

**APPENDIX G**

**Ground Investigation**



## SITE PLAN - BOREHOLE / TRIAL PIT LOCATIONS



Humberside Materials Laboratory Ltd  
Atherton Way, Brigg  
North Lincs, DN20 8AR  
Tel Fax 01652 652753

CLIENT :- Alan Finch of MLP

SITE :- Cob Gate, Whaplode



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## TRIAL PIT LOG

Trial pit  
No  
TP1

Client :- Alan Finch of MLP  
Site :- Cob Gate, Whaplode  
Project No :- 4540

Location :- see site plan  
Date :- 18-May-18

Coordinates E: 531898 N: 323939  
Elevation :-  
Excavated by :- 360 backacter

| Depth (m) | Lithology / Description / (thickness) / Depth                                                                 | Elevation | Samples | Water level | Notes |
|-----------|---------------------------------------------------------------------------------------------------------------|-----------|---------|-------------|-------|
| 0         | Brown silty fine SAND (TOPSOIL) (0.3)                                                                         | 0         |         |             |       |
| 0.2       |                                                                                                               | 0.2       | 1       | D           |       |
| 0.3       |                                                                                                               | 0.3       |         |             |       |
| 0.4       | Brown sandy SILT. Sand is fine. Assessed as loose to 1.0m bgl using hand trowel. (TIDAL FLAT DEPOSITS) (0.65) | 0.4       |         |             |       |
| 0.6       |                                                                                                               | 0.6       |         |             |       |
| 0.8       |                                                                                                               | 0.8       | 2       | D           |       |
| 0.95      |                                                                                                               | 0.95      |         |             |       |
| 1         | Brown very silty fine SAND. Assessed as medium dense using Mackintosh probe. (TIDAL FLAT DEPOSITS) (1.05)     | 1         | 3       | D           |       |
| 1.2       |                                                                                                               | 1.2       |         |             |       |
| 1.4       |                                                                                                               | 1.4       |         |             |       |
| 1.6       |                                                                                                               | 1.6       |         |             |       |
| 1.8       |                                                                                                               | 1.8       |         |             |       |
| 2         |                                                                                                               | 2         | 4       | D           |       |
| 2.2       |                                                                                                               | 2.2       |         |             |       |
| 2.4       |                                                                                                               | 2.4       |         |             |       |
| 2.6       |                                                                                                               | 2.6       |         |             |       |
| 2.8       |                                                                                                               | 2.8       |         |             |       |
| 3         |                                                                                                               | 3         |         |             |       |
| 3.2       |                                                                                                               | 3.2       |         |             |       |
| 3.4       |                                                                                                               | 3.4       |         |             |       |
| 3.6       |                                                                                                               | 3.6       |         |             |       |
| 3.8       |                                                                                                               | 3.8       |         |             |       |

medium  
ingress

Sample Key  
B Bulk  
D Disturbed  
W Water  
SS Split spoon  
C Cone

Notes :- Sides became unstable at about 1.6m - 2.0m bgl

File Ref :- 1059 / 4540

Logged by :- R Lester



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## **TRIAL PIT LOG**

**Trial pit  
No  
TP2**

Client :- Alan Finch of MLP  
Site :- Cob Gate, Whaplode  
Project No :- 1.6m

Location :- see site plan  
Date :- at

Coordinates E: 531987 N: 323922  
Elevation :-  
Excavated by :- became

| Depth (m) | Lithology / Description / (thickness) / Depth                                                                                                | Elevation | Samples | Water level | Notes |
|-----------|----------------------------------------------------------------------------------------------------------------------------------------------|-----------|---------|-------------|-------|
| 0         | Brown silty fine SAND (TOPSOIL)                                                                                                              | (0.3)     |         |             |       |
| 0.2       |                                                                                                                                              | 0.3       |         |             |       |
| 0.4       | Brown very silty fine SAND becoming medium dense below 1.0m bgl. Assessed as loose down to 1.0m bgl using hand trowel. (TIDAL FLAT DEPOSITS) | (1.8)     |         |             |       |
| 0.6       |                                                                                                                                              |           |         |             |       |
| 0.8       |                                                                                                                                              |           | 1       | D           |       |
| 1         |                                                                                                                                              |           |         |             |       |
| 1.2       |                                                                                                                                              |           |         |             |       |
| 1.4       |                                                                                                                                              |           |         |             |       |
| 1.6       |                                                                                                                                              |           |         |             |       |
| 1.8       |                                                                                                                                              |           |         |             |       |
| 2         |                                                                                                                                              | 2.1       |         |             |       |
| 2.2       |                                                                                                                                              |           |         |             |       |
| 2.4       |                                                                                                                                              |           |         |             |       |
| 2.6       |                                                                                                                                              |           |         |             |       |
| 2.8       |                                                                                                                                              |           |         |             |       |
| 3         |                                                                                                                                              |           |         |             |       |
| 3.2       |                                                                                                                                              |           |         |             |       |
| 3.4       |                                                                                                                                              |           |         |             |       |
| 3.6       |                                                                                                                                              |           |         |             |       |
| 3.8       |                                                                                                                                              |           |         |             |       |

Sample Key  
B Bulk  
D Disturbed  
W Water  
SS Split spoon  
C Cone

Notes :- Sides became unstable at about 1.6m - 2.0m bgl

File Ref :- about / 1.6m  
Logged by :- unstable



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## **TRIAL PIT LOG**

**Trial pit  
No  
TP3**

Client :- Alan Finch of MLP  
Site :- Cob Gate, Whaplode  
Project No :- 4540

Location :- see site plan  
Date :- 18-May-18

Coordinates E: 532013 N: 324075  
Elevation :-  
Excavated by :- 360 backacter

| Depth (m) | Lithology / Description / (thickness) / Depth                                                                                                         | Elevation | Samples | Water level | Notes          |
|-----------|-------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|---------|-------------|----------------|
| 0         | Brown silty fine SAND (TOPSOIL)                                                                                                                       | (0.3)     |         |             |                |
| 0.2       |                                                                                                                                                       | 0.3       | 1       | D           |                |
| 0.4       | Brown very silty fine SAND becoming loose to medium dense below 1.0m bgl. Assessed as loose down to 1.0m bgl using hand trowel. (TIDAL FLAT DEPOSITS) | (1.7)     |         |             |                |
| 0.6       |                                                                                                                                                       |           |         |             |                |
| 0.8       |                                                                                                                                                       |           |         |             |                |
| 1         |                                                                                                                                                       |           |         |             |                |
| 1.2       |                                                                                                                                                       |           |         |             |                |
| 1.4       |                                                                                                                                                       |           |         |             |                |
| 1.6       |                                                                                                                                                       |           |         |             |                |
| 1.8       |                                                                                                                                                       |           | 2       | D           | medium ingress |
| 2         |                                                                                                                                                       | 2         |         |             |                |
| 2.2       |                                                                                                                                                       |           |         |             |                |
| 2.4       |                                                                                                                                                       |           |         |             |                |
| 2.6       |                                                                                                                                                       |           |         |             |                |
| 2.8       |                                                                                                                                                       |           |         |             |                |
| 3         |                                                                                                                                                       |           |         |             |                |
| 3.2       |                                                                                                                                                       |           |         |             |                |
| 3.4       |                                                                                                                                                       |           |         |             |                |
| 3.6       |                                                                                                                                                       |           |         |             |                |
| 3.8       |                                                                                                                                                       |           |         |             |                |

Sample Key  
B Bulk  
D Disturbed  
W Water  
SS Split spoon  
C Cone

Notes :- Sides became unstable at about 1.6m - 2.0m bgl

File Ref :- 1059 / 4540

Logged by :- R Lester



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## **TRIAL PIT LOG**

**Trial pit  
No  
TP4**

Client :- Alan Finch of MLP  
Site :- Cob Gate, Whaplode  
Project No :- 4540

Location :- see site plan  
Date :- 18-May-18

Coordinates E: 531939 N: 324088  
Elevation :-  
Excavated by :- 360 backacter

| Depth (m) | Lithology / Description / (thickness) / Depth                                                                                                                          | Elevation | Samples | Water level | Notes |
|-----------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|---------|-------------|-------|
| 0         | Brown silty fine SAND (TOPSOIL)                                                                                                                                        | (0.3)     |         |             |       |
| 0.2       |                                                                                                                                                                        | 0.3       |         |             |       |
| 0.4       | Brown very silty fine SAND. Becoming medium dense below 1.0m bgl and loose below 1.7m bgl. Assessed as loose down to 1.0m bgl using hand trowel. (TIDAL FLAT DEPOSITS) | (1.8)     |         |             |       |
| 0.6       |                                                                                                                                                                        |           |         |             |       |
| 0.8       |                                                                                                                                                                        |           |         |             |       |
| 1         |                                                                                                                                                                        |           |         |             |       |
| 1.2       |                                                                                                                                                                        |           |         |             |       |
| 1.4       |                                                                                                                                                                        |           |         |             |       |
| 1.6       |                                                                                                                                                                        |           |         |             |       |
| 1.8       |                                                                                                                                                                        |           |         |             |       |
| 2         |                                                                                                                                                                        | 2.1       |         |             |       |
| 2.2       |                                                                                                                                                                        |           |         |             |       |
| 2.4       |                                                                                                                                                                        |           |         |             |       |
| 2.6       |                                                                                                                                                                        |           |         |             |       |
| 2.8       |                                                                                                                                                                        |           |         |             |       |
| 3         |                                                                                                                                                                        |           |         |             |       |
| 3.2       |                                                                                                                                                                        |           |         |             |       |
| 3.4       |                                                                                                                                                                        |           |         |             |       |
| 3.6       |                                                                                                                                                                        |           |         |             |       |
| 3.8       |                                                                                                                                                                        |           |         |             |       |

Sample Key  
B Bulk  
D Disturbed  
W Water  
SS Split spoon  
C Cone

Notes :- Sides became unstable at about 1.6m - 2.0m bgl

File Ref :- 1059 / 4540

Logged by :- R Lester



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## **TRIAL PIT LOG**

**Trial pit  
No  
TP5**

Client :- Alan Finch of MLP  
Site :- Cob Gate, Whaplode  
Project No :- 4540

Location :- see site plan  
Date :- 18-May-18

Coordinates E: 531968 N: 324002  
Elevation :-  
Excavated by :- 360 backacter

| Depth (m) | Lithology / Description / (thickness) / Depth                                                                                                                          | Elevation | Samples | Water level | Notes          |
|-----------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|---------|-------------|----------------|
| 0         | Brown silty fine SAND (TOPSOIL)                                                                                                                                        | (0.3)     |         |             |                |
| 0.2       |                                                                                                                                                                        | 0.3       |         |             |                |
| 0.4       | Brown very silty fine SAND. Becoming medium dense below 1.0m bgl and loose below 1.8m bgl. Assessed as loose down to 1.0m bgl using hand trowel. (TIDAL FLAT DEPOSITS) | (1.7)     |         |             |                |
| 0.6       |                                                                                                                                                                        |           | 1       | D           |                |
| 0.8       |                                                                                                                                                                        |           |         |             |                |
| 1         |                                                                                                                                                                        |           |         |             |                |
| 1.2       |                                                                                                                                                                        |           |         |             |                |
| 1.4       |                                                                                                                                                                        |           |         |             |                |
| 1.6       |                                                                                                                                                                        |           |         |             |                |
| 1.8       |                                                                                                                                                                        |           |         |             | medium ingress |
| 2         |                                                                                                                                                                        | 2         |         |             |                |
| 2.2       |                                                                                                                                                                        |           |         |             |                |
| 2.4       |                                                                                                                                                                        |           |         |             |                |
| 2.6       |                                                                                                                                                                        |           |         |             |                |
| 2.8       |                                                                                                                                                                        |           |         |             |                |
| 3         |                                                                                                                                                                        |           |         |             |                |
| 3.2       |                                                                                                                                                                        |           |         |             |                |
| 3.4       |                                                                                                                                                                        |           |         |             |                |
| 3.6       |                                                                                                                                                                        |           |         |             |                |
| 3.8       |                                                                                                                                                                        |           |         |             |                |

Sample Key  
B Bulk  
D Disturbed  
W Water  
SS Split spoon  
C Cone

Notes :- Sides became unstable at about 1.6m - 2.0m bgl

File Ref :- 1059 / 4540

Logged by :- R Lester



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## TRIAL PIT LOG

Trial pit  
No  
SA1

Client :- Alan Finch of MLP  
Site :- Cob Gate, Whaplode  
Project No :- 4540

Location :- see site plan  
Date :- 18-May-18

Coordinates E: 531978 N: 323939  
Elevation :-  
Excavated by :- 360 backacter

| Depth (m) | Lithology / Description / (thickness) / Depth                                                          | Elevation | Samples | Water level | Notes |
|-----------|--------------------------------------------------------------------------------------------------------|-----------|---------|-------------|-------|
| 0         | Brown silty fine SAND (TOPSOIL)                                                                        | (0.3)     |         |             |       |
| 0.2       |                                                                                                        | 0.3       |         |             |       |
| 0.4       | Brown very silty fine SAND. Assessed as loose to medium dense using hand trowel. (TIDAL FLAT DEPOSITS) | (1)       |         |             |       |
| 0.6       |                                                                                                        |           | 1       | D           |       |
| 0.8       |                                                                                                        |           |         |             |       |
| 1         |                                                                                                        |           |         |             |       |
| 1.2       |                                                                                                        | 1.3       |         |             |       |
| 1.4       |                                                                                                        |           |         |             |       |
| 1.6       |                                                                                                        |           |         |             |       |
| 1.8       |                                                                                                        |           |         |             |       |
| 2         |                                                                                                        |           |         |             |       |
| 2.2       |                                                                                                        |           |         |             |       |
| 2.4       |                                                                                                        |           |         |             |       |
| 2.6       |                                                                                                        |           |         |             |       |
| 2.8       |                                                                                                        |           |         |             |       |
| 3         |                                                                                                        |           |         |             |       |
| 3.2       |                                                                                                        |           |         |             |       |
| 3.4       |                                                                                                        |           |         |             |       |
| 3.6       |                                                                                                        |           |         |             |       |
| 3.8       |                                                                                                        |           |         |             |       |

Sample Key  
B Bulk  
D Disturbed  
W Water  
SS Split spoon  
C Cone

Notes :-

File Ref :- 1059 / 4540

Logged by :- R Lester



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## TRIAL PIT LOG

Trial pit  
No  
SA2

Client :- Alan Finch of MLP  
Site :- Cob Gate, Whaplode  
Project No :- 4540

Location :- see site plan  
Date :- 18-May-18

Coordinates E: 531941 N: 324055  
Elevation :-  
Excavated by :- 360 backacter

| Depth (m) | Lithology / Description / (thickness) / Depth                                                          | Elevation | Samples | Water level | Notes |
|-----------|--------------------------------------------------------------------------------------------------------|-----------|---------|-------------|-------|
| 0         | Brown silty fine SAND (TOPSOIL)                                                                        | (0.3)     |         |             |       |
| 0.2       |                                                                                                        | 0.3       |         |             |       |
| 0.4       | Brown very silty fine SAND. Assessed as loose to medium dense using hand trowel. (TIDAL FLAT DEPOSITS) | (1)       |         |             |       |
| 0.6       |                                                                                                        |           | 1       | D           |       |
| 0.8       |                                                                                                        |           |         |             |       |
| 1         |                                                                                                        |           |         |             |       |
| 1.2       |                                                                                                        | 1.3       | 2       | D           |       |
| 1.4       |                                                                                                        |           |         |             |       |
| 1.6       |                                                                                                        |           |         |             |       |
| 1.8       |                                                                                                        |           |         |             |       |
| 2         |                                                                                                        |           |         |             |       |
| 2.2       |                                                                                                        |           |         |             |       |
| 2.4       |                                                                                                        |           |         |             |       |
| 2.6       |                                                                                                        |           |         |             |       |
| 2.8       |                                                                                                        |           |         |             |       |
| 3         |                                                                                                        |           |         |             |       |
| 3.2       |                                                                                                        |           |         |             |       |
| 3.4       |                                                                                                        |           |         |             |       |
| 3.6       |                                                                                                        |           |         |             |       |
| 3.8       |                                                                                                        |           |         |             |       |

Sample Key  
B Bulk  
D Disturbed  
W Water  
SS Split spoon  
C Cone

Notes :-

File Ref :- 1059 / 4540

Logged by :- R Lester



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## TRIAL PIT LOG

Trial pit  
No  
SA3

Client :- Alan Finch of MLP  
Site :- Cob Gate, Whaplode  
Project No :- 4540

Location :- see site plan  
Date :- 18-May-18

Coordinates E: 531906 N: 323981  
Elevation :-  
Excavated by :- 360 backacter

| Depth (m) | Lithology / Description / (thickness) / Depth                                                              | Elevation | Samples | Water level | Notes |
|-----------|------------------------------------------------------------------------------------------------------------|-----------|---------|-------------|-------|
| 0         | Brown silty fine SAND (TOPSOIL) (0.3)                                                                      | 0         |         |             |       |
| 0.2       |                                                                                                            | 0.2       | 1       | D           |       |
| 0.3       | Brown very silty fine SAND. Assessed as loose to medium dense using hand trowel. (TIDAL FLAT DEPOSITS) (1) | 0.3       |         |             |       |
| 0.4       |                                                                                                            | 0.4       |         |             |       |
| 0.6       |                                                                                                            | 0.6       |         |             |       |
| 0.8       |                                                                                                            | 0.8       |         |             |       |
| 1         |                                                                                                            | 1         |         |             |       |
| 1.2       |                                                                                                            | 1.2       |         |             |       |
| 1.3       |                                                                                                            | 1.3       |         |             |       |
| 1.4       |                                                                                                            | 1.4       |         |             |       |
| 1.6       |                                                                                                            | 1.6       |         |             |       |
| 1.8       |                                                                                                            | 1.8       |         |             |       |
| 2         |                                                                                                            | 2         |         |             |       |
| 2.2       |                                                                                                            | 2.2       |         |             |       |
| 2.4       |                                                                                                            | 2.4       |         |             |       |
| 2.6       |                                                                                                            | 2.6       |         |             |       |
| 2.8       |                                                                                                            | 2.8       |         |             |       |
| 3         |                                                                                                            | 3         |         |             |       |
| 3.2       |                                                                                                            | 3.2       |         |             |       |
| 3.4       |                                                                                                            | 3.4       |         |             |       |
| 3.6       |                                                                                                            | 3.6       |         |             |       |
| 3.8       |                                                                                                            | 3.8       |         |             |       |

Sample Key  
B Bulk  
D Disturbed  
W Water  
SS Split spoon  
C Cone

Notes :-

File Ref :- 1059 / 4540

Logged by :- R Lester

# HUMBERSIDE MATERIALS LABORATORY LTD

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Tel & Fax 01652 652753

## DETERMINATION OF SOIL INFILTRATION RATE

Sample Ref S/48686/02

Client c/o A. Finch

|               |                                  |
|---------------|----------------------------------|
| Site          | Cobgate, Whaplode                |
| Location      | SA1                              |
| Date tested   | 10/05/2018                       |
| Determined by | R. Lester                        |
| Soil type     | Loose brown very silty fine SAND |

Calculation of Soil Infiltration Rate :- BRE Digest No. 365

| Calculation Data                            |                        |                 |                |
|---------------------------------------------|------------------------|-----------------|----------------|
| <b>Soakaway pit No</b>                      | <b>SA1</b>             |                 |                |
| Anticipated invert level                    | Not known              |                 |                |
| Pit Dimensions (l x w x d) (m)              | 1.70                   | 0.67            | 1.2            |
| Effective Depth (75% - 25%)                 | Determination 1        | 0.200           | m              |
|                                             | Determination 2        | 0.105           | m              |
| Effective volume (75% - 25%)                | Determination 1        | 0.228           | m <sup>3</sup> |
|                                             | Determination 2        | 0.120           | m <sup>3</sup> |
| Effective Surface Area<br>(75% - 25%)       | Determination 1        | 1.518           | m <sup>2</sup> |
|                                             | Determination 2        | 1.067           | m <sup>2</sup> |
| Time for soakaway (75%-25% effective depth) | Determination 1        | 49800           | Sec.           |
|                                             | Determination 2        | 44700           | Sec.           |
| <b>Soil Infiltration Rate (m/s)</b>         | <b>Determination 1</b> | <b>3.01E-06</b> | <b>m/s</b>     |
|                                             | <b>Determination 2</b> | <b>2.51E-06</b> | <b>m/s</b>     |

Comments

File ref 1059/4540

Signed M.J. Green C. Driver  
Director

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Atherton Way, Brigg  
North Lincolnshire DN20 8AR  
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## DETERMINATION OF SOIL INFILTRATION RATE

Sample Ref S/48686/03

Client A. Finch

|               |                                  |
|---------------|----------------------------------|
| Site          | Cobgate, Whaplode                |
| Location      | SA2                              |
| Date tested   | 10/05/2018                       |
| Determined by | R. Lester                        |
| Soil type     | Loose brown very silty fine SAND |

Calculation of Soil Infiltration Rate :- BRE Digest No. 365

| Calculation Data                            |                        |                 |                |
|---------------------------------------------|------------------------|-----------------|----------------|
| <b>Soakaway pit No</b>                      | <b>SA2</b>             |                 |                |
| Anticipated invert level                    | Not known              |                 |                |
| Pit Dimensions (l x w x d) (m)              | 1.70                   | 0.33            | 1.4            |
| Effective Depth (75% - 25%)                 | Determination 1        | 0.380           | m              |
|                                             | Determination 2        | 0.205           | m              |
| Effective volume (75% - 25%)                | Determination 1        | 0.213           | m <sup>3</sup> |
|                                             | Determination 2        | 0.115           | m <sup>3</sup> |
| Effective Surface Area<br>(75% - 25%)       | Determination 1        | 1.823           | m <sup>2</sup> |
|                                             | Determination 2        | 1.113           | m <sup>2</sup> |
| Time for soakaway (75%-25% effective depth) | Determination 1        | 30300           | Sec.           |
|                                             | Determination 2        | 34500           | Sec.           |
| <b>Soil Infiltration Rate (m/s)</b>         | <b>Determination 1</b> | <b>3.86E-06</b> | <b>m/s</b>     |
|                                             | <b>Determination 2</b> | <b>3.00E-06</b> | <b>m/s</b>     |

Comments

File ref 1059/4540

Signed M.J. Green C. Driver  
Director

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North Lincolnshire DN20 8AR  
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## DETERMINATION OF SOIL INFILTRATION RATE

Sample Ref S/48686/04

Client A Finch

|               |                                  |
|---------------|----------------------------------|
| Site          | Cobgate, Whaplode                |
| Location      | SA3                              |
| Date tested   | 10/05/2018                       |
| Determined by | R. Lester                        |
| Soil type     | Loose brown very silty fine SAND |

Calculation of Soil Infiltration Rate :- BRE Digest No. 365

| Calculation Data                            |                        |                 |                |
|---------------------------------------------|------------------------|-----------------|----------------|
| <b>Soakaway pit No</b>                      | <b>SA3</b>             |                 |                |
| Anticipated invert level                    | Not known              |                 |                |
| Pit Dimensions (l x w x d) (m)              | 2.00                   | 0.33            | 1.1            |
| Effective Depth (75% - 25%)                 | Determination 1        | 0.240           | m              |
|                                             | Determination 2        | 0.225           | m              |
| Effective volume (75% - 25%)                | Determination 1        | 0.158           | m <sup>3</sup> |
|                                             | Determination 2        | 0.149           | m <sup>3</sup> |
| Effective Surface Area<br>(75% - 25%)       | Determination 1        | 1.448           | m <sup>2</sup> |
|                                             | Determination 2        | 1.379           | m <sup>2</sup> |
| Time for soakaway (75%-25% effective depth) | Determination 1        | 35280           | Sec.           |
|                                             | Determination 2        | 48300           | Sec.           |
| <b>Soil Infiltration Rate (m/s)</b>         | <b>Determination 1</b> | <b>3.10E-06</b> | <b>m/s</b>     |
|                                             | <b>Determination 2</b> | <b>2.23E-06</b> | <b>m/s</b>     |

Comments

File ref 1059/4540

Signed M.J. Green C. Driver  
Director

**APPENDIX H**

**Proposed Drainage Layout**

Key

- Diverted Anglian Water Rising Main
- Adoptable Highway Drain (S38)
- Adoptable Swale (Highway drainage only - S38)
- Adoptable Foul Sewer (S104)
- Private Foul Drain
- Private Surface Water Drain
- Soakaway (Granular)
- Soakaway (Geocellular)

Note: Final drainage layout may differ to suit detailed design requirements.

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |               |    |     |            |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|----|-----|------------|
| P1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Initial Issue | SE | PE  | 07/18      |
| Rev                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Description   | Dm | Vfd | Date       |
| As outlined in section 2.3 of the CIB Industry Guidance to Designers, insignificant risks can usually be ignored, as can risks arising from routine construction activities, unless the design compounds or significantly alters these risks. In accordance with CDM Regulations 8, 9 and 11, any significant risks relating to the design features shown on this drawing have been identified and are annotated thus:  |               |    |     |            |
| <input checked="" type="checkbox"/> No significant risks have been identified.                                                                                                                                                                                                                                                                                                                                                                                                                               |               |    |     |            |
| <input type="checkbox"/> Significant risks have been identified - refer to notes on drawing for information on residual risks and any control measures to be employed.                                                                                                                                                                                                                                                                                                                                       |               |    |     |            |
| Refer to the current Designer's Risk Assessment sheets for further details.                                                                                                                                                                                                                                                                                                                                                                                                                                  |               |    |     |            |
| Designer's Signature                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |               | SE |     | Date 07/18 |

Drawing Status  
INFORMATION

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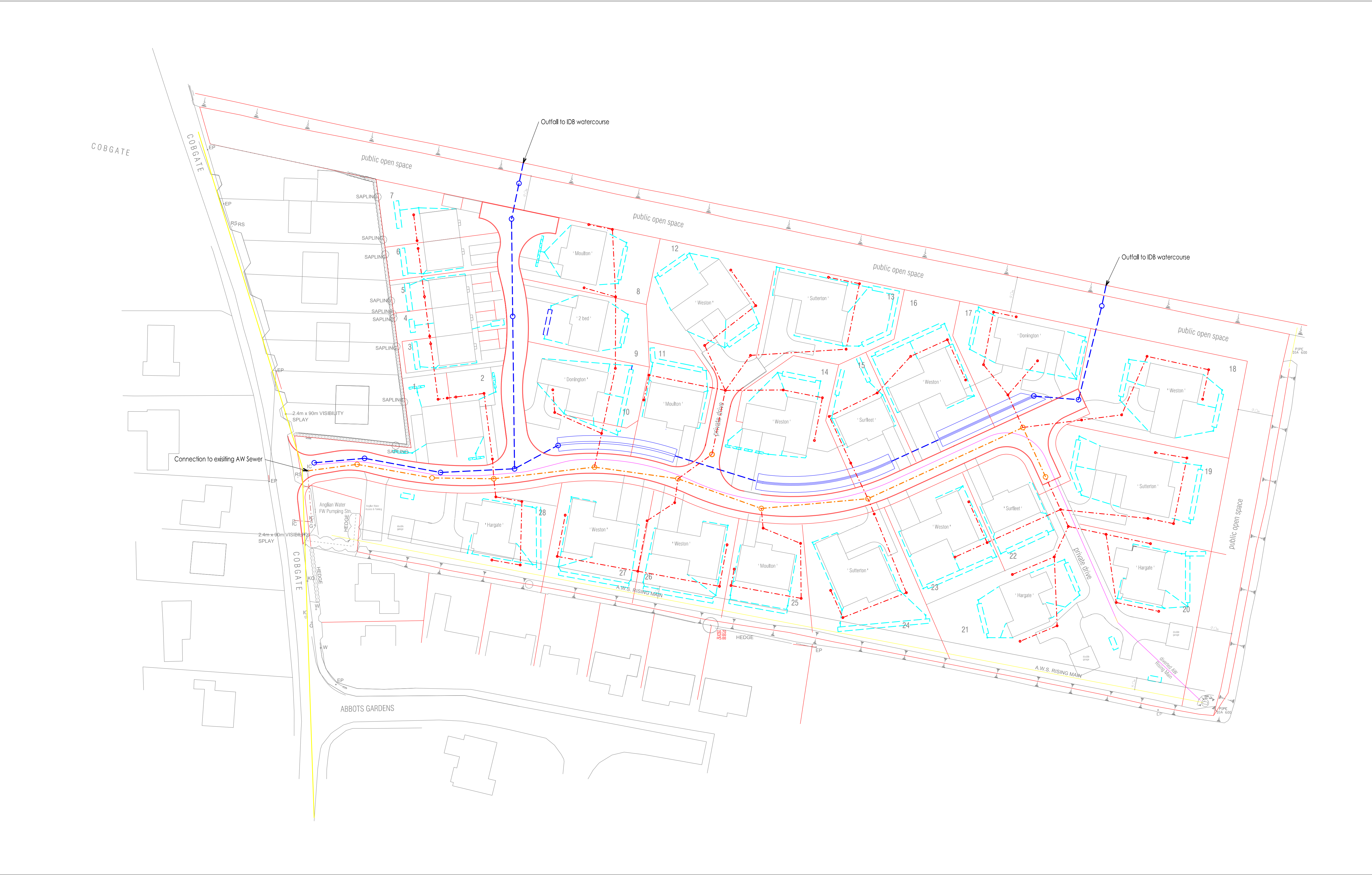
Also at Leeds, Cardiff, Winkworth

Project  
Proposed Residential Development  
Cobgate, Whaplode

Client  
Firdene Homes Limited

Title  
Drainage Strategy Layout

|                                                  |            |       |       |      |          |        |            |      |
|--------------------------------------------------|------------|-------|-------|------|----------|--------|------------|------|
| WmS Project Ref.                                 | 11748      | Drawn | SE    | Date | 03/07/18 | Scale  | Plan 1:500 | @ A1 |
| Drawing/Document Reference                       |            |       |       |      |          |        |            |      |
| Project                                          | Originator | Zone  | Level | Type | Role     | Number | Status     | Rev. |
| 11748 - WMS - ZZ - XX - DR - C - 39201 - S2 - P1 |            |       |       |      |          |        |            |      |



## **COB GATE, WHAPLODE**

### **DRAINAGE STATEMENT**

#### **APPENDIX I**

##### **Calculations**

## Results from design calculations for trench soakaway

Site Ref No : 11748  
 Site Address : Cobgate Whaplode  
 Comments : Plots 1-2  
  
 Total excavated depth of soakaway : 1.30 m  
 Ground level to invert of inflow pipe : 0.50 m  
  
 Impermeable surface area (A) : 35.00 m<sup>2</sup>  
 Soil infiltration rate (f) : 2.23E-06 m/s  
  
 Rainfall ratio : 0.4  
 Aggregate void : 95%

| Soakaway width 0.45 m |                     |
|-----------------------|---------------------|
| Storm duration (min)  | Soakaway length (m) |
| 5                     | 0.95                |
| 10                    | 1.35                |
| 15                    | 1.60                |
| 30                    | 2.05                |
| 60                    | 2.50                |
| 120                   | 2.95                |
| 240                   | 3.35                |
| 360                   | 3.55                |
| 600                   | 3.70                |
| <u>1440</u>           | <u>3.70</u>         |

NOTE: Critical storm durations are underlined

Total excavated volume = 2.16 m<sup>3</sup>

Volume of granular fill required = 1.33m<sup>3</sup>

Emptying time to 50% storage = 23.7 hours

Calculations are in accordance with BRE Digest 365

## Results from design calculations for trench soakaway

Site Ref No : 11748  
 Site Address : Cobgate Whaplode  
 Comments : Plot 3, 5-7

Total excavated depth of soakaway : 1.30 m  
 Ground level to invert of inflow pipe : 0.50 m

Impermeable surface area (A) : 71.00 m<sup>2</sup>  
 Soil infiltration rate (f) : 2.23E-06 m/s

Rainfall ratio : 0.4  
 Aggregate void : 35%

| Soakaway width 1.3 m |                     |
|----------------------|---------------------|
| Storm duration (min) | Soakaway length (m) |
| 5                    | 1.75                |
| 10                   | 2.50                |
| 15                   | 3.05                |
| 30                   | 3.85                |
| 60                   | 4.75                |
| 120                  | 5.60                |
| 240                  | 6.40                |
| 360                  | 6.80                |
| 600                  | 7.05                |
| <u>1440</u>          | <u>7.05</u>         |

NOTE: Critical storm durations are underlined

Total excavated volume = 11.91 m<sup>3</sup>

Volume of granular fill required = 7.33m<sup>3</sup>

Emptying time to 50% storage = 23.9 hours

Calculations are in accordance with BRE Digest 365

## Results from design calculations for trench soakaway

Site Ref No : 11748  
 Site Address : Cobgate Whaplode  
 Comments : Plots 4

Total excavated depth of soakaway : 1.30 m  
 Ground level to invert of inflow pipe : 0.50 m

Impermeable surface area (A) : 35.00 m<sup>2</sup>  
 Soil infiltration rate (f) : 2.23E-06 m/s

Rainfall ratio : 0.4  
 Aggregate void : 35%

| Soakaway width 1.3 m |                     |
|----------------------|---------------------|
| Storm duration (min) | Soakaway length (m) |
| 5                    | 0.90                |
| 10                   | 1.25                |
| 15                   | 1.50                |
| 30                   | 1.90                |
| 60                   | 2.35                |
| 120                  | 2.75                |
| 240                  | 3.10                |
| 360                  | 3.30                |
| <u>600</u>           | <u>3.40</u>         |
| 1440                 | 3.30                |

NOTE: Critical storm durations are underlined

Total excavated volume = 5.75 m<sup>3</sup>

Volume of granular fill required = 3.54m<sup>3</sup>

Emptying time to 50% storage = 20.5 hours

Calculations are in accordance with BRE Digest 365

## Results from design calculations for trench soakaway

Site Ref No : 11748  
 Site Address : Cobgate Whaplode  
 Comments : Plot 8

Total excavated depth of soakaway : 1.30 m  
 Ground level to invert of inflow pipe : 0.50 m

Impermeable surface area (A) : 70.00 m<sup>2</sup>  
 Soil infiltration rate (f) : 2.23E-06 m/s

Rainfall ratio : 0.4  
 Aggregate void : 35%

| Soakaway width 1.0 m |                     |
|----------------------|---------------------|
| Storm duration (min) | Soakaway length (m) |
| 5                    | 2.25                |
| 10                   | 3.20                |
| 15                   | 3.90                |
| 30                   | 4.95                |
| 60                   | 6.05                |
| 120                  | 7.15                |
| 240                  | 8.05                |
| 360                  | 8.50                |
| <u>600</u>           | <u>8.70</u>         |
| 1440                 | 8.40                |

NOTE: Critical storm durations are underlined

Total excavated volume = 11.31 m<sup>3</sup>

Volume of granular fill required = 6.96m<sup>3</sup>

Emptying time to 50% storage = 19.6 hours

Calculations are in accordance with BRE Digest 365

## Results from design calculations for trench soakaway

Site Ref No : 11748  
 Site Address : Cobgate Whaplode  
 Comments : Plots 8

Total excavated depth of soakaway : 1.30 m  
 Ground level to invert of inflow pipe : 0.50 m

Impermeable surface area (A) : 70.00 m<sup>2</sup>  
 Soil infiltration rate (f) : 2.23E-06 m/s

Rainfall ratio : 0.4  
 Aggregate void : 95%

| Soakaway width 0.4 m |                     |
|----------------------|---------------------|
| Storm duration (min) | Soakaway length (m) |
| 5                    | 2.10                |
| 10                   | 2.95                |
| 15                   | 3.60                |
| 30                   | 4.55                |
| 60                   | 5.60                |
| 120                  | 6.60                |
| 240                  | 7.50                |
| 360                  | 7.95                |
| <u>600</u>           | <u>8.25</u>         |
| 1440                 | 8.15                |

NOTE: Critical storm durations are underlined

Total excavated volume = 4.29 m<sup>3</sup>

Volume of granular fill required = 2.64m<sup>3</sup>

Emptying time to 50% storage = 22.6 hours

Calculations are in accordance with BRE Digest 365

## Results from design calculations for trench soakaway

Site Ref No : 11748  
 Site Address : Cobgate Whaplode  
 Comments : Plot 9

Total excavated depth of soakaway : 1.30 m  
 Ground level to invert of inflow pipe : 0.50 m

Impermeable surface area (A) : 54.00 m<sup>2</sup>  
 Soil infiltration rate (f) : 2.23E-06 m/s

Rainfall ratio : 0.4  
 Aggregate void : 35%

| Soakaway width 1.0 m |                     |
|----------------------|---------------------|
| Storm duration (min) | Soakaway length (m) |
| 5                    | 1.75                |
| 10                   | 2.50                |
| 15                   | 3.05                |
| 30                   | 3.80                |
| 60                   | 4.70                |
| 120                  | 5.50                |
| 240                  | 6.20                |
| 360                  | 6.55                |
| <u>600</u>           | <u>6.65</u>         |
| 1440                 | 6.40                |

NOTE: Critical storm durations are underlined

Total excavated volume = 8.65 m<sup>3</sup>

Volume of granular fill required = 5.32m<sup>3</sup>

Emptying time to 50% storage = 18.9 hours

Calculations are in accordance with BRE Digest 365

## Results from design calculations for trench soakaway

Site Ref No : 11748  
 Site Address : Cobgate Whaplode  
 Comments : Plot 10

Total excavated depth of soakaway : 1.30 m  
 Ground level to invert of inflow pipe : 0.50 m

Impermeable surface area (A) : 145.00 m<sup>2</sup>  
 Soil infiltration rate (f) : 2.23E-06 m/s

Rainfall ratio : 0.4  
 Aggregate void : 35%

| Soakaway width 1.15 m |                     |
|-----------------------|---------------------|
| Storm duration (min)  | Soakaway length (m) |
| 5                     | 4.05                |
| 10                    | 5.75                |
| 15                    | 7.05                |
| 30                    | 8.90                |
| 60                    | 10.95               |
| 120                   | 12.95               |
| 240                   | 14.75               |
| 360                   | 15.60               |
| <u>600</u>            | <u>16.20</u>        |
| 1440                  | 16.15               |

NOTE: Critical storm durations are underlined

Total excavated volume = 24.22 m<sup>3</sup>

Volume of granular fill required = 14.90m<sup>3</sup>

Emptying time to 50% storage = 23.4 hours

Calculations are in accordance with BRE Digest 365

## Results from design calculations for trench soakaway

Site Ref No : 11748  
 Site Address : Cobgate Whaplode  
 Comments : Plot 11 *h25*  
  
 Total excavated depth of soakaway : 1.30 m  
 Ground level to invert of inflow pipe : 0.50 m  
  
 Impermeable surface area (A) : 136.00 m<sup>2</sup>  
 Soil infiltration rate (f) : 2.23E-06 m/s  
  
 Rainfall ratio : 0.4  
 Aggregate void : 35%

| Soakaway width 1.15 m |                     |
|-----------------------|---------------------|
| Storm duration (min)  | Soakaway length (m) |
| 5                     | 3.80                |
| 10                    | 5.40                |
| 15                    | 6.60                |
| 30                    | 8.35                |
| 60                    | 10.25               |
| 120                   | 12.15               |
| 240                   | 13.80               |
| 360                   | 14.65               |
| <u>600</u>            | <u>15.15</u>        |
| 1440                  | 15.10               |

NOTE: Critical storm durations are underlined

Total excavated volume = 22.65 m<sup>3</sup>

Volume of granular fill required = 13.94m<sup>3</sup>

Emptying time to 50% storage = 23.3 hours

Calculations are in accordance with BRE Digest 365

## Results from design calculations for trench soakaway

Site Ref No : 11748  
 Site Address : Cobgate Whaplode  
 Comments : Plot 12 / 14 / 18

Total excavated depth of soakaway : 1.30 m  
 Ground level to invert of inflow pipe : 0.50 m

Impermeable surface area (A) : 82.00 m<sup>2</sup>  
 Soil infiltration rate (f) : 2.23E-06 m/s

Rainfall ratio : 0.4  
 Aggregate void : 35%

| Soakaway width 1.2 m |                     |
|----------------------|---------------------|
| Storm duration (min) | Soakaway length (m) |
| 5                    | 2.20                |
| 10                   | 3.15                |
| 15                   | 3.85                |
| 30                   | 4.85                |
| 60                   | 5.95                |
| 120                  | 7.00                |
| 240                  | 8.00                |
| 360                  | 8.45                |
| <u>600</u>           | <u>8.75</u>         |
| 1440                 | 8.70                |

NOTE: Critical storm durations are underlined

Total excavated volume = 13.65 m<sup>3</sup>

Volume of granular fill required = 8.40m<sup>3</sup>

Emptying time to 50% storage = 23.0 hours

Calculations are in accordance with BRE Digest 365

## Results from design calculations for trench soakaway

Site Ref No : 11748  
 Site Address : Cobgate Whaplode  
 Comments : Plot 13

Total excavated depth of soakaway : 1.30 m  
 Ground level to invert of inflow pipe : 0.50 m

Impermeable surface area (A) : 212.00 m<sup>2</sup>  
 Soil infiltration rate (f) : 2.23E-06 m/s

Rainfall ratio : 0.4  
 Aggregate void : 35%

| Soakaway width 1.15 m |                     |
|-----------------------|---------------------|
| Storm duration (min)  | Soakaway length (m) |
| 5                     | 5.90                |
| 10                    | 8.45                |
| 15                    | 10.30               |
| 30                    | 13.00               |
| 60                    | 16.00               |
| 120                   | 18.95               |
| 240                   | 21.55               |
| 360                   | 22.90               |
| 600                   | 23.75               |
| <u>1440</u>           | <u>23.75</u>        |

NOTE: Critical storm durations are underlined

Total excavated volume = 35.51 m<sup>3</sup>

Volume of granular fill required = 21.85m<sup>3</sup>

Emptying time to 50% storage = 23.9 hours

Calculations are in accordance with BRE Digest 365

## Results from design calculations for trench soakaway

Site Ref No : 11748  
 Site Address : Cobgate Whaplode  
 Comments : Plot 14

Total excavated depth of soakaway : 1.30 m  
 Ground level to invert of inflow pipe : 0.50 m

Impermeable surface area (A) : 82.00 m<sup>2</sup>  
 Soil infiltration rate (f) : 2.23E-06 m/s

Rainfall ratio : 0.4  
 Aggregate void : 95%

| Soakaway width 0.4 m |                     |
|----------------------|---------------------|
| Storm duration (min) | Soakaway length (m) |
| 5                    | 2.45                |
| 10                   | 3.45                |
| 15                   | 4.25                |
| 30                   | 5.35                |
| 60                   | 6.55                |
| 120                  | 7.75                |
| 240                  | 8.80                |
| 360                  | 9.35                |
| <u>600</u>           | <u>9.65</u>         |
| 1440                 | 9.60                |

NOTE: Critical storm durations are underlined

Total excavated volume = 5.02 m<sup>3</sup>

Volume of granular fill required = 3.09m<sup>3</sup>

Emptying time to 50% storage = 22.7 hours

Calculations are in accordance with BRE Digest 365

## Results from design calculations for trench soakaway

Site Ref No : 11748  
 Site Address : Cobgate Whaplode  
 Comments : Plot 15

Total excavated depth of soakaway : 1.30 m  
 Ground level to invert of inflow pipe : 0.50 m

Impermeable surface area (A) : 54.00 m<sup>2</sup>  
 Soil infiltration rate (f) : 2.23E-06 m/s

Rainfall ratio : 0.4  
 Aggregate void : 35%

| Soakaway width 1.0 m |                     |
|----------------------|---------------------|
| Storm duration (min) | Soakaway length (m) |
| 5                    | 1.75                |
| 10                   | 2.50                |
| 15                   | 3.05                |
| 30                   | 3.80                |
| 60                   | 4.70                |
| 120                  | 5.50                |
| 240                  | 6.20                |
| 360                  | 6.55                |
| <u>600</u>           | <u>6.65</u>         |
| 1440                 | 6.40                |

NOTE: Critical storm durations are underlined

Total excavated volume = 8.65 m<sup>3</sup>

Volume of granular fill required = 5.32m<sup>3</sup>

Emptying time to 50% storage = 18.9 hours

Calculations are in accordance with BRE Digest 365

## Results from design calculations for trench soakaway

Site Ref No : 11748  
 Site Address : Cobgate Whaplode  
 Comments : Plot 16 | ~~23~~/~~26~~/~~27~~  
  
 Total excavated depth of soakaway : 1.30 m  
 Ground level to invert of inflow pipe : 0.50 m  
  
 Impermeable surface area (A) : 164.00 m<sup>2</sup>  
 Soil infiltration rate (f) : 2.23E-06 m/s  
  
 Rainfall ratio : 0.4  
 Aggregate void : 35%

| Soakaway width 1.15 m |                     |
|-----------------------|---------------------|
| Storm duration (min)  | Soakaway length (m) |
| 5                     | 4.55                |
| 10                    | 6.55                |
| 15                    | 8.00                |
| 30                    | 10.05               |
| 60                    | 12.40               |
| 120                   | 14.65               |
| 240                   | 16.65               |
| 360                   | 17.70               |
| 600                   | 18.30               |
| <u>1440</u>           | <u>18.30</u>        |

NOTE: Critical storm durations are underlined

Total excavated volume = 27.36 m<sup>3</sup>

Volume of granular fill required = 16.84m<sup>3</sup>

Emptying time to 50% storage = 23.6 hours

Calculations are in accordance with BRE Digest 365

## Results from design calculations for trench soakaway

Site Ref No : 11748  
 Site Address : Cobgate Whaplode  
 Comments : Plot 17

Total excavated depth of soakaway : 1.30 m  
 Ground level to invert of inflow pipe : 0.50 m

Impermeable surface area (A) : 73.00 m<sup>2</sup>  
 Soil infiltration rate (f) : 2.23E-06 m/s

Rainfall ratio : 0.4  
 Aggregate void : 35%

| Soakaway width 1.0 m |                     |
|----------------------|---------------------|
| Storm duration (min) | Soakaway length (m) |
| 5                    | 2.35                |
| 10                   | 3.35                |
| 15                   | 4.10                |
| 30                   | 5.15                |
| 60                   | 6.30                |
| 120                  | 7.45                |
| 240                  | 8.40                |
| 360                  | 8.85                |
| <u>600</u>           | <u>9.05</u>         |
| 1440                 | 8.75                |

NOTE: Critical storm durations are underlined

Total excavated volume = 11.77 m<sup>3</sup>

Volume of granular fill required = 7.24m<sup>3</sup>

Emptying time to 50% storage = 19.6 hours

Calculations are in accordance with BRE Digest 365

## Results from design calculations for trench soakaway

Site Ref No : 11748  
 Site Address : Cobgate Whaplode  
 Comments : Plot 19  
  
 Total excavated depth of soakaway : 1.30 m  
 Ground level to invert of inflow pipe : 0.50 m  
  
 Impermeable surface area (A) : 122.00 m<sup>2</sup>  
 Soil infiltration rate (f) : 2.23E-06 m/s  
  
 Rainfall ratio : 0.4  
 Aggregate void : 35%

| Soakaway width 1.2 m |                     |
|----------------------|---------------------|
| Storm duration (min) | Soakaway length (m) |
| 5                    | 3.25                |
| 10                   | 4.65                |
| 15                   | 5.70                |
| 30                   | 7.20                |
| 60                   | 8.85                |
| 120                  | 10.45               |
| 240                  | 11.90               |
| 360                  | 12.65               |
| 600                  | 13.10               |
| <u>1440</u>          | <u>13.10</u>        |

NOTE: Critical storm durations are underlined

Total excavated volume = 20.44 m<sup>3</sup>

Volume of granular fill required = 12.58m<sup>3</sup>

Emptying time to 50% storage = 24.0 hours

Calculations are in accordance with BRE Digest 365

## Results from design calculations for trench soakaway

Site Ref No : 11748  
 Site Address : Cobgate Whaplode  
 Comments : Plot 20/23  
  
 Total excavated depth of soakaway : 1.30 m  
 Ground level to invert of inflow pipe : 0.50 m  
  
 Impermeable surface area (A) : 144.00 m<sup>2</sup>  
 Soil infiltration rate (f) : 2.23E-06 m/s  
  
 Rainfall ratio : 0.4  
 Aggregate void : 35%

| Soakaway width 1.15 m |                     |
|-----------------------|---------------------|
| Storm duration (min)  | Soakaway length (m) |
| 5                     | 4.00                |
| 10                    | 5.75                |
| 15                    | 7.00                |
| 30                    | 8.85                |
| 60                    | 10.90               |
| 120                   | 12.85               |
| 240                   | 14.60               |
| 360                   | 15.50               |
| <u>600</u>            | <u>16.05</u>        |
| 1440                  | 16.00               |

NOTE: Critical storm durations are underlined

Total excavated volume = 23.99 m<sup>3</sup>

Volume of granular fill required = 14.77m<sup>3</sup>

Emptying time to 50% storage = 23.4 hours

Calculations are in accordance with BRE Digest 365

## Results from design calculations for trench soakaway

Site Ref No : 11748  
 Site Address : Cobgate Whaplode  
 Comments : Plot 21

Total excavated depth of soakaway : 1.30 m  
 Ground level to invert of inflow pipe : 0.50 m

Impermeable surface area (A) : 72.00 m<sup>2</sup>  
 Soil infiltration rate (f) : 2.23E-06 m/s

Rainfall ratio : 0.4  
 Aggregate void : 35%

| Soakaway width 1.3 m |                     |
|----------------------|---------------------|
| Storm duration (min) | Soakaway length (m) |
| 5                    | 1.80                |
| 10                   | 2.55                |
| 15                   | 3.10                |
| 30                   | 3.90                |
| 60                   | 4.80                |
| 120                  | 5.70                |
| 240                  | 6.50                |
| 360                  | 6.90                |
| 600                  | 7.15                |
| <u>1440</u>          | <u>7.15</u>         |

NOTE: Critical storm durations are underlined

Total excavated volume = 12.08 m<sup>3</sup>

Volume of granular fill required = 7.44m<sup>3</sup>

Emptying time to 50% storage = 24.0 hours

Calculations are in accordance with BRE Digest 365

## Results from design calculations for trench soakaway

Site Ref No : 11748  
 Site Address : Cobgate Whaplode  
 Comments : Plot 22

Total excavated depth of soakaway : 1.30 m  
 Ground level to invert of inflow pipe : 0.50 m

Impermeable surface area (A) : 108.00 m<sup>2</sup>  
 Soil infiltration rate (f) : 2.23E-06 m/s

Rainfall ratio : 0.4  
 Aggregate void : 35%

| Soakaway width 1.15 m |                     |
|-----------------------|---------------------|
| Storm duration (min)  | Soakaway length (m) |
| 5                     | 3.00                |
| 10                    | 4.30                |
| 15                    | 5.25                |
| 30                    | 6.65                |
| 60                    | 8.15                |
| 120                   | 9.65                |
| 240                   | 10.95               |
| 360                   | 11.60               |
| <u>600</u>            | <u>12.00</u>        |
| 1440                  | 11.95               |

NOTE: Critical storm durations are underlined

Total excavated volume = 17.94 m<sup>3</sup>

Volume of granular fill required = 11.04m<sup>3</sup>

Emptying time to 50% storage = 22.9 hours

Calculations are in accordance with BRE Digest 365

## Results from design calculations for trench soakaway

Site Ref No : 11748  
 Site Address : Cobgate Whaplode  
 Comments : Plot 24

Total excavated depth of soakaway : 1.30 m  
 Ground level to invert of inflow pipe : 0.50 m

Impermeable surface area (A) : 212.00 m<sup>2</sup>  
 Soil infiltration rate (f) : 2.23E-06 m/s

Rainfall ratio : 0.4  
 Aggregate void : 35%

| Soakaway width 1.15 m |                     |
|-----------------------|---------------------|
| Storm duration (min)  | Soakaway length (m) |
| 5                     | 5.90                |
| 10                    | 8.45                |
| 15                    | 10.30               |
| 30                    | 13.00               |
| 60                    | 16.00               |
| 120                   | 18.95               |
| 240                   | 21.55               |
| 360                   | 22.90               |
| 600                   | 23.75               |
| <u>1440</u>           | <u>23.75</u>        |

NOTE: Critical storm durations are underlined

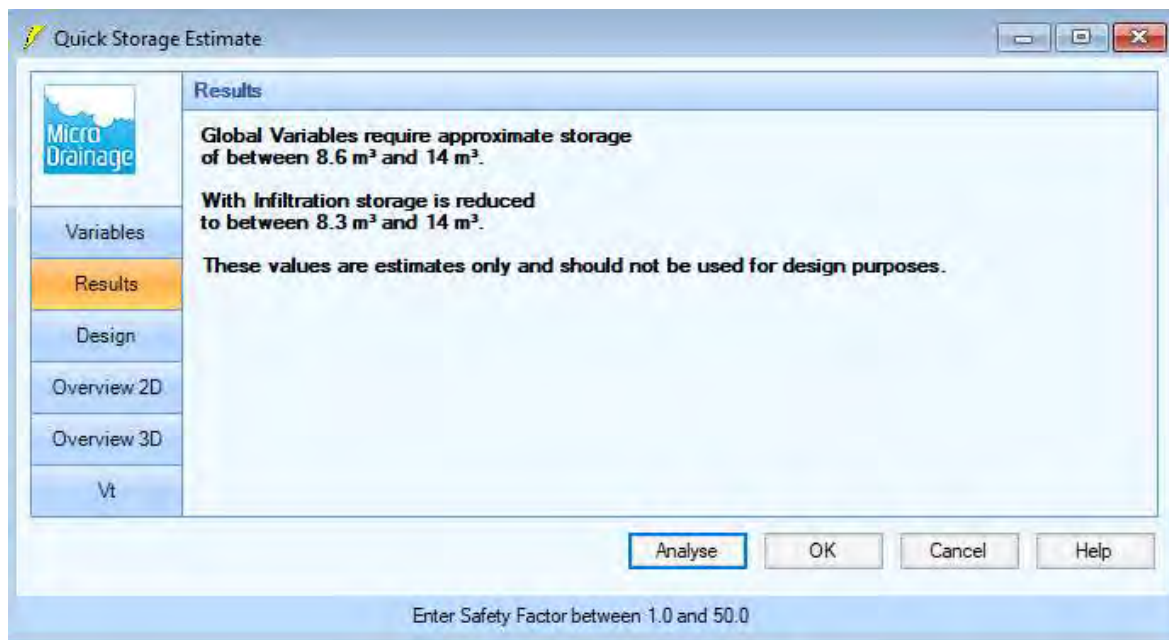
Total excavated volume = 35.51 m<sup>3</sup>

Volume of granular fill required = 21.85m<sup>3</sup>

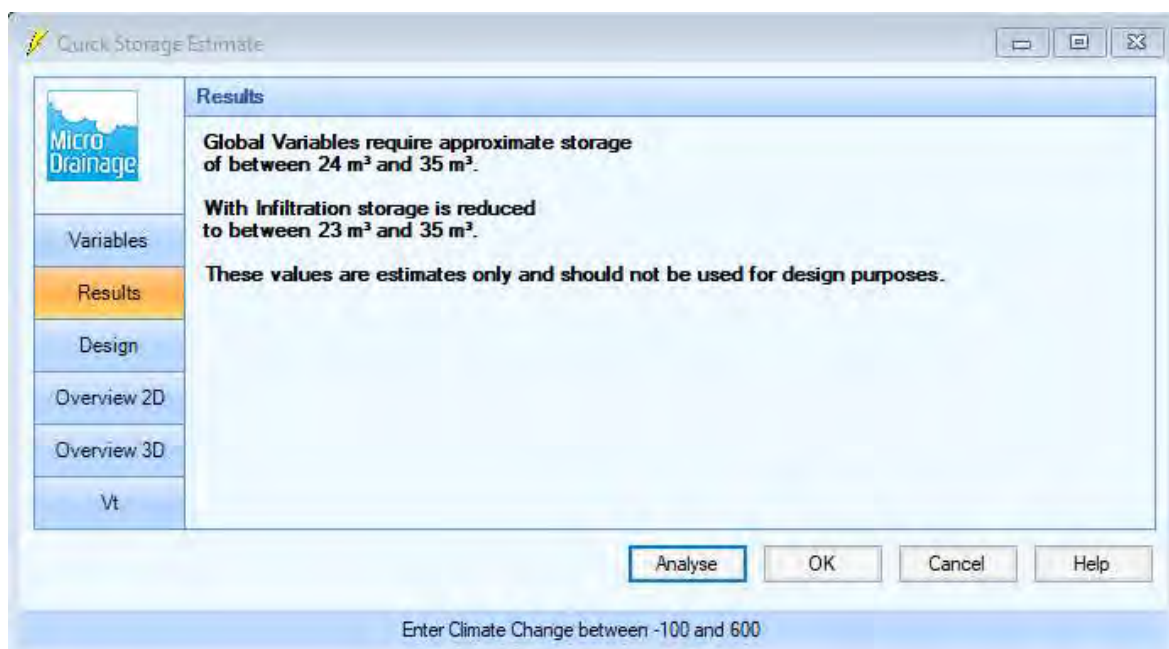
Emptying time to 50% storage = 23.9 hours

Calculations are in accordance with BRE Digest 365

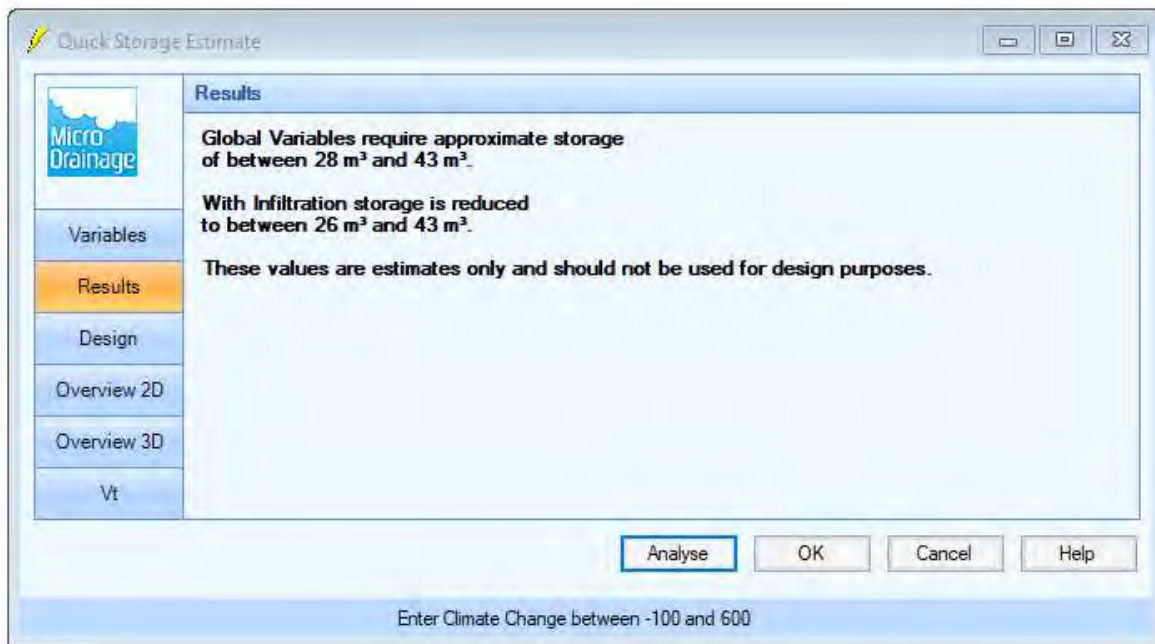
## Quick Storage Estimate Calculations



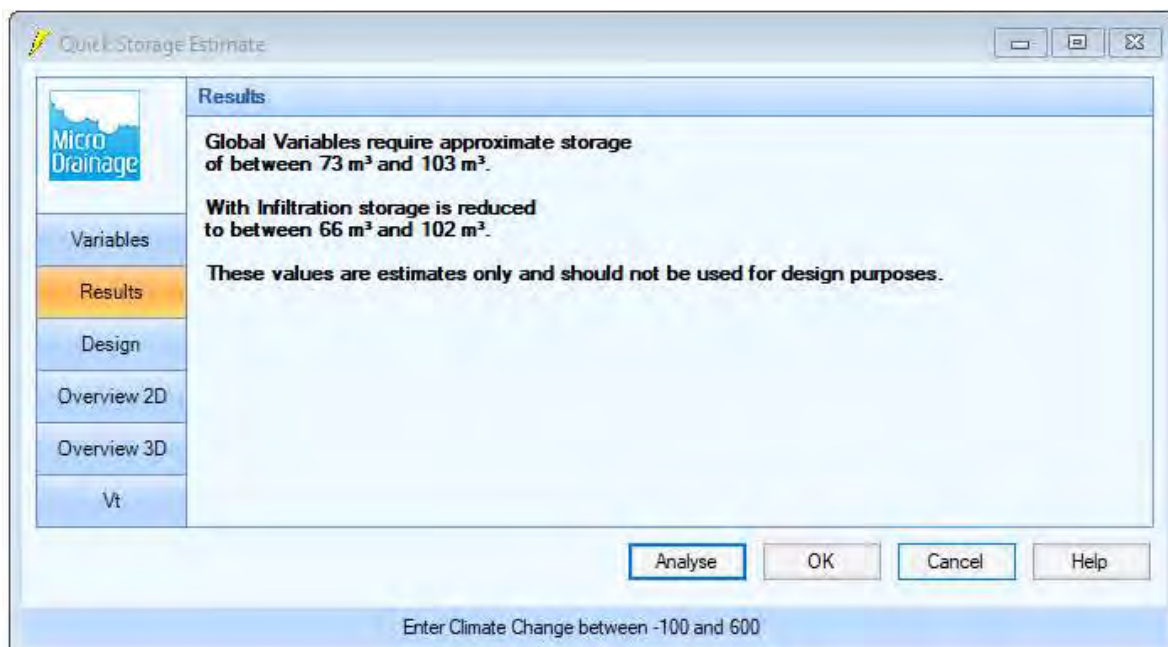
North attenuation volume – 30 year event



North attenuation volume – 100 year (+40CC) event



South attenuation volume – 30 year event



South attenuation volume – 100 year (+40CC) event

|                                                            |                               |                                                                                     |
|------------------------------------------------------------|-------------------------------|-------------------------------------------------------------------------------------|
| William Saunders                                           |                               | Page 1                                                                              |
| Sheppard Lockton House<br>Cafferata Way<br>Newark NG24 2TN | 11748<br>Cob Gate<br>Whaplode |  |
| Date 27/06/2018<br>File 18.06.27.MDX                       | Designed by PAE<br>Checked by |                                                                                     |
| Micro Drainage                                             | Network 2018.1                |                                                                                     |

### STORM SEWER DESIGN by the Modified Rational Method

#### Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - England and Wales

|                                      |        |                                       |       |
|--------------------------------------|--------|---------------------------------------|-------|
| Return Period (years)                | 2      | PIMP (%)                              | 100   |
| M5-60 (mm)                           | 19.000 | Add Flow / Climate Change (%)         | 0     |
| Ratio R                              | 0.400  | Minimum Backdrop Height (m)           | 0.200 |
| Maximum Rainfall (mm/hr)             | 100    | Maximum Backdrop Height (m)           | 1.500 |
| Maximum Time of Concentration (mins) | 60     | Min Design Depth for Optimisation (m) | 1.200 |
| Foul Sewage (l/s/ha)                 | 0.000  | Min Vel for Auto Design only (m/s)    | 1.00  |
| Volumetric Runoff Coeff.             | 0.750  | Min Slope for Optimisation (1:X)      | 500   |

Designed with Level Soffits

#### Time Area Diagram for Storm at outfall S (pipe S1.006)

| Time<br>(mins) | Area<br>(ha) | Time<br>(mins) | Area<br>(ha) | Time<br>(mins) | Area<br>(ha) |
|----------------|--------------|----------------|--------------|----------------|--------------|
| 0-4            | 0.061        | 4-8            | 0.077        | 8-12           | 0.008        |

Total Area Contributing (ha) = 0.146

Total Pipe Volume (m³) = 73.304

#### Time Area Diagram at outfall S (pipe S3.005)

| Time<br>(mins) | Area<br>(ha) | Time<br>(mins) | Area<br>(ha) | Time<br>(mins) | Area<br>(ha) |
|----------------|--------------|----------------|--------------|----------------|--------------|
| 0-4            | 0.025        | 4-8            | 0.037        | 8-12           | 0.000        |

Total Area Contributing (ha) = 0.063

Total Pipe Volume (m³) = 68.555

#### Network Design Table for Storm

| PN     | Length<br>(m) | Fall<br>(m) | Slope<br>(1:X) | I.Area<br>(ha) | T.E.<br>(mins) | Base<br>Flow (l/s) | k<br>(mm) | n | HYD<br>SECT | DIA<br>(mm) | Section Type | Auto<br>Design                                                                        |
|--------|---------------|-------------|----------------|----------------|----------------|--------------------|-----------|---|-------------|-------------|--------------|---------------------------------------------------------------------------------------|
| S1.000 | 12.992        | 0.052       | 249.8          | 0.021          | 5.00           | 0.0                | 0.600     |   | o           | 225         | Pipe/Conduit |  |

#### Network Results Table

| PN     | Rain<br>(mm/hr) | T.C.<br>(mins) | US/IL<br>(m) | Σ I.Area<br>(ha) | Σ Base<br>Flow (l/s) | Foul<br>(l/s) | Add Flow<br>(l/s) | Vel<br>(m/s) | Cap<br>(l/s) | Flow<br>(l/s) |
|--------|-----------------|----------------|--------------|------------------|----------------------|---------------|-------------------|--------------|--------------|---------------|
| S1.000 | 65.30           | 5.26           | 2.450        | 0.021            | 0.0                  | 0.0           | 0.0               | 0.82         | 32.7         | 3.8           |

William Saunders

Sheppard Lockton House  
Cafferata Way  
Newark NG24 2TN

Date 27/06/2018  
File 18.06.27.MDX

Micro Drainage

11748  
Cob Gate  
Whaplode

Designed by PAE  
Checked by

Network 2018.1

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Network Design Table for Storm

| PN     | Length<br>(m) | Fall<br>(m) | Slope<br>(1:X) | I.Area<br>(ha) | T.E.<br>(mins) | Base<br>Flow (l/s) | k<br>(mm) | n     | HYD<br>SECT | DIA<br>(mm) | Section Type | Auto<br>Design                                                                        |
|--------|---------------|-------------|----------------|----------------|----------------|--------------------|-----------|-------|-------------|-------------|--------------|---------------------------------------------------------------------------------------|
| S1.001 | 19.883        | 0.080       | 248.5          | 0.000          | 0.00           | 0.0                | 0.600     |       | o           | 225         | Pipe/Conduit |    |
| S1.002 | 19.051        | 0.076       | 250.7          | 0.016          | 0.00           | 0.0                | 0.600     |       | o           | 225         | Pipe/Conduit |    |
| S2.000 | 17.818        | 0.089       | 200.2          | 0.024          | 5.00           | 0.0                |           | 0.045 | 3 \=/       | 500         | 1:3 Swale    |    |
| S2.001 | 22.080        | 0.110       | 200.7          | 0.000          | 0.00           | 0.0                | 0.600     |       | o           | 225         | Pipe/Conduit |    |
| S2.002 | 30.524        | 0.153       | 199.5          | 0.026          | 0.00           | 0.0                |           | 0.045 | 3 \=/       | 500         | 1:3 Swale    |    |
| S2.003 | 12.789        | 0.064       | 199.8          | 0.000          | 0.00           | 0.0                | 0.600     |       | o           | 225         | Pipe/Conduit |    |
| S1.003 | 39.188        | 0.157       | 249.6          | 0.032          | 0.00           | 0.0                | 0.600     |       | o           | 225         | Pipe/Conduit |    |
| S1.004 | 25.924        | 0.104       | 249.3          | 0.009          | 0.00           | 0.0                | 0.600     |       | o           | 225         | Pipe/Conduit |    |
| S1.005 | 8.472         | 0.034       | 249.2          | 0.018          | 0.00           | 0.0                | 0.600     |       | o           | 225         | Pipe/Conduit |    |
| S1.006 | 5.418         | 0.022       | 246.3          | 0.000          | 0.00           | 0.0                | 0.600     |       | o           | 225         | Pipe/Conduit |    |
| S3.000 | 17.123        | 0.086       | 199.1          | 0.019          | 5.00           | 0.0                |           | 0.045 | 3 \=/       | 500         | 1:3 Swale    |   |
| S3.001 | 13.560        | 0.068       | 199.4          | 0.000          | 0.00           | 0.0                | 0.600     |       | o           | 225         | Pipe/Conduit |  |
| S3.002 | 26.700        | 0.134       | 199.3          | 0.045          | 0.00           | 0.0                |           | 0.045 | 3 \=/       | 500         | 1:3 Swale    |  |
| S3.003 | 12.213        | 0.061       | 200.2          | 0.000          | 0.00           | 0.0                | 0.600     |       | o           | 225         | Pipe/Conduit |  |
| S3.004 | 20.429        | 0.102       | 200.3          | 0.000          | 0.00           | 0.0                | 0.600     |       | o           | 225         | Pipe/Conduit |  |
| S3.005 | 5.418         | 0.027       | 200.7          | 0.000          | 0.00           | 0.0                | 0.600     |       | o           | 225         | Pipe/Conduit |  |

Network Results Table

| PN     | Rain<br>(mm/hr) | T.C.<br>(mins) | US/IL<br>(m) | Σ I.Area<br>(ha) | Σ Base<br>Flow (l/s) | Foul<br>(l/s) | Add Flow<br>(l/s) | Vel<br>(m/s) | Cap<br>(l/s) | Flow<br>(l/s) |
|--------|-----------------|----------------|--------------|------------------|----------------------|---------------|-------------------|--------------|--------------|---------------|
| S1.001 | 63.22           | 5.66           | 2.398        | 0.021            | 0.0                  | 0.0           | 0.0               | 0.82         | 32.8         | 3.8           |
| S1.002 | 61.36           | 6.05           | 2.318        | 0.037            | 0.0                  | 0.0           | 0.0               | 0.82         | 32.7         | 6.2           |
| S2.000 | 62.14           | 5.89           | 2.658        | 0.024            | 0.0                  | 0.0           | 0.0               | 0.33         | 47.7         | 4.0           |
| S2.001 | 60.29           | 6.29           | 2.569        | 0.024            | 0.0                  | 0.0           | 0.0               | 0.92         | 36.5         | 4.0           |
| S2.002 | 54.30           | 7.81           | 2.459        | 0.049            | 0.0                  | 0.0           | 0.0               | 0.34         | 47.8         | 7.3           |
| S2.003 | 53.50           | 8.04           | 2.306        | 0.049            | 0.0                  | 0.0           | 0.0               | 0.92         | 36.6         | 7.3           |
| S1.003 | 50.97           | 8.83           | 2.242        | 0.119            | 0.0                  | 0.0           | 0.0               | 0.82         | 32.7         | 16.5          |
| S1.004 | 49.44           | 9.35           | 2.085        | 0.128            | 0.0                  | 0.0           | 0.0               | 0.82         | 32.7         | 17.1          |
| S1.005 | 48.96           | 9.53           | 1.981        | 0.146            | 0.0                  | 0.0           | 0.0               | 0.82         | 32.8         | 19.4          |
| S1.006 | 48.66           | 9.64           | 1.947        | 0.146            | 0.0                  | 0.0           | 0.0               | 0.83         | 32.9         | 19.4          |
| S3.000 | 62.31           | 5.85           | 2.658        | 0.019            | 0.0                  | 0.0           | 0.0               | 0.34         | 47.8         | 3.1           |
| S3.001 | 61.16           | 6.10           | 2.572        | 0.019            | 0.0                  | 0.0           | 0.0               | 0.92         | 36.7         | 3.1           |
| S3.002 | 55.68           | 7.42           | 2.504        | 0.063            | 0.0                  | 0.0           | 0.0               | 0.34         | 47.8         | 9.5           |
| S3.003 | 54.87           | 7.64           | 2.370        | 0.063            | 0.0                  | 0.0           | 0.0               | 0.92         | 36.6         | 9.5           |
| S3.004 | 53.58           | 8.01           | 2.309        | 0.063            | 0.0                  | 0.0           | 0.0               | 0.92         | 36.6         | 9.5           |
| S3.005 | 53.25           | 8.11           | 2.207        | 0.063            | 0.0                  | 0.0           | 0.0               | 0.92         | 36.6         | 9.5           |

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|                        |                 |                                                                                     |
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| William Saunders       |                 | Page 3                                                                              |
| Sheppard Lockton House | 11748           |  |
| Cafferata Way          | Cob Gate        |                                                                                     |
| Newark NG24 2TN        | Whaplode        |                                                                                     |
| Date 27/06/2018        | Designed by PAE |                                                                                     |
| File 18.06.27.MDX      | Checked by      |                                                                                     |
| Micro Drainage         | Network 2018.1  |                                                                                     |

#### Simulation Criteria for Storm

|                                 |       |                                            |       |
|---------------------------------|-------|--------------------------------------------|-------|
| Volumetric Runoff Coeff         | 0.750 | Additional Flow - % of Total Flow          | 0.000 |
| Areal Reduction Factor          | 1.000 | MADD Factor * 10m <sup>3</sup> /ha Storage | 2.000 |
| Hot Start (mins)                | 0     | Inlet Coefficient                          | 0.800 |
| Hot Start Level (mm)            | 0     | Flow per Person per Day (l/per/day)        | 0.000 |
| Manhole Headloss Coeff (Global) | 0.500 | Run Time (mins)                            | 60    |
| Foul Sewage per hectare (l/s)   | 0.000 | Output Interval (mins)                     | 1     |
| Number of Input Hydrographs     | 0     | Number of Storage Structures               | 4     |
| Number of Online Controls       | 2     | Number of Time/Area Diagrams               | 0     |
| Number of Offline Controls      | 0     | Number of Real Time Controls               | 0     |

#### Synthetic Rainfall Details

|                       |                   |                       |        |
|-----------------------|-------------------|-----------------------|--------|
| Rainfall Model        | FSR               | Profile Type          | Summer |
| Return Period (years) | 2                 | Cv (Summer)           | 0.750  |
| Region                | England and Wales | Cv (Winter)           | 0.840  |
| M5-60 (mm)            | 19.000            | Storm Duration (mins) | 30     |
| Ratio R               | 0.400             |                       |        |

|                        |                 |                                                                                     |
|------------------------|-----------------|-------------------------------------------------------------------------------------|
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| Sheppard Lockton House | 11748           |  |
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| Newark NG24 2TN        | Whaplode        |                                                                                     |
| Date 27/06/2018        | Designed by PAE |                                                                                     |
| File 18.06.27.MDX      | Checked by      |                                                                                     |
| Micro Drainage         | Network 2018.1  |                                                                                     |

### Online Controls for Storm

**Hydro-Brake® Optimum Manhole: SS7, DS/PN: S1.006, Volume (m³): 1.6**

|                                   |                            |
|-----------------------------------|----------------------------|
| Unit Reference                    | MD-SHE-0090-4000-1311-4000 |
| Design Head (m)                   | 1.311                      |
| Design Flow (l/s)                 | 4.0                        |
| Flush-Flo™                        | Calculated                 |
| Objective                         | Minimise upstream storage  |
| Application                       | Surface                    |
| Sump Available                    | Yes                        |
| Diameter (mm)                     | 90                         |
| Invert Level (m)                  | 1.947                      |
| Minimum Outlet Pipe Diameter (mm) | 150                        |
| Suggested Manhole Diameter (mm)   | 1200                       |

| Control Points            | Head (m) | Flow (l/s) |
|---------------------------|----------|------------|
| Design Point (Calculated) | 1.311    | 4.0        |
| Flush-Flo™                | 0.396    | 4.0        |
| Kick-Flo®                 | 0.806    | 3.2        |
| Mean Flow over Head Range | -        | 3.5        |

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

| Depth (m) | Flow (l/s) | Depth (m) | Flow (l/s) | Depth (m) | Flow (l/s) | Depth (m) | Flow (l/s) |
|-----------|------------|-----------|------------|-----------|------------|-----------|------------|
| 0.100     | 2.8        | 1.200     | 3.8        | 3.000     | 5.9        | 7.000     | 8.8        |
| 0.200     | 3.7        | 1.400     | 4.1        | 3.500     | 6.3        | 7.500     | 9.1        |
| 0.300     | 3.9        | 1.600     | 4.4        | 4.000     | 6.7        | 8.000     | 9.3        |
| 0.400     | 4.0        | 1.800     | 4.6        | 4.500     | 7.1        | 8.500     | 9.6        |
| 0.500     | 3.9        | 2.000     | 4.9        | 5.000     | 7.5        | 9.000     | 9.9        |
| 0.600     | 3.8        | 2.200     | 5.1        | 5.500     | 7.8        | 9.500     | 10.1       |
| 0.800     | 3.2        | 2.400     | 5.3        | 6.000     | 8.1        |           |            |
| 1.000     | 3.5        | 2.600     | 5.5        | 6.500     | 8.5        |           |            |

**Hydro-Brake® Optimum Manhole: SS9, DS/PN: S3.005, Volume (m³): 0.8**

|                                   |                            |
|-----------------------------------|----------------------------|
| Unit Reference                    | MD-SHE-0094-4000-1051-4000 |
| Design Head (m)                   | 1.051                      |
| Design Flow (l/s)                 | 4.0                        |
| Flush-Flo™                        | Calculated                 |
| Objective                         | Minimise upstream storage  |
| Application                       | Surface                    |
| Sump Available                    | Yes                        |
| Diameter (mm)                     | 94                         |
| Invert Level (m)                  | 2.207                      |
| Minimum Outlet Pipe Diameter (mm) | 150                        |
| Suggested Manhole Diameter (mm)   | 1200                       |

|                                                            |                               |                                                                                     |
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| Sheppard Lockton House<br>Cafferata Way<br>Newark NG24 2TN | 11748<br>Cob Gate<br>Whaplode |  |
| Date 27/06/2018<br>File 18.06.27.MDX                       | Designed by PAE<br>Checked by |                                                                                     |
| Micro Drainage                                             | Network 2018.1                |                                                                                     |

Hydro-Brake® Optimum Manhole: SS9, DS/PN: S3.005, Volume (m³): 0.8

| Control Points            | Head (m) | Flow (l/s) |
|---------------------------|----------|------------|
| Design Point (Calculated) | 1.051    | 4.0        |
| Flush-Flo™                | 0.311    | 4.0        |
| Kick-Flo®                 | 0.658    | 3.2        |
| Mean Flow over Head Range | -        | 3.5        |

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

| Depth (m) | Flow (l/s) | Depth (m) | Flow (l/s) | Depth (m) | Flow (l/s) | Depth (m) | Flow (l/s) |
|-----------|------------|-----------|------------|-----------|------------|-----------|------------|
| 0.100     | 3.0        | 1.200     | 4.3        | 3.000     | 6.5        | 7.000     | 9.7        |
| 0.200     | 3.9        | 1.400     | 4.6        | 3.500     | 7.0        | 7.500     | 10.1       |
| 0.300     | 4.0        | 1.600     | 4.9        | 4.000     | 7.5        | 8.000     | 10.4       |
| 0.400     | 3.9        | 1.800     | 5.1        | 4.500     | 7.9        | 8.500     | 10.7       |
| 0.500     | 3.8        | 2.000     | 5.4        | 5.000     | 8.3        | 9.000     | 11.0       |
| 0.600     | 3.5        | 2.200     | 5.6        | 5.500     | 8.7        | 9.500     | 11.3       |
| 0.800     | 3.5        | 2.400     | 5.9        | 6.000     | 9.0        |           |            |
| 1.000     | 3.9        | 2.600     | 6.1        | 6.500     | 9.4        |           |            |

|                                                            |                               |                                                                                     |
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| Date 27/06/2018<br>File 18.06.27.MDX                       | Designed by PAE<br>Checked by |                                                                                     |
| Micro Drainage                                             | Network 2018.1                |                                                                                     |

### Storage Structures for Storm

#### Swale Manhole: SSW2, DS/PN: S2.001

Warning:- Volume should always be included unless the upstream pipe is being used for storage and/or as a carrier

|                                      |         |                            |       |
|--------------------------------------|---------|----------------------------|-------|
| Infiltration Coefficient Base (m/hr) | 0.00803 | Length (m)                 | 17.8  |
| Infiltration Coefficient Side (m/hr) | 0.00803 | Side Slope (1:X)           | 3.0   |
| Safety Factor                        | 2.0     | Slope (1:X)                | 200.0 |
| Porosity                             | 1.00    | Cap Volume Depth (m)       | 0.000 |
| Invert Level (m)                     | 2.569   | Cap Infiltration Depth (m) | 0.000 |
| Base Width (m)                       | 0.5     | Include Swale Volume       | No    |

#### Swale Manhole: SSW4, DS/PN: S2.003

Warning:- Volume should always be included unless the upstream pipe is being used for storage and/or as a carrier

|                                      |         |                            |       |
|--------------------------------------|---------|----------------------------|-------|
| Infiltration Coefficient Base (m/hr) | 0.00803 | Length (m)                 | 30.5  |
| Infiltration Coefficient Side (m/hr) | 0.00803 | Side Slope (1:X)           | 3.0   |
| Safety Factor                        | 2.0     | Slope (1:X)                | 200.0 |
| Porosity                             | 1.00    | Cap Volume Depth (m)       | 0.000 |
| Invert Level (m)                     | 2.306   | Cap Infiltration Depth (m) | 0.000 |
| Base Width (m)                       | 0.5     | Include Swale Volume       | No    |

#### Swale Manhole: SSW6, DS/PN: S3.001

Warning:- Volume should always be included unless the upstream pipe is being used for storage and/or as a carrier

|                                      |         |                            |       |
|--------------------------------------|---------|----------------------------|-------|
| Infiltration Coefficient Base (m/hr) | 0.00803 | Length (m)                 | 17.1  |
| Infiltration Coefficient Side (m/hr) | 0.00803 | Side Slope (1:X)           | 3.0   |
| Safety Factor                        | 2.0     | Slope (1:X)                | 200.0 |
| Porosity                             | 1.00    | Cap Volume Depth (m)       | 0.000 |
| Invert Level (m)                     | 2.572   | Cap Infiltration Depth (m) | 0.000 |
| Base Width (m)                       | 0.5     | Include Swale Volume       | No    |

#### Swale Manhole: SSW8, DS/PN: S3.003

Warning:- Volume should always be included unless the upstream pipe is being used for storage and/or as a carrier

|                                      |         |                            |       |
|--------------------------------------|---------|----------------------------|-------|
| Infiltration Coefficient Base (m/hr) | 0.00803 | Length (m)                 | 26.7  |
| Infiltration Coefficient Side (m/hr) | 0.00803 | Side Slope (1:X)           | 3.0   |
| Safety Factor                        | 2.0     | Slope (1:X)                | 200.0 |
| Porosity                             | 1.00    | Cap Volume Depth (m)       | 0.000 |
| Invert Level (m)                     | 2.370   | Cap Infiltration Depth (m) | 0.000 |
| Base Width (m)                       | 0.5     | Include Swale Volume       | No    |



|                                                            |                               |                                                                                     |
|------------------------------------------------------------|-------------------------------|-------------------------------------------------------------------------------------|
| William Saunders                                           |                               | Page 8                                                                              |
| Sheppard Lockton House<br>Cafferata Way<br>Newark NG24 2TN | 11748<br>Cob Gate<br>Whaplode |  |
| Date 27/06/2018<br>File 18.06.27.MDX                       | Designed by PAE<br>Checked by |                                                                                     |
| Micro Drainage                                             |                               | Network 2018.1                                                                      |

1 year Return Period Summary of Critical Results by Maximum Level (Rank 1)  
for Storm

| PN     | US/MH<br>Name | Water        | Surcharged   | Flooded        |                |                   | Pipe          | Status     | Level    |
|--------|---------------|--------------|--------------|----------------|----------------|-------------------|---------------|------------|----------|
|        |               | Level<br>(m) | Depth<br>(m) | Volume<br>(m³) | Flow /<br>Cap. | Overflow<br>(l/s) | Flow<br>(l/s) |            | Exceeded |
| S1.000 | SS1           | 2.487        | -0.188       | 0.000          | 0.06           |                   | 1.7           | OK         |          |
| S1.001 | SS2           | 2.434        | -0.189       | 0.000          | 0.06           |                   | 1.8           | OK         |          |
| S1.002 | SS3           | 2.395        | -0.148       | 0.000          | 0.08           |                   | 2.5           | OK         |          |
| S2.000 | SSW1          | 2.685        | -0.573       | 0.000          | 0.00           |                   | 1.9           | OK         |          |
| S2.001 | SSW2          | 2.602        | -0.192       | 0.000          | 0.05           |                   | 1.9           | OK*        |          |
| S2.002 | SSW3          | 2.498        | -0.561       | 0.000          | 0.00           |                   | 3.8           | OK         |          |
| S2.003 | SSW4          | 2.395        | -0.136       | 0.000          | 0.09           |                   | 3.2           | OK*        | 11       |
| S1.003 | SS4           | 2.393        | -0.074       | 0.000          | 0.24           |                   | 7.5           | OK         |          |
| S1.004 | SS5           | 2.384        | 0.074        | 0.000          | 0.18           |                   | 5.5           | SURCHARGED | 2        |
| S1.005 | SS6           | 2.375        | 0.169        | 0.000          | 0.17           |                   | 4.5           | SURCHARGED | 8        |
| S1.006 | SS7           | 2.371        | 0.199        | 0.000          | 0.16           |                   | 4.0           | SURCHARGED | 10       |

|                                                            |                               |                                                                                     |
|------------------------------------------------------------|-------------------------------|-------------------------------------------------------------------------------------|
| William Saunders                                           |                               | Page 9                                                                              |
| Sheppard Lockton House<br>Cafferata Way<br>Newark NG24 2TN | 11748<br>Cob Gate<br>Whaplode |  |
| Date 27/06/2018<br>File 18.06.27.MDX                       | Designed by PAE<br>Checked by |                                                                                     |
| Micro Drainage                                             | Network 2018.1                |                                                                                     |

1 year Return Period Summary of Critical Results by Maximum Level (Rank 1)  
for Storm

|        |       |       |        |        |           |           |           |           | Water    |
|--------|-------|-------|--------|--------|-----------|-----------|-----------|-----------|----------|
|        | US/MH |       |        | Return | Climate   | First (X) | First (Y) | First (Z) | Overflow |
| PN     | Name  | Storm | Period | Change | Surcharge | Flood     | Overflow  | Act.      | Level    |
| S3.000 | SSW5  | 60    | Summer | 1      | +0%       |           |           |           | 2.681    |
| S3.001 | SSW6  | 60    | Summer | 1      | +0%       | 100/60    | Winter    |           | 2.601    |
| S3.002 | SSW7  | 60    | Summer | 1      | +0%       |           |           |           | 2.549    |
| S3.003 | SSW8  | 60    | Summer | 1      | +0%       | 30/60     | Summer    |           | 2.426    |
| S3.004 | SS8   | 60    | Summer | 1      | +0%       |           |           |           | 2.391    |
| S3.005 | SS9   | 60    | Summer | 1      | +0%       |           |           |           | 2.384    |

|        |            | Surcharged Flooded |             |             |                | Pipe       |        |                |  |
|--------|------------|--------------------|-------------|-------------|----------------|------------|--------|----------------|--|
| PN     | US/MH Name | Depth (m)          | Volume (m³) | Flow / Cap. | Overflow (l/s) | Flow (l/s) | Status | Level Exceeded |  |
| S3.000 | SSW5       | -0.577             | 0.000       | 0.00        |                | 1.5        | OK     |                |  |
| S3.001 | SSW6       | -0.196             | 0.000       | 0.04        |                | 1.5        | OK*    |                |  |
| S3.002 | SSW7       | -0.608             | 0.000       | 0.00        |                | 4.9        | OK     |                |  |
| S3.003 | SSW8       | -0.169             | 0.000       | 0.14        |                | 4.8        | OK*    |                |  |
| S3.004 | SS8        | -0.143             | 0.000       | 0.13        |                | 4.6        | OK*    |                |  |
| S3.005 | SS9        | -0.048             | 0.000       | 0.12        |                | 3.7        | OK*    |                |  |

|                        |                 |                                                                                     |
|------------------------|-----------------|-------------------------------------------------------------------------------------|
| William Saunders       |                 | Page 10                                                                             |
| Sheppard Lockton House | 11748           |  |
| Cafferata Way          | Cob Gate        |                                                                                     |
| Newark NG24 2TN        | Whaplode        |                                                                                     |
| Date 27/06/2018        | Designed by PAE |                                                                                     |
| File 18.06.27.MDX      | Checked by      |                                                                                     |
| Micro Drainage         | Network 2018.1  |                                                                                     |

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1)  
for Storm

Simulation Criteria

Areal Reduction Factor 1.000      Additional Flow - % of Total Flow 0.000  
 Hot Start (mins)      0      MADD Factor \* 10m<sup>3</sup>/ha Storage 2.000  
 Hot Start Level (mm)      0      Inlet Coefficient 0.800  
 Manhole Headloss Coeff (Global) 0.500      Flow per Person per Day (l/per/day) 0.000  
 Foul Sewage per hectare (l/s) 0.000

Number of Input Hydrographs 0      Number of Storage Structures 4  
 Number of Online Controls 2      Number of Time/Area Diagrams 0  
 Number of Offline Controls 0      Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model      FEH  
 FEH Rainfall Version      1999  
 Site Location GB 532950 323900 TF 32950 23900  
 C (1km)      -0.023  
 D1 (1km)      0.321  
 D2 (1km)      0.299  
 D3 (1km)      0.211  
 E (1km)      0.315  
 F (1km)      2.483  
 Cv (Summer)      0.750  
 Cv (Winter)      0.840

Margin for Flood Risk Warning (mm) 300.0      DVD Status OFF  
 Analysis Timestep      Fine Inertia Status OFF  
 DTS Status      ON

Profile(s)      Summer and Winter  
 Duration(s) (mins)      60, 120, 180, 240, 360, 480, 600, 720, 960,  
                                          1440, 2160, 2880, 4320, 5760, 7200, 8640,  
                                          10080  
 Return Period(s) (years)      1, 30, 100  
 Climate Change (%)      0, 0, 40

| PN     | US/MH<br>Name | Storm      | Return<br>Period | Climate<br>Change | First (X)<br>Surcharge | First (Y)<br>Flood | First (Z)<br>Overflow | Overflow<br>Act. |
|--------|---------------|------------|------------------|-------------------|------------------------|--------------------|-----------------------|------------------|
| S1.000 | SS1           | 60 Winter  | 30               | +0%               | 30/60 Summer           |                    |                       |                  |
| S1.001 | SS2           | 60 Winter  | 30               | +0%               | 30/60 Summer           |                    |                       |                  |
| S1.002 | SS3           | 60 Winter  | 30               | +0%               | 30/60 Summer           |                    |                       |                  |
| S2.000 | SSW1          | 60 Winter  | 30               | +0%               |                        |                    |                       |                  |
| S2.001 | SSW2          | 60 Winter  | 30               | +0%               | 100/60 Summer          |                    |                       |                  |
| S2.002 | SSW3          | 60 Winter  | 30               | +0%               |                        |                    |                       |                  |
| S2.003 | SSW4          | 60 Winter  | 30               | +0%               | 30/60 Summer           | 100/60 Summer      |                       |                  |
| S1.003 | SS4           | 60 Winter  | 30               | +0%               | 30/60 Summer           |                    |                       |                  |
| S1.004 | SS5           | 180 Winter | 30               | +0%               | 1/60 Summer            | 100/360 Summer     |                       |                  |
| S1.005 | SS6           | 180 Winter | 30               | +0%               | 1/60 Summer            | 100/180 Summer     |                       |                  |
| S1.006 | SS7           | 180 Winter | 30               | +0%               | 1/60 Summer            | 30/1440 Summer     |                       |                  |

|                        |                 |                                                                                     |
|------------------------|-----------------|-------------------------------------------------------------------------------------|
| William Saunders       |                 | Page 11                                                                             |
| Sheppard Lockton House | 11748           |  |
| Cafferata Way          | Cob Gate        |                                                                                     |
| Newark NG24 2TN        | Whaplode        |                                                                                     |
| Date 27/06/2018        | Designed by PAE |                                                                                     |
| File 18.06.27.MDX      | Checked by      |                                                                                     |
| Micro Drainage         | Network 2018.1  |                                                                                     |

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1)  
for Storm

| PN     | US/MH<br>Name | Water        |              | Surcharged                  |                | Flooded           |               | Pipe        |  | Status | Level<br>Exceeded |
|--------|---------------|--------------|--------------|-----------------------------|----------------|-------------------|---------------|-------------|--|--------|-------------------|
|        |               | Level<br>(m) | Depth<br>(m) | Volume<br>(m <sup>3</sup> ) | Flow /<br>Cap. | Overflow<br>(l/s) | Flow<br>(l/s) |             |  |        |                   |
| S1.000 | SS1           | 2.738        | 0.063        | 0.000                       | 0.13           |                   | 3.7           | SURCHARGED  |  |        |                   |
| S1.001 | SS2           | 2.737        | 0.114        | 0.000                       | 0.10           |                   | 3.0           | SURCHARGED  |  |        |                   |
| S1.002 | SS3           | 2.736        | 0.193        | 0.000                       | 0.18           |                   | 5.3           | SURCHARGED  |  |        |                   |
| S2.000 | SSW1          | 2.733        | -0.525       | 0.000                       | 0.00           |                   | 4.7           | OK          |  |        |                   |
| S2.001 | SSW2          | 2.733        | -0.061       | 0.000                       | 0.12           |                   | 4.5           | OK*         |  |        |                   |
| S2.002 | SSW3          | 2.732        | -0.327       | 0.000                       | 0.01           |                   | 8.4           | OK          |  |        |                   |
| S2.003 | SSW4          | 2.732        | 0.201        | 0.000                       | 0.22           |                   | 7.9           | FLOOD RISK* |  |        | 11                |
| S1.003 | SS4           | 2.734        | 0.267        | 0.000                       | 0.29           |                   | 9.0           | SURCHARGED  |  |        |                   |
| S1.004 | SS5           | 2.814        | 0.504        | 0.000                       | 0.28           |                   | 8.5           | FLOOD RISK  |  |        | 2                 |
| S1.005 | SS6           | 2.850        | 0.644        | 0.000                       | 0.22           |                   | 5.9           | FLOOD RISK  |  |        | 8                 |
| S1.006 | SS7           | 2.849        | 0.677        | 0.000                       | 0.16           |                   | 4.0           | FLOOD RISK  |  |        | 10                |

|                                                            |                               |                                                                                     |
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| William Saunders                                           |                               | Page 12                                                                             |
| Sheppard Lockton House<br>Cafferata Way<br>Newark NG24 2TN | 11748<br>Cob Gate<br>Whaplode |  |
| Date 27/06/2018<br>File 18.06.27.MDX                       | Designed by PAE<br>Checked by |                                                                                     |
| Micro Drainage                                             | Network 2018.1                |                                                                                     |

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1)  
for Storm

|        |       |            |        |        |         |               |           |           |          | Water |
|--------|-------|------------|--------|--------|---------|---------------|-----------|-----------|----------|-------|
|        | US/MH |            |        | Return | Climate | First (X)     | First (Y) | First (Z) | Overflow | Level |
| PN     | Name  | Storm      | Period |        | Change  | Surcharge     | Flood     | Overflow  | Act.     | (m)   |
| S3.000 | SSW5  | 60 Summer  |        | 30     | +0%     |               |           |           |          | 2.701 |
| S3.001 | SSW6  | 60 Winter  |        | 30     | +0%     | 100/60 Winter |           |           |          | 2.636 |
| S3.002 | SSW7  | 60 Winter  |        | 30     | +0%     |               |           |           |          | 2.645 |
| S3.003 | SSW8  | 60 Winter  |        | 30     | +0%     | 30/60 Summer  |           |           |          | 2.644 |
| S3.004 | SS8   | 60 Winter  |        | 30     | +0%     |               |           |           |          | 2.534 |
| S3.005 | SS9   | 240 Winter |        | 30     | +0%     |               |           |           |          | 2.432 |

|        |            | Surcharged Flooded |             | Pipe        |                | Level      |             |
|--------|------------|--------------------|-------------|-------------|----------------|------------|-------------|
| PN     | US/MH Name | Depth (m)          | Volume (m³) | Flow / Cap. | Overflow (l/s) | Flow (l/s) | Status      |
| S3.000 | SSW5       | -0.557             | 0.000       | 0.00        |                | 4.3        | OK          |
| S3.001 | SSW6       | -0.161             | 0.000       | 0.10        |                | 3.5        | OK*         |
| S3.002 | SSW7       | -0.512             | 0.000       | 0.01        |                | 12.0       | OK          |
| S3.003 | SSW8       | 0.049              | 0.000       | 0.30        |                | 10.4       | SURCHARGED* |
| S3.004 | SS8        | 0.000              | 0.000       | 0.21        |                | 7.7        | SURCHARGED* |
| S3.005 | SS9        | 0.000              | 0.000       | 0.13        |                | 3.9        | SURCHARGED* |

|                        |                 |                                                                                     |
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| Sheppard Lockton House | 11748           |  |
| Cafferata Way          | Cob Gate        |                                                                                     |
| Newark NG24 2TN        | Whaplode        |                                                                                     |
| Date 27/06/2018        | Designed by PAE |                                                                                     |
| File 18.06.27.MDX      | Checked by      |                                                                                     |
| Micro Drainage         | Network 2018.1  |                                                                                     |

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

Areal Reduction Factor 1.000      Additional Flow - % of Total Flow 0.000  
 Hot Start (mins) 0      MADD Factor \* 10m<sup>3</sup>/ha Storage 2.000  
 Hot Start Level (mm) 0      Inlet Coefficient 0.800  
 Manhole Headloss Coeff (Global) 0.500      Flow per Person per Day (l/per/day) 0.000  
 Foul Sewage per hectare (l/s) 0.000

Number of Input Hydrographs 0      Number of Storage Structures 4  
 Number of Online Controls 2      Number of Time/Area Diagrams 0  
 Number of Offline Controls 0      Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FEH  
 FEH Rainfall Version 1999  
 Site Location GB 532950 323900 TF 32950 23900  
 C (1km) -0.023  
 D1 (1km) 0.321  
 D2 (1km) 0.299  
 D3 (1km) 0.211  
 E (1km) 0.315  
 F (1km) 2.483  
 Cv (Summer) 0.750  
 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 300.0      DVD Status OFF  
 Analysis Timestep Fine Inertia Status OFF  
 DTS Status ON

Profile(s) Summer and Winter  
 Duration(s) (mins) 60, 120, 180, 240, 360, 480, 600, 720, 960,  
 1440, 2160, 2880, 4320, 5760, 7200, 8640,  
 10080  
 Return Period(s) (years) 1, 30, 100  
 Climate Change (%) 0, 0, 40

| PN     | US/MH Name | Storm       | Return Period | Climate Change | First (X) Surge | First (Y) Flood | First (Z) Overflow | Overflow Act. |
|--------|------------|-------------|---------------|----------------|-----------------|-----------------|--------------------|---------------|
| S1.000 | SS1        | 60 Winter   | 100           | +40%           | 30/60 Summer    |                 |                    |               |
| S1.001 | SS2        | 60 Winter   | 100           | +40%           | 30/60 Summer    |                 |                    |               |
| S1.002 | SS3        | 60 Winter   | 100           | +40%           | 30/60 Summer    |                 |                    |               |
| S2.000 | SSW1       | 120 Winter  | 100           | +40%           |                 |                 |                    |               |
| S2.001 | SSW2       | 120 Winter  | 100           | +40%           | 100/60 Summer   |                 |                    |               |
| S2.002 | SSW3       | 120 Winter  | 100           | +40%           |                 |                 |                    |               |
| S2.003 | SSW4       | 120 Winter  | 100           | +40%           | 30/60 Summer    | 100/60 Summer   |                    |               |
| S1.003 | SS4        | 180 Winter  | 100           | +40%           | 30/60 Summer    |                 |                    |               |
| S1.004 | SS5        | 480 Winter  | 100           | +40%           | 1/60 Summer     | 100/360 Summer  |                    |               |
| S1.005 | SS6        | 480 Winter  | 100           | +40%           | 1/60 Summer     | 100/180 Summer  |                    |               |
| S1.006 | SS7        | 1440 Summer | 100           | +40%           | 1/60 Summer     | 30/1440 Summer  |                    |               |

|                        |                 |                                                                                     |
|------------------------|-----------------|-------------------------------------------------------------------------------------|
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| Sheppard Lockton House | 11748           |  |
| Cafferata Way          | Cob Gate        |                                                                                     |
| Newark NG24 2TN        | Whaplode        |                                                                                     |
| Date 27/06/2018        | Designed by PAE |                                                                                     |
| File 18.06.27.MDX      | Checked by      |                                                                                     |
| Micro Drainage         | Network 2018.1  |                                                                                     |

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

| PN     | US/MH<br>Name | Water        |              | Surcharged     |                | Flooded           |               | Pipe        |  | Status | Level<br>Exceeded |
|--------|---------------|--------------|--------------|----------------|----------------|-------------------|---------------|-------------|--|--------|-------------------|
|        |               | Level<br>(m) | Depth<br>(m) | Volume<br>(m³) | Flow /<br>Cap. | Overflow<br>(l/s) | Flow<br>(l/s) |             |  |        |                   |
| S1.000 | SS1           | 3.025        | 0.350        | 0.000          | 0.28           |                   | 7.9           | FLOOD RISK  |  |        |                   |
| S1.001 | SS2           | 3.014        | 0.391        | 0.000          | 0.25           |                   | 7.4           | FLOOD RISK  |  |        |                   |
| S1.002 | SS3           | 3.000        | 0.457        | 0.000          | 0.45           |                   | 13.1          | FLOOD RISK  |  |        |                   |
| S2.000 | SSW1          | 2.927        | -0.331       | 0.000          | 0.01           |                   | 5.3           | OK          |  |        |                   |
| S2.001 | SSW2          | 2.927        | 0.133        | 0.000          | 0.09           |                   | 3.3           | FLOOD RISK* |  |        |                   |
| S2.002 | SSW3          | 2.926        | -0.133       | 0.000          | 0.01           |                   | 6.6           | FLOOD RISK* |  |        |                   |
| S2.003 | SSW4          | 2.926        | 0.395        | 20.700         | 0.11           |                   | 3.9           | FLOOD       |  |        | 11                |
| S1.003 | SS4           | 2.979        | 0.512        | 0.000          | 0.39           |                   | 12.0          | FLOOD RISK  |  |        |                   |
| S1.004 | SS5           | 3.100        | 0.790        | 0.453          | 0.28           |                   | 8.6           | FLOOD       |  |        | 2                 |
| S1.005 | SS6           | 3.100        | 0.894        | 0.601          | 0.22           |                   | 5.8           | FLOOD       |  |        | 8                 |
| S1.006 | SS7           | 3.100        | 0.928        | 0.906          | 0.16           |                   | 3.9           | FLOOD       |  |        | 10                |

|                        |                 |                                                                                     |
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| William Saunders       |                 | Page 15                                                                             |
| Sheppard Lockton House | 11748           |  |
| Cafferata Way          | Cob Gate        |                                                                                     |
| Newark NG24 2TN        | Whaplode        |                                                                                     |
| Date 27/06/2018        | Designed by PAE |                                                                                     |
| File 18.06.27.MDX      | Checked by      |                                                                                     |
| Micro Drainage         | Network 2018.1  |                                                                                     |

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

|        |            |            |               |                |                     |                 |                    |               |  | Water     |
|--------|------------|------------|---------------|----------------|---------------------|-----------------|--------------------|---------------|--|-----------|
| PN     | US/MH Name | Storm      | Return Period | Climate Change | First (X) Surcharge | First (Y) Flood | First (Z) Overflow | Overflow Act. |  | Level (m) |
| S3.000 | SSW5       | 60 Winter  | 100           | +40%           |                     |                 |                    |               |  | 2.826     |
| S3.001 | SSW6       | 60 Winter  | 100           | +40%           | 100/60 Winter       |                 |                    |               |  | 2.826     |
| S3.002 | SSW7       | 60 Winter  | 100           | +40%           |                     |                 |                    |               |  | 2.839     |
| S3.003 | SSW8       | 60 Winter  | 100           | +40%           | 30/60 Summer        |                 |                    |               |  | 2.839     |
| S3.004 | SS8        | 360 Winter | 100           | +40%           |                     |                 |                    |               |  | 2.534     |
| S3.005 | SS9        | 480 Winter | 100           | +40%           |                     |                 |                    |               |  | 2.432     |

|        |            | Surcharged |             | Flooded     |                |            | Pipe        |                |  |
|--------|------------|------------|-------------|-------------|----------------|------------|-------------|----------------|--|
| PN     | US/MH Name | Depth (m)  | Volume (m³) | Flow / Cap. | Overflow (l/s) | Flow (l/s) | Status      | Level Exceeded |  |
| S3.000 | SSW5       | -0.432     | 0.000       | 0.01        |                | 7.3        | OK          |                |  |
| S3.001 | SSW6       | 0.029      | 0.000       | 0.14        |                | 5.2        | SURCHARGED* |                |  |
| S3.002 | SSW7       | -0.318     | 0.000       | 0.02        |                | 21.2       | OK          |                |  |
| S3.003 | SSW8       | 0.244      | 0.000       | 0.39        |                | 13.6       | FLOOD RISK* |                |  |
| S3.004 | SS8        | 0.000      | 0.000       | 0.19        |                | 6.9        | SURCHARGED* |                |  |
| S3.005 | SS9        | 0.000      | 0.000       | 0.13        |                | 4.0        | SURCHARGED* |                |  |

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