3.14 PPS 25, although now replaced by the NPPF, is still a useful guide to proving the appropriateness of a site's proposals with regards to its location and its susceptibility to flooding.

3.15 The policies outlined in PPS25 are designed to make regional and local planning authorities re-consider land uses in their strategic development plans, concentrating on the suitability of land uses within flood zones and give clear guidance on their responsibilities. Planning applications for individual developments will therefore have to consider the suitability of the proposed land use in the flood zone prior to the planning application.

3.16 Annex D of PPS25, refers to the 'Sequential Test', a tool used to gauge the suitability of a proposed development within a flood zone, with guidance being made to steer new development towards flood zone 1. Table D.1 outlines the categorisation of the different flood zones with flood zone 1 having the lowest probability and flood zone 3b having the highest with suitability being a Functional Floodplain. Table D.2 classifies the vulnerability of land uses from flooding. Table D.3 then matches the compatibilities of the site's vulnerability with the flood zone and then sees if an 'Exception Test' is required.

3.17 Annex E of PPS25, refers to 'The Assessment of Flood Risk', outlining the necessity of all developments to produce a Flood Risk Assessment that clearly proves that the proposed development has identified the sources of flood risk and mitigating measures that are required to reduce the risk of flooding to the users of the development in the future. Paragraph E.9 states:

- Planning applications for development proposals of 1 hectare or greater in Flood Zone 1 and all proposals for new development located in Flood Zones 2 and 3 (see Table D.1, Annex D) should be accompanied by a FRA. This should identify and assess the risks of all forms of flooding to and from the development and demonstrate how these flood risks will be managed, taking climate change into account. For major developments in Flood Zone 1, the FRA should identify opportunities to reduce the probability and consequences of flooding. A FRA will also be required where the proposed development or change of use to a more vulnerable class may be subject to other sources of flooding (see Annex C) or where the Environment Agency, Internal Drainage Board and/or other bodies have indicated that there may be drainage problems.

3.18 Annex F of PPS25, refers to 'Managing Surface Water', outlining the need to implement a strategy for dealing with surface water runoff as part of the Flood Risk Assessment. This annex refers to the effect of the development upon the surrounding area with a need to reduce its permeability. The annex also introduces the need for a sustainable urban drainage systems to be incorporated where possible on site to manage surface water in a manner which is easy to maintain and which provides benefit to the area. Reference to the Local Planning Authority's need to promote the use of SuDS is also made.

REGIONAL STRATEGY

'PRELIMINARY FLOOD RISK ASSESSMENT' (PFRA) – GLOUCESTERSHIRE COUNTY COUNCIL – NOVEMBER 2011

3.19 The PFRA was prepared by Gloucestershire County Council to fulfil their requirements as the Lead Local Flood Authority (LLFA) under the Flood Risk Regulations. The purpose of the PFRA was to assess past and future floods with significant harmful consequences and identify the areas of most significant flood risk in the catchment. The PFRA aimed to assess past flood incidents, identify the potential for future flooding and identify the area's most susceptible to significant flooding to aid the production of a flood mitigation strategy.

3.20 Gloucestershire identifies its catchment as being predominantly rural in setting whose population is mainly centred on Gloucester, Cheltenham, Stroud and Cirencester. The River Severn is the main Catchment River in the county although some of the southern Cotswold district feeds the River Thames and the western side of the Forrest of Dean feeds the River Wye.

3.21 Historical flooding incidents within the area are:-

- Cheltenham Borough – July 1967 & summer 2007.
- Cotswold District – March 1947, July 1968, August 1977, Sept 1992, Oct 1993, April 1998, Dec 2000, Summer 2007, Jan 2008.
- Forest of Dean – March 1947, July 1968, Dec 1981, Dec 2000, summer 2007.
- Gloucester City – Jan 1939, March 1947, July 1968, Dec 1981, Jan 1990, Dec 2000, Summer 2007.
- Stroud – Jan 1939, March 1947, Dec 1965, July 1968, Dec 1981, Jan 1990, Dec 2000, Summer 2007.
- Tewkesbury Borough – Jan 1939, March 1947, July 1968, Dec 1981, 1985, Jan 1990, April 1998, Dec 2000, Summer 2007.

3.22 The PFRA identified that the floods of the summer of 2007 were created by a dry spring followed by prolonged periods of intense rainfall which led to surface water overloading sewers and high river levels bursting their banks.

3.23 Cheltenham is mentioned in the historic flooding part of the report as having over 600 properties being flooded by the summer 2007 floods. Cheltenham suffered from Fluvial (River Chelt, Wymans Brook, Hatherley Brook, Mill Stream), surface runoff and exceedance from highway drains and public sewers. The areas mainly affected were

Charlton Kings (70 properties), River Chelt (230 properties), Hatherley (100 properties), Prestbury (70 properties) and Whaddon (250 properties).

3.24 Although there were several areas severely affected by flooding as mentioned above, the population densities within these areas weren't high enough to make it to the Environment Agency's Flood Risk Areas.

LOCAL STRATEGY

'STRATEGIC FLOOD RISK ASSESSMENT FOR LOCAL DEVELOPMENT FRAMEWORK – LEVEL 1' – PRODUCED BY HALCROW, ON BEHALF OF CHELTENHAM BOROUGH COUNCIL, DATED SEPTEMBER 2008.

3.25 The purpose of the level 1 SFRA was to assess and map all forms of flood risk from groundwater to river sources taking into account future climate change to allow councils to use as an evidence base for locating future development.

3.26 The SFRA breaks down the Borough into Flood Risk Zones in accordance with PPS25 'Development and Flood Risk', this information helps to set out the Borough's spatial strategy for development.

3.27 Historic flood map information provided within the report identified two areas close to the development site as suffering flooding during the July 1968 floods, one approximately 50m north-west of the site on the opposite side of the A40, the other approximately 100m south-west of the site on the Reddings. The historic flood map also shows areas along Hatherley Brook which suffered flooding during the summer 2007 floods, the nearest being approximately 200m east of the site next to the roundabout junction with the A40.

3.28 The information found within this report identified that although the development site itself was not subject to flooding historically and is not predicted to suffer flooding in the future, consideration will need to be made towards both Hatherley Brook and the Reddings, two areas which have historically suffered flooding.

4 SURFACE WATER MANAGEMENT PLAN (SWMP)

4.1 Currently the development land is made up of approximately 2.35 ha of green fields on the outskirts of Cheltenham, adjacent to the A40. The site has no evidence of built structures, is bound to the north and east with hedgerows with the south and west boundaries being unbound, forming part of the overall larger site for future development. It is proposed to provide a new access road off Grovefield Way, a Flagship Dealership with car showroom and servicing building with a 3000m² footprint and car parking. The developed site will provide approximately 1.65 ha of impermeable area.

4.2 The introduction of Schedule 3 of the Flood and Water Management Act, 2010, when it arrives, intends to put the onus of flood risk and the management of surface water onto the Lead Local Flood Authority. The implementation of the National SuDS Standards in October 2013 will provide the SuDS Approving Body (already set up within local councils) with implementable standards which they will use to assess suitability of development proposals.

4.3 Paragraph 3.8 confirms that the Asset Location maps, provided by Severn Trent Water, show the location of a public Foul Water sewer within North Road West which runs along the southern boundary of the site. The map information provided shows a public surface or combined water sewer running in a northerly direction along the length of Grovefield Way to the eastern boundary of the site. Foul Water sewers from the development can connect to the existing public Foul Water Sewer under a Section 104 agreement with Severn Trent Water, (see Appendix B for details of the asset location maps).

4.4 PPS 25 Annex F paragraph F8 says, 'Regional planning bodies and local authorities should promote the use of SuDS for the management of run-off. Local Planning Authorities (LPAs) should ensure that their policies and decisions on applications support and complement Building Regulations on sustainable rainwater drainage. These give priority to the use of infiltration drainage systems over first watercourses and then sewers.'

4.5 PPS25 Annex F paragraph F10 says, 'The surface water drainage arrangements for any development site should be such that the volumes and peak flow rates of surface water leaving a developed site are no greater than the rates prior to the proposed development, unless specific off-site arrangements are made and result in the same net effect.'

4.6 It is proposed that the presence of a suitable Aquifer is unlikely beneath the site and based on this the SWMP recommends the use SuDS for attenuation purposes only in a manner which actively reduces the discharge rate of the surface water runoff from site and provides water cleansing.

4.7 To achieve this, the drainage strategy recommends the use of the following:-

- Domestic drainage from roofs shall enter into a rainwater harvesting system that will provide grey water to the premises for use within its toilets and vehicle wash facilities, the tank will be required to store up to 50m³ based upon the demand loadings calculated for the peak water usage of the premises. The remaining volume of runoff for up to and including the 1 in 100 year event will overflow from the storage tank into extra depth of filter material provided by the permeable paved car park.

- Permeable Paved attenuation structures within western parking court will attenuate flows generated by the parking court itself as well as from the hard surfaced driveway areas, for storm events up to and including the 1 in 100 year storm event as indicated in Appendix A.4.

- Highways will use a combination of a piped drainage network and lined filtration trenches to attenuate carriageway and footway run-off from the site. The filter drains will be sized to accommodate the 1 in 100 year storm event before entering a piped drain.

- All drainage systems will discharge into the minor watercourse running along the northern boundary via a Flow Control Chamber, which will be designed to limit discharge to Greenfield runoff rates.

4.8 The implementation of Sustainable Drainage Systems will both attenuate and cleanse the run-off from the site improving the quality before entering the watercourse.

4.9 The Storage Estimates provided in Appendix C.2 show that for the 1 in 100 year return period, and assuming there is no infiltration properties through the ground (based upon hydrology map information from the British Geological Survey website and historic soakage testing carried out in 2008 as shown in Appendix G), between **916m³** of **1303m³** attenuation will need to be provided by the onsite surface water management system.

4.10 It is proposed that the western parking court uses permeable paving to accommodate runoff from itself as well as from the hard surfaced drives. Based an area of 5385m² and approximately 260mm depth of filter material and allowing for a 30% void ratio, a total of **417m³** volume of attenuation can be provided (see Appendix C.3).

4.11 It is proposed that impermeable areas provided by the new business premises will enter into a rainwater harvesting system. The runoff volumes generated by these areas for storm events up to and including the 1 in 100 year return period (+30 climate change allowance) will be required to be attenuated within a two phased storage system. Storage calculations have been provided for these areas estimated at a volume of **482m³**. It is proposed that **50m³** is re-used within grey water services within the building and the remaining **432m³** will overflow into extra granular material storage beneath the permeable paving within the western car park. Based upon a car park area of 5385m² and a void ratio of 30%, an additional 267mm depth of filter material is required beneath the permeable paved car park (see Appendix C.4 for permeable car park design calculations, which include additional

roof areas). A crated system could be used but at twice the cost of the additional granular material.

4.12 It is proposed that between 101m³ and 144m³ runoff generated by the highway areas are attenuated within lined filtration trenches. Using a design of trench approximately 2.2m wide, 1m deep, approximately 200m long and allowing 30% void ratio more than **122m³** volume of attenuation can be provided (see Appendix C.5 for the highway infiltration trench design calculations).

4.13 Through the implementation of the SuDS features described in paragraphs 4.10 – 4.12 a total of **1021m³** attenuation has been provided. Although paragraphs 4.10 - 4.12 show the site has the capacity to manage the storage requirements of the 1 in 100 year event, surface water management plans should account for exceedances where, for example, storm events exceed the 1 in 100 year return period. Appendix A.5 indicates their direction of flow which can be seen to be directed towards the north-west corner of the site.

APPROPRIATE SuDS TRAIN

4.14 Permeable paving – Permeable paving can be utilised beneath parking areas or driveways and can be lined to act as an attenuation system. The system uses a permeable block paver, which is similar to a normal block paver but has notches cut out of the corners, allowing water to permeate. The construction below is similar to that of a normal driveway construction but a layer of geo-textile material is placed on top of the upper sub-base to prevent the sand from the laying course washing through and filling the voids. The lower sub-base is made up of 10-63mm filter material.

4.15 Granular Filtration Trenches – Are long, narrow trenches back filled with 63mm – 10mm graded filter material allowing attenuation and water cleansing of the surface water runoff before discharge. They are lined with a membrane to prevent infiltration and ingress of silts (although the membrane can be replaced with a perforated geo-textile for infiltration purposes) and can either be specified with a perforated pipe at the bottom where flow direction is required or can incorporate a fin drain detail. Detailing of these trenches is important as a catch-pit should be incorporated at the inlets to the trench so that some silts can be filtered out prior to the trench which extends their practical working life.

4.16 Rainwater Harvesting – Is an above ground storage system consisting of a filtration unit connected to a storage tank which collects the runoff from the roofs, filters the runoff through several carbon filters before pumping the cleansed water through the commercial premises as grey water for use in toilets and wash facilities. Water re-cycling is becoming more popular as increase in water bills make their utilisation more desirable.

4.17 Green / Brown Roofs – Is an Architectural SuDS feature which is an attractive alternative to Rainwater Harvesting. The systems actively incorporate planting within the roof structure which allow for runoff to be stored and then used to feed the plants. Brown roofs take another step further by incorporating boulders and logs within the roof structure to encourage Bio diversity. Although the runoff is not re-utilised within the building, as it would

be with rainwater harvesting, they don't require storage tanks or pumps to move the runoff about. The additional cost of their construction can be offset by the reduction in attenuation requirements to below ground surface water drainage systems.

4.18 Swales – Are an above ground storage system consisting of an open ditch, with sloping sides and a flat base they provide attenuation and water cleansing properties. With a large surface area, they allow evaporation of contaminants as well as up to 20% of the stored runoff. They do however require large amounts of land take which are not always attractive to developers or adopting authorities and are not suitable for use with the proposed Masterplan layout.

5 RECOMMENDATIONS

5.1 Having carried out the Flood Risk Assessment and Surface Water Management Plan we can recommend the following:

- The site's commercial land use, being classified as 'Less Vulnerable', is suitably located within Flood Zone 1 which is in accordance with NPPF 'Technical Guidance' Tables 1-3 and PPS25, Annex D, Tables D1 – D3, chapter 2.

- It is recommended that parking courts use permeable block paving to cleanse and attenuate runoff from private footpaths and the driveways themselves.

- It is recommended that the main access road through the site is designed so as to drain into the lined filtration structures, located beneath footways, or Swales if space permits.

- Although priority should normally be given to using soakaways to reduce surface water run-off volume the site's geological and hydro-geological limitations make their use impractical. The location of the minor watercourse proves a more suitable discharge point.

- A detailed ground investigation, including infiltration testing and contamination analysis is carried out before detailed drainage designs are agreed, to ascertain the suitability of the SuDS recommended in Surface Water Management Plan and the scale of water cleansing required prior to discharge.

- It is recommended that the site runoff, through attenuation on site, will discharge at no greater than 8l/s into the minor watercourse in the north-west corner of the site under an agreement with Cheltenham Borough Council.

- Foul Water from the development will be drained via a separate Foul Water Sewer, to be adopted under a Section 104 agreement with Severn Trent Water. Foul water will discharge at a rate agreed with Severn Trent Water into a public Foul Water sewer within North Road West.

6 CONCLUSION

6.1 The Flood Risk Assessment identifies that the proposed development site is within Flood Zone 1 therefore posing a low risk to flooding. The flooding problem areas near to the site should benefit from the on-site attenuation provided by the SWMP.

6.2 The asset location plans provided by Severn Trent Water show no evidence of public surface water sewers that would have opportunity to cause flood risk to the development site.

6.3 The topography of the development site shows overland flows directing towards the north-west boundary.

6.4 By using rainwater harvesting to re-use runoff generated by the roof areas of the commercial premises, runoff volumes are reduced, requiring less attenuation within below ground structures.

6.5 By using SuDS features such as the lined filtration trenches and the permeable block paving to attenuate flows up to the 1 in 100 year storm event, the runoff time of entry is delayed for the extreme storms thereby actively creating betterment to the existing Greenfield flows, reducing flood risk to the surrounding areas.

6.6 The Surface Water Management Plan identifies that although the impermeable area will be increased on site from the existing scenario through using SuDS and for attenuation as well as water cleansing, runoff from the site is not increased and its water quality is improved.

6.7 Foul Water from the site will be discharged into public foul water sewers off site under agreement with the adopting water authority, Severn Trent Water.

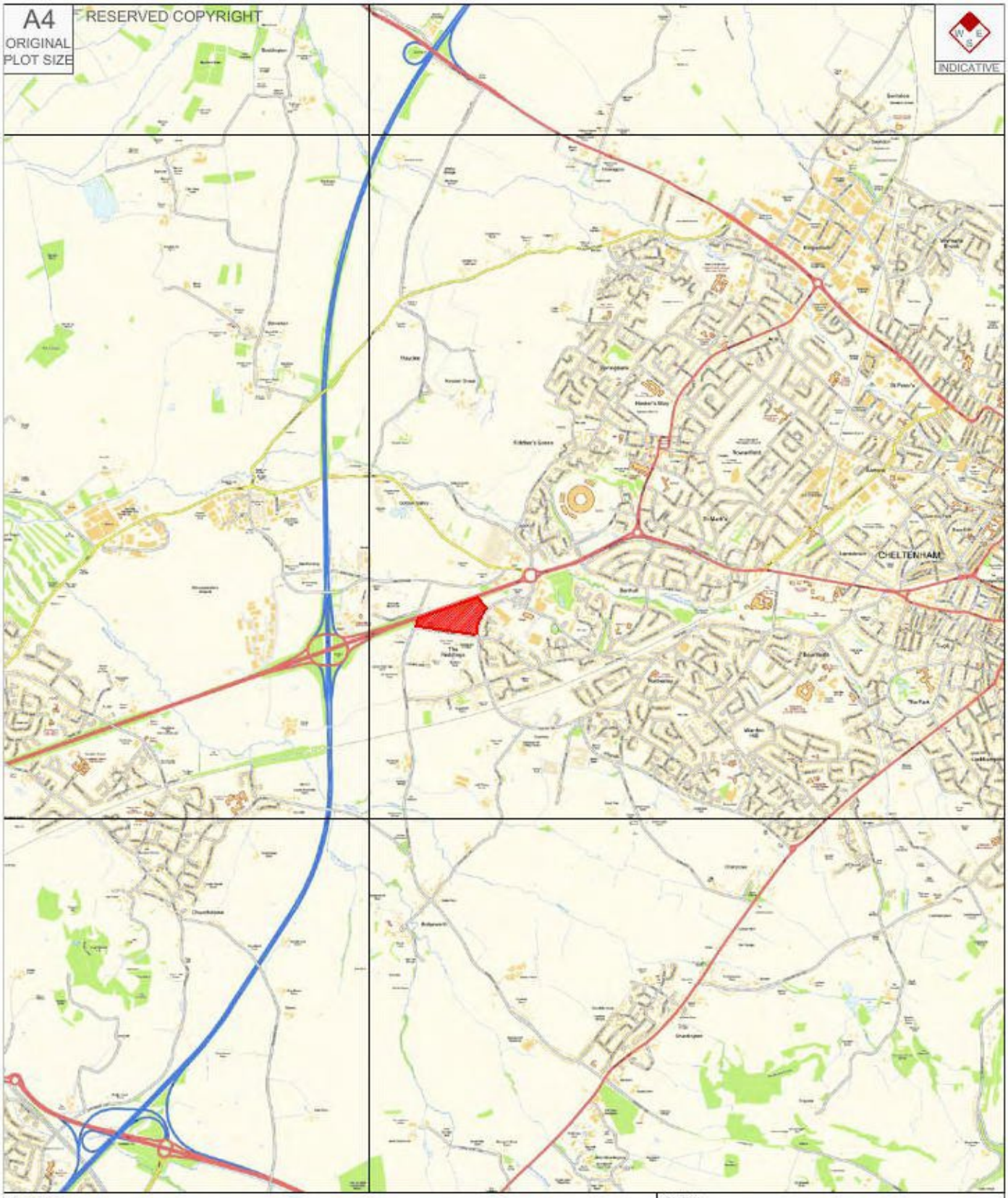
APPENDICES

APPENDIX A

SCHEME DRAWINGS

A4
ORIGINAL
PLOT SIZE

INDICATIVE



PROJECT:

LAND OFF GROVEFIELD WAY, CHELTENHAM

CLIENT:

COTSWOLD BMW GROUP

TITLE:

SITE LOCATION PLAN

NOTES:

STATUS:

INFORMATION

SCALE:	DATE:	DRAWN:	CHECKED:	APPROVED:
NTS	13.05.13	AJH	PCP	CMR

JOB NO:	DRAWING NO:	REVISION:
1303-30	Appendix A.1	-

Rev	Date	Details	Drawn by	Checked by	Approved by
-	-	-	-	-	-

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Cambridge
Cardiff
London
Welwyn Garden City

tpa
Transport Planning Associates

21 Berkeley Square
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Bristol
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0117 925 9400
www.tpa.uk.com

A1
ORIGINAL
PLOT SIZE

NOTES:

KEY:

FOOD STORE IMPERMEABLE AREAS

SITE BOUNDARY	
TOTAL SITE AREA=	23495m²
EXISTING IMPERMEABLE AREA=	0m²
EXISTING VEGETATED AREA=	23495m²
PROPOSED % IMPERMEABLE AREA=	0%

Lay-by

BLADON MEWS

TIBBERTON GROV

CHALFORD AVENUE

FRAMPTON MEWS

Playground

Rev	Date	Details	Drawn by	Checked by	Approved by
-	-	-	-	-	-

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Cardiff
Welwyn Garden City

Transport Planning Associates

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Welwyn Garden City
AL7 3BQ
01707 385 200
www.tpa.uk.com

CLIENT:
COTSWOLD BMW GROUP

PROJECT:
GROVEFIELD WAY
CHELTENHAM

TITLE:
EXISTING IMPERMEABLE AREAS PLAN

STATUS:
INFORMATION

SCALE:	DATE:	DRAWN:	CHECKED:	APPROVED:
1:500	15.05.13	AJH	PCP	JC

JOB NO:	DRAWING NO:	REVISION:
1303-30	Appendix A.2	

INDICATIVE

A1
ORIGINAL
PLOT SIZE

NOTES:

KEY:

FOOD STORE IMPERMEABLE AREAS

SITE BOUNDARY	
TOTAL SITE AREA=	23495m²
PROPOSED IMPERMEABLE AREA=	16155m²
PROPOSED VEGETATED AREA=	7340m²
PROPOSED % IMPERMEABLE AREA=	68.7%

Rev	Date	Details	Drawn by	Checked by	Approved by
-	-	-	-	-	-

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CLIENT:
COTSWOLD BMW GROUP

PROJECT:
GROVEFIELD WAY
CHELTENHAM

TITLE:
PROPOSED IMPERMEABLE AREAS PLAN

STATUS:
INFORMATION

SCALE:	DATE:	DRAWN:	CHECKED:	APPROVED:
1:500	15.05.13	AJH	PCP	JC

JOB NO:	DRAWING NO:	REVISION:
1303-30	Appendix A.3	

INDICATIVE

A1
ORIGINAL
PLOT SIZE

NOTES:

KEY:

SITE BOUNDARY

TOTAL SITE AREA=	23495m²
PROPOSED ROOF AREA=	7605m²
PROPOSED DRIVEWAYS=	1380m²
PROPOSED PARKING BAYS=	5385m²
PROPOSED ACCESS ROAD=	1420m²
PROPOSED FOOTWAYS=	365m²
PROPOSED LANDSCAPING=	7340m²
TOTAL IMPERMEABLE AREA=	16155m²
PROPOSED % IMPERMEABLE AREA=	68.7%

DRAINAGE KEY:

SURFACE WATER SEWER/HIGHWAY DRAIN

SURFACE WATER MANHOLE

6m DRAINAGE EASEMENT

ASSUMING A LIMITED DISCHARGE RATE OF 8L/S FOR THE WHOLE SITE ATTENUATING UP TO THE 1 IN 100 YEAR RETURN PERIOD BETWEEN AND RUNOFF IS GENERATED.

ATTENUATION

ROOF AREAS INTO RAINWATER HARVESTING SYSTEM TO BE RE-USED AS GREY WATER FOR UTILITIES AS TOILETS AND FIRE SPRINKLER SYSTEMS= 50m³ (NOT TO BE INCL. IN CALCS)

REMAINING ROOF VOLUME TO ENTER INTO ADDITIONAL DEPTH OF FILTER MATERIAL PROVIDED BENEATH THE PERMEABLE PAVED CAR PARK

HIGHWAY AND FOOTWAY AREAS TO ENTER INTO 2m WIDE BY 1.5m DEEP LINED FILTRATION TRENCH RUNNING BENEATH THE FOOTWAYS. 2.2m x 1m x 200m x 30% void ratio= 122m³

PERMEABLE PAVED CAR PARKING COURTS TO TAKE RUNOFF FROM ITSELF AS WELL AS FROM THE REMAINING HARD SURFACED DRIVES. 5385m² x 555mm deep x 30% voids= 899m³

TOTAL ATTENUATION PROPOSED=

Rev	Date	Details	Drawn by	Checked by	Approved by
A	05.06.13	Amended strategy to suit revised attenuation calculations.	AJH	PCP	CMR

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CLIENT:
COTSWOLD BMW GROUP

PROJECT:
GROVEFIELD WAY
CHELTENHAM

TITLE:
SURFACE WATER
MANAGEMENT PLAN

STATUS:
INFORMATION

SCALE:	DATE:	DRAWN:	CHECKED:	APPROVED:
1:500	15.05.13	AJH	PCP	JC

JOB NO:	DRAWING NO:	REVISION:
1303-30	Appendix A.4	A

W E S

INDICATIVE