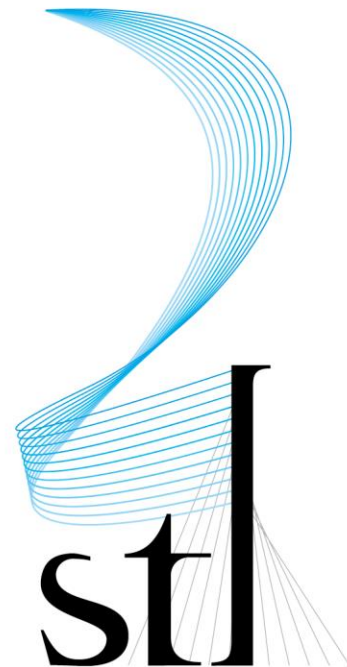


Our ref: 19-3422

Your ref:

Date: 14<sup>th</sup> March 2019



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**Drainage Calculations for:  
Proposed Development  
At  
Rochdale Road East  
Heywood  
Greater Manchester  
OL10 1PN**

**For  
Maxstretti Homes (Haywood) Ltd**

Company Reg No. 07280496

Registered Address:  
1 Barkers Lane, Sale,  
Cheshire, M33 6RP.

Directors  
Jonathan Hayes  
Belinda Hayes

Associate  
Mohammed Rawat

## Construction (Design & Management) Regulations 2015.

Under the C(D&M) Regs the designer's responsibility is limited to the reasonably foreseeable risks to persons involved in the construction, maintenance and repair of a structure from hazards that arise from the design. Therefore, this DRA only assesses the possible hazards that may arise from the specific structural design at this stage of the project. Should any alterations to the structure be carried out without the knowledge of the designer then no responsibility can be attributed.

It is the Contractors responsibility to use this document for the construction and future maintenance of the building as designed at this stage. This is not a Method Statement.

Under the C(D&M) Regulations 2015 it is the client's responsibility to ensure that every person designing the structure and every contractor who has been or may be appointed to work on the project is promptly provided with sufficient pre-construction information to ensure so far as is reasonably practicable the health and safety of all persons engaged in the construction work, liable to be affected by the way in which it is carried out, and who will use the structure in future.

## Designers Risk Analysis.

Considerations to be given are:

During initial construction.

Noise and vibrations. Not only consider the effects these may have on workers but also neighbours.

Contamination. Where ground may be contaminated may need to consider substructure works that do not allow leaching through surface etc.

Falls from height, generally over 2m. These include around edges of deep excavations, upper floor and roof edges.

Collapse of the structure under both temporary and permanent imposed loads.

Handling of structural elements. Consideration must be given to the weight of elements specified and whether mechanical handling is feasible. Otherwise consider splicing beams and columns etc or the use of lightweight masonry if acceptable.

Fire. Although on site welding may be necessary, using this near combustible materials is not wise.

Long term.

Falls from height, generally over 2m. Consideration should be given for the future maintenance of the building such as ladder restraint to upper walls.

Collapse of the structure under the permanent imposed loads. The structural elements should be clearly marked on the drawings.

## Standard documents.

Documents used:

|                                        |               |                       |
|----------------------------------------|---------------|-----------------------|
| Building Regulation Approved Documents | Part A        | Structure             |
|                                        | Part B        | Fire                  |
|                                        | Part C        | Site Preparation      |
|                                        | Part H        | Drainage              |
| British Codes of Practice              | BS8110 Part 1 | Concrete              |
|                                        | BS5950 Part 1 | Steel                 |
|                                        | BS5628 Part   | Unreinforced masonry  |
|                                        | BS5977        | Lintel design         |
|                                        | BS5268 Part   | Timber                |
|                                        | BS6399 Parts  | Dead & Imposed loads  |
| Euro Codes                             | EC1           | Actions on structures |
|                                        | EC2           | Concrete design       |
|                                        | EC3           | Steel Design          |
|                                        | EC5           | Timber design         |
|                                        | EC6           | Masonry design        |
| NHBC Standards 2011                    | Chapter 4.3   | Building near Trees   |

## BELOW GROUND DRAINAGE DESIGN.

### Surface water drainage Design.

Construction of a new apartment building on the site of a former car wash site.

The apartment building comprises ground floor carparking and 40 number one and two bedroom apartments over four floors. The property is to be constructed with a steel frame at ground floor level and transfer slab at first floor level with timber framed brick clad structure above.

The approximate area of the original car wash and hard landscaping is **745m<sup>2</sup>**

The new apartment building has a total roof area of **1425m<sup>2</sup>**

External paths and hardstanding is to be of permeable paving.

The existing surface water drainage discharges into the adopted sewers within Roeacre Street to the west.

Design the surface water system and attenuations for the additional roof area of **680m<sup>2</sup>**

Design the surface water drainage to allow for 1 year/ 30 year and 100year storm return periods with a storm duration of 15 min/ 30 min/ 60 min and allow for 30% climate change increase.

Due to the size of the site and the footprint of the building there is area on site where any form of soakaway can be installed, therefore allow for an attenuation system below the car park or over the car park terrace roof garden

Calculate increase in discharge from the additional roof area of **680m<sup>2</sup>**  
and restrict the increased flow to 5.0 l/sec

|          |                                |       |
|----------|--------------------------------|-------|
| Consider | 1 year storm over duration of  | 15min |
|          |                                | 30min |
|          |                                | 60min |
|          | 30 year storm over duration of | 15min |
|          |                                | 30min |
|          |                                | 60min |
|          | 100year storm over duration of | 15min |
|          |                                | 30min |
|          |                                | 60min |

Allow for a climate change increase of 30%

**Analysing these cases, the flow rates for the additional hard surface from the new building (680m<sup>2</sup>) are:**

|                |          |         |   |                      |
|----------------|----------|---------|---|----------------------|
| 1 year storm   | 6.1l/s,  | 4.0l/s  | & | 2.6l/s               |
| 30 year storm  | 15.0l/s, | 9.7l/s  | & | 6.1l/s               |
| 100 year storm | 19.6l/s, | 12.7l/s | & | 8.0l/s respectively. |

Consider the maximum flow rate for a 100 year storm/ 15 min duration Design Rainfall calculations

**DESIGN RAINFALL**

**In accordance with the Wallingford Procedure**

Tedds calculation version 2.0.00

**Design rainfall intensity**

|                                                      |                                                                                      |
|------------------------------------------------------|--------------------------------------------------------------------------------------|
| Location of catchment area                           | Manchester                                                                           |
| Storm duration                                       | D = <b>15</b> min                                                                    |
| Return period                                        | Period = <b>100</b> yr                                                               |
| Ratio 60 min to 2 day rainfall of 5 yr return period | r = <b>0.360</b>                                                                     |
| 5-year return period rainfall of 60 minutes duration | M5_60min = <b>18.0</b> mm                                                            |
| Increase of rainfall intensity due to global warming | p <sub>climate</sub> = <b>30</b> %                                                   |
| Factor Z1 (Wallingford procedure)                    | Z1 = <b>0.62</b>                                                                     |
| Rainfall for 15min storm with 5 year return period   | M5_15min <sub>i</sub> = Z1 × M5_60min × (1 + p <sub>climate</sub> ) = <b>14.5</b> mm |
| Factor Z2 (Wallingford procedure)                    | Z2 = <b>1.98</b>                                                                     |
| Rainfall for 15min storm with 100 year return period | M100_15min = Z2 × M5_15min <sub>i</sub> = <b>28.8</b> mm                             |
| Design rainfall intensity                            | I <sub>max</sub> = M100_15min / D = <b>115.0</b> mm/hr                               |

**Maximum surface water runoff**

|                                        |                                                                                |
|----------------------------------------|--------------------------------------------------------------------------------|
| Catchment area                         | A <sub>catch</sub> = <b>680</b> m <sup>2</sup>                                 |
| Percentage of area that is impermeable | p = <b>90</b> %                                                                |
| Maximum surface water runoff           | Q <sub>max</sub> = A <sub>catch</sub> × p × I <sub>max</sub> = <b>19.6</b> l/s |

**Provide a Hydro-brake flow restrictor with a maximum flow of 5L/sec to control/ restrict the increase in discharge rate into the existing branch drain and sewer in the road.**  
**Provide attenuation tanks to cater for the additional surface water .for the increased area for the proposed development**

**ATTENUATION DESIGN**

In accordance with CIRIA publication C753 - The SUDS Manual

Tedds calculation version 1.0.03

**EA\_Defra method****Site characteristics**

|                                                     |                                   |
|-----------------------------------------------------|-----------------------------------|
| Location                                            | Manchester                        |
| Hydrological region                                 | 10                                |
| Soil type (Wallingford Procedure W.R.A.P map)       | 2                                 |
| Standard percentage runoff                          | SPR = <b>0.30</b>                 |
| Average annual rainfall                             | SAAR = <b>880</b> mm              |
| 5 year return period rainfall of 60 minute duration | M5_60min = <b>18.0</b> mm         |
| Ratio 60-minute to 2 day rainfalls of 5 year return | r = <b>0.36</b>                   |
| Rainfall intensity increase due to global warming   | p <sub>climate</sub> = <b>30%</b> |
| Impervious area req. attenuation storage            | α = <b>90.0</b> %                 |

**Catchment details**

| Subcatchment | Name                     | Area (ha) | PIMP (%) | Impermeable.<br>area (ha) |
|--------------|--------------------------|-----------|----------|---------------------------|
| 1;           | additional roof<br>area; | 0.07;     | 90.0     | 0.06;                     |
| <b>Total</b> |                          | 0.07;     | 90.0     | 0.06;                     |

**Greenfield runoff rates**

|                                          |                                                                                                                                                                                          |
|------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Catchment area                           | AREA = <b>50.00</b> hectare                                                                                                                                                              |
| Greenfield runoff rate (50 hectare site) | $\bar{Q}_{\text{rural}} = 0.00108 \text{ m}^3/\text{s} \times (\text{AREA}/1\text{km}^2)^{0.89} \times (\text{SAAR}/1\text{mm})^{1.17} \times \text{SPR}^{2.17} =$<br><b>119.1</b> l / s |
| Greenfield runoff rate                   | $\bar{Q} = \bar{Q}_{\text{rural}} / \text{AREA} \times A =$ <b>0.2</b> l / s                                                                                                             |
| Greenfield runoff rate per unit area     | $\bar{Q}_A = \bar{Q} / A =$ <b>2.4</b> l / s / hectare                                                                                                                                   |

**Estimated site discharges**

|                            |                                                                                  |
|----------------------------|----------------------------------------------------------------------------------|
| FSR growth rate (1 year)   | FSR <sub>1yr</sub> = <b>0.87</b>                                                 |
| Discharge (1 year)         | Q <sub>1yr</sub> = $\bar{Q} \times \text{FSR}_{1\text{yr}} =$ <b>0.1</b> l/s     |
| FSR growth rate (30 year)  | FSR <sub>30yr</sub> = <b>1.70</b>                                                |
| Discharge (30 year)        | Q <sub>30yr</sub> = $\bar{Q} \times \text{FSR}_{30\text{yr}} =$ <b>0.3</b> l/s   |
| FSR growth rate (100 year) | FSR <sub>100yr</sub> = <b>2.08</b>                                               |
| Discharge (100 year)       | Q <sub>100yr</sub> = $\bar{Q} \times \text{FSR}_{100\text{yr}} =$ <b>0.3</b> l/s |

**Estimated attenuation volume - 1 year**

|                                                   |                                                                                            |
|---------------------------------------------------|--------------------------------------------------------------------------------------------|
| Attenuation storage vol (fig A7.1 - A7.8)         | Uvol <sub>1yr</sub> = <b>168.4</b> m <sup>3</sup> / hectare                                |
| Basic storage volume                              | BSV <sub>1yr</sub> = Uvol <sub>1yr</sub> × α × A = <b>10.31</b> m <sup>3</sup>             |
| FEH rainfall factor (figs A11.1, A6.1.1 - A6.3.4) | FF <sub>1yr</sub> = <b>0.95</b>                                                            |
| Storage volume ratio (fig A8.1 - A8.8)            | SVR <sub>1yr</sub> = <b>1.51</b>                                                           |
| Adjusted storage volume                           | ASV <sub>1yr</sub> = SVR <sub>1yr</sub> × BSV <sub>1yr</sub> = <b>15.60</b> m <sup>3</sup> |
| Hydrological regional volume ratio (fig A9.1)     | HR <sub>1yr</sub> = <b>1.00</b>                                                            |
| Final estimated attenuation storage               | Vol <sub>1yr</sub> = HR <sub>1yr</sub> × ASV <sub>1yr</sub> = <b>15.62</b> m <sup>3</sup>  |

Library item: Estimated attenuation output

**Estimated attenuation volume - 30 year**

Attenuation storage vol (fig A7.1 - A7.8)

$$Uvol_{30yr} = 347.3 \text{ m}^3 / \text{hectare}$$

Basic storage volume

$$BSV_{30yr} = Uvol_{30yr} \times \alpha \times A = 21.26 \text{ m}^3$$

FEH rainfall factor (figs A11.1, A6.1.1 - A6.3.4)

$$FF_{30yr} = 0.90$$

Storage volume ratio (fig A8.1 - A8.8)

$$SVR_{30yr} = 1.63$$

Adjusted storage volume

$$ASV_{30yr} = SVR_{30yr} \times BSV_{30yr} = 34.64 \text{ m}^3$$

Hydrological regional volume ratio (fig A9.1)

$$HR_{30yr} = 1.08$$

Final estimated attenuation storage

$$Vol_{30yr} = HR_{30yr} \times ASV_{30yr} = 37.39 \text{ m}^3$$

Library item: Estimated attenuation output

**Estimated attenuation volume - 100 year**

Attenuation storage vol (fig A7.1 - A7.8)

$$Uvol_{100yr} = 435.5 \text{ m}^3 / \text{hectare}$$

Basic storage volume

$$BSV_{100yr} = Uvol_{100yr} \times \alpha \times A = 26.65 \text{ m}^3$$

FEH rainfall factor (figs A11.1, A6.1.1 - A6.3.4)

$$FF_{100yr} = 0.90$$

Storage volume ratio (fig A8.1 - A8.8)

$$SVR_{100yr} = 1.63$$

Adjusted storage volume

$$ASV_{100yr} = SVR_{100yr} \times BSV_{100yr} = 43.43 \text{ m}^3$$

Hydrological regional volume ratio (fig A9.1)

$$HR_{100yr} = 1.11$$

Final estimated attenuation storage

$$Vol_{100yr} = HR_{100yr} \times ASV_{100yr} = 48.32 \text{ m}^3$$

Library item: Estimated attenuation output

**Attenuation storage required**

Vol. increase due to head-discharge relationship

$$p_{hydro} = 1.25$$

Maximum attenuation storage required

$$V_{req\_max} = Vol_{30yr} \times p_{hydro} = 46.7 \text{ m}^3$$

**Interception storage**

Interception rainfall depth

$$d_{int} = 5 \text{ mm}$$

Volume of interception storage required

$$V_{int\_req} = 0.8 \times A_{imp} \times d_{int} = 2.45 \text{ m}^3$$

**Long term storage**

Proportion of paved area draining in to network

$$\alpha = 0.9$$

Proportion of pervious area draining in to network

$$\beta = 0.5$$

Rainfall depth for 100years, 6 hour event

$$RD = M100_{360} = 74.1 \text{ mm}$$

Extra runoff vol of dev.runoff over greenfield runoff

$$Vol_{xs} = \max(RD \times A \times (PIMP \times \alpha \times 0.8 + ((1 - PIMP) \times \beta \times SPR) - SPR), 0 \text{ m}^3) = 18.30 \text{ m}^3$$

**Treatment volume**

Treatment volume (assume 80% runoff)

$$T_{vol} = 0.8 \times A \times 15 \text{ mm} \times PIMP = 7.34 \text{ m}^3$$

**Provide min 46.7m3 of attenuation storage for the additional discharge from the proposed building.**

**Provide min 3m wide x 0.8m deep x 20m long Wavin Aquacell Core or equivalent attenuation tanks below the ground level car park**

**Wavin Aquacell Core attenuation tanks to be installed in accordance with manufacturers specification.**

**Alternatively provide AGB Blue Roof attenuation system below the garden terrace over the car park.**

**Provide 200mm deep AGB Blue Roof attenuation system (8.5m wide x 35m long x 0.2m deep) Designed by specialists**

**Provide Hydro-brake flow restrictor with a maximum flow rate of 5L/sec to control the discharge from the attenuation system into the surface water drains and adopted drains.**