

Technical Note

Project:	Brandhall Urban Village	Job No:	60653817
Subject:	Surface Water Drainage Strategy – Options1 to 4		
Prepared by:	Luke Palmer	Date:	12.05.22
Checked by:	David Mulkerrin	Date:	17.05.22
Approved by:	Claire Parkinson	Date:	17.05.22

Background

AECOM has been requested by Sandwell Metropolitan Borough Council (SMBC) to review the potential surface water drainage strategy for four development options for the proposed Brandhall Urban Village site. The options are as follows:

Option 1

Retain as a park (No change to existing situation) so no drainage strategy required

Option2

Development of a 2 form entry primary school to the north west of the site, retention of remainder of the site as a park.

Option 3

Development of a 2 form entry primary school to the north west of the site plus residential development (up to 190 units) to the east of the site (Parcels R1 and R2) and retention of remainder of the site as a park.

Option 4

Development of a 2 form entry primary school to the north west of the site plus residential development (up to 360 units) including parcels R1, R2, R3 and R4 with retention of remainder of site as a park.

Surface Water Drainage Strategy

This technical note should be read in conjunction with the following drawings, included as Appendix A:

Brandhall Drainage Strategy – Option 2, drawing reference 60653817-CIV-002

Brandhall Drainage Strategy – Option 3, drawing reference 60653817-CIV-003

Brandhall Drainage Strategy – Option 4, drawing reference 60653817-CIV-004

Assumptions

This strategy has been developed to assist in decision making regarding the proposed development proposals at the Brandhall Urban Village site. At this stage, no consultation has been undertaken with the Lead Local Flood Authority or the Environment Agency regarding design requirements for this particular site, therefore the strategy is subject to change.

It is assumed, at this stage, that infiltration techniques are unsuitable at this site, however this should be confirmed by soakage testing.

When preparing this high-level drainage strategy we have assumed that all of the required attenuation volume will be contained within a basin/pond prior to discharge into the Brandhall Brook , to identify the potential land take associated with these features.

To calculate the attenuation volumes we have carried out an assessment using discharge rates equivalent to greenfield rates of runoff restricted to QBar. These discharge rates have been used to determine the attenuation requirements for the 1 in 100 year storm event + 30% climate change allowance, based on

guidance provided within 'The Black Country Authorities Level 1 Strategic Flood Risk Assessment, dated 25th June 2020. There is currently no allowance for development creep in the calculations.

It should be noted that this assessment has been carried out using FSR rainfall data. However, the LLFA may request the use of FEH data (to be purchased) which may increase the attenuation volumes required.

For the purpose of this assessment, it has been assumed that the primary school site will be 50% percentage impermeable (PIMP), the residential development parcels will be 65% PIMP.

The indicative pond size as shown on the drainage strategy option drawings is based on attenuating the QBar volume in a pond with a depth of 1.5m. There will be a requirement to provide freeboard during detailed design, typically this is 300mm, so the max. water depth will be 1.2m. The earthworks associated with the ponds have not been included in the overall area at this stage.

The development of the drainage strategy would refine the design of the attenuation features required for each catchment, with input from landscape architects.

As a drainage strategy for the preferred option is developed further, we would recommend that SuDS are also incorporated within the development parcels using a range of techniques, including: green/blue roofs, bio-retention areas, swales, ponds and permeable paving.

Option 2 – Primary school

The proposals identify the construction of a new 2 form entry primary school located in the north-west of the Brandhall development site.

The area is steeply sloping with a ground level of approximately 189mAOD in the south, falling away to the north and the east. The eastern edge of the development site is at approximately 180mAOD, the north-western boundary of the site is at approximately 185.5mAOD. The site has been divided into two catchments reflecting the current topography.

Catchment A – Development Area of 0.78ha, and impermeable area of 0.39ha. Storage volume required 293m³. Storage shown as a pond/basin within the north-western corner of the development site. Discharge from this catchment requires further assessment, it may be appropriate to connect into the existing surface water sewer.

Catchment B – Development Area of 1.90ha, and impermeable area of 0.95ha. Storage volume required 713m³. Storage shown as a basin/pond located to the east of the development. Earthworks will be required to form the pond within the sloping ground. Two potential outfall options are shown, either north to an existing ditch, which connects into the brook at the north of the site, or east directly into the brook.

Option 3 – Primary school and Residential Development R1 and R2

The proposals identify new 2 form entry primary school, and an area of residential development located in the east of the site.

Primary school – see Option 2 above.

Residential Parcel R1 is steeply sloping with a high point in the south of the site at 190mAOD, falling away to the east (181mAOD), north (185mAOD) and west (186mAOD).

Development area of 3.29ha, impermeable area of 2.14ha. Storage volume required 1,607m³.

As a result of the topography, it is likely that the site would be divided into three sub-catchments, with separate attenuation for each. The Drainage Strategy Option 3 drawing identifies three areas of storage outside of the development parcels, and also outside of the current flood envelope. Earthworks will be required to form the pond within the sloping ground. All three areas would discharge directly to the brook.

Residential Parcel R2 is steeply sloping with a high point in the south of the site at 196mAOD, falling away to the north-east (185mAOD).

Development area of 1.803ha, impermeable area of 1.17ha. Storage volume required 879m³.

As a result of the topography, it is likely that the site would be one large catchment, although the attenuation may be separated due to topographical constraints. The Drainage Strategy Option 3 drawing currently identifies one storage area located directly to the north-east of the development site, and a further larger storage area directly north of the development parcel. This location is constrained due to the steep topography, the location of the brook and flood envelope, and also the proposed pedestrian site access. Earthworks will be required to form the pond(s) within the sloping ground. Any attenuation pond would discharge directly to the brook.

Option 4 – Primary school and Residential Development R1, R2 and R3, R4

The proposals identify new 2 form entry primary school, and an area of residential development located in the east of the site.

Primary school – see Option 2 above.

Residential Parcel R1 and R2 – See Option 3 above.

Residential Parcel R3 is steeply sloping with a high point in the south of the site at 195mAOD, falling away to the north (184mAOD).

Development area of 2.124ha, impermeable area of 1.38ha. Storage volume required 1,036m³.

As a result of the topography, it is likely that the site would be one large catchment, with attenuation located remote from the development parcel, at a lower level on the site closer to the brook. The Drainage Strategy Option 4 drawing identifies an open channel connecting the development to the attenuation basin/pond which then discharges into an existing pond on the site. Earthworks will be required to form the pond within the sloping ground.

Residential Parcel R4 is steeply sloping with a high point in the south of the site at 191.5mAOD, falling away to the east (187mAOD).

Development area of 1.871ha, impermeable area of 1.22ha. Storage volume required 915m³.

As a result of the topography, it is likely that the site would be one large catchment, with attenuation located remote from the development parcel, at a lower level. The Drainage Strategy Option 4 drawing identifies an open channel connecting the development to the attenuation basin/pond which then discharges into an existing pond on the site, also via an open channel. Earthworks will be required to form the pond within the sloping ground.

Conclusions

A high-level drainage strategy has been developed for Options 2, 3 and 4 for Brandhall Urban Village. The purpose of the strategy is to identify the potential volumes of surface water that require attenuation for each development parcel, and the likely area required to accommodate this run-off water within the site.

The purpose of the on-site attenuation is to restrict the surface water run-off from the development parcels to greenfield rates. This would aim to mimic the current scenario and will not increase the risk of flooding at the site, or downstream of the site. The development of the drainage strategy should be undertaken in conjunction with the flood risk assessment.

Based on the preferred development option, the drainage strategy will be developed further to refine the attenuation required, and to understand the earthworks required to form attenuation features within the existing sloping topography.

The design approach will need to be discussed with the Lead Local Flood Authority or the Environment Agency, and is therefore subject to change.

Appendix A – Drainage Strategy Option Drawings

ISO A1 594mm x 841mm

Drainage Strategy Notes

- The site itself is a former golf course. Brandhall Brook flows through the site from south to north and is designated by the EA as a main River. There are numerous piped outfalls from the golf course land drainage into the Brook. Towards the north of the golf course site, Brandhall Brook is culverted into a ponded area behind a large embankment which appears to be for flood relief. Here it has its confluence with a stream that flows around the eastern perimeter of the site, which is also culverted into the ponded area.
- Several tributaries meet Brandhall Brook within the golf course site. These are generally straight drainage ditches/trenches.
- An unnamed tributary of Brandhall Brook flows around the eastern perimeter of the golf course. This emerges into the golf course site, having been culverted beneath the school to the south east of the site. The culverted channel enters a concrete weir structure between the golf course and the residential properties to the northeast of the site.
- It is assumed at this stage that infiltration techniques are unsuitable at this site, however this is to be confirmed by soakage testing.
- Surface water runoff is to be discharged to one or more of the following:
 - into the ground (infiltration) - to be confirmed as per note 4
 - to a surface water body - either the Brandhall Brook or tributaries
- The current strategy is for the proposed rate of surface water runoff from the site to not exceed existing greenfield rates of runoff. The red line boundary of the proposed development gives the development area at 37.2ha. The Institute of Hydrology Report 124, Flood Estimation from Small Catchments, has been used to determine peak greenfield runoff rates for the catchment as it is smaller than 50ha. The analysis for determining the peak greenfield discharge rate has used 50ha in the formula and the flow rate value linearly interpolated based on the ratio of the development to 50ha. The greenfield runoff rates are shown below.

Return Period	Existing total development runoff (l/s)	Existing development runoff (l/s/ha)
Q1	161.3	4.36
QBar	190.0	5.14
Q30	372.3	10.06
Q100	488.4	13.2



- Indicative catchment areas are based on ground level information taken from Brunel Surveys topographical survey.
- Indicative land use proposals have been assigned to each catchment and the percentage impermeable areas assumed.
- There is no allowance for development creep in the calculations. This will need to be agreed with the LLFA.
- The proposed discharge rate from the site is calculated from the table above with the required attenuation to prevent flooding from a 1 in 100 year storm plus an increase of 30% to account for climate change, calculated using source control module within Microdrainage.
- FSR Rainfall has currently been used in the attenuation assessment. However it is presumed that the LLFA will request FEH rainfall data (to be purchased), which is likely to increase the volume required.
- A surface water treatment train is to be devised for the development which will require treatment at source (i.e swales and permeable paving) as well as the approximate attenuation as shown on this drawing.
- The proposals on this drawing are indicative only and are a means for starting discussions on surface water proposals for the development. The design approach will need to be discussed with the LLFA and EA so is subject to change.

Drainage Constraints



- Surface water sewer crossing site. Size TBC. Assume 10m easement.
- Foul water sewer crossing site. Size TBC. Assume 5m easement.
- DN300 Foul water sewer crossing site. Easement width TBC. Assume 5m
- Surface water sewer crossing site. Size TBC. Assume 10m easement.
- SW Discharge point for Primary School Catchment A to be confirmed. Potential to discharge into surface water sewer
- Runoff from the developed site is to be restricted to greenfield rate of runoff resulting in attenuation to be provided by the way of SUDS

Brandhall Masterplan - Option 2

Development of a Primary School in the North-West corner of the site, remainder of site to be retained as park area.

Due to Topography, proposal is for Primary School area to be split into 2 drainage catchments.

Total Primary School area - 2.684ha
 Catchment A - 0.784ha
 Catchment B - 1.9ha

Primary School Site (Catchment A)

Overall Dev. Area - 0.784ha
 Assumed PIMP - 50% (Education)
 Impermeable Area - 0.39ha

Flow Rates

QBar Flow Rate - 0.39 x 5.14 = 2.01l/s

Attenuation Volumes (100Yr + 30% CC FSR Data)
 *Max attenuation volumes shown

QBar - 293m³

Primary School Site (Catchment B)

Overall Dev. Area - 1.90ha
 Assumed PIMP - 50% (Education)
 Impermeable Area - 0.95ha

Flow Rates

QBar Flow Rate - 0.95 x 5.14 = 4.88l/s

Attenuation Volumes (100Yr + 30% CC FSR Data)
 *Max attenuation volumes shown

QBar - 713m³



PROJECT

Brandhall Urban Village

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KEY

- Development Boundary
- Proposed Residential Parcel
- Proposed Primary School Site
- Extent of Flood Envelope
- Indicative Surface Water Attenuation Basin
- Existing Public Right of Way (PROW)
- Existing path
- Proposed foot/cycleway
- Potential primary street
- Pedestrian access point
- Potential vehicle access point
- Existing pedestrian bridge
- Potential emergency access point

CHECKING/VERIFICATION

DRAWN	LP	CHECKED	DM
VERIFIED	CP	DATE	17.05.22

ISSUE/REVISION

NO	DATE	DESCRIPTION
P1	17.05.22	Preliminary Issue
I/R	DATE	DESCRIPTION

SHEET TITLE

Brandhall Drainage Strategy Option 2

PROJECT NUMBER

60653817

SHEET NUMBER

60653817-CIV-002

SCALE

1:2000

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USC A1 594mm x 841mm

Drainage Strategy Notes

- The site itself is a former golf course. Brandhall Brook flows through the site from south to north and is designated by the EA as a main River. There are numerous piped outfalls from the golf course land drainage into the Brook. Towards the north of the golf course site, Brandhall Brook is culverted into a ponded area behind a large embankment which appears to be for flood relief. Here it has its confluence with a stream that flows around the eastern perimeter of the site, which is also culverted into the ponded area.
- Several tributaries meet Brandhall Brook within the golf course site. These are generally straight drainage ditches/trenches.
- An unnamed tributary of Brandhall Brook flows around the eastern perimeter of the golf course. This emerges into the golf course site, having been culverted beneath the school to the south east of the site. The culverted channel enters a concrete weir structure between the golf course and the residential properties to the northeast of the site.
- It is assumed at this stage that infiltration techniques are unsuitable at this site, however this is to be confirmed by soakage testing.
- Surface water runoff is to be discharged to one or more of the following:
 - into the ground (infiltration) - to be confirmed as per note 4
 - to a surface water body - either the Brandhall Brook or tributaries
- The current strategy is for the proposed rate of surface water runoff from the site to not exceed existing greenfield rates of runoff. The red line boundary of the proposed development gives the development area at 37.2ha. The Institute of Hydrology Report 124, Flood Estimation from Small Catchments, has been used to determine peak greenfield runoff rates for the catchment as it is smaller than 50ha. The analysis for determining the peak greenfield discharge rate has used 50ha in the formula and the flow rate value linearly interpolated based on the ratio of the development to 50ha. The greenfield runoff rates are shown below.

Return Period	Existing total development runoff (l/s)	Existing development runoff (l/s/ha)
Q1	161.3	4.36
QBar	190.0	5.14
Q30	372.3	10.06
Q100	488.4	13.2

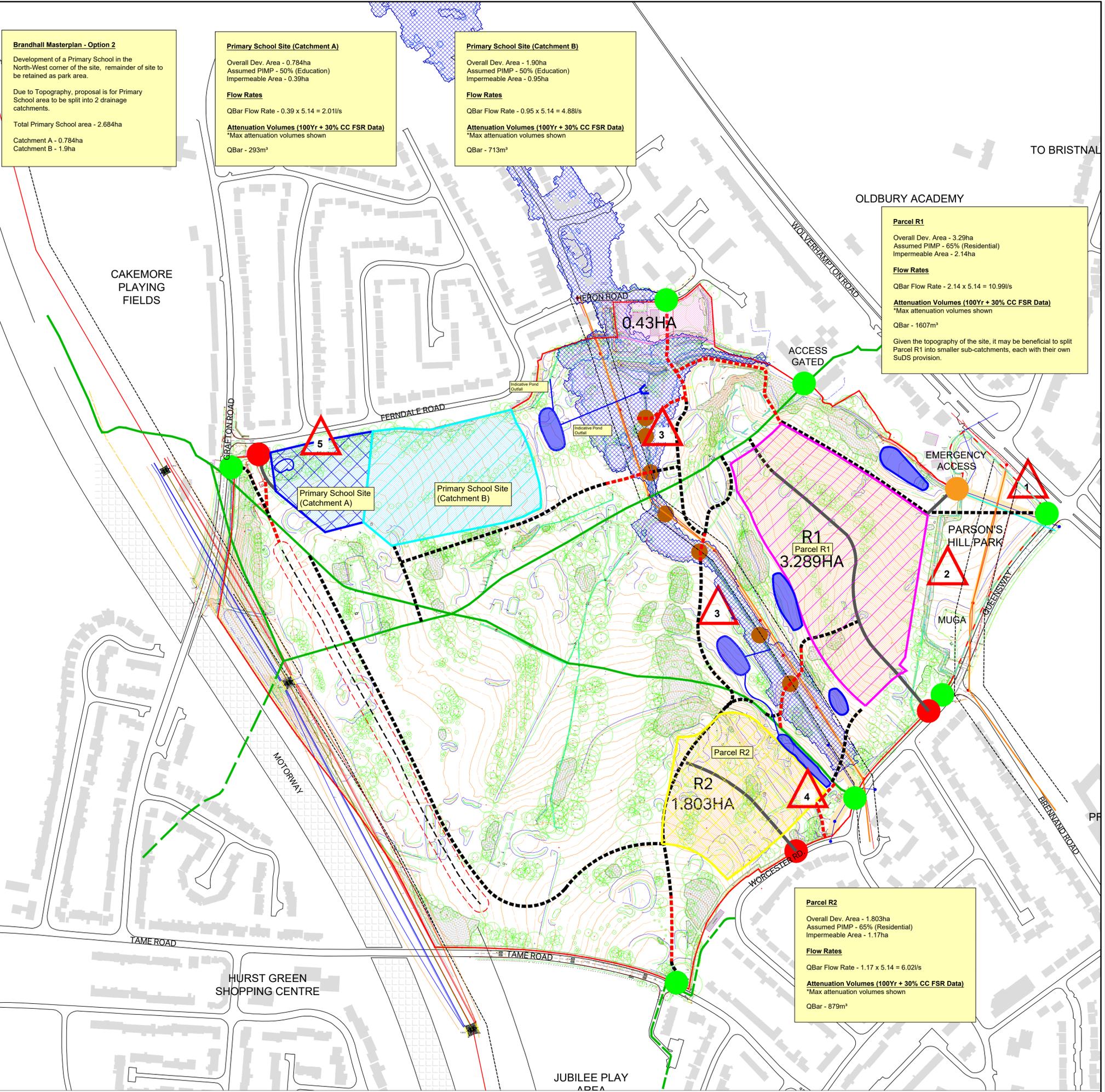


- Indicative catchment areas are based on ground level information taken from the Brunel Surveys topographical survey.
- Indicative land use proposals have been assigned to each catchment and the percentage impermeable areas assumed.
- There is no allowance for development creep in the calculations. This will need to be agreed with the LLFA.
- The proposed discharge rate from the site is calculated from the table above with the required attenuation to prevent flooding from a 1 in 100 year storm plus an increase of 30% to account for climate change, calculated using source control module within Microdrainage.
- FSR Rainfall has currently been used in the attenuation assessment. However it is presumed that the LLFA will request FEH rainfall data (to be purchased), which is likely to increase the volume required.
- A surface water treatment train is to be devised for the development which will require treatment at source (i.e. swales and permeable paving) as well as the approximate attenuation as shown on this drawing.
- The proposals on this drawing are indicative only and are a means for starting discussions on surface water proposals for the development. The design approach will need to be discussed with the LLFA and EA so is subject to change.

Drainage Constraints



- Surface water sewer crossing site. Size TBC. Assume 10m easement.
- Foul water sewer crossing site. Size TBC. Assume 5m easement.
- DN300 Foul water sewer crossing site. Easement width TBC. Assume 5m
- Surface water sewer crossing site. Size TBC. Assume 10m easement.
- SW Discharge point for Primary School Catchment A to be confirmed. Potential to discharge into surface water sewer
- Runoff from the developed site is to be restricted to greenfield rate of runoff resulting in attenuation to be provided by the way of SUDS



Brandhall Masterplan - Option 2

Development of a Primary School in the North-West corner of the site, remainder of site to be retained as park area.

Due to Topography, proposal is for Primary School area to be split into 2 drainage catchments.

Total Primary School area - 2.684ha

Catchment A - 0.784ha
Catchment B - 1.9ha

Primary School Site (Catchment A)

Overall Dev. Area - 0.784ha
Assumed PIMP - 50% (Education)
Impermeable Area - 0.39ha

Flow Rates

QBar Flow Rate - 0.39 x 5.14 = 2.01l/s

Attenuation Volumes (100Yr + 30% CC FSR Data)
*Max attenuation volumes shown

QBar - 293m³

Primary School Site (Catchment B)

Overall Dev. Area - 1.90ha
Assumed PIMP - 50% (Education)
Impermeable Area - 0.95ha

Flow Rates

QBar Flow Rate - 0.95 x 5.14 = 4.88l/s

Attenuation Volumes (100Yr + 30% CC FSR Data)
*Max attenuation volumes shown

QBar - 713m³

Parcel R1

Overall Dev. Area - 3.29ha
Assumed PIMP - 65% (Residential)
Impermeable Area - 2.14ha

Flow Rates

QBar Flow Rate - 2.14 x 5.14 = 10.99l/s

Attenuation Volumes (100Yr + 30% CC FSR Data)
*Max attenuation volumes shown

QBar - 1607m³

Given the topography of the site, it may be beneficial to split Parcel R1 into smaller sub-catchments, each with their own SuDS provision.

Parcel R2

Overall Dev. Area - 1.803ha
Assumed PIMP - 65% (Residential)
Impermeable Area - 1.17ha

Flow Rates

QBar Flow Rate - 1.17 x 5.14 = 6.02l/s

Attenuation Volumes (100Yr + 30% CC FSR Data)
*Max attenuation volumes shown

QBar - 879m³



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- Existing path
- Proposed foot/cycleway
- Potential primary street
- Pedestrian access point
- Potential vehicle access point
- Existing pedestrian bridge
- Potential emergency access point

CHECKING/VERIFICATION

DRAWN:	LP	CHECKED:	DM
VERIFIED:	CP	DATE:	17.05.22

ISSUE/REVISION

NO.	DATE	DESCRIPTION
P1	17.05.22	Preliminary Issue
I/R	DATE	DESCRIPTION

SHEET TITLE

Brandhall Drainage Strategy Option 3

PROJECT NUMBER

60653817

SHEET NUMBER

60653817-CIV-003

SCALE

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Drainage Strategy Notes

- The site itself is a former golf course. Brandhall Brook flows through the site from south to north and is designated by the EA as a main River. There are numerous piped outfalls from the golf course land drainage into the Brook. Towards the north of the golf course site, Brandhall Brook is culverted into a ponded area behind a large embankment which appears to be for flood relief. Here it has its confluence with a stream that flows around the eastern perimeter of the site, which is also culverted into the ponded area.
- Several tributaries meet Brandhall Brook within the golf course site. These are generally straight drainage ditches/trenches.
- An unnamed tributary of Brandhall Brook flows around the eastern perimeter of the golf course. This emerges into the golf course site, having been culverted beneath the school to the south east of the site. The culverted channel enters a concrete weir structure between the golf course and the residential properties to the northeast of the site.
- It is assumed at this stage that infiltration techniques are unsuitable at this site, however this is to be confirmed by soakage testing.
- Surface water runoff is to be discharged to one or more of the following: into the ground (infiltration) - to be confirmed as per note 4 to a surface water body - either the Brandhall Brook or tributaries
- The current strategy is for the proposed rate of surface water runoff from the site to not exceed existing greenfield rates of runoff. The red line boundary of the proposed development gives the development area at 37.2ha. The Institute of Hydrology Report 124, Flood Estimation from Small Catchments, has been used to determine peak greenfield runoff rates for the catchment as it is smaller than 50ha. The analysis for determining the peak greenfield discharge rate has used 50ha in the formula and the flow rate value linearly interpolated based on the ratio of the development to 50ha. The greenfield runoff rates are shown below.

Return Period	Existing total development runoff (l/s)	Existing development runoff (l/s/ha)
Q1	161.3	4.36
QBar	190.0	5.14
Q30	372.3	10.06
Q100	488.4	13.2



- Indicative catchment areas are shown on the plan based on ground level information taken from the Brunel surveys topographical survey.
- Indicative land use proposals have been assigned to each catchment and the percentage impermeable areas assumed.
- There is no allowance for development creep in the calculations. This will need to be agreed with the LLFA.
- The proposed discharge rate from the site is calculated from the table above with the required attenuation to prevent flooding from a 1 in 100 year storm plus an increase of 30% to account for climate change, calculated using source control module within Microdrainage.
- FSR Rainfall has currently been used in the attenuation assessment. However it is presumed that the LLFA will request FEH rainfall data (to be purchased), which is likely to increase the volume required.
- A surface water treatment train is to be devised for the development which will require treatment at source (i.e swales and permeable paving) as well as the approximate attenuation as shown on this drawing.
- The proposals on this drawing are indicative only and are a means for starting discussions on surface water proposals for the development. The design approach will need to be discussed with the LLFA and EA so is subject to change.

Drainage Constraints



- Surface water sewer crossing site. Size TBC. Assume 10m easement.
- Foul water sewer crossing site. Size TBC. Assume 5m easement.
- DN300 Foul water sewer crossing site. Easement width TBC. Assume 5m
- Surface water sewer crossing site. Size TBC. Assume 10m easement.
- SW Discharge point for primary School Catchment A to be confirmed. Potential to discharge into surface water sewer
- Runoff from the developed site is to be restricted to greenfield rate of runoff resulting in attenuation to be provided by the way of SUDS

Brandhall Masterplan - Option 2

Development of a Primary School in the North-West corner of the site, remainder of site to be retained as park area.

Due to Topography, proposal is for Primary School area to be split into 2 drainage catchments.

Total Primary School area - 2.684ha
 Catchment A - 0.784ha
 Catchment B - 1.9ha

Primary School Site (Catchment A)

Overall Dev. Area - 0.784ha
 Assumed PIMP - 50% (Education)
 Impermeable Area - 0.39ha

Flow Rates

QBar Flow Rate - 0.39 x 5.14 = 2.01l/s

Attenuation Volumes (100Yr + 30% CC FSR Data)
 *Max attenuation volumes shown
 QBar - 293m³

Primary School Site (Catchment B)

Overall Dev. Area - 1.90ha
 Assumed PIMP - 50% (Education)
 Impermeable Area - 0.95ha

Flow Rates

QBar Flow Rate - 0.95 x 5.14 = 4.88l/s

Attenuation Volumes (100Yr + 30% CC FSR Data)
 *Max attenuation volumes shown
 QBar - 713m³

Parcel R1

Overall Dev. Area - 3.29ha
 Assumed PIMP - 65% (Residential)
 Impermeable Area - 2.14ha

Flow Rates

QBar Flow Rate - 2.14 x 5.14 = 10.99l/s

Attenuation Volumes (100Yr + 30% CC FSR Data)
 *Max attenuation volumes shown
 QBar - 1607m³

Given the topography of the site, it may be beneficial to split Parcel R1 into smaller sub-catchments, each with their own SuDS provision.

Parcel R4

Overall Dev. Area - 1.871ha
 Assumed PIMP - 65% (Residential)
 Impermeable Area - 1.22ha

Flow Rates

QBar Flow Rate - 1.22 x 5.14 = 6.25l/s

Attenuation Volumes (100Yr + 30% CC FSR Data)
 *Max attenuation volumes shown
 QBar - 915m³

Parcel R3

Overall Dev. Area - 2.124ha
 Assumed PIMP - 65% (Residential)
 Impermeable Area - 1.38ha

Flow Rates

QBar Flow Rate - 1.38 x 5.14 = 7.10l/s

Attenuation Volumes (100Yr + 30% CC FSR Data)
 *Max attenuation volumes shown
 QBar - 1036m³

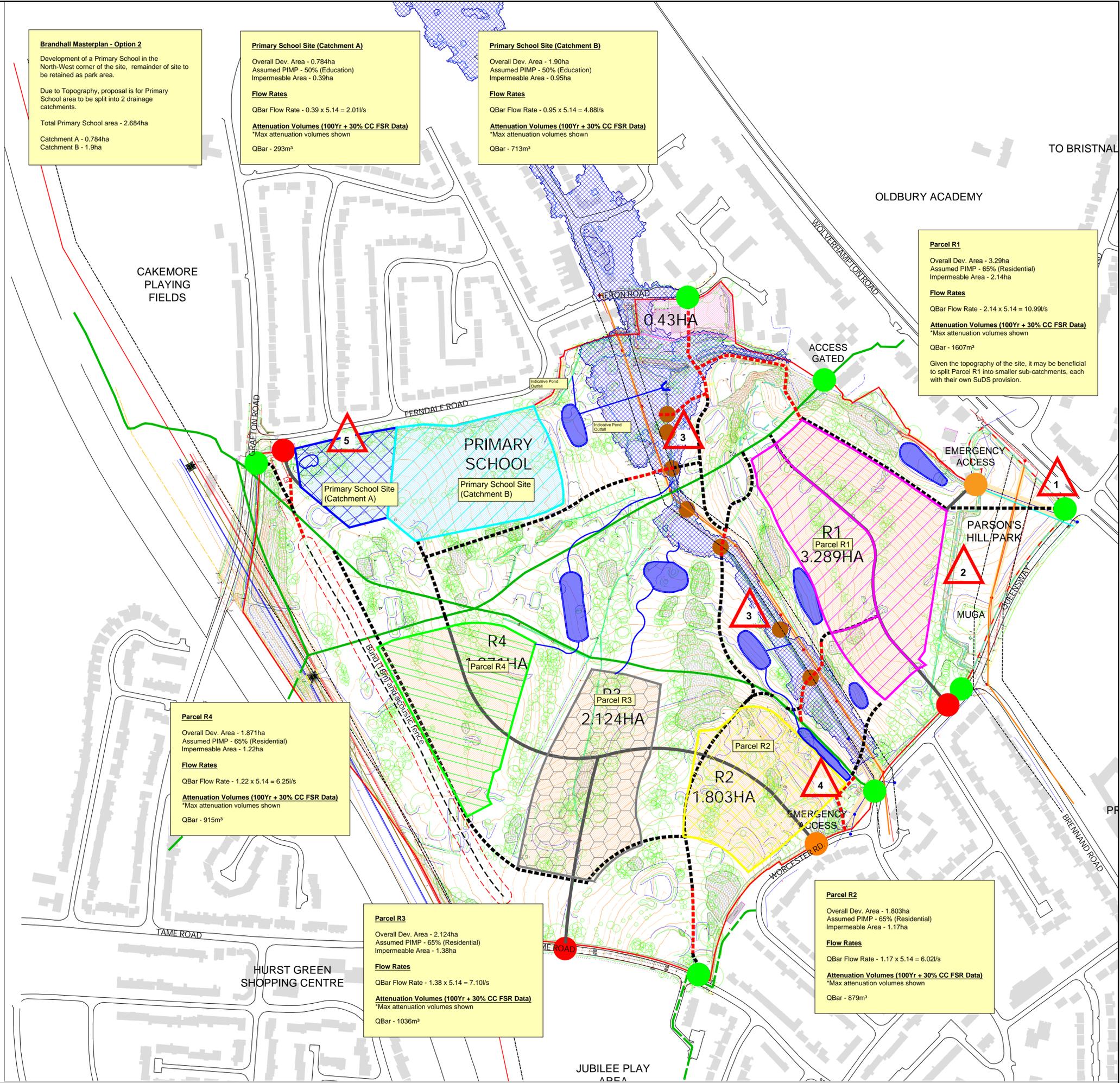
Parcel R2

Overall Dev. Area - 1.803ha
 Assumed PIMP - 65% (Residential)
 Impermeable Area - 1.17ha

Flow Rates

QBar Flow Rate - 1.17 x 5.14 = 6.02l/s

Attenuation Volumes (100Yr + 30% CC FSR Data)
 *Max attenuation volumes shown
 QBar - 879m³



PROJECT

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- Existing path
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- Potential primary street
- Pedestrian access point
- Potential vehicle access point
- Existing pedestrian bridge
- Potential emergency access point

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ISSUE/REVISION

NO.	DATE	DESCRIPTION
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I/R	DATE	DESCRIPTION

SHEET TITLE

Brandhall Drainage Strategy Option 4

PROJECT NUMBER

60653817

SHEET NUMBER

60653817-CIV-004

SCALE

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