## Existing Network Details for Foul - Main

| PN | Length (m) | Fall (m) | Slope (1:X) | I.Area (ha) | T.E. (mins) | Base Flow (l/s) | k (mm) | HYD SECT | DIA (mm) | Section Type |
|---|---|---|---|---|---|---|---|---|---|---|
| F1.000 | 29.947 | 0.499 | 60.0 | 0.000 | 5.00 | 0.1 | 1.500 | o | 225 | Pipe/Conduit |
| F1.001 | 17.355 | 0.289 | 60.1 | 0.000 | 0.00 | 0.1 | 1.500 | o | 225 | Pipe/Conduit |
| F1.002 | 12.882 | 0.215 | 59.9 | 0.000 | 0.00 | 0.0 | 1.500 | o | 225 | Pipe/Conduit |
| F2.000 | 34.519 | 0.777 | 44.4 | 0.000 | 5.00 | 0.2 | 1.500 | o | 225 | Pipe/Conduit |
| F1.003 | 61.036 | 0.763 | 80.0 | 0.000 | 0.00 | 0.4 | 1.500 | o | 225 | Pipe/Conduit |
| F3.000 | 53.673 | 1.579 | 34.0 | 0.000 | 5.00 | 0.3 | 1.500 | o | 225 | Pipe/Conduit |

## Network Results Table

| PN | US/IL (m) | Σ I.Area (ha) | Σ Base Flow (l/s) | Vel (m/s) | Cap (l/s) |
|---|---|---|---|---|---|
| F1.000 | 120.985 | 0.000 | 0.1 | 1.48 | 59.0 |
| F1.001 | 120.486 | 0.000 | 0.2 | 1.48 | 59.0 |
| F1.002 | 118.775 | 0.000 | 0.2 | 1.48 | 59.0 |
| F2.000 | 119.325 | 0.000 | 0.2 | 1.72 | 68.6 |
| F1.003 | 118.560 | 0.000 | 0.7 | 1.28 | 51.1 |
| F3.000 | 119.376 | 0.000 | 0.3 | 1.97 | 78.4 |

## Existing Network Details for Foul - Main

| PN | Length (m) | Fall (m) | Slope (1:X) | I.Area (ha) | T.E. (mins) | Base Flow (l/s) | k (mm) | HYD SECT | DIA (mm) | Section Type |
|---|---|---|---|---|---|---|---|---|---|---|
| F4.000 | 36.460 | 1.053 | 34.6 | 0.000 | 5.00 | 0.3 | 1.500 | o | 225 | Pipe/Conduit |
| F1.004 | 38.376 | 0.203 | 189.0 | 0.000 | 0.00 | 0.2 | 1.500 | o | 225 | Pipe/Conduit |
| F1.005 | 14.168 | 0.075 | 189.0 | 0.000 | 0.00 | 0.1 | 1.500 | o | 225 | Pipe/Conduit |
| F1.006 | 19.050 | 0.314 | 60.7 | 0.000 | 0.00 | 0.2 | 1.500 | o | 225 | Pipe/Conduit |
| F5.000 | 46.044 | 2.348 | 19.6 | 0.000 | 5.00 | 0.2 | 1.500 | o | 225 | Pipe/Conduit |
| F1.007 | 25.575 | 1.174 | 21.8 | 0.000 | 0.00 | 0.1 | 1.500 | o | 225 | Pipe/Conduit |
| F1.008 | 38.723 | 2.460 | 15.7 | 0.000 | 0.00 | 0.3 | 1.500 | o | 225 | Pipe/Conduit |

## Network Results Table

| PN | US/IL (m) | Σ I.Area (ha) | Σ Base Flow (l/s) | Vel (m/s) | Cap (l/s) |
|---|---|---|---|---|---|
| F4.000 | 118.850 | 0.000 | 0.3 | 1.95 | 77.7 |
| F1.004 | 117.797 | 0.000 | 1.5 | 0.83 | 33.1 |
| F1.005 | 117.594 | 0.000 | 1.5 | 0.83 | 33.1 |
| F1.006 | 117.519 | 0.000 | 1.7 | 1.48 | 58.7 |
| F5.000 | 120.011 | 0.000 | 0.2 | 2.60 | 103.3 |
| F1.007 | 117.205 | 0.000 | 2.1 | 2.47 | 98.0 |
| F1.008 | 116.031 | 0.000 | 2.4 | 2.90 | 115.4 |

## Existing Network Details for Foul - Main

| PN | Length (m) | Fall (m) | Slope (1:X) | I.Area (ha) | T.E. (mins) | Base Flow (l/s) | k (mm) | HYD SECT | DIA (mm) | Section Type |
|---|---|---|---|---|---|---|---|---|---|---|
| F1.009 | 21.189 | 0.918 | 23.1 | 0.000 | 0.00 | 0.3 | 1.500 | o | 225 | Pipe/Conduit |
| F6.000 | 50.261 | 1.140 | 44.1 | 0.000 | 5.00 | 0.4 | 1.500 | o | 225 | Pipe/Conduit |
| F6.001 | 22.860 | 0.523 | 43.7 | 0.000 | 0.00 | 0.1 | 1.500 | o | 225 | Pipe/Conduit |
| F7.000 | 29.693 | 1.188 | 25.0 | 0.000 | 5.00 | 0.2 | 1.500 | o | 225 | Pipe/Conduit |
| F7.001 | 21.057 | 0.880 | 23.9 | 0.000 | 0.00 | 0.1 | 1.500 | o | 225 | Pipe/Conduit |
| F6.002 | 10.927 | 0.380 | 28.8 | 0.000 | 0.00 | 0.1 | 1.500 | o | 225 | Pipe/Conduit |
| F6.003 | 16.379 | 0.199 | 82.3 | 0.000 | 0.00 | 0.0 | 1.500 | o | 225 | Pipe/Conduit |

## Network Results Table

| PN | US/IL (m) | Σ I.Area (ha) | Σ Base Flow (l/s) | Vel (m/s) | Cap (l/s) |
|---|---|---|---|---|---|
| F1.009 | 113.571 | 0.000 | 2.6 | 2.39 | 95.2 |
| F6.000 | 117.373 | 0.000 | 0.4 | 1.73 | 68.9 |
| F6.001 | 115.920 | 0.000 | 0.5 | 1.74 | 69.1 |
| F7.000 | 117.778 | 0.000 | 0.2 | 2.30 | 91.5 |
| F7.001 | 116.590 | 0.000 | 0.3 | 2.35 | 93.5 |
| F6.002 | 115.397 | 0.000 | 0.9 | 2.15 | 85.3 |
| F6.003 | 115.017 | 0.000 | 0.9 | 1.27 | 50.3 |

## Existing Network Details for Foul - Main

| PN | Length (m) | Fall (m) | Slope (1:X) | I.Area (ha) | T.E. (mins) | Base Flow (l/s) | k (mm) | HYD SECT | DIA (mm) | Section Type |
|---|---|---|---|---|---|---|---|---|---|---|
| F8.000 | 74.944 | 1.500 | 50.0 | 0.000 | 5.00 | 0.4 | 1.500 | o | 225 | Pipe/Conduit |
| F6.004 | 17.208 | 0.319 | 53.9 | 0.000 | 0.00 | 0.0 | 1.500 | o | 225 | Pipe/Conduit |
| F6.005 | 27.110 | 0.559 | 48.5 | 0.000 | 0.00 | 0.1 | 1.500 | o | 225 | Pipe/Conduit |
| F6.006 | 23.807 | 0.749 | 31.8 | 0.000 | 0.00 | 0.1 | 1.500 | o | 225 | Pipe/Conduit |
| F6.007 | 15.194 | 0.576 | 26.4 | 0.000 | 0.00 | 0.0 | 1.500 | o | 225 | Pipe/Conduit |
| F1.010 | 32.780 | 0.998 | 32.8 | 0.000 | 0.00 | 0.0 | 1.500 | o | 225 | Pipe/Conduit |
| F1.011 | 53.685 | 2.868 | 18.7 | 0.000 | 0.00 | 0.0 | 1.500 | o | 225 | Pipe/Conduit |

## Network Results Table

| PN | US/IL (m) | Σ I.Area (ha) | Σ Base Flow (l/s) | Vel (m/s) | Cap (l/s) |
|---|---|---|---|---|---|
| F8.000 | 116.631 | 0.000 | 0.4 | 1.63 | 64.7 |
| F6.004 | 114.818 | 0.000 | 1.3 | 1.56 | 62.2 |
| F6.005 | 114.499 | 0.000 | 1.4 | 1.65 | 65.6 |
| F6.006 | 113.940 | 0.000 | 1.5 | 2.04 | 81.1 |
| F6.007 | 113.191 | 0.000 | 1.5 | 2.24 | 89.1 |
| F1.010 | 112.398 | 0.000 | 4.1 | 2.01 | 79.8 |
| F1.011 | 111.400 | 0.000 | 4.1 | 2.66 | 105.8 |

## Existing Network Details for Foul - Main

| PN | Length (m) | Fall (m) | Slope (1:X) | I.Area (ha) | T.E. (mins) | Base Flow (l/s) | k (mm) | HYD SECT | DIA (mm) | Section Type |
|---|---|---|---|---|---|---|---|---|---|---|
| F1.012 | 38.476 | 1.977 | 19.5 | 0.000 | 0.00 | 0.0 | 1.500 | o | 225 | Pipe/Conduit |
| F1.013 | 14.946 | 0.217 | 68.9 | 0.000 | 0.00 | 0.0 | 1.500 | o | 225 | Pipe/Conduit |

## Network Results Table

| PN | US/IL (m) | Σ I.Area (ha) | Σ Base Flow (l/s) | Vel (m/s) | Cap (l/s) |
|---|---|---|---|---|---|
| F1.012 | 108.532 | 0.000 | 4.1 | 2.61 | 103.7 |
| F1.013 | 106.555 | 0.000 | 4.1 | 1.38 | 55.0 |

## Manhole Schedules for Foul - Main

| MH Name | MH CL (m) | MH Depth (m) | MH Connection | MH Diam.,L*W (mm) | Pipe Out PN | Pipe Out Invert Level (m) | Pipe Out Diameter (mm) | Pipes In PN | Pipes In Invert Level (m) | Pipes In Diameter (mm) | Backdrop (mm) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| F5 | 123.190 | 2.205 | Open Manhole | 1200 | F1.000 | 120.985 | 225 | | | | |
| F6 | 122.332 | 1.846 | Open Manhole | 1200 | F1.001 | 120.486 | 225 | F1.000 | 120.486 | 225 | |
| F8 | 121.828 | 3.053 | Open Manhole | 1200 | F1.002 | 118.775 | 225 | F1.001 | 120.197 | 225 | 1422 |
| F12 | 120.950 | 1.625 | Open Manhole | 1200 | F2.000 | 119.325 | 225 | | | | |
| F13 | 121.436 | 2.888 | Open Manhole | 1200 | F1.003 | 118.560 | 225 | F1.002 | 118.560 | 225 | |
| | | | | | | | | F2.000 | 118.548 | 225 | |
| F14 | 123.017 | 3.641 | Open Manhole | 1200 | F3.000 | 119.376 | 225 | | | | |
| F15A | 120.275 | 1.425 | Open Manhole | 1200 | F4.000 | 118.850 | 225 | | | | |
| F15 | 120.107 | 2.310 | Open Manhole | 1200 | F1.004 | 117.797 | 225 | F1.003 | 117.797 | 225 | |
| | | | | | | | | F3.000 | 117.797 | 225 | |
| | | | | | | | | F4.000 | 117.797 | 225 | |
| F16 | 119.577 | 1.983 | Open Manhole | 1200 | F1.005 | 117.594 | 225 | F1.004 | 117.594 | 225 | |
| F17 | 119.402 | 1.883 | Open Manhole | 1200 | F1.006 | 117.519 | 225 | F1.005 | 117.519 | 225 | |
| F18 | 121.630 | 1.619 | Open Manhole | 1200 | F5.000 | 120.011 | 225 | | | | |
| F19 | 119.088 | 1.883 | Open Manhole | 1200 | F1.007 | 117.205 | 225 | F1.006 | 117.205 | 225 | |
| | | | | | | | | F5.000 | 117.663 | 225 | 458 |
| F20 | 118.031 | 2.000 | Open Manhole | 1200 | F1.008 | 116.031 | 225 | F1.007 | 116.031 | 225 | |
| F21 | 115.271 | 1.700 | Open Manhole | 1200 | F1.009 | 113.571 | 225 | F1.008 | 113.571 | 225 | |
| F22 | 118.971 | 1.598 | Open Manhole | 1200 | F6.000 | 117.373 | 225 | | | | |

## Manhole Schedules for Foul - Main

| MH Name | MH CL (m) | MH Depth (m) | MH Connection | MH Diam.,L*W (mm) | Pipe Out PN | Pipe Out Invert Level (m) | Pipe Out Diameter (mm) | Pipes In PN | Pipes In Invert Level (m) | Pipes In Diameter (mm) | Backdrop (mm) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| F23 | 117.698 | 1.778 | Open Manhole | 1200 | F6.001 | 115.920 | 225 | F6.000 | 116.233 | 225 | 313 |
| F24 | 119.912 | 2.134 | Open Manhole | 1200 | F7.000 | 117.778 | 225 | | | | |
| F25 | 118.015 | 1.425 | Open Manhole | 1200 | F7.001 | 116.590 | 225 | F7.000 | 116.590 | 225 | |
| F26 | 117.135 | 1.738 | Open Manhole | 1200 | F6.002 | 115.397 | 225 | F6.001 | 115.397 | 225 | |
| | | | | | | | | F7.001 | 115.710 | 225 | 313 |
| F27 | 116.755 | 1.738 | Open Manhole | 1200 | F6.003 | 115.017 | 225 | F6.002 | 115.017 | 225 | |
| F28 | 118.056 | 1.425 | Open Manhole | 1200 | F8.000 | 116.631 | 225 | | | | |
| F29 | 116.641 | 1.823 | Open Manhole | 1200 | F6.004 | 114.818 | 225 | F6.003 | 114.818 | 225 | |
| | | | | | | | | F8.000 | 115.131 | 225 | 313 |
| F30 | 116.237 | 1.738 | Open Manhole | 1200 | F6.005 | 114.499 | 225 | F6.004 | 114.499 | 225 | |
| F31 | 115.678 | 1.738 | Open Manhole | 1200 | F6.006 | 113.940 | 225 | F6.005 | 113.940 | 225 | |
| F32 | 114.929 | 1.738 | Open Manhole | 1200 | F6.007 | 113.191 | 225 | F6.006 | 113.191 | 225 | |
| F33 | 114.353 | 1.955 | Open Manhole | 1200 | F1.010 | 112.398 | 225 | F1.009 | 112.653 | 225 | 255 |
| | | | | | | | | F6.007 | 112.615 | 225 | 217 |
| F34 | 113.050 | 1.650 | Open Manhole | 1200 | F1.011 | 111.400 | 225 | F1.010 | 111.400 | 225 | |
| F35 | 109.957 | 1.425 | Open Manhole | 1200 | F1.012 | 108.532 | 225 | F1.011 | 108.532 | 225 | |
| F36 | 107.980 | 1.425 | Open Manhole | 1200 | F1.013 | 106.555 | 225 | F1.012 | 106.555 | 225 | |
| FEx CMH | 107.530 | 1.192 | Open Manhole | 0 | | OUTFALL | | F1.013 | 106.338 | 225 | |

## PIPELINE SCHEDULES for Foul - Main

### Upstream Manhole

| PN | Hyd Sect | Diam (mm) | MH Name | C.Level (m) | I.Level (m) | D.Depth (m) | MH Connection | MH DIAM., L*W (mm) |
|---|---|---|---|---|---|---|---|---|
| F1.000 | o | 225 | F5 | 123.190 | 120.985 | 1.980 | Open Manhole | 1200 |
| F1.001 | o | 225 | F6 | 122.332 | 120.486 | 1.621 | Open Manhole | 1200 |
| F1.002 | o | 225 | F8 | 121.828 | 118.775 | 2.828 | Open Manhole | 1200 |
| F2.000 | o | 225 | F12 | 120.950 | 119.325 | 1.400 | Open Manhole | 1200 |
| F1.003 | o | 225 | F13 | 121.436 | 118.560 | 2.651 | Open Manhole | 1200 |
| F3.000 | o | 225 | F14 | 123.017 | 119.376 | 3.416 | Open Manhole | 1200 |

### Downstream Manhole

| PN | Length (m) | Slope (1:X) | MH Name | C.Level (m) | I.Level (m) | D.Depth (m) | MH Connection | MH DIAM., L*W (mm) |
|---|---|---|---|---|---|---|---|---|
| F1.000 | 29.947 | 60.0 | F6 | 122.332 | 120.486 | 1.621 | Open Manhole | 1200 |
| F1.001 | 17.355 | 60.1 | F8 | 121.828 | 120.197 | 1.406 | Open Manhole | 1200 |
| F1.002 | 12.882 | 59.9 | F13 | 121.436 | 118.560 | 2.651 | Open Manhole | 1200 |
| F2.000 | 34.519 | 44.4 | F13 | 121.436 | 118.548 | 2.663 | Open Manhole | 1200 |
| F1.003 | 61.036 | 80.0 | F15 | 120.107 | 117.797 | 2.085 | Open Manhole | 1200 |
| F3.000 | 53.673 | 34.0 | F15 | 120.107 | 117.797 | 2.085 | Open Manhole | 1200 |

## PIPELINE SCHEDULES for Foul - Main

### Upstream Manhole

| PN | Hyd Sect | Diam (mm) | MH Name | C.Level (m) | I.Level (m) | D.Depth (m) | MH Connection | MH DIAM., L*W (mm) |
|---|---|---|---|---|---|---|---|---|
| F4.000 | o | 225 | F15A | 120.275 | 118.850 | 1.200 | Open Manhole | 1200 |
| F1.004 | o | 225 | F15 | 120.107 | 117.797 | 2.085 | Open Manhole | 1200 |
| F1.005 | o | 225 | F16 | 119.577 | 117.594 | 1.758 | Open Manhole | 1200 |
| F1.006 | o | 225 | F17 | 119.402 | 117.519 | 1.658 | Open Manhole | 1200 |
| F5.000 | o | 225 | F18 | 121.630 | 120.011 | 1.394 | Open Manhole | 1200 |

### Downstream Manhole

| PN | Length (m) | Slope (1:X) | MH Name | C.Level (m) | I.Level (m) | D.Depth (m) | MH Connection | MH DIAM., L*W (mm) |
|---|---|---|---|---|---|---|---|---|
| F4.000 | 36.460 | 34.6 | F15 | 120.107 | 117.797 | 2.085 | Open Manhole | 1200 |
| F1.004 | 38.376 | 189.0 | F16 | 119.577 | 117.594 | 1.758 | Open Manhole | 1200 |
| F1.005 | 14.168 | 189.0 | F17 | 119.402 | 117.519 | 1.658 | Open Manhole | 1200 |
| F1.006 | 19.050 | 60.7 | F19 | 119.088 | 117.205 | 1.658 | Open Manhole | 1200 |
| F5.000 | 46.044 | 19.6 | F19 | 119.088 | 117.663 | 1.200 | Open Manhole | 1200 |

## PIPELINE SCHEDULES for Foul - Main

### Upstream Manhole

| PN | Hyd Sect | Diam (mm) | MH Name | C.Level (m) | I.Level (m) | D.Depth (m) | MH Connection | MH DIAM., L*W (mm) |
|---|---|---|---|---|---|---|---|---|
| F1.007 | o | 225 | F19 | 119.088 | 117.205 | 1.658 | Open Manhole | 1200 |
| F1.008 | o | 225 | F20 | 118.031 | 116.031 | 1.775 | Open Manhole | 1200 |
| F1.009 | o | 225 | F21 | 115.271 | 113.571 | 1.475 | Open Manhole | 1200 |
| F6.000 | o | 225 | F22 | 118.971 | 117.373 | 1.373 | Open Manhole | 1200 |
| F6.001 | o | 225 | F23 | 117.698 | 115.920 | 1.553 | Open Manhole | 1200 |
| F7.000 | o | 225 | F24 | 119.912 | 117.778 | 1.909 | Open Manhole | 1200 |
| F7.001 | o | 225 | F25 | 118.015 | 116.590 | 1.200 | Open Manhole | 1200 |

### Downstream Manhole

| PN | Length (m) | Slope (1:X) | MH Name | C.Level (m) | I.Level (m) | D.Depth (m) | MH Connection | MH DIAM., L*W (mm) |
|---|---|---|---|---|---|---|---|---|
| F1.007 | 25.575 | 21.8 | F20 | 118.031 | 116.031 | 1.775 | Open Manhole | 1200 |
| F1.008 | 38.723 | 15.7 | F21 | 115.271 | 113.571 | 1.475 | Open Manhole | 1200 |
| F1.009 | 21.189 | 23.1 | F33 | 114.353 | 112.653 | 1.475 | Open Manhole | 1200 |
| F6.000 | 50.261 | 44.1 | F23 | 117.698 | 116.233 | 1.240 | Open Manhole | 1200 |
| F6.001 | 22.860 | 43.7 | F26 | 117.135 | 115.397 | 1.513 | Open Manhole | 1200 |
| F7.000 | 29.693 | 25.0 | F25 | 118.015 | 116.590 | 1.200 | Open Manhole | 1200 |
| F7.001 | 21.057 | 23.9 | F26 | 117.135 | 115.710 | 1.200 | Open Manhole | 1200 |

## PIPELINE SCHEDULES for Foul - Main

### Upstream Manhole

| PN | Hyd Sect | Diam (mm) | MH Name | C.Level (m) | I.Level (m) | D.Depth (m) | MH Connection | MH DIAM., L*W (mm) |
|---|---|---|---|---|---|---|---|---|
| F6.002 | o | 225 | F26 | 117.135 | 115.397 | 1.513 | Open Manhole | 1200 |
| F6.003 | o | 225 | F27 | 116.755 | 115.017 | 1.513 | Open Manhole | 1200 |
| F8.000 | o | 225 | F28 | 118.056 | 116.631 | 1.200 | Open Manhole | 1200 |
| F6.004 | o | 225 | F29 | 116.641 | 114.818 | 1.598 | Open Manhole | 1200 |
| F6.005 | o | 225 | F30 | 116.237 | 114.499 | 1.513 | Open Manhole | 1200 |
| F6.006 | o | 225 | F31 | 115.678 | 113.940 | 1.513 | Open Manhole | 1200 |

### Downstream Manhole

| PN | Length (m) | Slope (1:X) | MH Name | C.Level (m) | I.Level (m) | D.Depth (m) | MH Connection | MH DIAM., L*W (mm) |
|---|---|---|---|---|---|---|---|---|
| F6.002 | 10.927 | 28.8 | F27 | 116.755 | 115.017 | 1.513 | Open Manhole | 1200 |
| F6.003 | 16.379 | 82.3 | F29 | 116.641 | 114.818 | 1.598 | Open Manhole | 1200 |
| F8.000 | 74.944 | 50.0 | F29 | 116.641 | 115.131 | 1.285 | Open Manhole | 1200 |
| F6.004 | 17.208 | 53.9 | F30 | 116.237 | 114.499 | 1.513 | Open Manhole | 1200 |
| F6.005 | 27.110 | 48.5 | F31 | 115.678 | 113.940 | 1.513 | Open Manhole | 1200 |
| F6.006 | 23.807 | 31.8 | F32 | 114.929 | 113.191 | 1.513 | Open Manhole | 1200 |

## PIPELINE SCHEDULES for Foul - Main

### Upstream Manhole

| PN | Hyd Sect | Diam (mm) | MH Name | C.Level (m) | I.Level (m) | D.Depth (m) | MH Connection | MH DIAM., L*W (mm) |
|---|---|---|---|---|---|---|---|---|
| F6.007 | o | 225 | F32 | 114.929 | 113.191 | 1.513 | Open Manhole | 1200 |
| F1.010 | o | 225 | F33 | 114.353 | 112.398 | 1.730 | Open Manhole | 1200 |
| F1.011 | o | 225 | F34 | 113.050 | 111.400 | 1.425 | Open Manhole | 1200 |
| F1.012 | o | 225 | F35 | 109.957 | 108.532 | 1.200 | Open Manhole | 1200 |
| F1.013 | o | 225 | F36 | 107.980 | 106.555 | 1.200 | Open Manhole | 1200 |

### Downstream Manhole

| PN | Length (m) | Slope (1:X) | MH Name | C.Level (m) | I.Level (m) | D.Depth (m) | MH Connection | MH DIAM., L*W (mm) |
|---|---|---|---|---|---|---|---|---|
| F6.007 | 15.194 | 26.4 | F33 | 114.353 | 112.615 | 1.513 | Open Manhole | 1200 |
| F1.010 | 32.780 | 32.8 | F34 | 113.050 | 111.400 | 1.425 | Open Manhole | 1200 |
| F1.011 | 53.685 | 18.7 | F35 | 109.957 | 108.532 | 1.200 | Open Manhole | 1200 |
| F1.012 | 38.476 | 19.5 | F36 | 107.980 | 106.555 | 1.200 | Open Manhole | 1200 |
| F1.013 | 14.946 | 68.9 | FEx CMH | 107.530 | 106.338 | 0.967 | Open Manhole | 0 |

## Summary of Critical Results by Maximum Level (Rank 1) for Foul - Main

### Simulation Criteria

Areal Reduction Factor 1.000 Manhole Headloss Coeff (Global) 0.500 MADD Factor * 10m³/ha Storage 4.000
Hot Start (mins) 0 Foul Sewage per hectare (l/s) 0.000 Inlet Coeffiecient 0.800
Hot Start Level (mm) 0 Additional Flow - % of Total Flow 0.000 Flow per Person per Day (l/per/day) 0.000

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

### Synthetic Rainfall Details

Rainfall Model FSR M5-60 (mm) 17.000 Cv (Summer) 0.750
Region Scotland and Ireland Ratio R 0.238 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 300.0 DVD Status ON
Analysis Timestep 2.5 Second Increment (Extended) Inertia Status ON
DTS Status ON

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440
Return Period(s) (years) 2, 5, 30, 100
Climate Change (%) 10, 10, 10, 10

| PN | US/MH Name | Storm | Return Period | Climate Change | First (X) Surcharge | First (Y) Flood | First (Z) Overflow | Overflow Act. | Water Level (m) | Surcharged Depth (m) | Flooded Volume (m³) | Flow / Cap. | Overflow (l/s) | Pipe Flow (l/s) | Status |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| F1.000 | F5 | 600 Winter | 2 | +10% | | | | | 120.987 | -0.223 | 0.000 | 0.00 | | 0.1 | OK |
| F1.001 | F6 | 480 Winter | 2 | +10% | | | | | 120.490 | -0.221 | 0.000 | 0.00 | | 0.2 | OK |

## Summary of Critical Results by Maximum Level (Rank 1) for Foul - Main

| PN | US/MH Name | Level Exceeded |
|---|---|---|
| F1.000 | F5 | |
| F1.001 | F6 | |

## Summary of Critical Results by Maximum Level (Rank 1) for Foul - Main

| PN | US/MH Name | Storm | Return Period | Climate Change | First (X) Surcharge | First (Y) Flood | First (Z) Overflow | Overflow Act. | Water Level (m) | Surcharged Depth (m) | Flooded Volume (m³) | Flow / Cap. | Overflow (l/s) | Pipe Flow (l/s) | Status |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| F1.002 | F8 | 120 Winter | 5 | +10% | | | | | 118.779 | -0.221 | 0.000 | 0.00 | | 0.2 | OK |
| F2.000 | F12 | 60 Winter | 5 | +10% | | | | | 119.328 | -0.222 | 0.000 | 0.00 | | 0.2 | OK |
| F1.003 | F13 | 360 Summer | 100 | +10% | | | | | 118.575 | -0.210 | 0.000 | 0.01 | | 0.7 | OK |
| F3.000 | F14 | 120 Winter | 5 | +10% | | | | | 119.380 | -0.221 | 0.000 | 0.00 | | 0.3 | OK |
| F4.000 | F15A | 30 Winter | 5 | +10% | | | | | 118.854 | -0.221 | 0.000 | 0.00 | | 0.3 | OK |
| F1.004 | F15 | 600 Summer | 30 | +10% | | | | | 117.828 | -0.194 | 0.000 | 0.05 | | 1.5 | OK |
| F1.005 | F16 | 180 Winter | 30 | +10% | | | | | 117.627 | -0.192 | 0.000 | 0.05 | | 1.5 | OK |
| F1.006 | F17 | 180 Winter | 5 | +10% | | | | | 117.545 | -0.199 | 0.000 | 0.03 | | 1.7 | OK |
| F5.000 | F18 | 120 Winter | 5 | +10% | | | | | 120.013 | -0.223 | 0.000 | 0.00 | | 0.2 | OK |
| F1.007 | F19 | 1440 Summer | 100 | +10% | | | | | 117.228 | -0.202 | 0.000 | 0.02 | | 2.1 | OK |
| F1.008 | F20 | 60 Winter | 5 | +10% | | | | | 116.054 | -0.202 | 0.000 | 0.02 | | 2.4 | OK |
| F1.009 | F21 | 960 Summer | 100 | +10% | | | | | 113.596 | -0.200 | 0.000 | 0.03 | | 2.6 | OK |
| F6.000 | F22 | 15 Winter | 5 | +10% | | | | | 117.379 | -0.219 | 0.000 | 0.01 | | 0.4 | OK |
| F6.001 | F23 | 120 Winter | 5 | +10% | | | | | 115.928 | -0.217 | 0.000 | 0.01 | | 0.5 | OK |
| F7.000 | F24 | 120 Winter | 5 | +10% | | | | | 117.780 | -0.223 | 0.000 | 0.00 | | 0.2 | OK |
| F7.001 | F25 | 120 Winter | 5 | +10% | | | | | 116.593 | -0.222 | 0.000 | 0.00 | | 0.3 | OK |
| F6.002 | F26 | 120 Winter | 5 | +10% | | | | | 115.410 | -0.212 | 0.000 | 0.01 | | 0.9 | OK |
| F6.003 | F27 | 120 Winter | 5 | +10% | | | | | 115.037 | -0.205 | 0.000 | 0.02 | | 0.9 | OK |
| F8.000 | F28 | 720 Summer | 100 | +10% | | | | | 116.637 | -0.219 | 0.000 | 0.01 | | 0.4 | OK |
| F6.004 | F29 | 120 Winter | 5 | +10% | | | | | 114.841 | -0.202 | 0.000 | 0.02 | | 1.3 | OK |
| F6.005 | F30 | 120 Winter | 5 | +10% | | | | | 114.522 | -0.202 | 0.000 | 0.02 | | 1.4 | OK |
| F6.006 | F31 | 120 Winter | 5 | +10% | | | | | 113.961 | -0.204 | 0.000 | 0.02 | | 1.5 | OK |
| F6.007 | F32 | 720 Winter | 2 | +10% | | | | | 113.211 | -0.205 | 0.000 | 0.02 | | 1.5 | OK |
| F1.010 | F33 | 480 Summer | 30 | +10% | | | | | 112.432 | -0.191 | 0.000 | 0.05 | | 4.1 | OK |
| F1.011 | F34 | 480 Summer | 30 | +10% | | | | | 111.429 | -0.196 | 0.000 | 0.04 | | 4.1 | OK |

## Summary of Critical Results by Maximum Level (Rank 1) for Foul - Main

| PN | US/MH Name | Level Exceeded |
|---|---|---|
| F1.002 | F8 | |
| F2.000 | F12 | |
| F1.003 | F13 | |
| F3.000 | F14 | |
| F4.000 | F15A | |
| F1.004 | F15 | |
| F1.005 | F16 | |
| F1.006 | F17 | |
| F5.000 | F18 | |
| F1.007 | F19 | |
| F1.008 | F20 | |
| F1.009 | F21 | |
| F6.000 | F22 | |
| F6.001 | F23 | |
| F7.000 | F24 | |
| F7.001 | F25 | |
| F6.002 | F26 | |
| F6.003 | F27 | |
| F8.000 | F28 | |
| F6.004 | F29 | |
| F6.005 | F30 | |
| F6.006 | F31 | |
| F6.007 | F32 | |
| F1.010 | F33 | |

## Summary of Critical Results by Maximum Level (Rank 1) for Foul - Main

| PN | US/MH Name | Level Exceeded |
|---|---|---|
| F1.011 | F34 | |

## Summary of Critical Results by Maximum Level (Rank 1) for Foul - Main

| PN | US/MH Name | Storm | Return Period | Climate Change | First (X) Surcharge | First (Y) Flood | First (Z) Overflow | Overflow Act. | Water Level (m) | Surcharged Depth (m) | Flooded Volume ($m^3$) | Flow / Cap. | Overflow (l/s) | Pipe Flow (l/s) | Status |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| F1.012 | F35 | 360 Summer | 5 | +10% | | | | | 108.561 | -0.196 | 0.000 | 0.04 | | 4.1 | OK |
| F1.013 | F36 | 480 Summer | 100 | +10% | | | | | 106.598 | -0.182 | 0.000 | 0.08 | | 4.1 | OK |

| PN | US/MH Name | Level Exceeded |
|---|---|---|
| F1.012 | F35 | |
| F1.013 | F36 | |

## STORM SEWER DESIGN by the Modified Rational Method

### Design Criteria for Storm Network

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - Scotland and Ireland

| | | | | | |
|---|---|---|---|---|---|
| Return Period (years) | 2 | Foul Sewage (l/s/ha) | 0.000 | Maximum Backdrop Height (m) | 1.600 |
| M5-60 (mm) | 17.000 | Volumetric Runoff Coeff. | 0.750 | Min Design Depth for Optimisation (m) | 1.200 |
| Ratio R | 0.238 | PIMP (%) | 100 | Min Vel for Auto Design only (m/s) | 1.00 |
| Maximum Rainfall (mm/hr) | 50 | Add Flow / Climate Change (%) | 0 | Min Slope for Optimisation (1:X) | 500 |
| Maximum Time of Concentration (mins) | 30 | Minimum Backdrop Height (m) | 0.650 | | |

Designed with Level Soffits

### Network Design Table for Storm Network

« - Indicates pipe capacity < flow

| PN | Length (m) | Fall (m) | Slope (1:X) | I.Area (ha) | T.E. (mins) | Base Flow (l/s) | k (mm) | HYD SECT | DIA (mm) | Section Type | Auto Design |
|---|---|---|---|---|---|---|---|---|---|---|---|

### Network Results Table

| PN | Rain (mm/hr) | T.C. (mins) | US/IL (m) | Σ I.Area (ha) | Σ Base Flow (l/s) | Foul (l/s) | Add Flow (l/s) | Vel (m/s) | Cap (l/s) | Flow (l/s) |
|---|---|---|---|---|---|---|---|---|---|---|

## Network Design Table for Storm Network

| PN | Length (m) | Fall (m) | Slope (1:X) | I.Area (ha) | T.E. (mins) | Base Flow (l/s) | k (mm) | HYD SECT | DIA (mm) | Section Type | Auto Design |
|---|---|---|---|---|---|---|---|---|---|---|---|
| S2.000 | 28.096 | 0.511 | 55.0 | 0.050 | 4.00 | 0.0 | 0.600 | o | 300 | Pipe/Conduit | |
| S2.001 | 17.367 | 0.316 | 55.0 | 0.036 | 0.00 | 0.0 | 0.600 | o | 300 | Pipe/Conduit | |
| S2.002 | 12.706 | 0.231 | 55.0 | 0.026 | 0.00 | 0.0 | 0.600 | o | 300 | Pipe/Conduit | |
| S3.000 | 35.841 | 0.211 | 169.9 | 0.075 | 4.00 | 0.0 | 0.600 | o | 375 | Pipe/Conduit | |
| S2.003 | 58.196 | 0.707 | 82.3 | 0.000 | 0.00 | 0.0 | 0.600 | o | 375 | Pipe/Conduit | |
| S4.000 | 50.706 | 1.525 | 33.2 | 0.203 | 4.00 | 0.0 | 0.600 | o | 225 | Pipe/Conduit | |

## Network Results Table

| PN | Rain (mm/hr) | T.C. (mins) | US/IL (m) | Σ I.Area (ha) | Σ Base Flow (l/s) | Foul (l/s) | Add Flow (l/s) | Vel (m/s) | Cap (l/s) | Flow (l/s) |
|---|---|---|---|---|---|---|---|---|---|---|
| S2.000 | 50.00 | 4.22 | 120.947 | 0.050 | 0.0 | 0.0 | 0.0 | 2.12 | 150.2 | 6.7 |
| S2.001 | 49.69 | 4.36 | 120.436 | 0.086 | 0.0 | 0.0 | 0.0 | 2.13 | 150.2 | 11.6 |
| S2.002 | 49.32 | 4.46 | 119.470 | 0.112 | 0.0 | 0.0 | 0.0 | 2.12 | 150.2 | 15.0 |
| S3.000 | 49.42 | 4.43 | 119.375 | 0.075 | 0.0 | 0.0 | 0.0 | 1.39 | 153.2 | 10.0 |
| S2.003 | 47.63 | 4.94 | 119.164 | 0.187 | 0.0 | 0.0 | 0.0 | 2.00 | 220.7 | 24.1 |
| S4.000 | 49.63 | 4.37 | 120.132 | 0.203 | 0.0 | 0.0 | 0.0 | 2.28 | 90.5 | 27.3 |

## Network Design Table for Storm Network

| PN | Length (m) | Fall (m) | Slope (1:X) | I.Area (ha) | T.E. (mins) | Base Flow (l/s) | k (mm) | HYD SECT | DIA (mm) | Section Type | Auto Design |
|---|---|---|---|---|---|---|---|---|---|---|---|
| S5.000 | 36.505 | 0.243 | 150.2 | 0.131 | 4.00 | 0.0 | 0.600 | o | 225 | Pipe/Conduit | |
| S2.004 | 40.509 | 0.455 | 89.0 | 0.202 | 0.00 | 0.0 | 0.600 | o | 450 | Pipe/Conduit | |
| S2.005 | 14.168 | 0.175 | 81.0 | 0.062 | 0.00 | 0.0 | 0.600 | o | 450 | Pipe/Conduit | |
| S2.006 | 17.588 | 0.389 | 45.2 | 0.047 | 0.00 | 0.0 | 0.600 | o | 450 | Pipe/Conduit | |
| S6.000 | 44.490 | 1.542 | 28.9 | 0.123 | 4.00 | 0.0 | 0.600 | o | 225 | Pipe/Conduit | |
| S2.007 | 29.295 | 0.382 | 76.7 | 0.059 | 0.00 | 0.0 | 0.600 | o | 450 | Pipe/Conduit | |
| S2.008 | 38.230 | 0.760 | 50.3 | 0.224 | 0.00 | 0.0 | 0.600 | o | 450 | Pipe/Conduit | |

## Network Results Table

| PN | Rain (mm/hr) | T.C. (mins) | US/IL (m) | Σ I.Area (ha) | Σ Base Flow (l/s) | Foul (l/s) | Add Flow (l/s) | Vel (m/s) | Cap (l/s) | Flow (l/s) |
|---|---|---|---|---|---|---|---|---|---|---|
| S5.000 | 48.91 | 4.57 | 118.850 | 0.131 | 0.0 | 0.0 | 0.0 | 1.06 | 42.3 | 17.3 |
| S2.004 | 46.62 | 5.25 | 118.382 | 0.723 | 0.0 | 0.0 | 0.0 | 2.16 | 342.8 | 91.3 |
| S2.005 | 46.29 | 5.36 | 117.927 | 0.785 | 0.0 | 0.0 | 0.0 | 2.26 | 359.6 | 98.4 |
| S2.006 | 46.00 | 5.46 | 117.752 | 0.832 | 0.0 | 0.0 | 0.0 | 3.03 | 481.9 | 103.6 |
| S6.000 | 49.89 | 4.30 | 119.130 | 0.123 | 0.0 | 0.0 | 0.0 | 2.45 | 97.2 | 16.6 |
| S2.007 | 45.37 | 5.67 | 116.763 | 1.014 | 0.0 | 0.0 | 0.0 | 2.32 | 369.5 | 124.6 |
| S2.008 | 44.73 | 5.89 | 114.381 | 1.238 | 0.0 | 0.0 | 0.0 | 2.87 | 456.8 | 149.9 |

## Network Design Table for Storm Network

| PN | Length (m) | Fall (m) | Slope (1:X) | I.Area (ha) | T.E. (mins) | Base Flow (l/s) | k (mm) | HYD SECT | DIA (mm) | Section Type | Auto Design |
|---|---|---|---|---|---|---|---|---|---|---|---|
| S2.009 | 23.035 | 0.468 | 49.2 | 0.048 | 0.00 | 0.0 | 0.600 | o | 450 | Pipe/Conduit | |
| S7.000 | 49.948 | 1.015 | 49.2 | 0.158 | 4.00 | 0.0 | 0.600 | o | 225 | Pipe/Conduit | |
| S7.001 | 20.609 | 0.488 | 42.2 | 0.051 | 0.00 | 0.0 | 0.600 | o | 300 | Pipe/Conduit | |
| S8.000 | 29.946 | 1.050 | 28.5 | 0.119 | 4.00 | 0.0 | 0.600 | o | 225 | Pipe/Conduit | |
| S8.001 | 18.889 | 0.805 | 23.5 | 0.061 | 0.00 | 0.0 | 0.600 | o | 225 | Pipe/Conduit | |
| S7.002 | 13.041 | 0.380 | 34.3 | 0.018 | 0.00 | 0.0 | 0.600 | o | 300 | Pipe/Conduit | |
| S7.003 | 18.156 | 0.296 | 61.3 | 0.027 | 0.00 | 0.0 | 0.600 | o | 300 | Pipe/Conduit | |

## Network Results Table

| PN | Rain (mm/hr) | T.C. (mins) | US/IL (m) | Σ I.Area (ha) | Σ Base Flow (l/s) | Foul (l/s) | Add Flow (l/s) | Vel (m/s) | Cap (l/s) | Flow (l/s) |
|---|---|---|---|---|---|---|---|---|---|---|
| S2.009 | 44.36 | 6.02 | 113.021 | 1.286 | 0.0 | 0.0 | 0.0 | 2.90 | 461.8 | 154.5 |
| S7.000 | 49.36 | 4.45 | 117.213 | 0.158 | 0.0 | 0.0 | 0.0 | 1.87 | 74.3 | 21.1 |
| S7.001 | 48.85 | 4.59 | 116.198 | 0.209 | 0.0 | 0.0 | 0.0 | 2.43 | 171.5 | 27.7 |
| S8.000 | 50.00 | 4.20 | 117.565 | 0.119 | 0.0 | 0.0 | 0.0 | 2.46 | 97.8 | 16.1 |
| S8.001 | 49.83 | 4.32 | 116.515 | 0.180 | 0.0 | 0.0 | 0.0 | 2.71 | 107.9 | 24.4 |
| S7.002 | 48.57 | 4.67 | 115.710 | 0.407 | 0.0 | 0.0 | 0.0 | 2.69 | 190.3 | 53.6 |
| S7.003 | 48.05 | 4.82 | 115.330 | 0.434 | 0.0 | 0.0 | 0.0 | 2.01 | 142.2 | 56.4 |

## Network Design Table for Storm Network

| PN | Length (m) | Fall (m) | Slope (1:X) | I.Area (ha) | T.E. (mins) | Base Flow (l/s) | k (mm) | HYD SECT | DIA (mm) | Section Type | Auto Design |
|---|---|---|---|---|---|---|---|---|---|---|---|
| S9.000 | 76.088 | 1.522 | 50.0 | 0.212 | 4.00 | 0.0 | 0.600 | o | 225 | Pipe/Conduit | |
| S7.004 | 15.114 | 0.297 | 50.9 | 0.019 | 0.00 | 0.0 | 0.600 | o | 300 | Pipe/Conduit | |
| S7.005 | 27.110 | 0.559 | 48.5 | 0.105 | 0.00 | 0.0 | 0.600 | o | 375 | Pipe/Conduit | |
| S7.006 | 23.807 | 0.749 | 31.8 | 0.081 | 0.00 | 0.0 | 0.600 | o | 375 | Pipe/Conduit | |
| S7.007 | 15.771 | 0.326 | 48.4 | 0.021 | 0.00 | 0.0 | 0.600 | o | 450 | Pipe/Conduit | |
| S2.010 | 30.842 | 1.350 | 22.8 | 0.045 | 0.00 | 0.0 | 0.600 | o | 450 | Pipe/Conduit | |
| S2.011 | 54.345 | 2.896 | 18.8 | 0.068 | 0.00 | 0.0 | 0.600 | o | 450 | Pipe/Conduit | |

## Network Results Table

| PN | Rain (mm/hr) | T.C. (mins) | US/IL (m) | Σ I.Area (ha) | Σ Base Flow (l/s) | Foul (l/s) | Add Flow (l/s) | Vel (m/s) | Cap (l/s) | Flow (l/s) |
|---|---|---|---|---|---|---|---|---|---|---|
| S9.000 | 48.51 | 4.68 | 116.556 | 0.212 | 0.0 | 0.0 | 0.0 | 1.85 | 73.7 | 27.9 |
| S7.004 | 47.66 | 4.93 | 115.034 | 0.665 | 0.0 | 0.0 | 0.0 | 2.21 | 156.2 | 85.8 |
| S7.005 | 47.10 | 5.11 | 114.737 | 0.770 | 0.0 | 0.0 | 0.0 | 2.61 | 288.0 | 98.2 |
| S7.006 | 46.70 | 5.23 | 114.178 | 0.851 | 0.0 | 0.0 | 0.0 | 3.22 | 356.1 | 107.6 |
| S7.007 | 46.42 | 5.32 | 113.029 | 0.871 | 0.0 | 0.0 | 0.0 | 2.93 | 465.8 | 109.6 |
| S2.010 | 44.03 | 6.14 | 112.553 | 2.202 | 0.0 | 0.0 | 0.0 | 4.27 | 678.8 | 262.6 |
| S2.011 | 43.52 | 6.33 | 111.203 | 2.270 | 0.0 | 0.0 | 0.0 | 4.71 | 749.1 | 267.6 |

## Network Design Table for Storm Network

| PN | Length (m) | Fall (m) | Slope (1:X) | I.Area (ha) | T.E. (mins) | Base Flow (l/s) | k (mm) | HYD SECT | DIA (mm) | Section Type | Auto Design |
|---|---|---|---|---|---|---|---|---|---|---|---|
| S2.012 | 35.114 | 1.341 | 26.2 | 0.000 | 0.00 | 0.0 | 0.600 | o | 300 | Pipe/Conduit | |
| S2.013 | 15.617 | 0.306 | 51.0 | 0.000 | 0.00 | 0.0 | 0.600 | o | 300 | Pipe/Conduit | |

## Network Results Table

| PN | Rain (mm/hr) | T.C. (mins) | US/IL (m) | Σ I.Area (ha) | Σ Base Flow (l/s) | Foul (l/s) | Add Flow (l/s) | Vel (m/s) | Cap (l/s) | Flow (l/s) |
|---|---|---|---|---|---|---|---|---|---|---|
| S2.012 | 43.03 | 6.52 | 108.057 | 2.270 | 0.0 | 0.0 | 0.0 | 3.08 | 218.1« | 267.6 |
| S2.013 | 42.73 | 6.64 | 106.641 | 2.270 | 0.0 | 0.0 | 0.0 | 2.21 | 155.9« | 267.6 |

## Manhole Schedules for Storm Network

| MH Name | MH CL (m) | MH Depth (m) | MH Connection | MH Diam.,L*W (mm) | Pipe Out PN | Pipe Out Invert Level (m) | Pipe Out Diameter (mm) | Pipes In PN | Pipes In Invert Level (m) | Pipes In Diameter (mm) | Backdrop (mm) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| S5 | 123.190 | 2.243 | Open Manhole | 1200 | S2.000 | 120.947 | 300 | | | | |
| S6 | 122.332 | 1.896 | Open Manhole | 1200 | S2.001 | 120.436 | 300 | S2.000 | 120.436 | 300 | |
| S7 | 121.828 | 2.358 | Open Manhole | 1200 | S2.002 | 119.470 | 300 | S2.001 | 120.120 | 300 | 650 |
| S12 | 120.950 | 1.575 | Open Manhole | 1350 | S3.000 | 119.375 | 375 | | | | |
| S13 | 121.436 | 2.272 | Open Manhole | 1350 | S2.003 | 119.164 | 375 | S2.002 | 119.239 | 300 | |
| | | | | | | | | S3.000 | 119.164 | 375 | |
| S14 | 123.018 | 2.886 | Open Manhole | 1200 | S4.000 | 120.132 | 225 | | | | |
| S15A | 120.275 | 1.425 | Open Manhole | 1200 | S5.000 | 118.850 | 225 | | | | |
| S15 | 120.032 | 1.650 | Open Manhole | 1350 | S2.004 | 118.382 | 450 | S2.003 | 118.457 | 375 | |
| | | | | | | | | S4.000 | 118.607 | 225 | |
| | | | | | | | | S5.000 | 118.607 | 225 | |
| S16 | 119.577 | 1.650 | Open Manhole | 1350 | S2.005 | 117.927 | 450 | S2.004 | 117.927 | 450 | |
| S17 | 119.402 | 1.650 | Open Manhole | 1350 | S2.006 | 117.752 | 450 | S2.005 | 117.752 | 450 | |
| S18 | 121.630 | 2.500 | Open Manhole | 1200 | S6.000 | 119.130 | 225 | | | | |
| S19 | 119.088 | 2.325 | Open Manhole | 1350 | S2.007 | 116.763 | 450 | S2.006 | 117.363 | 450 | 600 |
| | | | | | | | | S6.000 | 117.588 | 225 | 600 |
| S20 | 118.031 | 3.650 | Open Manhole | 1350 | S2.008 | 114.381 | 450 | S2.007 | 116.381 | 450 | 2000 |
| S21 | 115.271 | 2.250 | Open Manhole | 1350 | S2.009 | 113.021 | 450 | S2.008 | 113.621 | 450 | 600 |
| S22 | 118.971 | 1.758 | Open Manhole | 1200 | S7.000 | 117.213 | 225 | | | | |

## Manhole Schedules for Storm Network

| MH Name | MH CL (m) | MH Depth (m) | MH Connection | MH Diam.,L*W (mm) | Pipe Out PN | Pipe Out Invert Level (m) | Pipe Out Diameter (mm) | Pipes In PN | Pipes In Invert Level (m) | Pipes In Diameter (mm) | Backdrop (mm) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| S23 | 117.698 | 1.500 | Open Manhole | 1200 | S7.001 | 116.198 | 300 | S7.000 | 116.198 | 225 | |
| S24 | 119.912 | 2.347 | Open Manhole | 1200 | S8.000 | 117.565 | 225 | | | | |
| S25 | 118.015 | 1.500 | Open Manhole | 1050 | S8.001 | 116.515 | 225 | S8.000 | 116.515 | 225 | |
| S26 | 117.135 | 1.425 | Open Manhole | 1050 | S7.002 | 115.710 | 300 | S7.001 | 115.710 | 300 | |
| | | | | | | | | S8.001 | 115.710 | 225 | |
| S27 | 116.755 | 1.425 | Open Manhole | 1050 | S7.003 | 115.330 | 300 | S7.002 | 115.330 | 300 | |
| S28 | 118.056 | 1.500 | Open Manhole | 1050 | S9.000 | 116.556 | 225 | | | | |
| S29 | 116.641 | 1.607 | Open Manhole | 1050 | S7.004 | 115.034 | 300 | S7.003 | 115.034 | 300 | |
| | | | | | | | | S9.000 | 115.034 | 225 | |
| S30 | 116.237 | 1.500 | Open Manhole | 1050 | S7.005 | 114.737 | 375 | S7.004 | 114.737 | 300 | |
| S31 | 115.678 | 1.500 | Open Manhole | 1050 | S7.006 | 114.178 | 375 | S7.005 | 114.178 | 375 | |
| S32 | 114.929 | 1.900 | Open Manhole | 1050 | S7.007 | 113.029 | 450 | S7.006 | 113.429 | 375 | 325 |
| S33 | 114.353 | 1.800 | Open Manhole | 1500 | S2.010 | 112.553 | 450 | S2.009 | 112.553 | 450 | |
| | | | | | | | | S7.007 | 112.703 | 450 | 150 |
| S34 | 113.050 | 1.847 | Open Manhole | 1500 | S2.011 | 111.203 | 450 | S2.010 | 111.203 | 450 | |
| S35 | 109.957 | 1.900 | Open Manhole | 1500 | S2.012 | 108.057 | 300 | S2.011 | 108.307 | 450 | 400 |
| S36 | 107.980 | 1.339 | Open Manhole | 1500 | S2.013 | 106.641 | 300 | S2.012 | 106.716 | 300 | 75 |
| SO/F 1 | 106.935 | 0.600 | Open Manhole | 1200 | | OUTFALL | | S2.013 | 106.335 | 300 | |

## PIPELINE SCHEDULES for Storm Network

### Upstream Manhole

| PN | Hyd Sect | Diam (mm) | MH Name | C.Level (m) | I.Level (m) | D.Depth (m) | MH Connection | MH DIAM., L*W (mm) |
|---|---|---|---|---|---|---|---|---|
| S2.000 | o | 300 | S5 | 123.190 | 120.947 | 1.943 | Open Manhole | 1200 |
| S2.001 | o | 300 | S6 | 122.332 | 120.436 | 1.596 | Open Manhole | 1200 |
| S2.002 | o | 300 | S7 | 121.828 | 119.470 | 2.058 | Open Manhole | 1200 |
| S3.000 | o | 375 | S12 | 120.950 | 119.375 | 1.200 | Open Manhole | 1350 |
| S2.003 | o | 375 | S13 | 121.436 | 119.164 | 1.897 | Open Manhole | 1350 |
| S4.000 | o | 225 | S14 | 123.018 | 120.132 | 2.661 | Open Manhole | 1200 |

### Downstream Manhole

| PN | Length (m) | Slope (1:X) | MH Name | C.Level (m) | I.Level (m) | D.Depth (m) | MH Connection | MH DIAM., L*W (mm) |
|---|---|---|---|---|---|---|---|---|
| S2.000 | 28.096 | 55.0 | S6 | 122.332 | 120.436 | 1.596 | Open Manhole | 1200 |
| S2.001 | 17.367 | 55.0 | S7 | 121.828 | 120.120 | 1.408 | Open Manhole | 1200 |
| S2.002 | 12.706 | 55.0 | S13 | 121.436 | 119.239 | 1.897 | Open Manhole | 1350 |
| S3.000 | 35.841 | 169.9 | S13 | 121.436 | 119.164 | 1.897 | Open Manhole | 1350 |
| S2.003 | 58.196 | 82.3 | S15 | 120.032 | 118.457 | 1.200 | Open Manhole | 1350 |
| S4.000 | 50.706 | 33.2 | S15 | 120.032 | 118.607 | 1.200 | Open Manhole | 1350 |

## PIPELINE SCHEDULES for Storm Network

### Upstream Manhole

| PN | Hyd Sect | Diam (mm) | MH Name | C.Level (m) | I.Level (m) | D.Depth (m) | MH Connection | MH DIAM., L*W (mm) |
|---|---|---|---|---|---|---|---|---|
| S5.000 | o | 225 | S15A | 120.275 | 118.850 | 1.200 | Open Manhole | 1200 |
| S2.004 | o | 450 | S15 | 120.032 | 118.382 | 1.200 | Open Manhole | 1350 |
| S2.005 | o | 450 | S16 | 119.577 | 117.927 | 1.200 | Open Manhole | 1350 |
| S2.006 | o | 450 | S17 | 119.402 | 117.752 | 1.200 | Open Manhole | 1350 |
| S6.000 | o | 225 | S18 | 121.630 | 119.130 | 2.275 | Open Manhole | 1200 |

### Downstream Manhole

| PN | Length (m) | Slope (1:X) | MH Name | C.Level (m) | I.Level (m) | D.Depth (m) | MH Connection | MH DIAM., L*W (mm) |
|---|---|---|---|---|---|---|---|---|
| S5.000 | 36.505 | 150.2 | S15 | 120.032 | 118.607 | 1.200 | Open Manhole | 1350 |
| S2.004 | 40.509 | 89.0 | S16 | 119.577 | 117.927 | 1.200 | Open Manhole | 1350 |
| S2.005 | 14.168 | 81.0 | S17 | 119.402 | 117.752 | 1.200 | Open Manhole | 1350 |
| S2.006 | 17.588 | 45.2 | S19 | 119.088 | 117.363 | 1.275 | Open Manhole | 1350 |
| S6.000 | 44.490 | 28.9 | S19 | 119.088 | 117.588 | 1.275 | Open Manhole | 1350 |

## PIPELINE SCHEDULES for Storm Network

### Upstream Manhole

| PN | Hyd Sect | Diam (mm) | MH Name | C.Level (m) | I.Level (m) | D.Depth (m) | MH Connection | MH DIAM., L*W (mm) |
|---|---|---|---|---|---|---|---|---|
| S2.007 | o | 450 | S19 | 119.088 | 116.763 | 1.875 | Open Manhole | 1350 |
| S2.008 | o | 450 | S20 | 118.031 | 114.381 | 3.200 | Open Manhole | 1350 |
| S2.009 | o | 450 | S21 | 115.271 | 113.021 | 1.800 | Open Manhole | 1350 |
| S7.000 | o | 225 | S22 | 118.971 | 117.213 | 1.533 | Open Manhole | 1200 |
| S7.001 | o | 300 | S23 | 117.698 | 116.198 | 1.200 | Open Manhole | 1200 |
| S8.000 | o | 225 | S24 | 119.912 | 117.565 | 2.122 | Open Manhole | 1200 |
| S8.001 | o | 225 | S25 | 118.015 | 116.515 | 1.275 | Open Manhole | 1050 |

### Downstream Manhole

| PN | Length (m) | Slope (1:X) | MH Name | C.Level (m) | I.Level (m) | D.Depth (m) | MH Connection | MH DIAM., L*W (mm) |
|---|---|---|---|---|---|---|---|---|
| S2.007 | 29.295 | 76.7 | S20 | 118.031 | 116.381 | 1.200 | Open Manhole | 1350 |
| S2.008 | 38.230 | 50.3 | S21 | 115.271 | 113.621 | 1.200 | Open Manhole | 1350 |
| S2.009 | 23.035 | 49.2 | S33 | 114.353 | 112.553 | 1.350 | Open Manhole | 1500 |
| S7.000 | 49.948 | 49.2 | S23 | 117.698 | 116.198 | 1.275 | Open Manhole | 1200 |
| S7.001 | 20.609 | 42.2 | S26 | 117.135 | 115.710 | 1.125 | Open Manhole | 1050 |
| S8.000 | 29.946 | 28.5 | S25 | 118.015 | 116.515 | 1.275 | Open Manhole | 1050 |
| S8.001 | 18.889 | 23.5 | S26 | 117.135 | 115.710 | 1.200 | Open Manhole | 1050 |

## PIPELINE SCHEDULES for Storm Network

### Upstream Manhole

| PN | Hyd Sect | Diam (mm) | MH Name | C.Level (m) | I.Level (m) | D.Depth (m) | MH Connection | MH DIAM., L*W (mm) |
|---|---|---|---|---|---|---|---|---|
| S7.002 | o | 300 | S26 | 117.135 | 115.710 | 1.125 | Open Manhole | 1050 |
| S7.003 | o | 300 | S27 | 116.755 | 115.330 | 1.125 | Open Manhole | 1050 |
| S9.000 | o | 225 | S28 | 118.056 | 116.556 | 1.275 | Open Manhole | 1050 |
| S7.004 | o | 300 | S29 | 116.641 | 115.034 | 1.307 | Open Manhole | 1050 |
| S7.005 | o | 375 | S30 | 116.237 | 114.737 | 1.125 | Open Manhole | 1050 |
| S7.006 | o | 375 | S31 | 115.678 | 114.178 | 1.125 | Open Manhole | 1050 |

### Downstream Manhole

| PN | Length (m) | Slope (1:X) | MH Name | C.Level (m) | I.Level (m) | D.Depth (m) | MH Connection | MH DIAM., L*W (mm) |
|---|---|---|---|---|---|---|---|---|
| S7.002 | 13.041 | 34.3 | S27 | 116.755 | 115.330 | 1.125 | Open Manhole | 1050 |
| S7.003 | 18.156 | 61.3 | S29 | 116.641 | 115.034 | 1.307 | Open Manhole | 1050 |
| S9.000 | 76.088 | 50.0 | S29 | 116.641 | 115.034 | 1.382 | Open Manhole | 1050 |
| S7.004 | 15.114 | 50.9 | S30 | 116.237 | 114.737 | 1.200 | Open Manhole | 1050 |
| S7.005 | 27.110 | 48.5 | S31 | 115.678 | 114.178 | 1.125 | Open Manhole | 1050 |
| S7.006 | 23.807 | 31.8 | S32 | 114.929 | 113.429 | 1.125 | Open Manhole | 1050 |

## PIPELINE SCHEDULES for Storm Network

### Upstream Manhole

| PN | Hyd Sect | Diam (mm) | MH Name | C.Level (m) | I.Level (m) | D.Depth (m) | MH Connection | MH DIAM., L*W (mm) |
|---|---|---|---|---|---|---|---|---|
| S7.007 | o | 450 | S32 | 114.929 | 113.029 | 1.450 | Open Manhole | 1050 |
| S2.010 | o | 450 | S33 | 114.353 | 112.553 | 1.350 | Open Manhole | 1500 |
| S2.011 | o | 450 | S34 | 113.050 | 111.203 | 1.397 | Open Manhole | 1500 |
| S2.012 | o | 300 | S35 | 109.957 | 108.057 | 1.600 | Open Manhole | 1500 |
| S2.013 | o | 300 | S36 | 107.980 | 106.641 | 1.039 | Open Manhole | 1500 |

### Downstream Manhole

| PN | Length (m) | Slope (1:X) | MH Name | C.Level (m) | I.Level (m) | D.Depth (m) | MH Connection | MH DIAM., L*W (mm) |
|---|---|---|---|---|---|---|---|---|
| S7.007 | 15.771 | 48.4 | S33 | 114.353 | 112.703 | 1.200 | Open Manhole | 1500 |
| S2.010 | 30.842 | 22.8 | S34 | 113.050 | 111.203 | 1.397 | Open Manhole | 1500 |
| S2.011 | 54.345 | 18.8 | S35 | 109.957 | 108.307 | 1.200 | Open Manhole | 1500 |
| S2.012 | 35.114 | 26.2 | S36 | 107.980 | 106.716 | 0.964 | Open Manhole | 1500 |
| S2.013 | 15.617 | 51.0 | SO/F 1 | 106.935 | 106.335 | 0.300 | Open Manhole | 1200 |

## Free Flowing Outfall Details for Storm Network

| Outfall Pipe Number | Outfall Name | C. Level (m) | I. Level (m) | Min I. Level (m) | D,L (mm) | W (mm) |
|---|---|---|---|---|---|---|
| S2.013 | SO/F 1 | 106.935 | 106.335 | 0.000 | 1200 | 0 |

## Simulation Criteria for Storm Network

| | | | | | |
|---|---|---|---|---|---|
| Volumetric Runoff Coeff | 0.750 | Manhole Headloss Coeff (Global) | 0.500 | Inlet Coeffiecient | 0.800 |
| Areal Reduction Factor | 1.000 | Foul Sewage per hectare (l/s) | 0.000 | Flow per Person per Day (l/per/day) | 0.000 |
| Hot Start (mins) | 0 | Additional Flow - % of Total Flow | 0.000 | Run Time (mins) | 60 |
| Hot Start Level (mm) | 0 | MADD Factor * 10m³/ha Storage | 4.000 | Output Interval (mins) | 1 |

| | | |
|---|---|---|
| Number of Input Hydrographs 0 | Number of Offline Controls 0 | Number of Time/Area Diagrams 0 |
| Number of Online Controls 2 | Number of Storage Structures 1 | Number of Real Time Controls 0 |

## Synthetic Rainfall Details

| | | | | | |
|---|---|---|---|---|---|
| Rainfall Model | FSR | M5-60 (mm) | 17.000 | Cv (Summer) | 0.750 |
| Return Period (years) | 2 | Ratio R | 0.238 | Cv (Winter) | 0.840 |
| Region | Scotland and Ireland | Profile Type | Summer | Storm Duration (mins) | 15 |

## Online Controls for Storm Network

### Hydro-Brake® Optimum Manhole: S13, DS/PN: S2.003, Volume (m³): 7.9

| | | | |
|---|---|---|---|
| Unit Reference | MD-CHE-0226-3500-1800-3500 | Sump Available | No |
| Design Head (m) | 1.800 | Diameter (mm) | 226 |
| Design Flow (l/s) | 35.0 | Invert Level (m) | 119.164 |
| Flush-Flo™ | Calculated | Minimum Outlet Pipe Diameter (mm) | 300 |
| Objective | Minimise upstream storage | Suggested Manhole Diameter (mm) | 1500 |
| Application | Surface | | |

| Control Points | Head (m) | Flow (l/s) | Control Points | Head (m) | Flow (l/s) |
|---|---|---|---|---|---|
| Design Point (Calculated) | 1.800 | 35.0 | Kick-Flo® | 0.629 | 21.3 |
| Flush-Flo™ | 0.460 | 34.9 | Mean Flow over Head Range | - | 26.1 |

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) | Depth (m) | Flow (l/s) | Depth (m) | Flow (l/s) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.100 | 6.2 | 0.600 | 21.5 | 1.600 | 33.0 | 2.600 | 41.9 | 5.000 | 57.8 | 7.500 | 70.5 |
| 0.200 | 18.4 | 0.800 | 23.5 | 1.800 | 35.0 | 3.000 | 45.0 | 5.500 | 60.5 | 8.000 | 72.8 |
| 0.300 | 27.0 | 1.000 | 26.2 | 2.000 | 36.8 | 3.500 | 48.5 | 6.000 | 63.2 | 8.500 | 75.0 |
| 0.400 | 33.4 | 1.200 | 28.7 | 2.200 | 38.6 | 4.000 | 51.8 | 6.500 | 65.7 | 9.000 | 77.1 |
| 0.500 | 33.1 | 1.400 | 30.9 | 2.400 | 40.3 | 4.500 | 54.9 | 7.000 | 68.2 | 9.500 | 79.2 |

## Hydro-Brake® Manhole: S34, DS/PN: S2.011, Volume (m³): 7.9

Design Head (m) 1.000 Design Flow (l/s) 260.0 Hydro-Brake® Type Md10 Diameter (mm) 434 Invert Level (m) 111.203

| Depth (m) | Flow (l/s) | Depth (m) | Flow (l/s) | Depth (m) | Flow (l/s) | Depth (m) | Flow (l/s) | Depth (m) | Flow (l/s) | Depth (m) | Flow (l/s) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.100 | 16.1 | 0.600 | 161.1 | 1.600 | 332.4 | 2.600 | 423.7 | 5.000 | 587.6 | 7.500 | 719.6 |
| 0.200 | 41.3 | 0.800 | 215.7 | 1.800 | 352.5 | 3.000 | 455.1 | 5.500 | 616.2 | 8.000 | 743.2 |
| 0.300 | 70.1 | 1.000 | 259.1 | 2.000 | 371.6 | 3.500 | 491.6 | 6.000 | 643.6 | 8.500 | 766.1 |
| 0.400 | 100.5 | 1.200 | 287.8 | 2.200 | 389.7 | 4.000 | 525.5 | 6.500 | 669.9 | 9.000 | 788.3 |
| 0.500 | 131.2 | 1.400 | 310.9 | 2.400 | 407.1 | 4.500 | 557.4 | 7.000 | 695.2 | 9.500 | 809.9 |

## Storage Structures for Storm Network

### Tank or Pond Manhole: S34, DS/PN: S2.011

Invert Level (m) 111.203

| Depth (m) | Area (m²) | Depth (m) | Area (m²) | Depth (m) | Area (m²) | Depth (m) | Area (m²) | Depth (m) | Area (m²) | Depth (m) | Area (m²) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.000 | 315.0 | 0.200 | 315.0 | 0.400 | 315.0 | 0.600 | 315.0 | 0.800 | 315.0 | 1.000 | 315.0 |
| 0.100 | 315.0 | 0.300 | 315.0 | 0.500 | 315.0 | 0.700 | 315.0 | 0.900 | 315.0 | 1.100 | 0.0 |

## Summary of Critical Results by Maximum Level (Rank 1) for Storm Network

### Simulation Criteria

Areal Reduction Factor 1.000 Manhole Headloss Coeff (Global) 0.500 MADD Factor * 10m³/ha Storage 4.000
Hot Start (mins) 0 Foul Sewage per hectare (l/s) 0.000 Inlet Coeffiecient 0.800
Hot Start Level (mm) 0 Additional Flow - % of Total Flow 0.000 Flow per Person per Day (l/per/day) 0.000

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 2 Number of Storage Structures 1 Number of Real Time Controls 0

### Synthetic Rainfall Details

Rainfall Model FSR M5-60 (mm) 17.000 Cv (Summer) 0.750
Region Scotland and Ireland Ratio R 0.238 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 300.0 DVD Status ON
Analysis Timestep 2.5 Second Increment (Extended) Inertia Status ON
DTS Status ON

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440
Return Period(s) (years) 2, 5, 30, 100
Climate Change (%) 10, 10, 10, 10

| PN | US/MH Name | Storm | Return Period | Climate Change | First (X) Surcharge | First (Y) Flood | First (Z) Overflow | Overflow Act. | Water Level (m) | Surcharged Depth (m) | Flooded Volume (m³) | Flow / Cap. | Overflow (l/s) | Pipe Flow (l/s) | Status |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| S2.000 | S5 | 15 Winter | 100 | +10% | | | | | 121.023 | -0.224 | 0.000 | 0.15 | | 18.6 | OK |
| S2.001 | S6 | 30 Winter | 100 | +10% | | | | | 120.547 | -0.189 | 0.000 | 0.20 | | 26.1 | OK |

## Summary of Critical Results by Maximum Level (Rank 1) for Storm Network

| PN | US/MH Name | Level Exceeded |
|---|---|---|
| S2.000 | S5 | |
| S2.001 | S6 | |

## Summary of Critical Results by Maximum Level (Rank 1) for Storm Network

| PN | US/MH Name | Storm | Return Period | Climate Change | First (X) Surcharge | First (Y) Flood | First (Z) Overflow | Overflow Act. | Water Level (m) | Surcharged Depth (m) | Flooded Volume (m³) | Flow / Cap. | Overflow (l/s) | Pipe Flow (l/s) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| S2.002 | S7 | 30 Winter | 100 | +10% | 30/15 Summer | | | | 120.531 | 0.761 | 0.000 | 0.24 | | 29.5 |
| S3.000 | S12 | 30 Winter | 100 | +10% | 30/15 Summer | | | | 120.526 | 0.776 | 0.000 | 0.12 | | 16.1 |
| S2.003 | S13 | 30 Winter | 100 | +10% | 30/15 Summer | | | | 120.516 | 0.977 | 0.000 | 0.16 | | 30.4 |
| S4.000 | S14 | 15 Winter | 100 | +10% | | | | | 120.295 | -0.062 | 0.000 | 0.88 | | 76.0 |
| S5.000 | S15A | 15 Winter | 100 | +10% | 100/15 Summer | | | | 119.157 | 0.082 | 0.000 | 1.14 | | 45.7 |
| S2.004 | S15 | 15 Winter | 100 | +10% | | | | | 118.693 | -0.139 | 0.000 | 0.80 | | 214.8 |
| S2.005 | S16 | 15 Winter | 100 | +10% | | | | | 118.299 | -0.078 | 0.000 | 1.00 | | 235.7 |
| S2.006 | S17 | 15 Winter | 100 | +10% | | | | | 118.036 | -0.166 | 0.000 | 0.71 | | 251.3 |
| S6.000 | S18 | 15 Winter | 100 | +10% | | | | | 119.242 | -0.113 | 0.000 | 0.50 | | 46.1 |
| S2.007 | S19 | 15 Winter | 100 | +10% | | | | | 117.147 | -0.066 | 0.000 | 0.99 | | 314.5 |
| S2.008 | S20 | 15 Winter | 100 | +10% | | | | | 114.739 | -0.092 | 0.000 | 0.96 | | 389.4 |
| S2.009 | S21 | 15 Winter | 100 | +10% | 100/15 Summer | | | | 113.872 | 0.401 | 0.000 | 1.03 | | 393.5 |
| S7.000 | S22 | 15 Winter | 100 | +10% | | | | | 117.370 | -0.068 | 0.000 | 0.82 | | 58.7 |
| S7.001 | S23 | 15 Winter | 100 | +10% | 100/15 Summer | | | | 116.616 | 0.118 | 0.000 | 0.47 | | 70.0 |
| S8.000 | S24 | 15 Winter | 100 | +10% | | | | | 117.676 | -0.114 | 0.000 | 0.49 | | 44.6 |
| S8.001 | S25 | 15 Winter | 100 | +10% | | | | | 116.707 | -0.033 | 0.000 | 0.67 | | 65.3 |
| S7.002 | S26 | 15 Winter | 100 | +10% | 30/15 Summer | | | | 116.418 | 0.408 | 0.000 | 0.83 | | 127.7 |
| S7.003 | S27 | 15 Winter | 100 | +10% | 30/15 Summer | | | | 116.148 | 0.518 | 0.000 | 1.11 | | 136.3 |
| S9.000 | S28 | 15 Winter | 100 | +10% | 100/15 Summer | | | | 117.010 | 0.229 | 0.000 | 0.89 | | 64.1 |
| S7.004 | S29 | 15 Winter | 100 | +10% | 30/15 Summer | | | | 115.769 | 0.435 | 0.000 | 1.57 | | 206.2 |
| S7.005 | S30 | 15 Winter | 100 | +10% | | | | | 115.027 | -0.085 | 0.000 | 0.94 | | 237.2 |
| S7.006 | S31 | 15 Winter | 100 | +10% | | | | | 114.448 | -0.105 | 0.000 | 0.86 | | 262.5 |
| S7.007 | S32 | 15 Winter | 100 | +10% | 100/15 Summer | | | | 113.628 | 0.149 | 0.000 | 0.81 | | 262.2 |
| S2.010 | S33 | 15 Winter | 100 | +10% | 100/15 Summer | | | | 113.406 | 0.403 | 0.000 | 1.11 | | 651.8 |
| S2.011 | S34 | 60 Winter | 100 | +10% | 5/30 Summer | | | | 112.185 | 0.532 | 0.000 | 0.37 | | 255.7 |

## Summary of Critical Results by Maximum Level (Rank 1) for Storm Network

| PN | US/MH Name | Status | Level Exceeded |
|---|---|---|---|
| S2.002 | S7 | SURCHARGED | |
| S3.000 | S12 | SURCHARGED | |
| S2.003 | S13 | SURCHARGED | |
| S4.000 | S14 | OK | |
| S5.000 | S15A | SURCHARGED | |
| S2.004 | S15 | OK | |
| S2.005 | S16 | OK | |
| S2.006 | S17 | OK | |
| S6.000 | S18 | OK | |
| S2.007 | S19 | OK | |
| S2.008 | S20 | OK | |
| S2.009 | S21 | SURCHARGED | |
| S7.000 | S22 | OK | |
| S7.001 | S23 | SURCHARGED | |
| S8.000 | S24 | OK | |
| S8.001 | S25 | OK | |
| S7.002 | S26 | SURCHARGED | |
| S7.003 | S27 | SURCHARGED | |
| S9.000 | S28 | SURCHARGED | |
| S7.004 | S29 | SURCHARGED | |
| S7.005 | S30 | OK | |
| S7.006 | S31 | OK | |
| S7.007 | S32 | SURCHARGED | |
| S2.010 | S33 | SURCHARGED | |

## Summary of Critical Results by Maximum Level (Rank 1) for Storm Network

| PN | US/MH Name | Status | Level Exceeded |
|---|---|---|---|
| S2.011 | S34 | SURCHARGED | |

## Summary of Critical Results by Maximum Level (Rank 1) for Storm Network

| PN | US/MH Name | Storm | Return Period | Climate Change | First (X) Surcharge | First (Y) Flood | First (Z) Overflow | Overflow Act. | Water Level (m) | Surcharged Depth (m) | Flooded Volume ($m^3$) | Flow / Cap. | Overflow (l/s) | Pipe Flow (l/s) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| S2.012 | S35 | 60 Winter | 100 | +10% | 30/30 Winter | | | | 109.906 | 1.549 | 0.000 | 1.26 | | 253.7 |
| S2.013 | S36 | 60 Winter | 100 | +10% | 5/30 Winter | | | | 107.761 | 0.820 | 0.000 | 1.93 | | 253.7 |

| PN | US/MH Name | Status | Level Exceeded |
|---|---|---|---|
| S2.012 | S35 | FLOOD RISK | |
| S2.013 | S36 | FLOOD RISK | |

ATKINS

Member of the SNC-Lavalin Group

# Cork NW Regeneration Quarter - Phase 4A

## Stage 1 Road Safety Audit

Cork City Council

April2021

# Notice

This document and its contents have been prepared and are intended solely for Cork City Council's information and use in relation to the Cork North West Regeneration Quarter Phase 4A.

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## Document history

| Revision | Purpose description | Origin-ated | Checked | Reviewed | Author-ised | Date |
|---|---|---|---|---|---|---|
| Rev 0 | Draft Issue | KB | KB | JB | KB | 08/04/2021 |
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## Client signoff

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|---|---|
| Client | Cork City Council |
| Project | Cork North West Regeneration Quarter – Phase 4A |
| Job number | 5204404 |

# Contents



## Tables

# 1. Introduction

## 1.1. Background

This report describes the findings of a Stage 1 Road Safety Audit associated with the Cork North West Regeneration Quarter – Phase 4A.

The scheme involves the construction of new residential units on an infill site between Knocknaheeny Ave. and Killala Green in Cork City. The site audited at this time is that site designated as Phase 4A under the City Northwest Quarter Regeneration Masterplan, Knocknaheeny.

The Stage 1 Audit has been completed in April 2021 by Atkins on behalf of Cork City Council.

## 1.2. Site Inspection

The site visit was undertaken on the 8th of April 2021. In accordance with current Government Level 5 Covid-19 restrictions the site visit has been undertaken with all necessary precautions in place i.e. team members travel in separate vehicles, social distancing observed on site and all post visit discussions were completed by telephone.

## 1.3. The Team

The Road Safety Audit Team members were as follows:

- Team Leader: **Keith Barry** BE (Hons) CEng MIEI
- Team Member: **James Bohan** MEng Nat Dip Eng CEng MIEI

A copy of the TII approval documentation for the audit team is included in Appendix A.

## 1.4. The Design

The following drawings were examined as part of the Road Safety Audit (RSA) process:

**Table 1-1 - Drawing List**

| Drawing No | Drawing Title | Revision |
|---|---|---|
| CNW-P4A-ATK-P4A-Z0-DR-C-950100 | Proposed Road Layout and Indicative Road Levels | P01 |
| CNW-P4A-ATK-P4A-Z0-DR-C-950120 | Proposed Road Layout Long section | P01 |
| CNW-P4A-ATK-P4A-Z0-DR-C-950131 | Proposed Road Layout Junction Sight Lines Sheet 2 | P01 |
| CNW-P4A-ATK-P4A-Z0-DR-C-950700 | Proposed Pavement Layout Plan | P01 |
| CNW-P4A-ATK-P4A-Z0-DR-C-950705 | Proposed Route Types | A |
| CNW-P4A-ATK-P4A-Z0-DR-C-950750 | Proposed Road Layout Plan Vehicle Tracking Analysis | P01 |
| CNW-P4A-ATK-P4A-Z0-DR-C-951200 | Proposed Road Signs and Traffic Markings | P01 |
| RK5137848/C/435 | Proposed Public Lighting Layout | B |

## 1.5. Road Safety Audit Compliance

### Procedure and Scope

This Road Safety Audit has been carried out in accordance with the procedures and scope set out in TII publication number **GE-STY-01024 - Road Safety Audit**.

As part of the road safety audit process, the Audit Team have examined only those issues within the design which relate directly to road safety.

### Compliance with Design Standards

The road safety audit process is not a design check, therefore verification or compliance with design standards has not formed part of the audit process.

### Minimising Risk of Collision Occurrence

All problems described in this report are considered by the Audit Team to require action in order to improve the safety of the scheme and minimise the risk of collision occurrence.

## 1.6. Road Safety Audit Compliance

No existing collision statistical information was provided, and a review of the Road Safety Authority online collision database indicates that there were no recorded collisions within the scheme area between 2005 and 2016 inclusive. There are 4 no. collisions recorded on the adjacent Knocknaheeny Ave. One involved a pedestrian which resulted in minor injuries and the other three were vehicle incidents at the junction of Knocknaheeny Road and Harbour View Road. It should be noted that the RSA collision database is not a comprehensive record and does not include damage only collisions or any collisions recorded since 2016.

The location of these four collisions has been indicated in Figure 1-1, with the collision characteristics summarised in Table 1-2. Of the four recorded collisions one (25%) involved pedestrians or cyclists. As the scheme will introduce additional residential properties to the area it is likely that VRU umbers will increase, thus the design proposals should ensure that priority and protection is given to VRUs in the urban environment, and that overall vehicle speeds are reduced.

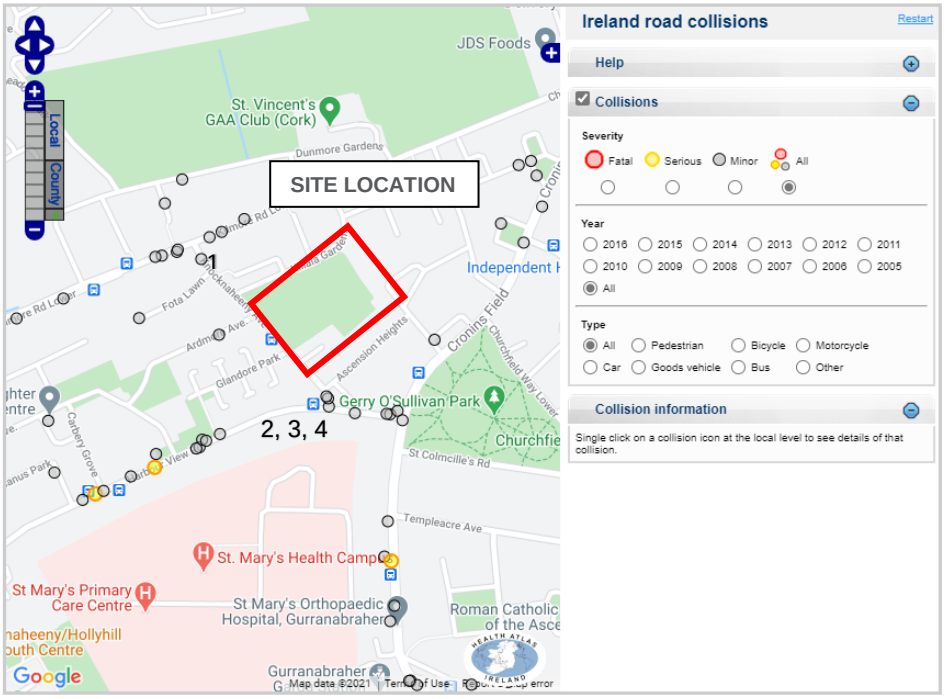



**Figure 1-1 - RSA Collision Database 2005 - 2016**

| No. | Severity | Casualties | Year | Vehicle | Circumstances | Day | Time |
|---|---|---|---|---|---|---|---|
| 1 | Minor | 1 | 2011 | Car | Pedestrian | Tues | 16.00-19.00 |
| 2 | Minor | 1 | 2007 | Car | Other | Sun | 16.00-19.00 |
| 3 | Minor | 2 | 2008 | Car | Other | Wed | 10.00-16.00 |
| 4 | Minor | 4 | 2012 | Car | Rear end, straight | Mon | 19.00-23.00 |

**Table 1-2 - Summary of Collision Characteristics**

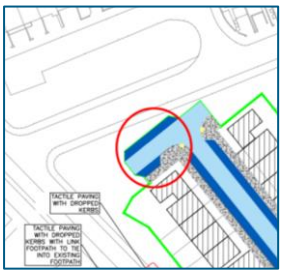
# 2. Road Safety Issues Identified

## 2.1. Problem: Parking spaces within the turning area

**Location: Northern end of side road 07**

The proposed turning area at the end of side road 07 (cul-de-sac) contains parking bays. Vehicles using these spaces will have to either reverse out of the turning area, putting vulnerable road users at risk or will have to attempt at three-point turn manoeuvre within the turning area increasing the risk of material damage collisions.

**Figure 2-1 – Parking within turning area**



**Recommendation**

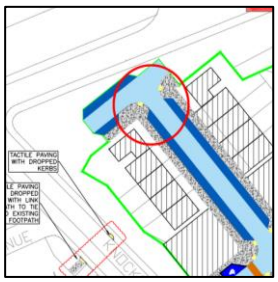
It is recommended that the designer should provide additional paved area at the end of the turning area to facilitate manoeuvres of exiting vehicles.

## 2.2. Problem: Misaligned tactile paving

**Location: Northern end of side road 07**

The tactile paving at the proposed pedestrian crossing at the northern end of side road 07 appears to be misaligned. Tactile paving should align with the tactile paving on the opposite side of the road to ensure visually impaired users are correctly guided across the road. Misaligned paving could result in visually impaired users walking out into the carriageway in front of oncoming vehicles.

**Figure 2-2 – Misaligned tactile paving**



**Recommendation**

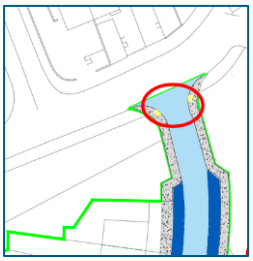
The tactile paving, throughout the scheme should be checked to ensure it properly aligns with the opposite side of the road crossing.

## 2.3. Problem: Use of link road as a Rat-Run

**Location: Junction of Link road and Killala Green**

There is the potential for the new link road through Phase 4A to be used as a Rat-Run with the associated risk of increased speeds. This could put pedestrians along the road but particularly at the junction with Killala Green at risk of collision with vehicles, leading to pedestrian/vehicle type collisions which may result in serious injury.

**Figure 2-3 – Use of Link road as a Rat-Run**

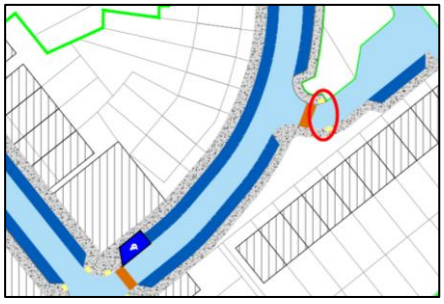


**Recommendation**
In keeping with the treatments at other junctions on the scheme consideration should be given to the use of a ramp at the entrance / pedestrian crossing at this location.

## 2.4. Problem: Pedestrian Crossing located away from the Desire Line

**Location: Junction of Side Road 10 and Link road**
The pedestrian crossing at this location does not appear to align with the likely pedestrian desire line. This could result in pedestrians crossing away from the designated location, which could catch a driver unaware resulting in a risk of a vehicle / pedestrian collision.

**Figure 2-4 – Pedestrian Crossing located away from the Desire Line**



**Recommendation**
It is recommended that the designer should consider relocation of the crossing closer to the pedestrian desire line.

## 2.5. Problem: Shared Space Detailing

**Location: Southern end of the north – South spine road**

The detail for the shared space at the above location (Drawing CNW-P4A-ATK-P4A-Z0-DR-C-950700) does not indicate any footpaths immediately in front of the houses. This has the potential to bring vehicles and pedestrians into conflict.

**Figure 2-5 – Shared Space Detailing**

**Recommendation**

It is recommended that the designer should consider a buffer zone between the housing and the vehicle accessible shared space to give pedestrians comfort when entering / exiting the houses.

## 2.6. Problem: Potential Adverse Camber

**Location: Junction of Side Road 10 and Link Road**

With the downhill gradient on the Link Road creates the potential for the introduction of adverse camber at the junction with Side Road 10. Adverse camber can lead to several difficulties including drainage issues, uncomfortable ride quality for drivers and difficulty in manoeuvring large vehicle such as refuse trucks.

**Figure 2-6 – Potential Adverse Camber**

**Recommendation**

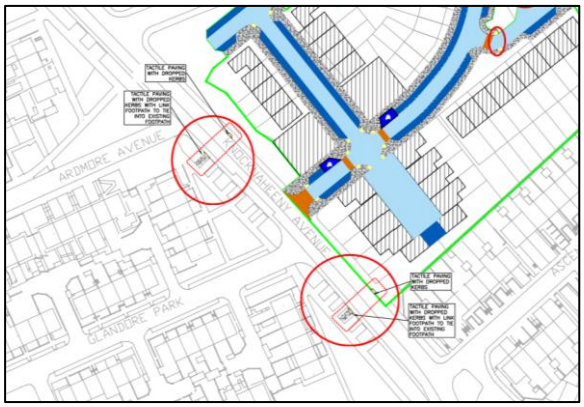
It is recommended that the designer should consider the geometry of the link road / side road tie-in to ensure a free draining smooth interface is provided.

## 2.7. Problem: Vehicle Speed on Knocknaheeny Avenue

**Location: Knocknaheeny Avenue**

During the site visit several vehicles were observed travelling at a higher than appropriate speed on Knocknaheeny Avenue in the direction of Harbour View Road. The scheme proposes to introduce uncontrolled crossings at two locations on Knocknaheeny Avenue. Pedestrians crossing at these locations are potentially at risk of collision.

**Figure 2-7 – Vehicle Speed on Knocknaheeny Avenue**




**Recommendation**

It is recommended that the designer should consider providing some advance warning measures in association with the introduction of the pedestrian crossings, which increase driver awareness of the pedestrians at the crossings and thus encouraging them to travel at an appropriate speed on approach. These measures could include additional advance warning signage, modified road markings and ensuring adequate public lighting is provided at these locations.

# 3. Audit Team Statement

## 3.1. Certification

We certify that we have examined the drawings and documents listed in Chapter 1 of this Report.

## 3.2. Sole Purpose

The Road Safety Audit has been carried out with the sole purpose of identifying any features of the design which could be removed or modified in order to improve the road safety aspects of the scheme.

## 3.3. Implementation of RSA Recommendations

The problems identified herein have been noted in the Report together with their associated recommendations for road safety improvements. We (the Audit Team) propose that these recommendations should be studied with a view to implementation.

## 3.4. Audit Team's Independence to the Design Process

No member of the Audit Team has been otherwise involved with the design of the measures audited.

## 3.5. Road Safety Audit Team Sign-Off

**Keith Barry**
Audit Team Leader
Road Safety Engineering Team
**ATKINS**

Signed: 
Date: 12th April 2021

**James Bohan**
Audit Team Member
Road Safety Engineering Team
**ATKINS**

Signed: 
Date: 12th April 2021

# 4. Designers Response

## 4.1. Preparing a Response to the Road Safety Audit

The Designer should prepare an Audit Response for each of the recommendations using the Road Safety Audit Feedback Form attached in Appendix A.

When completed, this form should be signed by the Designer and returned to the Audit Team.

## 4.2. Returning the Feedback Form

Please return the completed Road Safety Audit Feedback Form attached in Appendix A of this report to the following email or postal address:

Email address: Keith.Barry@atkinsglobal.com

Postal address: WS Atkins
Unit 2B
2200 Cork Airport Business Park
Cork
T12 R279
Telephone: 00 353 (0)21 429 0300

The Audit Team will consider the Designers response and reply indicating acceptance or otherwise of the Designers response to each recommendation.

## 4.3. Triggering the Need for an Exception Report

If the situation arises where the Designer and the Audit Team cannot agree on an appropriate means of addressing an underlying safety issue identified as part of the audit process, an Exception Report must be prepared by the Designer on each disputed item listed in the audit report.

# Appendices

# Appendix A. Audit Team Approvals

# A.1. Team Leader

*Keith Barry*
*Atkins House*
*150 Lakeside Drive*
*Airside Business Park*
*Swords, Co.Dublin*

Date: 20/12/2019

Ref: KB217558

**re: APPROVAL AS ROAD SAFETY AUDITOR**

Dear Keith Barry,

You meet the qualification and experience requirements for Road Safety Audit as follows:

| Scheme Category | Audit Team Status | Team Leader Expiry Date |
|---|---|---|
| Road Scheme | Team Leader | 31/12/2021 |
| Development Scheme | Team Leader | 31/12/2021 |

The above assessment is based on information supplied and the qualification and experience requirements of National Roads Authority in accordance with HD 19 “Road Safety Audit”. Further approval through RSAAS must be sought for the proposed road safety audit team for each audit undertaken on a National Road.

Yours sincerely,

Lucy Curtis

*Regional Road Safety Engineer*
roadsafetyaudits@tii.ie

## A.2. Team Member

*James Bohan*
*Atkins House*
*150 Lakeside Drive*
*Airside Business Park*
*Swords, Co. Dublin*

Date: 13/06/2016

Ref: JB*182

**re: APPROVAL AS ROAD SAFETY AUDITOR**

Dear James Bohan,

You meet the qualification and experience requirements for Road Safety Audit as follows:

| Scheme Category | Audit Team Status | Team Leader Expiry Date |
|---|---|---|
| Road Scheme | Team Member | |
| Development Scheme | Team Member | |

The above assessment is based on information supplied and the qualification and experience requirements of National Roads Authority in accordance with HD 19 “Road Safety Audit”. Further approval through RSAAS must be sought for the proposed road safety audit team for each audit undertaken on a National Road.

Yours sincerely,

Lucy Curtis

Regional Road Safety Engineer
roadsafetyaudits@tii.ie

# Appendix B. Road Safety Audit Feedback Form

**Scheme:** Cork NW Regeneration Quarter - Phase 4A

**Audit Stage:** Stage 1 Road Safety Audit

**Date Audit Completed:** **12th April 2021**

| | To be completed by the Designer | | | To be completed by the Audit Team |
|---|---|---|---|---|
| Paragraph No. in Safety Audit Report | Problem accepted (yes/no) | Recommended measure accepted (yes/no) | Alternative measures or comments | Alternative Measures accepted by Auditors (yes/no) |
| 2.1 | Yes | Yes | | |
| 2.2 | Yes | Yes | | |
| 2.3 | Yes | Yes | | |
| 2.4 | Yes | Yes | | |
| 2.5 | Yes | Yes | Boundary wall to be introduced in front of the units so no safety concerns regarding individuals stepping from front door onto shared surface. | |
| 2.6 | Yes | Yes | To be addressed at detailed design | |
| 2.7 | Yes | Yes | Crossing points to be positioned at existing public lighting pole locations to ensure appropriate lighting levels and advanced warning signs to be installed. | |

**Signed by the Designer: Martin O Sullivan** **Date: 18.04.2021**

Martin O Sullivan

**Signed by the Audit Team Leader:** **Date: 19 / 04 / 2021**

Keith Barry

**Signed by the Employer:** **Date:** 19.04.2021

Marain Hutnik

**WS Atkins International Limited**
Atkins House
150 Airside Business Park
Swords
Co. Dublin
K67 K5W4

**Tel: +353 1 810 8000**

**DATE:** 14 April 2021

**DESIGNER:** NS

**PROJECT No:** 5204404 Rev A

**PROJECT NAME:** Housing Development Knocknaheeny Avenue, Cork - Atkins

Residential area designed in accordance with EN13201-2:2015
Category P3.

# Outdoor Lighting Report

**Coastal Quater - Bray**

**PREPARED BY:**

Design Software from:
Atkins Limited,
150 Airside Business Park,
Swords,
Co. Dublin, Ireland

# Layout Report

## General Data

Dimensions in Metres Angles in Degrees
Grid Origin 565610.2m x 572901.3m
Area 260.4m x 217.3m
Sample Spacing 1.50m x 1.50m

## Luminaires

### Luminaire A Data

| | |
|---|---|
| Supplier | C U Phosco |
| Type | P852-24-S1-NW-W7-0350-26W |
| Lamp(s) | 740SS NW |
| Lamp Flux (klm) | 3.55 |
| File Name | P852-24-S1-NW-W7-0350-26W.ies |
| Maintenance Factor | 0.89 |
| Imax70,80,90(cd/klm) | 502.8, 86.6, 0.0 |
| No. in Project | 15 |

## Layout

| ID | Type | X | Y | Height | Angle | Tilt | Cant | Out-reach | Target X | Target Y | Target Z |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | A | 565712.72 | 572971.18 | 6.00 | 309.00 | 0.00 | 0.00 | 0.40 | | | |
| 2 | A | 565734.31 | 572975.87 | 6.00 | 135.00 | 0.00 | 0.00 | 0.40 | | | |
| 3 | A | 565726.85 | 572986.81 | 6.00 | 43.00 | 0.00 | 0.00 | 0.40 | | | |
| 4 | A | 565723.44 | 573008.40 | 6.00 | 229.00 | 0.00 | 0.00 | 0.40 | | | |
| 5 | A | 565699.96 | 573020.32 | 6.00 | 40.00 | 0.00 | 0.00 | 0.40 | | | |
| 6 | A | 565742.54 | 572969.59 | 6.00 | 38.00 | 0.00 | 0.00 | 0.40 | | | |
| 7 | A | 565685.56 | 573035.86 | 6.00 | 317.00 | 0.00 | 0.00 | 0.40 | | | |
| 8 | A | 565759.83 | 572961.87 | 6.00 | 229.00 | 0.00 | 0.00 | 0.40 | | | |
| 9 | A | 565751.23 | 573002.64 | 6.00 | 314.00 | 0.00 | 0.00 | 0.40 | | | |
| 10 | A | 565773.71 | 573012.60 | 6.00 | 142.00 | 0.00 | 0.00 | 0.40 | | | |
| 11 | A | 565771.96 | 573037.59 | 6.00 | 351.00 | 0.00 | 0.00 | 0.40 | | | |
| 12 | A | 565781.18 | 573062.81 | 6.00 | 197.00 | 0.00 | 0.00 | 0.40 | | | |
| 13 | A | 565793.57 | 573024.87 | 6.00 | 135.00 | 0.00 | 0.00 | 0.40 | | | |
| 14 | A | 565808.55 | 573037.18 | 6.00 | 132.00 | 0.00 | 0.00 | 0.40 | | | |
| 15 | A | 565798.08 | 573050.40 | 6.00 | 358.00 | 0.00 | 0.00 | 0.40 | | | |

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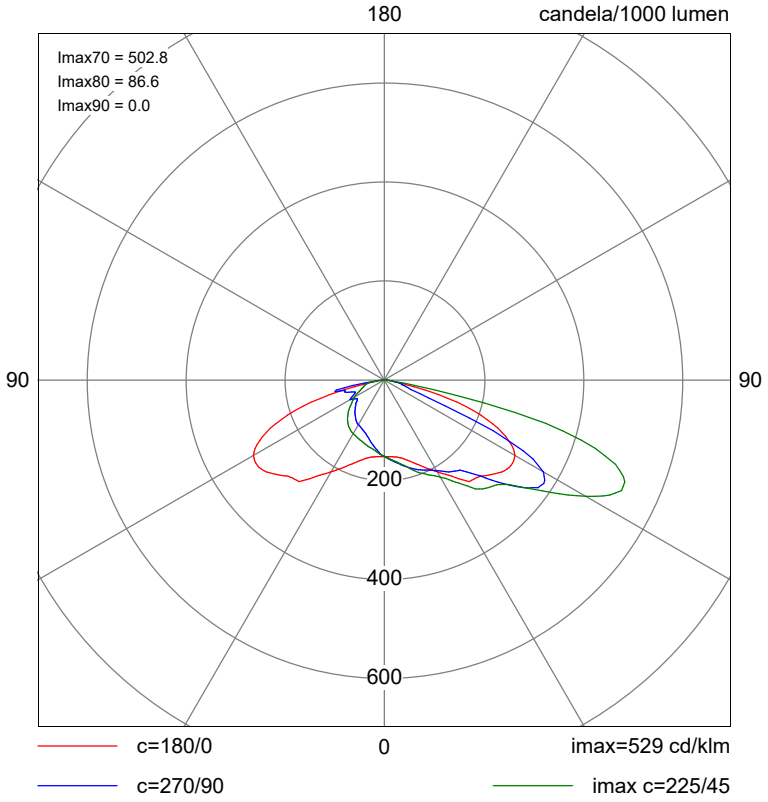
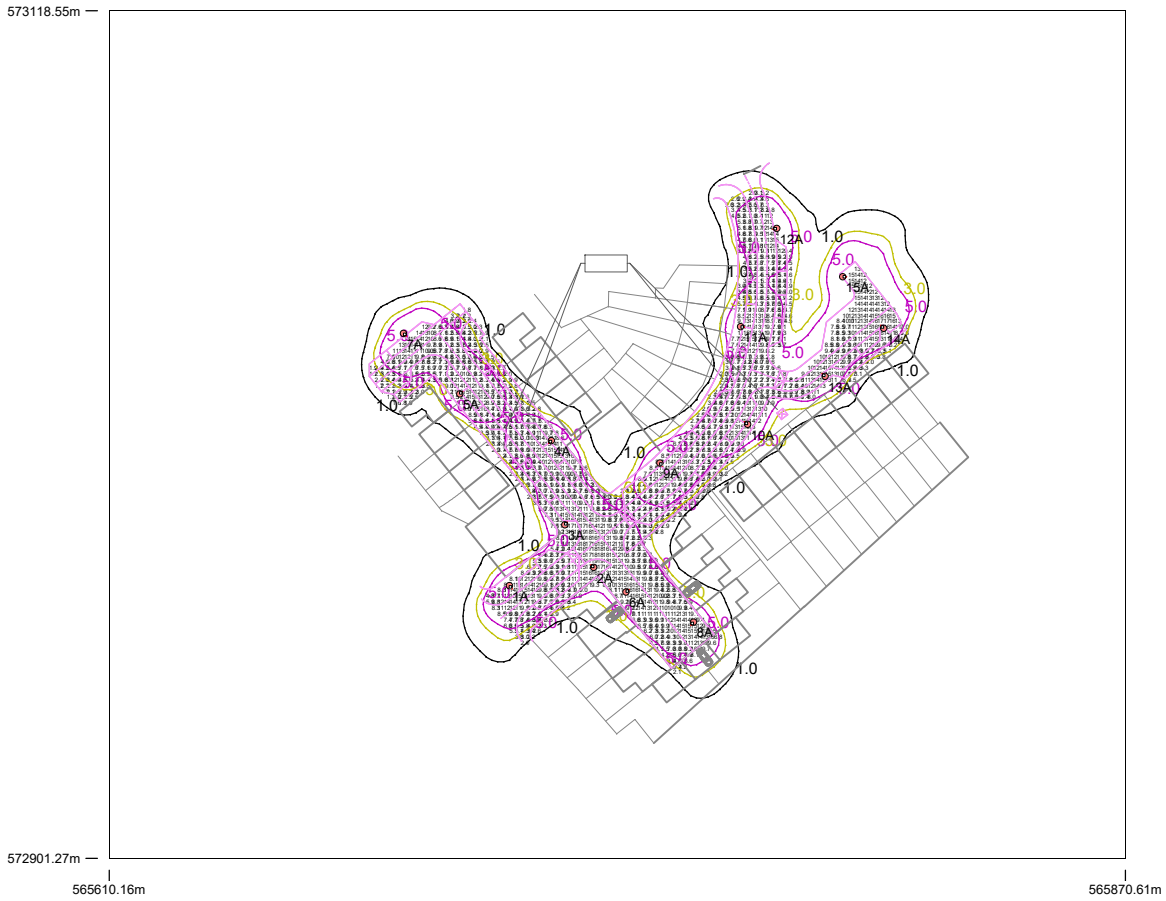
# Polar Diagram

## Luminaire A P852-24-S1-NW-W7-0350-26W



# Horizontal Illuminance (lux)

Grid 1

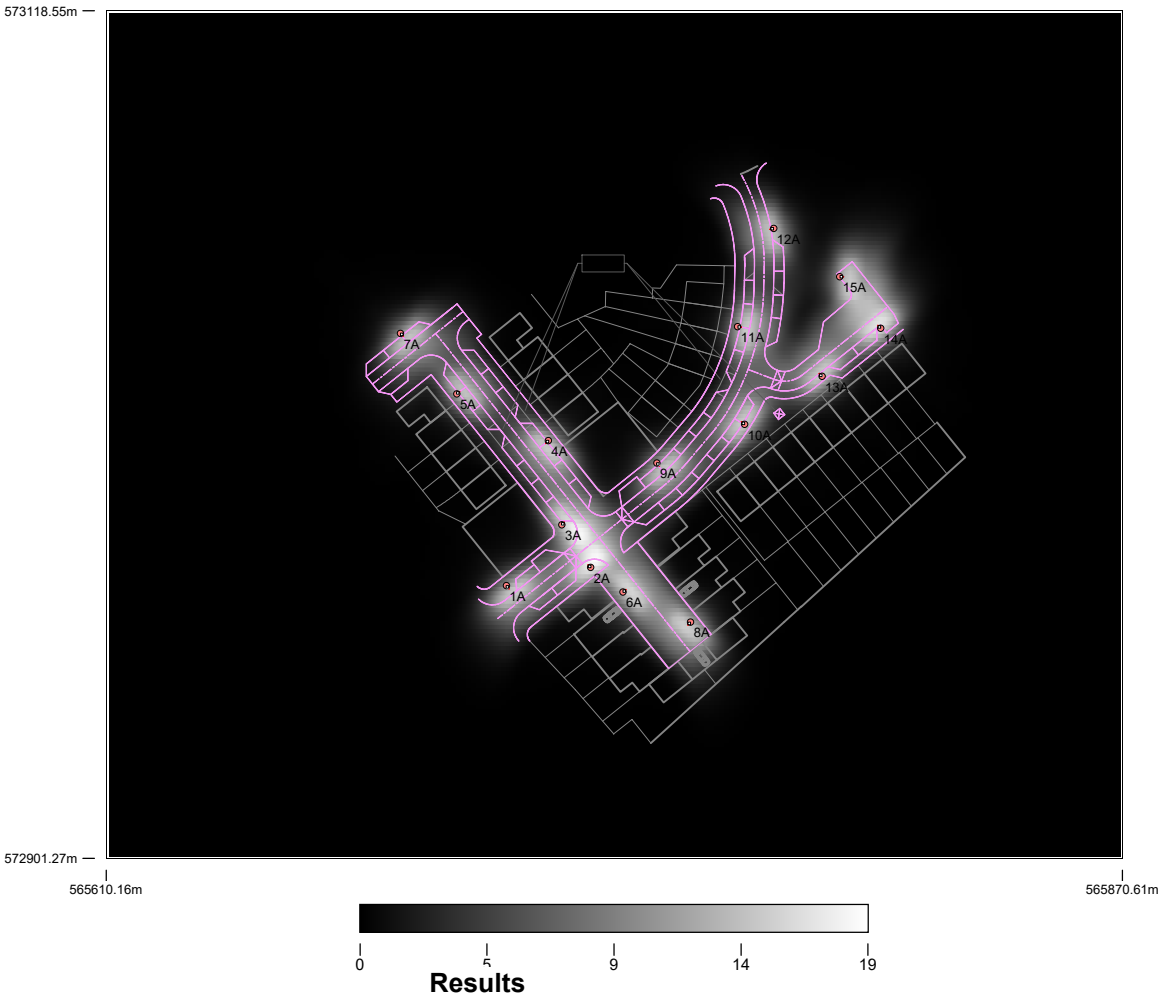



## Results

| | |
|---|---|
| Eav | 8.50 |
| Emin | 1.60 |
| Emax | 18.87 |
| Emin/Emax | 0.08 |
| Emin/Eav | 0.19 |
| | |

# Horizontal Illuminance (lux)

Grid 1



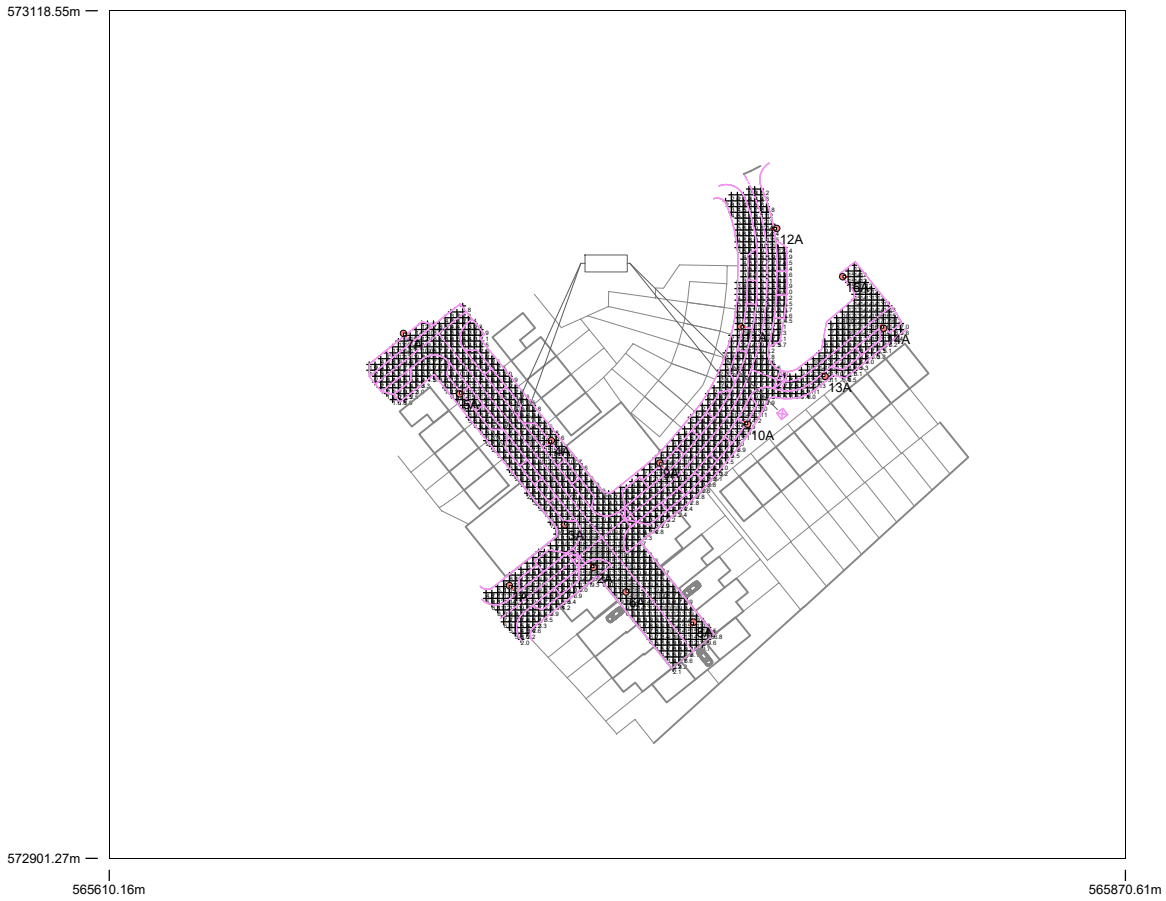

## Results

| | |
|---|---|
| Eav | 8.50 |
| Emin | 1.60 |
| Emax | 18.87 |
| Emin/Emax | 0.08 |
| Emin/Eav | 0.19 |
| | |

8158124437

# Horizontal Illuminance (lux)

Grid 1




## Results

| | |
|---|---|
| Eav | 8.50 |
| Emin | 1.60 |
| Emax | 18.87 |
| Emin/Emax | 0.08 |
| Emin/Eav | 0.19 |
| | |

# City North Quarter Regeneration Phase 4A

## Engineering & Energy Report (Part L Requirement)

Housing Agency Ltd

**31 March 2021**

Contains *sensitive* information

# Notice

This document and its contents have been prepared and are intended solely for Housing Agency information and use in relation for Planning Purposes.

WS Atkins International Limited assumes no responsibility to any other party in respect of or arising out of or in connection with this document and/or its contents.

This document has 11 pages including the cover.

## Document history

| **Job number: 5204404** | | | **Document ref: R01** | | | |
|---|---|---|---|---|---|---|
| Revision | Purpose description | Originated | Checked | Reviewed | Authorised | Date |
| Rev 01 | Part 8 Planning | NS/MT | AK | NS | MOS | 31/03/21 |
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## Client signoff

| | |
|---|---|
| Client | Housing Agency |
| Project | City North Quarter Regeneration – Phase 4A |
| Document title | Engineering & Energy Report (Part L Requirement) |
| Job no. | 5204404 |
| Document No. | 5204404/ATK/MEP/DG0001 |
| Document Reference | R01 |

# Table of contents

# Outline

This document has been prepared and checked in accordance with Atkins BS OHSAS 18001:2007, EN ISO 9001:2015 and EN ISO 14001:2015.

This document has been prepared by Atkins, with all practical experience, caution and persistent work within the terms of the Contract with the Client, take into account of the resources devoted to us by agreement with the Client.

Atkins reject any responsibility to the Client and others in respect of any matters outside the scope of the above.

This document is confidential to the Client and Atkins accept no responsibility of whatsoever nature to third parties to whom this report, or any part thereof, is made known. Any such party relies on the report at its own risk.

# 1. Part L of the Building Regulation Design

## 1.1. Public Lighting Standards

This section outlines the proposed public lighting schemes for the proposed residential development on lands at Knocknaheany Avenue and Killala Gardens, Co. Cork, Phase 4A.

The Energy efficiency requirements for lighting design will be compliance with Building Services Guides. Minimum efficacy standards for light fittings will be defined as a very high light specification quality, energy efficiency and future proofed external and internal lighting for City North Quarter Regeneration site development for Cork City Council (CCC) and Housing Agency.

The site development public lighting will be designed to its CCC specific requirements, illuminance level and uniformity to meet the lighting class for each area. All works will comply with the latest editions of the relevant standards, in particular the works shall be designed to take full account of:

- BS EN 13201 part 2 – Road Lighting Performance requirements.
- BS EN 13201 Part 3 – Road Lighting Details calculation of performance.
- BS EN 13201 Part 4 – Details methods of measuring light performance.
- The Current British Standards for Road Lighting are BS 5489 and BS EN 13201.
- BS EN 60529 - Specification for Degrees of Protection for enclosures.
- BS EN 60598-2-3 - Luminaires for Road and Street Lighting.
- BS 5489 -1 - Code of Practice for the design of road lighting.
- BS EN ISO 1461 Hot dip galvanized coatings on fabricated iron and steel articles. Specifications and test methods.
- IS EN 40-1 – Lighting Columns (Definitions and terms).
- IS EN 40-2- Lighting Columns (General requirements and dimensions).
- IS EN 40-3 - Lighting Columns (Design and verification and Verification by testing).
- IS EN 40-5 - Lighting Columns (Requirements for steel lighting columns).
- Roads Act, 1993. Road Traffic Act, 1994.
- Safety, Health and Welfare at Work Act 2005.
- Safety, Health and Welfare at Work Construction Regulations 2013.
- Building Control Act 2007.
- Road Traffic (Control of Traffic) Regulations 2006.
- ET 101 - National Rules for Electrical Installations published by ETCI.
- ET 211 - Code of Practice for Public Lighting Installations in Residential Areas published by ETCI.
- BS 7671 - Requirements for Electrical Installations. 7

Where a design standard has been revised, the latest edition will apply to all new lighting design / and installation.

## 1.2. Health & Safety

The attention of the Designer / Developer will be drawn to the obligations arising under the Safety, Health and Welfare at Work Act 2005 or latest approved version such as:

- Safety, Health and Welfare at Work (General Application) Regulations 2007 to 2012 or latest approved version.
- Safety, Health and Welfare at Work (Construction) regulations 2013 or latest approved version. Account will be taken of any traffic management measures that may be required during the installation of public lighting schemes including compliance with Chapter 8 of the Traffic Signals Manual published by the Department of Transport and CCC Public Lighting Department Requirement.

## 1.3. Public Lighting Design Requirement:

The site development public lighting installations will be designed by a competent public lighting engineer who has successfully completed the Institution of Lighting Professionals (ILP) Diploma in Exterior Lighting and is an active member of the Institution of Lighting Professionals, and as accepted by the CCC Public Lighting Department, to ensure that best practice is applied in the external lighting design of this residential development. This will include the requirement that public lighting schemes considers from junctions and traffic (both Pedestrian and Vehicular) conflict areas back i.e. T-junctions, pedestrian crossings, public and private car parking, etc.

All new systems of public lighting of a new development will be designed and installed in accordance with the requirements and as accepted by the CCC Public Lighting Department.

The overall lighting requirements for a specific area will be identified within the EN13201:2015, British and European design code. This will then be expanded and refined to take account of an area's unique character and needs in terms of vehicular/ pedestrian activity, location of local amenities, etc by the design brief. However, generally the requirements of the specific design code as stated above in Public Lighting Standards will be met.

As a general rule, new luminaires will be of LED technology source although consideration to alternative light sources (particularly for the purposes of floodlighting) will be given where appropriate. Whether there may be situations in popular locations used heavily at night a higher level of illumination will be anticipated. For particularly sensitive vicinity locations it will be recommended to arrange for trial installations to demonstrate the effectiveness of the lighting and its impact on surrounding areas. All luminaires will be manufactured to a minimum of IP 66 to BS EN 60590 for the lamp containment area and should be manufactured from vandal-resistant material. Lanterns will be designed and tested to provide a minimum normal operating life of 25years.

Construction of lighting columns and luminaire specifications shall comply with the CCC Public Lighting Installations in Residential Guideline Document.

Lighting control and installation details shall also comply with the above document.

In determining levels of illumination, lighting positions and styles, the design brief will consider pedestrian and vehicular uses/needs in relation to the following:

- Areas of activity - Bus stops, paths, etc and areas of conflict (junctions, etc).
- Building heights.
- Street features - crossing points, sitting areas, tree planting, pinch-points, materials / colours, etc.
- Ground form levels (important to people with disabilities), hazards, etc.
- Local knowledge, incidence of vandalism, accident black spots, etc.

### 1.3.1. Obtrusive Lighting

Considerations will be given to the restriction of obtrusive light by:

- The control of the type of light source Restricting the level of light emitted by the luminaire at high angles usually between 70 and 90 degrees.
- The use of full horizontal cut off luminaires for mounting heights above 6m will have a substantial effect on restricting obtrusive light. Similarly, the use of shallow bowl luminaires for mounting heights of 6m or less will help to reduce the overall level of obtrusive light produced by road lighting installations, but may add to the numbers of lighting units required
- Careful consideration will be given to the design, installation, and maintenance of any lighting systems adjacent to the site to reduce the risk of damaging the night sight of the transport operators or reducing the visibility of signalling equipment.

## 1.4. Lighting Classes Proposed

The lighting classes assigned to the various locations within the development are outlined below and detailed in the public lighting report provided.

### 1.4.1. The Residential Areas

Residential areas will be designed using an 'P4' illuminance class derived from BS EN 13201. General street lighting will be installed on 6m columns.

### 1.4.2. Car Parks

Car parks are to be lit in accordance with BS5489-1:2013, recommendation as outlined in the CIBSE Lighting Guide and 'Secure by Design' guidance. The maintained illuminance level for the Car Park is proposed 20 lux. Car park luminaires will be installed on 8m columns.

Group switching of car park lighting will be facilitated via an astro-timer and photocell and a suitably rated contactor located within a dedicated feeder pillar.

### 1.4.3. Pedestrian Crossings

Pedestrian crossings will be lit in accordance with BS5489-1:2013 and ILP Technical Report 12.

The maintained illuminance level for the pedestrian crossing is proposed as follows:

- Average vertical illuminance on this axis of pedestrian crossing at a height of 1m: Ev ≥ 40 lux
- Uniformity of vertical illuminance on lane in front of the driver (Ev min/Ev av): 0.20
- Average horizontal illuminance on pedestrian crossing at ground level: Eh ≥ 80 lux
- Uniformity of horizontal illuminance (Eh min/Eh av): 0.30

Traffic route lighting and lighting of residential estates will be powered by landlord boards.

### 1.4.4. Cycleways

Cycleways will be lit in accordance with BS5489-1:2013 and BSEN 13201-2. Lighting columns positioned on cycleways will be set back a minimum of 0.5m to avoid contact with handlebars. Where the cycleway cannot be accessed by an elevated platform, raising and lowering columns will be installed. Raising and lowering columns shall be orientated so that the lantern head can be lowered safely without obstruction and, when in its collapsed position, shall not cause an obstruction to road users and pedestrians.

## 1.5. Trees & Arboriculture

Trees and other vegetation will not impede the functions of public lighting units. A separation of 5 metres between the lighting column and the outside of the crown will be allowed for the lighting to work as designed. Trees or vegetation will not be planted within 7 metres of a public light column.

The design will take into consideration the layout of the proposed public lighting column locations and the proposed landscape design. Both layouts will be coordinated to achieve the 7 metres separation between all trees and public lighting columns.

# 2. Energy Statement/ Nearly Zero Energy Building (NZEB)

The NZEB standard will apply to all buildings owned and occupied as refer to Department of Housing, Planning and Local Government and as per the building regulations and DEAP methodology. This will be equivalent to a 25% improvement in energy performance on the 2011 Building Regulations.

The key to Part L for NZEB compliance will include a Maximum Energy Performance Coefficient of 0.3, a Maximum Carbon Performance of 0.35 and a renewable Energy Ratio of 20%.

The cost optimal level is a primary energy performance of less than 125 kWh/m2/yr, when calculated using DEAP or upgrade of roof insulation and heating system. The nearly zero or very low amount of energy required will be covered to a very significant extent by energy from renewable sources, including energy from renewable sources produced on-site or nearby.

Proposed minimum threshold level compliance achieved with TGD L Dwellings as indicated below Fig 1: -

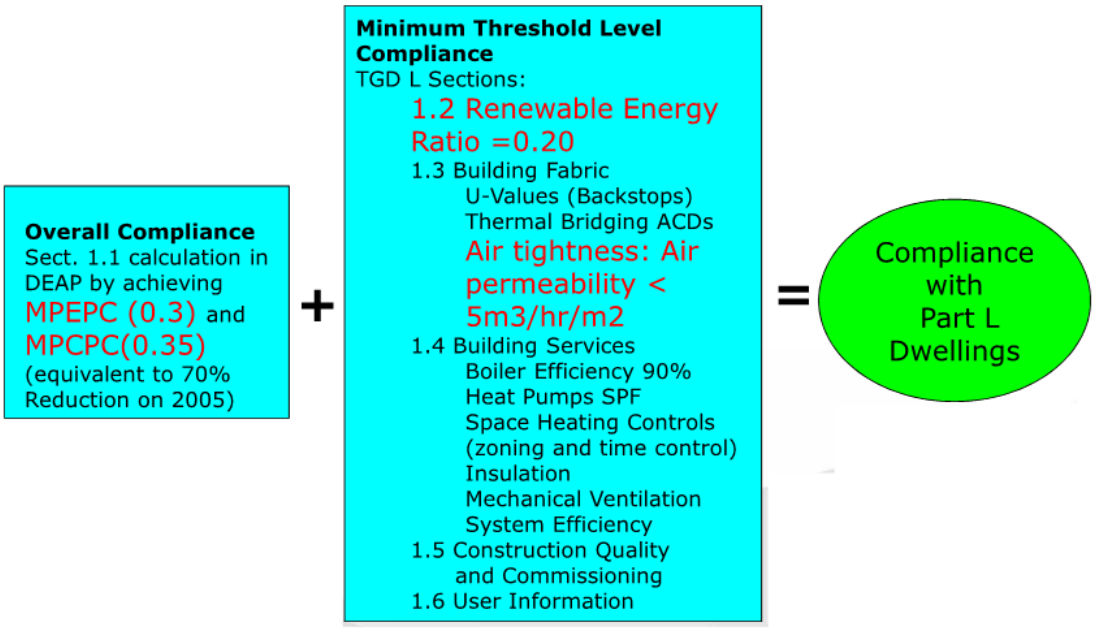


*Figure 1 - Minimum Threshold Level Compliance*

The design for the dwellings and apartments will include:

- LED lighting accounted for in DEAP (A+ bulbs, 94 lumen/cW, 4 W/m²)
- Efficient hot water uses in showers/taps accounted for in DEAP (125 l/p/d and 6l/min flow restrictor)
- Individual heat pumps for space heating and hot water production
- Mechanical ventilation for houses and apartments

## 2.1. Energy Statement

The proposed design strategy will ensure sustainable energy efficiency to ensure low running cost of use and consideration of green energy.

Some of considerations are listed below: -

- The apartment and houses to be designed will have a compact and efficient form, use of terrace and semidetached building formations limiting the heat loss and, where appropriate, availing of the heat gains through the fabric of the building
- Highly insulated external building façade
- Ensuring that the building is appropriately designed to limit overheating and hence the need for cooling
- Materials with long time life expectancy and low embodied energy.
- Consideration of water saving measures including water saving devices and controls and limiting the heat loss from pipes, ducts and vessels used for the transport or storage of heated water or air.
- Providing energy efficient space heating equipment, domestic hot water production systems, and ventilation systems, with effective controls.
- Providing energy efficient artificial lighting systems (LED) and adequate control of public and internal lighting systems.
- The guidance of the MEP design in compliance with Building Regulations Part L recommendations for conservation of fuel and energy setting of minimum energy performance requirements for building to achieve the Nearly Zero Energy Building, providing that the energy performance of the building is such as to limit the calculated primary energy consumption and related Carbon Dioxide (CO2) emissions as is reasonably practicable.
- Limitation of Carbon Dioxide (CO2) emissions to a Nearly Zero Energy Building level insofar as is reasonably practicable of for Landlord areas/ domestic buildings using the Energy Assessment Procedure (NEAP) published by Sustainable Energy Authority of Ireland.
- Ensuring that when a building element that forms part of the building envelope and has a significant impact on the energy performance of the building envelope, and the energy performance of the building element meets minimum energy performance requirements, functionally and economically feasible.
- The energy performance of each house/ and apartment will comply with the requirement of Part L building regulations and achieving no lower than a BER of A2.
- System design that provides to the building owner or occupants sufficient information about the building, the fixed building services, controls and their maintenance requirements so that the building can be operated in such a manner as to use no more fuel and energy than is reasonable.

## 2.2. E-Car Charging Provision

If required Electric Car (E-Car) charging points will be provided in accordance with CCC Development Plan 2016-2022.

## 2.3. Design Information:

The total estimated power electrical load for the phase 4A development have been based on BSRIA / Rules of Thumb Guidelines for building services (5th Edition) - CIBSE / Energy Benchmarks.

- A figure of 84(W/m²) is allowed for landlord areas. The figure is expressed in W/m² NIA, based on a net to gross ratio of 80% and mechanical power for plantrooms requirements (Rules of thumbs 5th edition / Energy Benchmarks).
- Predicting Electrical Future Load Growth - 10% power load growth factor is considered regarding future power expansion for the building associated with Building expansion and function of the building or facilities and Equipment technology within the building.
- Renewable Energy - Based on the Heat pumps systems.

- Rule of Thumb - Flats / Apartments 80(w/m2) electrical load. Note, Flat or apartment 7.5kw is employed with all electrical cooking and heating via heat pumps.
- Every house which has a parking space on curtilage to allow for a possible charging point. 20% of visitor spaces to allow for a possible charging point. Within the apartment Blocks, 20% of spaces to allow for a possible charging point with capacity to bring this up to 50%.
- The target efficiency for the apartment Blocks is 75% gross to net.
- Houses and Apartments Blocks heating and domestic hot water production will be achieved with individual heat pumps.
- Apartments can be assumed as 60sqm for 1-bed, 85 sqm for 2-beds and 110 sqm for 3 beds.
- Allowance to be made for EV charging points for future proofing and based on a minimum charging power per active charging station.

### 2.3.1. Metering Strategy

- Single Occupancy Dwellings & Apartments - The meters supplying the units will be located outside the building

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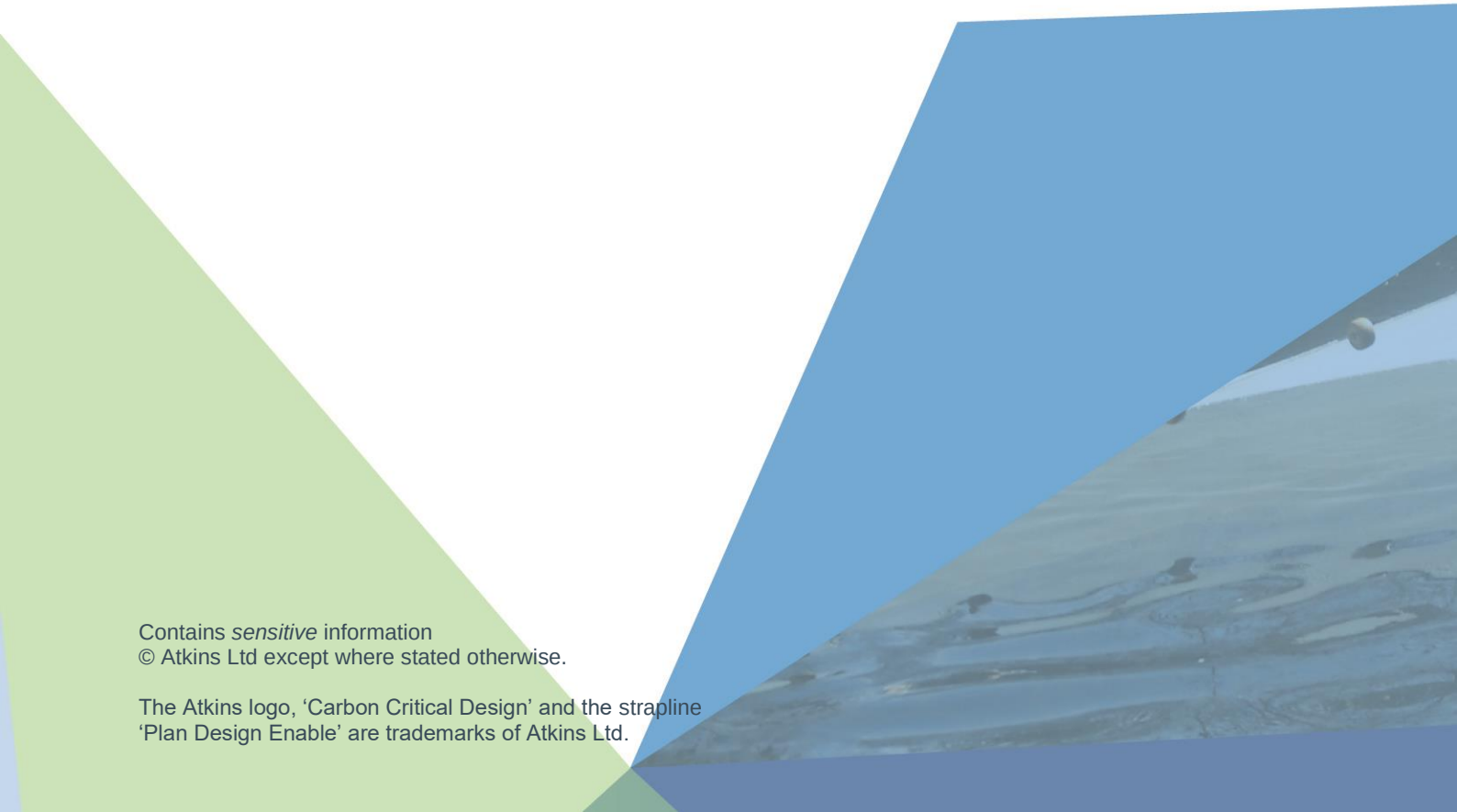

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Oifig Sheachadta na
Cathrach Theas
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Irish Water
PO Box 448,
South City
Delivery Office,
Cork City.

www.water.ie

8 February 2021

**Re: CDS21000293 pre-connection enquiry - Subject to contract | Contract denied**

**Connection for Housing Development of 43 unit(s) at Cork North West Quarter Regeneration, Kilmore Road Lower, Cork, Cork**

Dear Sir/Madam,

Irish Water has reviewed your pre-connection enquiry in relation to a Water & Wastewater connection at Cork North West Quarter Regeneration, Kilmore Road Lower, Cork, Cork (the **Premises**). Based upon the details you have provided with your pre-connection enquiry and on our desk top analysis of the capacity currently available in the Irish Water network(s) as assessed by Irish Water, we wish to advise you that your proposed connection to the Irish Water network(s) can be facilitated at this moment in time.

| **SERVICE** | **OUTCOME OF PRE-CONNECTION ENQUIRY**<br>**THIS IS NOT A CONNECTION OFFER. YOU MUST APPLY FOR A CONNECTION(S) TO THE IRISH WATER NETWORK(S) IF YOU WISH TO PROCEED.** |
|---|---|
| Water Connection | Feasible without infrastructure upgrade by Irish Water |
| Wastewater Connection | Feasible without infrastructure upgrade by Irish Water |
| **SITE SPECIFIC COMMENTS** | |
| Water Connection | Connections can be made to the water mains as per the drawings provided with this enquiry |
| Wastewater Connection | Connection can be made to the sewer at the south west of the site |
| The design and construction of the Water & Wastewater pipes and related infrastructure to be installed in this development shall comply with the Irish Water Connections and Developer Services Standard Details and Codes of Practice that are available on the Irish Water website. Irish Water reserves the right to supplement these requirements with Codes of Practice and these will be issued with the connection agreement. | |

**The map included below outlines the current Irish Water infrastructure adjacent to your site:**


Reproduced from the Ordnance Survey of Ireland by Permission of the Government. License No. 3-3-34

Whilst every care has been taken in its compilation Irish Water gives this information as to the position of its underground network as a general guide only on the strict understanding that it is based on the best available information provided by each Local Authority in Ireland to Irish Water. Irish Water can assume no responsibility for and give no guarantees, undertakings or warranties concerning the accuracy, completeness or up to date nature of the information provided and does not accept any liability whatsoever arising from any errors or omissions. This information should not be relied upon in the event of excavations or any other works being carried out in the vicinity of the Irish Water underground network. The onus is on the parties carrying out excavations or any other works to ensure the exact location of the Irish Water underground network is identified prior to excavations or any other works being carried out. Service connection pipes are not generally shown but their presence should be anticipated.

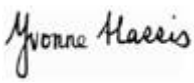
**General Notes:**

1) The initial assessment referred to above is carried out taking into account water demand and wastewater discharge volumes and infrastructure details on the date of the assessment. **The availability of capacity may change at any date after this assessment.**
2) This feedback does not constitute a contract in whole or in part to provide a connection to any Irish Water infrastructure. All feasibility assessments are subject to the constraints of the Irish Water Capital Investment Plan.
3) The feedback provided is subject to a Connection Agreement/contract being signed at a later date.

4) A Connection Agreement will be required to commencing the connection works associated with the enquiry this can be applied for at https://www.water.ie/connections/get-connected/
5) A Connection Agreement cannot be issued until all statutory approvals are successfully in place.
6) Irish Water Connection Policy/ Charges can be found at https://www.water.ie/connections/information/connection-charges/
7) Please note the Confirmation of Feasibility does not extend to your fire flow requirements.
8) Irish Water is not responsible for the management or disposal of storm water or ground waters. You are advised to contact the relevant Local Authority to discuss the management or disposal of proposed storm water or ground water discharges
9) To access Irish Water Maps email datarequests@water.ie
10) All works to the Irish Water infrastructure, including works in the Public Space, shall have to be carried out by Irish Water.

If you have any further questions, please contact Brian O'Mahony from the design team on 022 52205 or email bomahony@water.ie For further information, visit **www.water.ie/connections.**

Yours sincerely,



**Yvonne Harris**

**Head of Customer Operations**

ATKINS

Member of the SNC-Lavalin Group

# CORK NORTHWEST REGENERATION QUARTER; PHASE 4A

## Engineering Planning Report

The Housing Agency

March 2022

# Notice

This document and its contents have been prepared and are intended solely as information for The Housing Agency and use in relation to the development of a proposed Phase 4A site of the Cork Northwest Regeneration Quarter.

Atkins Ireland assumes no responsibility to any other party in respect of or arising out of or in connection with this document and/or its contents.

This document has 17 pages including the cover.

## Document history

| Revision | Purpose description | Originated | Checked | Reviewed | Authorised | Date |
|---|---|---|---|---|---|---|
| Rev 0.0 | Part 8 Planning | DH | JOK | MK | MOS | 31/01/2022 |
| Rev 0.0 | Part 8 Planning | DH | JOK | MK | MOS | 01/03/2022 |
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## Client signoff

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|---|---|
| Client | The Housing Agency |
| Project | Cork Northwest Regeneration Quarter; Phase 4A |
| Job number | 5204404 |
| Client signature / date | |

# Contents

# 1. Introduction

This Engineering Planning Report is submitted as part of the Part 8 planning application for Phase 4A of the Cork Northwest Regeneration Quarter. This report encompasses the Civil, Mechanical and Electrical aspects of the project. The Proposed Development site is the site of a former sports pitch on the northeast side of Knocknaheeny Avenue, on the north side of Cork City, County Cork.


**Figure 01 Site Location.**

The report and its appendixes address the following engineering aspects associated with the development;

- Road Engineering
- Foul Water Drainage
- Storm Drainage
- Potable Water Supply
- Part L Report
- Public Lighting

This report is to be read in conjunction with the applicable reports attached to this report and the Engineering Drawing set, as attached in Appendix C;

# 2. Existing Site

## 2.1. Existing Site

The existing site is the site of a former sports pitch on the northeast side of Knocknaheeny Avenue, on the north side of Cork City, County Cork.

The proposed site is considered brownfield and may have significant amounts of fill associated with the original housing developments in the areas dating back to the 1950`s. The majority of the site is in pasture with and area to the southwest corner containing some elements of hardstanding. The proposal is to develop a 43-unit development on the site.

## 2.2. Existing Civils

The site slopes from North to South with a large embankment on the northern face increasing in height from West to East. The Southwest corner has been utilised as a storage depo by Cork City Council in the past and there are remnants of utilities in the area associated with the depo. A topographical survey of the existing site along with (GPR)/Utility surveys have been carried out.

The surveys have identified the following utilities/services in the vicinity of the site;

- Foul Water Drainage
- Storm Water Drainage
- Watermains
- Telecoms (Eircom and Virgin Media)
- Overhead & Underground Electrical Cables
- Gas
- ENet
- Public Lighting

# 3. Roads & Traffic Engineering

## 3.1. Site Access and Circulation

The roads infrastructure for the proposed development is as per the adopted Masterplan design for the regeneration project. Access to the site will be via Knocknaheeny Avenue at the southwest corner and Killala Gardens to the Northeast corner.

A Stage 01 Road Safety Audit has been completed for the proposed development and all actions called for in the audit have been accepted and addressed in the scheme design. Please refer to Appendix D for the Stage 01 RSA. Following consultation with Cork City Council Roads Department, it has been agreed to include for pedestrian crossing points across Knocknaheeny Avenue to facilitate mobility. These crossing points will consist of dropdown kerbs and tactile paving. Please refer to Appendix C & D for further details.

The road layout, road section widths and road build up have all been maintained in line with the adopted Masterplan design requirements. All shared surfaces will be maintained in line with the areas called up in the masterplan design.

The proposals outlined above has been discussed with Cork City Council with no objections raised to the proposed scheme.

## 3.2. Pavements

There are various pavement options proposed within the site comprising bituminous and concrete.

Trafficked areas:

Road - 200mm total bituminous on 150mm CL 804 on minimum capping required in line with TII MCDRW.

Car Parking Bays - 200mm total bituminous on 150mm CL 804 on minimum capping required in line with TII MCDRW.

Concrete Footpaths at vehicle cross over points – 225mm concrete on 150mm CL 804 on minimum capping required in line with TII MCDRW

Pedestrian areas:

Footpaths 100mm concrete on 150mm CL 804

# 4. Potable Water Supply

## 4.1. Proposed Water Infrastructure

The potable water supply for the proposed development has been designed in accordance with Irish Water Code of Practice and Standard Construction Details.

It is proposed to provide the watermains infrastructure across the phase in line with the masterplan design, which will encompass 150mm diameter, 100mm diameter and 63mm diameter lines. The water main infrastructure will take into account tie in locations for future phases in line with the masterplan design. The phase will be connected to the water infrastructure of Phase 3B which is to the Southwest of the site. Refer to Appendix C for watermain layout drawings.

An Irish Water Pre-Connection Enquiry has been submitted to Irish Water for the proposed water demand based on the information contained within this Planning Report and the adopted masterplan design. A letter of confirmation of feasibility (reference no. CDS21000293) has been received from Irish Water for the proposal as outlined above. Refer to Appendix G for a copy of confirmation of feasibility letter.

# 5. Foul Water Drainage

## 5.1. Proposed Foul Infrastructure

It is proposed to provide a foul water pipe network in line with the adopted masterplan design for Phase 4A. There has been an allowance made for the future tie in of phases in line with the masterplan. Phase 4A will tie directly into the new foul infrastructure constructed as part of Phase 3B which is situated to the southwest of the site.

An Irish Water Pre-Connection Enquiry has been submitted to Irish Water for the proposed foul layout based on the information contained within this Planning Report and the adopted masterplan design. A letter of confirmation of feasibility (reference no. CDS21000293) has been received from Irish Water for the proposal as outlined above. Refer to Appendix G for a copy of conformation of feasibility letter.

“MicroDrainage” which is and industry standard tool for design and assessment of gravity sewer drainage networks has been used to model the proposed foul network. The MicroDrainage model shows that the proposed foul network has adequate capacity for the flows that will be generated from the proposed development and will achieve self-cleansing velocities. The foul network has been designed to achieve self-cleansing velocity in the pipe system at least once per day. This varies for pipe sizes with full bore self-cleansing are in accordance with Irish Water Wastewater Code of Practice.

Refer to Appendix A for design criteria and manhole schedules for the foul drainage network and to Appendix C for Proposed Foul Water Drainage Layouts.

The entire foul water network will be constructed in accordance with Irish Water Code of Practice and Standard Details.

# 6. Surface Water Drainage

## 6.1. Proposed Surface Water Drainage

It is proposed that the development site will collect the surface water runoff and discharge the flow under gravity conditions into the storm infrastructure network as adopted under the masterplan design. Pipe diameters will vary from 225mm to 450mm allowing all tie in location invert levels to future phases to be maintained as per the masterplan design.

“MicroDrainage” which is and industry standard tool for design and assessment of gravity sewer drainage networks has been used to model the proposed surface water network. The MicroDrainage model shows that the proposed surface water network has adequate capacity for the flows that will be generated from the proposed development and will achieve the full bore self-cleansing velocities

A hydro-brake manhole has been included on the line to allow for future installation of a flow control device, once the attenuation is constructed which is part of Phase 5A of the masterplan. The flow control device will be designed and installed as part of Phase 5A storm water design strategy.

Given the nature of site, the surface water runoff overland flow has been considered and site levels designed accordingly. Proposed levels allow surface water runoff to fall away and avoid ponding around buildings by grading pavements towards either the eastern, western or southern landscaping areas ensuring the critical infrastructure will be protected during exceedance events.

Surface Water Drainage will be constructed with the Greater Dublin Code of Practice for Drainage Works Version 6.0 and Cork City Council standards and details.

Refer to Appendix B for surface water drainage schedules and simulation results along with Appendix C for Proposed Surface Water Drainage Layouts.

## 6.2. Site Design Details

A minimum cover of 1.2m has been provided for the proposed network to give sufficient cover to soffit level within road locations, with a minimum slope specified to achieve self-cleansing velocities to reduce drainage depths at the downstream of the site. Steeper gradients have been proposed in the northern section of drainage by the access road to maintain the minimum 1.2m cover. Where the desired 1.2m cover cannot be achieved, an absolute minimum 900mm is proposed and surround the pipe in concrete to ensure adequate protection is maintained.

The proposed impermeable areas have been incorporated into the hydraulic model, with 100% of impermeable areas applied to the drainage network. The Phase 4A roads shall drain via traditional proprietary products such as kerb, gullies and drains to the storm water network.

The proposed surface water design was designed to provide the following.

- No surcharging in the 1 in 5-year storm event.
- No flooding in the 1 in 30-year storm event.
- No flooding against a 1 in 100-year storm event (including climate change allowance) or controlled flooding allowing the volume to be contained on site and not impact the surrounding infrastructure.

# Appendices

# Appendix A. Foul Drainage Design Criteria and Manhole Schedules

# Appendix B. Surface Water Drainage: Design Criteria, Pipeline Schedules, Flow Control Design and Network Simulation Results

# Appendix C. Engineering Drawings

# Appendix D. Stage 01; Road Safety Audit.

# Appendix E. Public Lighting Report

# Appendix F. Part L Report

# Appendix G. Irish Water Pre-Connection Enquiry for Potable Water and Wastewater

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