





## APPENDIX B

### Greenfield Runoff Calculation

Project: Sipson

Created By: KTP

Job No: 120406

Checked By: KBL

Date: Jun-12

### Q BAR (rural)

$$0.00108 \times \text{AREA}^{0.89} \times \text{SAAR}^{1.17} \times \text{SOIL}^{2.17} \quad (\text{IOH Report No.124})$$

### Parameters:

AREA: 0.072 (km<sup>2</sup>)

SAAR: 619 (mm)

SOIL: 0.3

50 ha = 0.5 km<sup>2</sup>

50 ha:

$$0.00108 \quad \times \quad 0.072^{0.89} \quad \times \quad 619^{1.17} \quad \times \quad 0.3^{2.17}$$

$$= 0.079 \text{ m}^3/\text{s}$$

$$= 78.911 \text{ l/s}$$

$$= 1.578 \text{ l/s/ha}$$

$$\underline{\underline{\text{Mean Annual Flood from Site} = 11.441 \text{ l/s}}}$$

**Storage Calculation****Storage Design**

Project: Sipson

Created By: KTP

Job No: 120408

Checked By: KBL

Storage: **Carriageway S2**

Date: Aug-12

**Design Rainfall**

r = 0.4

**Rainfall****100 Year Rainfall rate**

|         |          |           |          |
|---------|----------|-----------|----------|
| M5-5    | 7.47 mm  | M100-5    | 13.81 mm |
| M5-10   | 10.47 mm | M100-10   | 20.07 mm |
| M5-15   | 12.67 mm | M100-15   | 24.73 mm |
| M5- 30  | 16.07 mm | M100-30   | 32.11 mm |
| M5- 60  | 20.00 mm | M100-60   | 40.60 mm |
| M5- 120 | 24.13 mm | M100-120  | 48.59 mm |
| M5- 240 | 28.93 mm | M100-240  | 57.25 mm |
| M5- 360 | 32.07 mm | M100-360  | 62.64 mm |
| M5- 600 | 35.87 mm | M100-600  | 68.97 mm |
| M5-1440 | 44.80 mm | M100-1440 | 82.95 mm |

### Storage Design - UNDERGROUND STORAGE

Drained Area                    **4964.28 m<sup>2</sup>**  
percentage of free volume        100.00%

#### Storm duration

|           | Volume of SW Runoff   | Volume of Infiltration<br>during Storm | Vol storage required  |
|-----------|-----------------------|----------------------------------------|-----------------------|
| M100-5    | 89.11 m <sup>3</sup>  | 0.37 m <sup>3</sup>                    | 88.74 m <sup>3</sup>  |
| M100-10   | 129.52 m <sup>3</sup> | 0.73 m <sup>3</sup>                    | 128.79 m <sup>3</sup> |
| M100-15   | 159.62 m <sup>3</sup> | 1.10 m <sup>3</sup>                    | 158.52 m <sup>3</sup> |
| M100-30   | 207.22 m <sup>3</sup> | 2.20 m <sup>3</sup>                    | 205.03 m <sup>3</sup> |
| M100-60   | 262.01 m <sup>3</sup> | 4.39 m <sup>3</sup>                    | 257.62 m <sup>3</sup> |
| M100-120  | 313.59 m <sup>3</sup> | 8.78 m <sup>3</sup>                    | 304.81 m <sup>3</sup> |
| M100-240  | 369.44 m <sup>3</sup> | 17.57 m <sup>3</sup>                   | 351.87 m <sup>3</sup> |
| M100-360  | 404.26 m <sup>3</sup> | 26.35 m <sup>3</sup>                   | 377.91 m <sup>3</sup> |
| M100-600  | 445.13 m <sup>3</sup> | 43.92 m <sup>3</sup>                   | 401.21 m <sup>3</sup> |
| M100-1440 | 535.33 m <sup>3</sup> | 105.41 m <sup>3</sup>                  | 429.93 m <sup>3</sup> |

Maximum Storage Required:                    **429.93 m<sup>3</sup>**

### Storage Calculation

### Storage Design

Project: Sipson

Created By: KTP

Job No: 120408

Checked By: KBL

Storage: Carriageway S1

Date: Aug-12

### Design Rainfall

r = 0.4

#### Rainfall

#### 100 Year Rainfall rate

|         |          |           |          |
|---------|----------|-----------|----------|
| M5-5    | 7.47 mm  | M100-5    | 13.81 mm |
| M5-10   | 10.47 mm | M100-10   | 20.07 mm |
| M5-15   | 12.67 mm | M100-15   | 24.73 mm |
| M5-30   | 16.07 mm | M100-30   | 32.11 mm |
| M5-60   | 20.00 mm | M100-60   | 40.60 mm |
| M5-120  | 24.13 mm | M100-120  | 48.59 mm |
| M5-240  | 28.93 mm | M100-240  | 57.25 mm |
| M5-360  | 32.07 mm | M100-360  | 62.64 mm |
| M5-600  | 35.87 mm | M100-600  | 68.97 mm |
| M5-1440 | 44.80 mm | M100-1440 | 82.95 mm |

Storage Design - POND 2

Drained Area                    2010.83 m<sup>2</sup>  
percentage of free volume        100.00%

Storm duration

|           | Volume of SW Runoff   | Volume of Infiltration<br>during Storm | Vol storage required  |
|-----------|-----------------------|----------------------------------------|-----------------------|
| M100-5    | 36.09 m <sup>3</sup>  | 0.37 m <sup>3</sup>                    | 35.73 m <sup>3</sup>  |
| M100-10   | 52.46 m <sup>3</sup>  | 0.73 m <sup>3</sup>                    | 51.73 m <sup>3</sup>  |
| M100-15   | 64.66 m <sup>3</sup>  | 1.10 m <sup>3</sup>                    | 63.56 m <sup>3</sup>  |
| M100-30   | 83.94 m <sup>3</sup>  | 2.20 m <sup>3</sup>                    | 81.74 m <sup>3</sup>  |
| M100-60   | 106.13 m <sup>3</sup> | 4.39 m <sup>3</sup>                    | 101.74 m <sup>3</sup> |
| M100-120  | 127.02 m <sup>3</sup> | 8.78 m <sup>3</sup>                    | 118.24 m <sup>3</sup> |
| M100-240  | 149.64 m <sup>3</sup> | 17.57 m <sup>3</sup>                   | 132.08 m <sup>3</sup> |
| M100-360  | 163.75 m <sup>3</sup> | 26.35 m <sup>3</sup>                   | 137.40 m <sup>3</sup> |
| M100-600  | 180.30 m <sup>3</sup> | 43.92 m <sup>3</sup>                   | 136.38 m <sup>3</sup> |
| M100-1440 | 216.84 m <sup>3</sup> | 105.41 m <sup>3</sup>                  | 111.43 m <sup>3</sup> |

Maximum Storage Required:                    137.40 m<sup>3</sup>

## Storage Calculation

### Storage Design

Project: Sipson

Created By: KTP

Job No: 120408

Checked By: KBL

Storage: **Residential**

Date: Aug-12

### Design Rainfall

r = 0.4

#### Rainfall

#### 100 Year Rainfall rate

|         |          |           |          |
|---------|----------|-----------|----------|
| M5-5    | 7.47 mm  | M100-5    | 13.81 mm |
| M5-10   | 10.47 mm | M100-10   | 20.07 mm |
| M5-15   | 12.67 mm | M100-15   | 24.73 mm |
| M5-30   | 16.07 mm | M100-30   | 32.11 mm |
| M5-60   | 20.00 mm | M100-60   | 40.60 mm |
| M5-120  | 24.13 mm | M100-120  | 48.59 mm |
| M5-240  | 28.93 mm | M100-240  | 57.25 mm |
| M5-360  | 32.07 mm | M100-360  | 62.64 mm |
| M5-600  | 35.87 mm | M100-600  | 68.97 mm |
| M5-1440 | 44.80 mm | M100-1440 | 82.95 mm |



### Storage Design - UNDERGROUND STORAGE

Drained Area                    **3602.00 m<sup>2</sup>**  
percentage of free volume            **100.00%**

#### Storm duration

|           | Volume of SW Runoff   | Volume of Infiltration<br>during Storm | Vol storage required  |
|-----------|-----------------------|----------------------------------------|-----------------------|
| M100-5    | 64.65 m <sup>3</sup>  | 1.23 m <sup>3</sup>                    | 63.42 m <sup>3</sup>  |
| M100-10   | 93.98 m <sup>3</sup>  | 2.47 m <sup>3</sup>                    | 91.51 m <sup>3</sup>  |
| M100-15   | 115.82 m <sup>3</sup> | 3.70 m <sup>3</sup>                    | 112.12 m <sup>3</sup> |
| M100-30   | 150.36 m <sup>3</sup> | 7.40 m <sup>3</sup>                    | 142.96 m <sup>3</sup> |
| M100-60   | 190.11 m <sup>3</sup> | 14.80 m <sup>3</sup>                   | 175.32 m <sup>3</sup> |
| M100-120  | 227.54 m <sup>3</sup> | 29.59 m <sup>3</sup>                   | 197.94 m <sup>3</sup> |
| M100-240  | 268.06 m <sup>3</sup> | 59.18 m <sup>3</sup>                   | 208.87 m <sup>3</sup> |
| M100-360  | 293.32 m <sup>3</sup> | 88.78 m <sup>3</sup>                   | 204.55 m <sup>3</sup> |
| M100-600  | 322.98 m <sup>3</sup> | 147.96 m <sup>3</sup>                  | 175.02 m <sup>3</sup> |
| M100-1440 | 388.43 m <sup>3</sup> | 355.10 m <sup>3</sup>                  | 33.33 m <sup>3</sup>  |

Maximum Storage Required:            **208.87 m<sup>3</sup>**



**Storage Calculation****Storage Design****Project:** Sipson**Created By** KTP**Job No:** 120408**Checked B** KBL**Storage:** Community Hall**Date:** Aug-12**Design Rainfall****r =** 0.4**Rainfall****100 Year Rainfall rate**

|         |          |           |          |
|---------|----------|-----------|----------|
| M5-5    | 7.47 mm  | M100-5    | 13.81 mm |
| M5-10   | 10.47 mm | M100-10   | 20.07 mm |
| M5-15   | 12.67 mm | M100-15   | 24.73 mm |
| M5- 30  | 16.07 mm | M100-30   | 32.11 mm |
| M5- 60  | 20.00 mm | M100-60   | 40.60 mm |
| M5- 120 | 24.13 mm | M100-120  | 48.59 mm |
| M5- 240 | 28.93 mm | M100-240  | 57.25 mm |
| M5- 360 | 32.07 mm | M100-360  | 62.64 mm |
| M5- 600 | 35.87 mm | M100-600  | 68.97 mm |
| M5-1440 | 44.80 mm | M100-1440 | 82.95 mm |



### Storage Design - POND 1

Drained Area                    **459.47 m<sup>2</sup>**  
percentage of free volume        **100.00%**

### Storm duration

|           | Volume of SW Runoff  | Volume of Infiltration<br>during Storm | Vol storage required |
|-----------|----------------------|----------------------------------------|----------------------|
| M100-5    | 8.25 m <sup>3</sup>  | 0.12 m <sup>3</sup>                    | 8.12 m <sup>3</sup>  |
| M100-10   | 11.99 m <sup>3</sup> | 0.25 m <sup>3</sup>                    | 11.74 m <sup>3</sup> |
| M100-15   | 14.77 m <sup>3</sup> | 0.37 m <sup>3</sup>                    | 14.40 m <sup>3</sup> |
| M100-30   | 19.18 m <sup>3</sup> | 0.74 m <sup>3</sup>                    | 18.44 m <sup>3</sup> |
| M100-60   | 24.25 m <sup>3</sup> | 1.48 m <sup>3</sup>                    | 22.77 m <sup>3</sup> |
| M100-120  | 29.02 m <sup>3</sup> | 2.95 m <sup>3</sup>                    | 26.07 m <sup>3</sup> |
| M100-240  | 34.19 m <sup>3</sup> | 5.90 m <sup>3</sup>                    | 28.29 m <sup>3</sup> |
| M100-360  | 37.42 m <sup>3</sup> | 8.86 m <sup>3</sup>                    | 28.56 m <sup>3</sup> |
| M100-600  | 41.20 m <sup>3</sup> | 14.76 m <sup>3</sup>                   | 26.44 m <sup>3</sup> |
| M100-1440 | 49.55 m <sup>3</sup> | 35.42 m <sup>3</sup>                   | 14.12 m <sup>3</sup> |

Maximum Storage Required:                    **28.56 m<sup>3</sup>**

### Storage Calculation

#### Storage Design

Project: Sipson

Created By: KTP

Job No: 120408

Checked By: KBL

Storage: **Light Industrial Units**

Date: Aug-12

#### Design Rainfall

r = 0.4

#### Rainfall

#### 100 Year Rainfall rate

|         |          |           |          |
|---------|----------|-----------|----------|
| M5-5    | 7.47 mm  | M100-5    | 13.81 mm |
| M5-10   | 10.47 mm | M100-10   | 20.07 mm |
| M5-15   | 12.67 mm | M100-15   | 24.73 mm |
| M5- 30  | 16.07 mm | M100-30   | 32.11 mm |
| M5- 60  | 20.00 mm | M100-60   | 40.60 mm |
| M5- 120 | 24.13 mm | M100-120  | 48.59 mm |
| M5- 240 | 28.93 mm | M100-240  | 57.25 mm |
| M5- 360 | 32.07 mm | M100-360  | 62.64 mm |
| M5- 600 | 35.87 mm | M100-600  | 68.97 mm |
| M5-1440 | 44.80 mm | M100-1440 | 82.95 mm |



Storage Design - POND 1

Drained Area                    **3229.09 m<sup>2</sup>**  
percentage of free volume            **100.00%**

Storm duration

|           | Volume of SW Runoff   | Volume of Infiltration<br>during Storm | Vol storage required  |
|-----------|-----------------------|----------------------------------------|-----------------------|
| M100-5    | 57.96 m <sup>3</sup>  | 0.34 m <sup>3</sup>                    | 57.62 m <sup>3</sup>  |
| M100-10   | 84.25 m <sup>3</sup>  | 0.68 m <sup>3</sup>                    | 83.57 m <sup>3</sup>  |
| M100-15   | 103.83 m <sup>3</sup> | 1.02 m <sup>3</sup>                    | 102.81 m <sup>3</sup> |
| M100-30   | 134.79 m <sup>3</sup> | 2.03 m <sup>3</sup>                    | 132.76 m <sup>3</sup> |
| M100-60   | 170.43 m <sup>3</sup> | 4.07 m <sup>3</sup>                    | 166.36 m <sup>3</sup> |
| M100-120  | 203.98 m <sup>3</sup> | 8.14 m <sup>3</sup>                    | 195.84 m <sup>3</sup> |
| M100-240  | 240.31 m <sup>3</sup> | 16.27 m <sup>3</sup>                   | 224.03 m <sup>3</sup> |
| M100-360  | 262.96 m <sup>3</sup> | 24.41 m <sup>3</sup>                   | 238.55 m <sup>3</sup> |
| M100-600  | 289.54 m <sup>3</sup> | 40.68 m <sup>3</sup>                   | 248.86 m <sup>3</sup> |
| M100-1440 | 348.22 m <sup>3</sup> | 97.63 m <sup>3</sup>                   | 250.58 m <sup>3</sup> |

Maximum Storage Required:    **250.58 m<sup>3</sup>**

**Storage Calculation****Storage Design**

Project: Sipson

Created By: KTP

Job No: 120408

Checked By: KBL

Storage: **Hotel**

Date: Aug-12

**Design Rainfall**

r = 0.4

**Rainfall****100 Year Rainfall rate**

|         |          |           |          |
|---------|----------|-----------|----------|
| M5-5    | 7.47 mm  | M100-5    | 13.81 mm |
| M5-10   | 10.47 mm | M100-10   | 20.07 mm |
| M5-15   | 12.67 mm | M100-15   | 24.73 mm |
| M5- 30  | 16.07 mm | M100-30   | 32.11 mm |
| M5- 60  | 20.00 mm | M100-60   | 40.60 mm |
| M5- 120 | 24.13 mm | M100-120  | 48.59 mm |
| M5- 240 | 28.93 mm | M100-240  | 57.25 mm |
| M5- 360 | 32.07 mm | M100-360  | 62.64 mm |
| M5- 600 | 35.87 mm | M100-600  | 68.97 mm |
| M5-1440 | 44.80 mm | M100-1440 | 82.95 mm |



Storage Design - SWALE

Drained Area                    **1737.67 m<sup>2</sup>**  
percentage of free volume            100.00%

Storm duration

|           | Volume of SW Runoff   | Volume of Infiltration<br>during Storm | Vol storage required  |
|-----------|-----------------------|----------------------------------------|-----------------------|
| M100-5    | 31.19 m <sup>3</sup>  | 0.71 m <sup>3</sup>                    | 30.48 m <sup>3</sup>  |
| M100-10   | 45.34 m <sup>3</sup>  | 1.42 m <sup>3</sup>                    | 43.91 m <sup>3</sup>  |
| M100-15   | 55.87 m <sup>3</sup>  | 2.13 m <sup>3</sup>                    | 53.74 m <sup>3</sup>  |
| M100-30   | 72.54 m <sup>3</sup>  | 4.27 m <sup>3</sup>                    | 68.27 m <sup>3</sup>  |
| M100-60   | 91.71 m <sup>3</sup>  | 8.53 m <sup>3</sup>                    | 83.18 m <sup>3</sup>  |
| M100-120  | 109.77 m <sup>3</sup> | 17.06 m <sup>3</sup>                   | 92.70 m <sup>3</sup>  |
| M100-240  | 129.32 m <sup>3</sup> | 34.13 m <sup>3</sup>                   | 95.19 m <sup>3</sup>  |
| M100-360  | 141.50 m <sup>3</sup> | 51.19 m <sup>3</sup>                   | 90.31 m <sup>3</sup>  |
| M100-600  | 155.81 m <sup>3</sup> | 85.32 m <sup>3</sup>                   | 70.49 m <sup>3</sup>  |
| M100-1440 | 187.39 m <sup>3</sup> | 204.77 m <sup>3</sup>                  | -17.38 m <sup>3</sup> |

Maximum Storage Required:        **95.19 m<sup>3</sup>**

## Storage Calculation

### Storage Design

Project: Sipson

Created By: KTP

Job No: 120408

Checked By: KBL

Storage: Garden Centre

Date: Aug-12

### Design Rainfall

r = 0.4

#### Rainfall

#### 100 Year Rainfall rate

|         |          |           |          |
|---------|----------|-----------|----------|
| M5-5    | 7.47 mm  | M100-5    | 13.81 mm |
| M5-10   | 10.47 mm | M100-10   | 20.07 mm |
| M5-15   | 12.67 mm | M100-15   | 24.73 mm |
| M5- 30  | 16.07 mm | M100-30   | 32.11 mm |
| M5- 60  | 20.00 mm | M100-60   | 40.60 mm |
| M5- 120 | 24.13 mm | M100-120  | 48.59 mm |
| M5- 240 | 28.93 mm | M100-240  | 57.25 mm |
| M5- 360 | 32.07 mm | M100-360  | 62.64 mm |
| M5- 600 | 35.87 mm | M100-600  | 68.97 mm |
| M5-1440 | 44.80 mm | M100-1440 | 82.95 mm |



Storage Design - SWALE

Drained Area                    **2076.65 m<sup>2</sup>**  
percentage of free volume            **100.00%**

Storm duration

|           | Volume of SW Runoff   | Volume of Infiltration<br>during Storm | Vol storage required  |
|-----------|-----------------------|----------------------------------------|-----------------------|
| M100-5    | 37.28 m <sup>3</sup>  | 0.48 m <sup>3</sup>                    | 36.79 m <sup>3</sup>  |
| M100-10   | 54.18 m <sup>3</sup>  | 0.97 m <sup>3</sup>                    | 53.21 m <sup>3</sup>  |
| M100-15   | 66.77 m <sup>3</sup>  | 1.45 m <sup>3</sup>                    | 65.32 m <sup>3</sup>  |
| M100-30   | 86.69 m <sup>3</sup>  | 2.90 m <sup>3</sup>                    | 83.79 m <sup>3</sup>  |
| M100-60   | 109.61 m <sup>3</sup> | 5.80 m <sup>3</sup>                    | 103.81 m <sup>3</sup> |
| M100-120  | 131.18 m <sup>3</sup> | 11.59 m <sup>3</sup>                   | 119.59 m <sup>3</sup> |
| M100-240  | 154.54 m <sup>3</sup> | 23.18 m <sup>3</sup>                   | 131.36 m <sup>3</sup> |
| M100-360  | 169.11 m <sup>3</sup> | 34.78 m <sup>3</sup>                   | 134.33 m <sup>3</sup> |
| M100-600  | 186.21 m <sup>3</sup> | 57.96 m <sup>3</sup>                   | 128.25 m <sup>3</sup> |
| M100-1440 | 223.94 m <sup>3</sup> | 139.10 m <sup>3</sup>                  | 84.84 m <sup>3</sup>  |

Maximum Storage Required:    **134.33 m<sup>3</sup>**