



**Banners Gate Limited**  
**10-11 Birmingham Street**  
**Halesowen**  
**B63 3HN**

**File: NETWORK 01 - 2022.08.24.PFD**  
**Network: Storm Network 1**  
**Oliver Bayley**  
**24/08/2022**

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**Surface Water Highway Network**

**Design Settings**

|                                      |        |                                    |               |
|--------------------------------------|--------|------------------------------------|---------------|
| Rainfall Methodology                 | FEH-13 | Minimum Velocity (m/s)             | 1.00          |
| Return Period (years)                | 30     | Connection Type                    | Level Soffits |
| Additional Flow (%)                  | 0      | Minimum Backdrop Height (m)        | 1.800         |
| CV                                   | 0.840  | Preferred Cover Depth (m)          | 1.200         |
| Time of Entry (mins)                 | 4.00   | Include Intermediate Ground        | ✓             |
| Maximum Time of Concentration (mins) | 30.00  | Enforce best practice design rules | ✓             |
| Maximum Rainfall (mm/hr)             | 500.0  |                                    |               |

**Nodes**

| <b>Name</b> | <b>Area<br/>(ha)</b> | <b>T of E<br/>(mins)</b> | <b>Cover<br/>Level<br/>(m)</b> | <b>Diameter<br/>(mm)</b> | <b>Depth<br/>(m)</b> |
|-------------|----------------------|--------------------------|--------------------------------|--------------------------|----------------------|
| HD02        | 0.013                | 4.00                     | 108.443                        | 1350                     | 1.443                |
| HD04        | 0.065                | 4.00                     | 108.246                        | 1350                     | 1.446                |
| HD06        | 0.021                | 4.00                     | 107.803                        | 1350                     | 1.453                |
| HD08        | 0.046                | 4.00                     | 107.689                        | 1350                     | 1.539                |
| HD10        | 0.051                | 4.00                     | 107.338                        | 1350                     | 1.538                |
| HD12        | 0.024                | 4.00                     | 106.788                        | 1350                     | 1.538                |
| HD14        | 0.023                | 4.00                     | 108.213                        | 1350                     | 1.463                |
| HD16        | 0.037                | 4.00                     | 107.608                        | 1350                     | 1.458                |
| HD18        | 0.025                | 4.00                     | 106.644                        | 1350                     | 1.594                |
| HD20        | 0.015                | 4.00                     | 105.893                        | 1350                     | 1.543                |
| HD22        | 0.027                | 4.00                     | 105.372                        | 1350                     | 1.522                |
| HD24        | 0.084                | 4.00                     | 103.966                        | 1350                     | 1.516                |
| BASIN       |                      |                          | 103.200                        | 100                      | 0.900                |



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Links

| Name  | US Node | DS Node | Length (m) | US IL (m) | DS IL (m) | Slope (1:X) | Dia (mm) | T of C (mins) | Rain (mm/hr) |
|-------|---------|---------|------------|-----------|-----------|-------------|----------|---------------|--------------|
| 1.000 | HD02    | HD04    | 17.256     | 107.000   | 106.800   | 86.3        | 225      | 4.15          | 139.9        |
| 1.001 | HD04    | HD06    | 44.675     | 106.800   | 106.350   | 99.3        | 225      | 4.85          | 139.9        |
| 1.002 | HD06    | HD08    | 11.370     | 106.350   | 106.225   | 91.0        | 225      | 4.96          | 139.9        |
| 1.003 | HD08    | HD10    | 34.804     | 106.150   | 105.800   | 99.4        | 300      | 5.40          | 136.0        |
| 1.004 | HD10    | HD12    | 53.659     | 105.800   | 105.250   | 97.6        | 300      | 5.91          | 131.0        |
| 1.005 | HD12    | HD18    | 21.123     | 105.250   | 105.050   | 105.6       | 300      | 6.26          | 127.9        |
| 2.000 | HD14    | HD16    | 20.232     | 106.750   | 106.150   | 33.7        | 225      | 4.15          | 139.9        |
| 2.001 | HD16    | HD18    | 32.073     | 106.150   | 105.125   | 31.3        | 225      | 4.38          | 139.9        |
| 1.006 | HD18    | HD20    | 19.381     | 105.050   | 104.350   | 27.7        | 300      | 6.35          | 127.1        |
| 1.007 | HD20    | HD22    | 10.260     | 104.350   | 103.850   | 20.5        | 300      | 6.40          | 126.7        |
| 1.008 | HD22    | HD24    | 28.485     | 103.850   | 102.450   | 20.3        | 300      | 6.51          | 125.7        |
| 1.009 | HD24    | BASIN   | 15.121     | 102.450   | 102.300   | 100.8       | 300      | 6.55          | 125.4        |

| Name  | Vel (m/s) | Cap (l/s) | Flow (l/s) | Σ Area (ha) | Σ Add Inflow (l/s) |
|-------|-----------|-----------|------------|-------------|--------------------|
| 1.000 | 1.408     | 56.0      | 5.5        | 0.013       | 0.0                |
| 1.001 | 1.312     | 52.2      | 33.1       | 0.078       | 0.0                |
| 1.002 | 1.371     | 54.5      | 42.0       | 0.099       | 0.0                |
| 1.003 | 1.576     | 111.4     | 59.9       | 0.145       | 0.0                |
| 1.004 | 1.592     | 112.5     | 77.9       | 0.196       | 0.0                |
| 1.005 | 1.529     | 108.1     | 85.4       | 0.220       | 0.0                |
| 2.000 | 2.260     | 89.9      | 9.8        | 0.023       | 0.0                |
| 2.001 | 2.347     | 93.3      | 25.5       | 0.060       | 0.0                |
| 1.006 | 2.999     | 212.0     | 117.7      | 0.305       | 0.0                |
| 1.007 | 3.486     | 246.4     | 123.1      | 0.320       | 0.0                |
| 1.008 | 3.501     | 247.4     | 132.4      | 0.347       | 0.0                |
| 1.009 | 1.566     | 110.7     | 164.1      | 0.431       | 0.0                |



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**Simulation Settings**

|                      |        |                        |          |   |     |
|----------------------|--------|------------------------|----------|---|-----|
| Rainfall Methodology | FEH-13 | Analysis Speed         | Detailed | Additional Storage (m <sup>3</sup> /ha) | 0.0 |
| Summer CV            | 0.840  | Skip Steady State      | x        | Check Discharge Rate(s)                 | x   |
| Winter CV            | 0.750  | Drain Down Time (mins) | 1440     | Check Discharge Volume                  | x   |

**Storm Durations**

15 | 30 | 60 | 120 | 180 | 240 | 360 | 480 | 600 | 720 | 960 | 1440

| Return Period (years) | Climate Change (CC %) | Additional Area (A %) | Additional Flow (Q %) | Return Period (years) | Climate Change (CC %) | Additional Area (A %) | Additional Flow (Q %) |
|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| 2                     | 0                     | 0                     | 0                     | 100                   | 40                    | 0                     | 0                     |
| 30                    | 0                     | 0                     | 0                     |                       |                       |                       |                       |

**Node BASIN Depth/Area Storage Structure**

|                             |         |               |      |                           |         |
|-----------------------------|---------|---------------|------|---------------------------|---------|
| Base Inf Coefficient (m/hr) | 1.76400 | Safety Factor | 10.0 | Invert Level (m)          | 102.000 |
| Side Inf Coefficient (m/hr) | 1.76400 | Porosity      | 1.00 | Time to half empty (mins) | 159     |

| Depth (m) | Area (m <sup>2</sup> ) | Inf Area (m <sup>2</sup> ) | Depth (m) | Area (m <sup>2</sup> ) | Inf Area (m <sup>2</sup> ) |
|-----------|------------------------|----------------------------|-----------|------------------------|----------------------------|
| 0.000     | 148.5                  | 148.5                      | 1.200     | 511.1                  | 511.1                      |



**Results for 2 year Critical Storm Duration. Lowest mass balance: 99.83%**

| <b>Node Event</b> | <b>US Node</b> | <b>Peak (mins)</b> | <b>Level (m)</b> | <b>Depth (m)</b> | <b>Inflow (l/s)</b> | <b>Node Vol (m³)</b> | <b>Flood (m³)</b> | <b>Status</b> |
|-------------------|----------------|--------------------|------------------|------------------|---------------------|----------------------|-------------------|---------------|
| 15 minute summer  | HD02           | 10                 | 107.031          | 0.031            | 2.3                 | 0.0443               | 0.0000            | OK            |
| 15 minute summer  | HD04           | 10                 | 106.878          | 0.078            | 13.6                | 0.1112               | 0.0000            | OK            |
| 15 minute summer  | HD06           | 10                 | 106.442          | 0.092            | 17.1                | 0.1317               | 0.0000            | OK            |
| 15 minute summer  | HD08           | 10                 | 106.247          | 0.097            | 24.7                | 0.1382               | 0.0000            | OK            |
| 15 minute summer  | HD10           | 10                 | 105.910          | 0.110            | 33.4                | 0.1579               | 0.0000            | OK            |
| 15 minute summer  | HD12           | 11                 | 105.378          | 0.128            | 36.3                | 0.1825               | 0.0000            | OK            |
| 15 minute summer  | HD14           | 10                 | 106.782          | 0.032            | 4.0                 | 0.0462               | 0.0000            | OK            |
| 15 minute summer  | HD16           | 10                 | 106.201          | 0.051            | 10.4                | 0.0735               | 0.0000            | OK            |
| 15 minute summer  | HD18           | 11                 | 105.154          | 0.104            | 49.5                | 0.1487               | 0.0000            | OK            |
| 15 minute summer  | HD20           | 11                 | 104.454          | 0.104            | 52.1                | 0.1482               | 0.0000            | OK            |
| 15 minute summer  | HD22           | 11                 | 103.947          | 0.097            | 56.3                | 0.1384               | 0.0000            | OK            |
| 15 minute summer  | HD24           | 11                 | 102.641          | 0.191            | 68.6                | 0.2727               | 0.0000            | OK            |
| 120 minute summer | BASIN          | 82                 | 102.167          | -0.133           | 31.6                | 29.0103              | 0.0000            | OK            |

| <b>Link Event (Upstream Depth)</b> | <b>US Node</b> | <b>Link</b>  | <b>DS Node</b> | <b>Outflow (l/s)</b> | <b>Velocity (m/s)</b> | <b>Flow/Cap</b> | <b>Link Vol (m³)</b> |
|------------------------------------|----------------|--------------|----------------|----------------------|-----------------------|-----------------|----------------------|
| 15 minute summer                   | HD02           | 1.000        | HD04           | 2.3                  | 0.312                 | 0.041           | 0.1330               |
| 15 minute summer                   | HD04           | 1.001        | HD06           | 13.5                 | 0.990                 | 0.260           | 0.6120               |
| 15 minute summer                   | HD06           | 1.002        | HD08           | 16.7                 | 1.157                 | 0.307           | 0.1647               |
| 15 minute summer                   | HD08           | 1.003        | HD10           | 24.5                 | 1.137                 | 0.219           | 0.7494               |
| 15 minute summer                   | HD10           | 1.004        | HD12           | 32.3                 | 1.262                 | 0.287           | 1.3842               |
| 15 minute summer                   | HD12           | 1.005        | HD18           | 36.6                 | 1.459                 | 0.338           | 0.5299               |
| 15 minute summer                   | HD14           | 2.000        | HD16           | 4.0                  | 0.797                 | 0.044           | 0.1040               |
| 15 minute summer                   | HD16           | 2.001        | HD18           | 10.3                 | 1.541                 | 0.111           | 0.2152               |
| 15 minute summer                   | HD18           | 1.006        | HD20           | 50.0                 | 2.313                 | 0.236           | 0.4187               |
| 15 minute summer                   | HD20           | 1.007        | HD22           | 52.4                 | 2.547                 | 0.213           | 0.2112               |
| 15 minute summer                   | HD22           | 1.008        | HD24           | 56.5                 | 1.696                 | 0.228           | 0.9517               |
| 15 minute summer                   | HD24           | 1.009        | BASIN          | 69.2                 | 1.567                 | 0.626           | 0.6677               |
| 120 minute summer                  | BASIN          | Infiltration |                | 9.1                  |                       |                 |                      |



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**Results for 30 year Critical Storm Duration. Lowest mass balance: 99.83%**

| Node Event       | US Node | Peak (mins) | Level (m) | Depth (m) | Inflow (l/s) | Node Vol (m³) | Flood (m³) | Status     |
|------------------|---------|-------------|-----------|-----------|--------------|---------------|------------|------------|
| 15 minute summer | HD02    | 10          | 107.048   | 0.048     | 5.7          | 0.0690        | 0.0000     | OK         |
| 15 minute summer | HD04    | 10          | 106.934   | 0.134     | 34.3         | 0.1920        | 0.0000     | OK         |
| 15 minute summer | HD06    | 10          | 106.520   | 0.170     | 43.6         | 0.2426        | 0.0000     | OK         |
| 15 minute summer | HD08    | 10          | 106.319   | 0.169     | 63.1         | 0.2415        | 0.0000     | OK         |
| 15 minute summer | HD10    | 10          | 105.999   | 0.199     | 85.1         | 0.2843        | 0.0000     | OK         |
| 15 minute summer | HD12    | 11          | 105.483   | 0.233     | 93.8         | 0.3340        | 0.0000     | OK         |
| 15 minute summer | HD14    | 10          | 106.801   | 0.051     | 10.1         | 0.0726        | 0.0000     | OK         |
| 15 minute summer | HD16    | 9           | 106.232   | 0.082     | 26.4         | 0.1174        | 0.0000     | OK         |
| 15 minute summer | HD18    | 10          | 105.234   | 0.184     | 127.4        | 0.2627        | 0.0000     | OK         |
| 15 minute summer | HD20    | 11          | 104.536   | 0.186     | 132.3        | 0.2657        | 0.0000     | OK         |
| 15 minute summer | HD22    | 11          | 104.033   | 0.183     | 143.0        | 0.2613        | 0.0000     | OK         |
| 15 minute summer | HD24    | 11          | 103.136   | 0.686     | 176.4        | 0.9820        | 0.0000     | SURCHARGED |
| 60 minute summer | BASIN   | 57          | 102.407   | 0.107     | 111.6        | 85.5470       | 0.0000     | OK         |

| Link Event<br>(Upstream Depth) | US Node | Link         | DS Node | Outflow (l/s) | Velocity (m/s) | Flow/Cap | Link Vol (m³) |
|--------------------------------|---------|--------------|---------|---------------|----------------|----------|---------------|
| 15 minute summer               | HD02    | 1.000        | HD04    | 5.7           | 0.378          | 0.102    | 0.2666        |
| 15 minute summer               | HD04    | 1.001        | HD06    | 34.4          | 1.207          | 0.659    | 1.2684        |
| 15 minute summer               | HD06    | 1.002        | HD08    | 42.9          | 1.430          | 0.788    | 0.3410        |
| 15 minute summer               | HD08    | 1.003        | HD10    | 62.7          | 1.387          | 0.563    | 1.5721        |
| 15 minute summer               | HD10    | 1.004        | HD12    | 83.2          | 1.542          | 0.739    | 2.8873        |
| 15 minute summer               | HD12    | 1.005        | HD18    | 93.4          | 1.792          | 0.864    | 1.0978        |
| 15 minute summer               | HD14    | 2.000        | HD16    | 10.1          | 1.040          | 0.112    | 0.1989        |
| 15 minute summer               | HD16    | 2.001        | HD18    | 26.4          | 1.893          | 0.283    | 0.5117        |
| 15 minute summer               | HD18    | 1.006        | HD20    | 126.9         | 2.793          | 0.599    | 0.8811        |
| 15 minute summer               | HD20    | 1.007        | HD22    | 133.2         | 3.023          | 0.541    | 0.4651        |
| 15 minute summer               | HD22    | 1.008        | HD24    | 144.6         | 2.256          | 0.584    | 1.6423        |
| 15 minute summer               | HD24    | 1.009        | BASIN   | 177.5         | 2.521          | 1.604    | 1.0540        |
| 60 minute summer               | BASIN   | Infiltration |         | 12.8          |                |          |               |



**Results for 100 year +40% CC Critical Storm Duration. Lowest mass balance: 99.83%**

| <b>Node Event</b> | <b>US Node</b> | <b>Peak (mins)</b> | <b>Level (m)</b> | <b>Depth (m)</b> | <b>Inflow (l/s)</b> | <b>Node Vol (m<sup>3</sup>)</b> | <b>Flood (m<sup>3</sup>)</b> | <b>Status</b> |
|-------------------|----------------|--------------------|------------------|------------------|---------------------|---------------------------------|------------------------------|---------------|
| 15 minute summer  | HD02           | 11                 | 107.612          | 0.612            | 12.9                | 0.8760                          | 0.0000                       | SURCHARGED    |
| 15 minute summer  | HD04           | 11                 | 107.624          | 0.824            | 59.2                | 1.1785                          | 0.0000                       | SURCHARGED    |
| 15 minute summer  | HD06           | 11                 | 107.272          | 0.922            | 63.6                | 1.3191                          | 0.0000                       | SURCHARGED    |
| 15 minute summer  | HD08           | 11                 | 107.105          | 0.955            | 99.0                | 1.3666                          | 0.0000                       | SURCHARGED    |
| 15 minute summer  | HD10           | 11                 | 106.890          | 1.090            | 131.3               | 1.5595                          | 0.0000                       | SURCHARGED    |
| 15 minute summer  | HD12           | 11                 | 106.292          | 1.042            | 127.1               | 1.4912                          | 0.0000                       | SURCHARGED    |
| 15 minute summer  | HD14           | 10                 | 106.819          | 0.069            | 18.3                | 0.0981                          | 0.0000                       | OK            |
| 15 minute summer  | HD16           | 11                 | 106.269          | 0.119            | 47.7                | 0.1700                          | 0.0000                       | OK            |
| 15 minute summer  | HD18           | 11                 | 105.952          | 0.902            | 187.3               | 1.2908                          | 0.0000                       | SURCHARGED    |
| 15 minute summer  | HD20           | 11                 | 105.306          | 0.956            | 190.4               | 1.3680                          | 0.0000                       | SURCHARGED    |
| 15 minute summer  | HD22           | 11                 | 104.853          | 1.003            | 198.5               | 1.4350                          | 0.0000                       | SURCHARGED    |
| 15 minute summer  | HD24           | 11                 | 103.710          | 1.260            | 252.6               | 1.8034                          | 0.0000                       | FLOOD RISK    |
| 120 minute summer | BASIN          | 98                 | 102.688          | 0.388            | 131.8               | 173.7317                        | 0.0000                       | OK            |

| <b>Link Event (Upstream Depth)</b> | <b>US Node</b> | <b>Link</b>  | <b>DS Node</b> | <b>Outflow (l/s)</b> | <b>Velocity (m/s)</b> | <b>Flow/Cap</b> | <b>Link Vol (m<sup>3</sup>)</b> |
|------------------------------------|----------------|--------------|----------------|----------------------|-----------------------|-----------------|---------------------------------|
| 15 minute summer                   | HD02           | 1.000        | HD04           | 14.8                 | 0.398                 | 0.265           | 0.6863                          |
| 15 minute summer                   | HD04           | 1.001        | HD06           | 46.9                 | 1.278                 | 0.900           | 1.7768                          |
| 15 minute summer                   | HD06           | 1.002        | HD08           | 62.6                 | 1.574                 | 1.147           | 0.4522                          |
| 15 minute summer                   | HD08           | 1.003        | HD10           | 90.8                 | 1.387                 | 0.815           | 2.4509                          |
| 15 minute summer                   | HD10           | 1.004        | HD12           | 108.7                | 1.544                 | 0.966           | 3.7786                          |
| 15 minute summer                   | HD12           | 1.005        | HD18           | 122.8                | 1.873                 | 1.136           | 1.4875                          |
| 15 minute summer                   | HD14           | 2.000        | HD16           | 18.3                 | 1.222                 | 0.204           | 0.3140                          |
| 15 minute summer                   | HD16           | 2.001        | HD18           | 45.9                 | 1.973                 | 0.492           | 0.9785                          |
| 15 minute summer                   | HD18           | 1.006        | HD20           | 178.5                | 2.756                 | 0.842           | 1.3648                          |
| 15 minute summer                   | HD20           | 1.007        | HD22           | 185.7                | 3.065                 | 0.754           | 0.7225                          |
| 15 minute summer                   | HD22           | 1.008        | HD24           | 201.4                | 2.860                 | 0.814           | 2.0059                          |
| 15 minute summer                   | HD24           | 1.009        | BASIN          | 253.0                | 3.594                 | 2.287           | 1.0540                          |
| 120 minute summer                  | BASIN          | Infiltration |                | 17.1                 |                       |                 |                                 |