
IL: 12.1

32883801
13.79
12.26

TQ32883802
CL: 13.68
IL: 12.25

OUTLET
CL: 13.280
IL: 11.582

INLET
CL: 13.280
IL: 11.52

Ø610
Ø457
990 x 762
1371 x 914
Ø1828
Ø305
Ø300
Ø229
Ø630

EXISTING STORM SEWER RETAINED

PROPOSED DIVERSION OF FLOWS FROM LA ROSE LANE TO BASIN VIA MH TQ32884905

EXISTING STORM SEWER RETAINED

PROPOSED 300mm DIVERSION TO BASIN AT EXISTING MH TQ32884905

PROPOSED NEW MANHOLE UPSTREAM OF CONNECTION TO STONEBRIDGE BROOK CULVERT

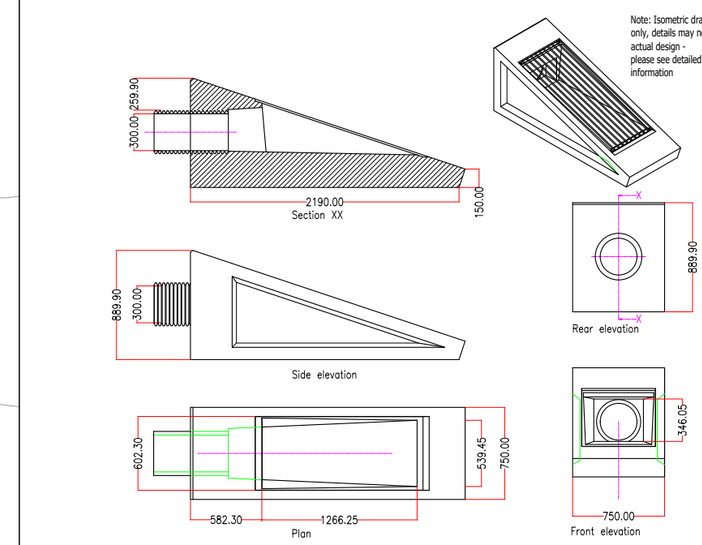
13.297m
13.276m
11.520m
11.520m
Flat
12.159m
12.378m
13.451m
13.402m
13.199m
12.644m
12.593m
12.438m
13.288m
12.944m
12.577m
12.590m
13.563m
1 in 5
1 in 4
1 in 3
1 in 6
1 in 40
1 in 49
1 in 36
1 in 10
13.100
13.000
12.900
13.200
12.300
12.200
12.100
12.000
11.900
12.500
12.400
13.600

MIXED VEGETATION
GRASS
TMAC
CPS
TPS
BP
RAMP
BENCH
HEDGE 1.4m
MOUND

LEGEND

- SITE BOUNDARY
- EXISTING STORM SEWER
- PROPOSED BASIN / CONTOURS
- PROPOSED STORM SEWER

DETAIL A: ATHLON 300mm "SWALE" INLET/OUTLET
NTS



ISSUE	DRN	APP	DATE	NOTES / DESCRIPTION
03	MR	PD	21/07/2023	DRAINAGE DETAILS ADDED
02	MR	PD	16/06/2023	MINOR UPDATES TO BASIN AT EXISTING PATH
01	MR	PD	14/06/2023	FIRST ISSUE FOR INFORMATION

STATUS: PRELIMINARY

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F: 028 9084 1525
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Co. Antrim, BT36 5QA

PROJECT: CHESTNUTS PARK HARINGEY

CLIENT: LONDON BOROUGH OF HARINGEY

DRAWING TITLE: PRELIMINARY BASIN LEVELS

SCALE	ORIGINAL SIZE
1:200	A1

DRAWN	CHECKED	DATE
MR	PD	21/07/2023

PROJECT No.	DRAWING No.	ISSUE NO.
M01600-11	SK_100	03