

# SDP

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W

J ob Ref: Ford Road  
Arundel

Title: Surface Water Drainage Calculations Report

J ob No: E 19-003

By: Nigel J ones

Date: April 2020 (First Issue)

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Structural Design Consulting Engineers Ltd Registered No. 2601187 England  
Head Office: Suite 3, Salar House, Campfield Road, St Albans, Herts AL1 5HT

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## Surface Water Network MicroDrainage Calculations -

## Outfall 1 Network

|                                                                |                                           |                                                                                     |
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| Suite 3, Salar House<br>61 Campfield Road<br>St Albans AL1 5HT | OUTFALL 1 NETWORK<br>FORD ROAD<br>ARUNDEL |  |
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| Innovyze                                                       | Network 2019.1                            |                                                                                     |

# STORM SEWER DESIGN by the Modified Rational Method

## Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - England and Wales

|                                      |        |                                       |       |
|--------------------------------------|--------|---------------------------------------|-------|
| Return Period (years)                | 100    | PIMP (%)                              | 100   |
| M5-60 (mm)                           | 19.900 | Add Flow / Climate Change (%)         | 40    |
| Ratio R                              | 0.350  | Minimum Backdrop Height (m)           | 0.200 |
| Maximum Rainfall (mm/hr)             | 50     | Maximum Backdrop Height (m)           | 1.500 |
| Maximum Time of Concentration (mins) | 30     | Min Design Depth for Optimisation (m) | 1.200 |
| Foul Sewage (l/s/ha)                 | 0.000  | Min Vel for Auto Design only (m/s)    | 1.00  |
| Volumetric Runoff Coeff.             | 0.750  | Min Slope for Optimisation (1:X)      | 500   |

Designed with Level Soffits

## Time Area Diagram for Storm

| Time<br>(mins) | Area<br>(ha) | Time<br>(mins) | Area<br>(ha) |
|----------------|--------------|----------------|--------------|
| 0-4            | 0.053        | 4-8            | 0.019        |

Total Area Contributing (ha) = 0.072

Total Pipe Volume (m<sup>3</sup>) = 56.315

|                                                                |                                           |                                                                                     |
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| Innovyze                                                       | Network 2019.1                            |                                                                                     |

Manhole Schedules for Storm

| MH Name | MH CL (m) | MH Depth (m) | MH Connection | MH Diam., L*W (mm) | PN    | Pipe Out Invert Level (m) | Diameter (mm) | PN    | Pipes In Invert Level (m) | Diameter (mm) | Backdrop (mm) |
|---------|-----------|--------------|---------------|--------------------|-------|---------------------------|---------------|-------|---------------------------|---------------|---------------|
| 1       | 5.225     | 2.975        | Open Manhole  | 600                | 1.000 | 2.250                     | 300           |       |                           |               |               |
| 2       | 5.225     | 2.985        | Open Manhole  | 500                | 1.001 | 2.240                     |               | 1.000 | 2.240                     | 300           |               |
| 3       | 3.900     | 1.940        | Open Manhole  | 500                | 1.002 | 1.960                     | 300           | 1.001 | 1.960                     |               |               |
| 4       | 3.900     | 1.950        | Open Manhole  | 600                | 1.003 | 1.950                     | 300           | 1.002 | 1.950                     | 300           |               |
| 5       | 3.750     | 1.850        | Open Manhole  | 600                | 1.004 | 1.900                     | 300           | 1.003 | 1.900                     | 300           |               |
| 6       | 3.700     | 1.820        | Open Manhole  | 600                | 1.005 | 1.880                     | 300           | 1.004 | 1.880                     | 300           |               |
| 7       | 3.500     | 1.680        | Open Manhole  | 1200               | 1.006 | 1.820                     | 150           | 1.005 | 1.820                     | 300           |               |
|         | 3.130     | 1.375        | Open Manhole  | 0                  |       | OUTFALL                   |               | 1.006 | 1.745                     | 150           |               |

No coordinates have been specified, layout information cannot be produced.

|                                                                |                                           |                                                                                     |
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PIPELINE SCHEDULES for Storm

Upstream Manhole

| PN    | Hyd  | Diam | MH   | C.Level | I.Level | D.Depth | MH           | MH DIAM., L*W |
|-------|------|------|------|---------|---------|---------|--------------|---------------|
|       | Sect | (mm) | Name | (m)     | (m)     | (m)     | Connection   | (mm)          |
| 1.000 | o    |      | 1    | 5.225   | 2.250   | 2.675   | Open Manhole | 600           |
| 1.001 | →\_/ |      | 2    | 5.225   | 2.240   | 1.734   | Open Manhole | 500           |
| 1.002 | o    | 300  | 3    | 3.900   | 1.960   | 1.640   | Open Manhole | 500           |
| 1.003 | o    | 300  | 4    | 3.900   | 1.950   | 1.650   | Open Manhole | 600           |
| 1.004 | o    | 300  | 5    | 3.750   | 1.900   | 1.550   | Open Manhole | 600           |
| 1.005 | o    | 300  | 6    | 3.700   | 1.880   | 1.520   | Open Manhole | 600           |
| 1.006 | o    | 150  | 7    | 3.500   | 1.820   | 1.530   | Open Manhole | 1200          |

Downstream Manhole

| PN    | Length | Slope | MH   | C.Level | I.Level | D.Depth | MH           | MH DIAM., L*W |
|-------|--------|-------|------|---------|---------|---------|--------------|---------------|
|       | (m)    | (1:X) | Name | (m)     | (m)     | (m)     | Connection   | (mm)          |
| 1.000 | 1.400  | 140.0 | 2    | 5.225   | 2.240   | 2.685   | Open Manhole | 500           |
| 1.001 | 44.000 | 157.1 | 3    | 3.900   | 1.960   | 0.589   | Open Manhole | 500           |
| 1.002 | 1.000  | 100.0 | 4    | 3.900   | 1.950   | 1.650   | Open Manhole | 600           |
| 1.003 | 1.780  | 35.6  | 5    | 3.750   | 1.900   | 1.550   | Open Manhole | 600           |
| 1.004 | 1.900  | 95.0  | 6    | 3.700   | 1.880   | 1.520   | Open Manhole | 600           |
| 1.005 | 9.500  | 158.3 | 7    | 3.500   | 1.820   | 1.380   | Open Manhole | 1200          |
| 1.006 | 10.860 | 144.8 |      | 3.120   | 1.745   | 1.225   | Open Manhole | 0             |

|                                                                |                                           |                                                                                     |
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Online Controls for Storm

Hydro-Brake® Optimum Manhole: 7, DS/PN: 1.006, Volume (m³): 2.5

Unit Reference MD-SHE-0047-1000-1000-1000  
Design Head (m) 1.000  
Design Flow (l/s) 1.0  
Flush-Flo™ Calculated  
Objective Minimise upstream storage  
Application Surface  
Sump Available Yes  
Diameter (mm) 47  
Invert Level (m) 1.820  
Minimum Outlet Pipe Diameter (mm) 75  
Suggested Manhole Diameter (mm) 1200

| Control Points            | Head (m) | Flow (l/s) | Control Points            | Head (m) | Flow (l/s) |
|---------------------------|----------|------------|---------------------------|----------|------------|
| Design Point (Calculated) | 1.000    | 1.0        | Kick-Flo®                 | 0.415    | 0.7        |
| Flush-Flo™                | 0.205    | 0.8        | Mean Flow over Head Range | -        | 0.8        |

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) |
|-----------|------------|-----------|------------|-----------|------------|-----------|------------|-----------|------------|
| 0.100     | 0.8        | 0.800     | 0.9        | 2.000     | 1.4        | 4.000     | 1.9        | 7.000     | 2.4        |
| 0.200     | 0.8        | 1.000     | 1.0        | 2.200     | 1.4        | 4.500     | 2.0        | 7.500     | 2.5        |
| 0.300     | 0.8        | 1.200     | 1.1        | 2.400     | 1.5        | 5.000     | 2.1        | 8.000     | 2.6        |
| 0.400     | 0.7        | 1.400     | 1.2        | 2.600     | 1.5        | 5.500     | 2.2        | 8.500     | 2.7        |
| 0.500     | 0.7        | 1.600     | 1.2        | 3.000     | 1.6        | 6.000     | 2.3        | 9.000     | 2.7        |
| 0.600     | 0.8        | 1.800     | 1.3        | 3.500     | 1.8        | 6.500     | 2.3        | 9.500     | 2.8        |

|                                                                |                                           |                                                                                     |
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| Innovyze                                                       | Network 2019.1                            |                                                                                     |

Storage Structures for Storm

Tank or Pond Pipe: 1.001

Manning's N 0.030 Invert Level (m) 2.240

| Depth (m) | Area (m <sup>2</sup> ) | Depth (m) | Area (m <sup>2</sup> ) | Depth (m) | Area (m <sup>2</sup> ) |
|-----------|------------------------|-----------|------------------------|-----------|------------------------|
| 0.000     | 44.0                   | 1.250     | 44.0                   | 1.251     | 0.0                    |

Volume Summary (Static)

Length Calculations based on True Length

| Pipe Number | USMH Name | Manhole Volume (m <sup>3</sup> ) | Pipe Volume (m <sup>3</sup> ) | Storage Structure Volume (m <sup>3</sup> ) | Total Volume (m <sup>3</sup> ) |
|-------------|-----------|----------------------------------|-------------------------------|--------------------------------------------|--------------------------------|
| 1.000       | 1         | 0.841                            | 0.060                         | 0.000                                      | 0.901                          |
| 1.001       | 2         | 0.586                            | 54.397                        | 0.000                                      | 54.983                         |
| 1.002       | 3         | 0.381                            | 0.032                         | 0.000                                      | 0.413                          |
| 1.003       | 4         | 0.551                            | 0.083                         | 0.000                                      | 0.635                          |
| 1.004       | 5         | 0.523                            | 0.092                         | 0.000                                      | 0.615                          |
| 1.005       | 6         | 0.515                            | 0.608                         | 0.000                                      | 1.122                          |
| 1.006       | 7         | 1.900                            | 0.181                         | 0.000                                      | 2.081                          |
| Total       |           | 5.297                            | 55.459                        | 0.000                                      | 60.756                         |

|                                                                |                                           |                                                                                     |
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| Innovyze                                                       | Network 2019.1                            |                                                                                     |

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

#### Simulation Criteria

Areal Reduction Factor 1.000    Additional Flow - % of Total Flow 0.000  
 Hot Start (mins) 0    MADD Factor \* 10m³/ha Storage 2.000  
 Hot Start Level (mm) 0    Inlet Coefficient 0.800  
 Manhole Headloss Coeff (Global) 0.500    Flow per Person per Day (l/per/day) 0.000  
 Foul Sewage per hectare (l/s) 0.000

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

#### Synthetic Rainfall Details

Rainfall Model    FSR M5-60 (mm) 19.500 Cv (Summer) 0.750  
 Region England and Wales    Ratio R 0.350 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 150.0  
 Analysis Timestep 2.5 Second Increment (Extended)  
 DTS Status ON  
 DVD Status ON  
 Inertia 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) 100  
 Climate Change (%) 40

| US/MH |              | Storm | Return Period | Climate Change | First (X) Surchage | First (Y) Flood | First (Z) Overflow | Overflow Act. | Water Level | Surcharged Depth |
|-------|--------------|-------|---------------|----------------|--------------------|-----------------|--------------------|---------------|-------------|------------------|
| PN    | Name         |       |               |                |                    |                 |                    |               | (m)         | (m)              |
| 1.000 | 1 360 Winter |       | 100           | +40%           |                    |                 |                    |               | 2.407       | -0.143           |
| 1.001 | 2 360 Winter |       | 100           | +40%           |                    |                 |                    |               | 2.406       | -1.085           |
| 1.002 | 3 360 Winter |       | 100           | +40%           | 100/30 Summer      |                 |                    |               | 2.407       | 0.147            |
| 1.003 | 4 360 Winter |       | 100           | +40%           | 100/15 Summer      |                 |                    |               | 2.543       | 0.293            |
| 1.004 | 5 360 Winter |       | 100           | +40%           | 100/15 Summer      |                 |                    |               | 2.655       | 0.455            |
| 1.005 | 6 360 Winter |       | 100           | +40%           | 100/15 Summer      |                 |                    |               | 2.712       | 0.532            |
| 1.006 | 7 360 Winter |       | 100           | +40%           | 100/15 Summer      |                 |                    |               | 2.770       | 0.800            |

| PN    | US/MH Name | Flooded     |                   | Pipe       |                | Status     | Level Exceeded |
|-------|------------|-------------|-------------------|------------|----------------|------------|----------------|
|       |            | Volume (m³) | Flow / Cap. (l/s) | Flow (l/s) | Overflow (l/s) |            |                |
| 1.000 | 1          | 0.000       | 0.00              | 0.1        |                | OK         |                |
| 1.001 | 2          | 0.000       | 0.02              | 23.6       |                | OK         |                |
| 1.002 | 3          | 0.000       | 0.54              | 31.3       |                | SURCHARGED |                |
| 1.003 | 4          | 0.000       | 0.46              | 28.5       |                | SURCHARGED |                |
| 1.004 | 5          | 0.000       | 0.45              | 24.6       |                | SURCHARGED |                |
| 1.005 | 6          | 0.000       | 0.32              | 19.7       |                | SURCHARGED |                |
| 1.006 | 7          | 0.000       | 0.07              | 0.9        |                | SURCHARGED |                |

## Outfall 2 Network

|                                                                |                                           |                                                                                     |
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| Innovyze                                                       | Network 2019.1                            |                                                                                     |

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - England and Wales

|                                      |        |                                       |       |
|--------------------------------------|--------|---------------------------------------|-------|
| Return Period (years)                | 100    | PIMP (%)                              | 100   |
| M5-60 (mm)                           | 19.900 | Add Flow / Climate Change (%)         | 40    |
| Ratio R                              | 0.350  | Minimum Backdrop Height (m)           | 0.200 |
| Maximum Rainfall (mm/hr)             | 50     | Maximum Backdrop Height (m)           | 1.500 |
| Maximum Time of Concentration (mins) | 30     | Min Design Depth for Optimisation (m) | 1.200 |
| Foul Sewage (l/s/ha)                 | 0.000  | Min Vel for Auto Design only (m/s)    | 1.00  |
| Volumetric Runoff Coeff.             | 0.750  | Min Slope for Optimisation (1:X)      | 500   |

Designed with Level Soffits

Time Area Diagram for Storm

| Time<br>(mins) | Area<br>(ha) | Time<br>(mins) | Area<br>(ha) |
|----------------|--------------|----------------|--------------|
| 0-4            | 0.054        | 4-8            | 0.012        |

Total Area Contributing (ha) = 0.066

Total Pipe Volume (m<sup>3</sup>) = 39.044

|                                                                |                                           |                                                                                     |
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| Innovyze                                                       | Network 2019.1                            |                                                                                     |

Manhole Schedules for Storm

| MH Name | MH CL (m) | MH Depth (m) | MH Connection  | MH Diam., L*W (mm) | PN    | Pipe Out Invert Level (m) | Diameter (mm) | PN    | Pipes In Invert Level (m) | Diameter (mm) | Backdrop (mm) |
|---------|-----------|--------------|----------------|--------------------|-------|---------------------------|---------------|-------|---------------------------|---------------|---------------|
| 1       | 5.375     | 1.055        | Open Manhole   | 500                | 1.000 | 4.320                     | 100           |       |                           |               |               |
| 2       | 5.375     | 1.071        | Open Manhole   | 500                | 1.001 | 4.304                     |               | 1.000 | 4.304                     | 100           |               |
| 3       | 5.375     | 1.081        | Open Manhole   | 500                | 1.002 | 4.294                     | 300           | 1.001 | 4.294                     |               |               |
| 4       | 5.375     | 1.091        | Open Manhole   | 500                | 1.003 | 4.284                     |               | 1.002 | 4.284                     | 300           |               |
| 5       | 5.375     | 1.103        | Open Manhole   | 500                | 1.004 | 4.272                     | 300           | 1.003 | 4.272                     |               |               |
| 6       | 5.375     | 1.118        | Open Manhole   | 500                | 1.005 | 4.257                     |               | 1.004 | 4.257                     | 300           |               |
| 7       | 5.375     | 1.134        | Open Manhole   | 500                | 1.006 | 4.241                     | 150           | 1.005 | 4.241                     |               |               |
| 8       | 2.650     | 1.000        | Sealed Manhole | 500                | 1.007 | 1.650                     | 150           | 1.006 | 1.650                     | 150           |               |
| 9       | 2.500     | 1.200        | Sealed Manhole | 1200               | 1.008 | 1.300                     | 150           | 1.007 | 1.300                     | 150           |               |
|         | 2.000     | 0.850        | Open Manhole   | 0                  |       | OUTFALL                   |               | 1.008 | 1.150                     | 150           |               |

No coordinates have been specified, layout information cannot be produced.

|                                                                |                                           |                                                                                     |
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### PIPELINE SCHEDULES for Storm

#### Upstream Manhole

| PN    | Hyd   | Diam | MH   | C.Level | I.Level | D.Depth | MH             | MH DIAM., L*W |
|-------|-------|------|------|---------|---------|---------|----------------|---------------|
|       | Sect  | (mm) | Name | (m)     | (m)     | (m)     | Connection     | (mm)          |
| 1.000 | o     |      | 1    | 5.375   | 4.320   | 0.955   | Open Manhole   | 500           |
| 1.001 | - \ / |      | 2    | 5.375   | 4.304   | 0.570   | Open Manhole   | 500           |
| 1.002 | o     | 300  | 3    | 5.375   | 4.294   | 0.791   | Open Manhole   | 500           |
| 1.003 | - \ / |      | 4    | 5.375   | 4.284   | 0.590   | Open Manhole   | 500           |
| 1.004 | o     | 300  | 5    | 5.375   | 4.272   | 0.803   | Open Manhole   | 500           |
| 1.005 | - \ / |      | 6    | 5.375   | 4.257   | 0.617   | Open Manhole   | 500           |
| 1.006 | o     | 150  | 7    | 5.375   | 4.241   | 0.984   | Open Manhole   | 500           |
| 1.007 | o     | 150  | 8    | 2.650   | 1.650   | 0.850   | Sealed Manhole | 500           |
| 1.008 | o     | 150  | 9    | 2.500   | 1.300   | 1.050   | Sealed Manhole | 1200          |

#### Downstream Manhole

| PN    | Length | Slope | MH   | C.Level | I.Level | D.Depth | MH             | MH DIAM., L*W |
|-------|--------|-------|------|---------|---------|---------|----------------|---------------|
|       | (m)    | (1:X) | Name | (m)     | (m)     | (m)     | Connection     | (mm)          |
| 1.000 | 1.600  | 100.0 | 2    | 5.375   | 4.304   | 0.971   | Open Manhole   | 500           |
| 1.001 | 5.000  | 500.0 | 3    | 5.375   | 4.294   | 0.580   | Open Manhole   | 500           |
| 1.002 | 3.200  | 320.0 | 4    | 5.375   | 4.284   | 0.791   | Open Manhole   | 500           |
| 1.003 | 6.000  | 500.0 | 5    | 5.375   | 4.272   | 0.602   | Open Manhole   | 500           |
| 1.004 | 4.450  | 296.7 | 6    | 5.375   | 4.257   | 0.813   | Open Manhole   | 500           |
| 1.005 | 8.000  | 500.0 | 7    | 5.375   | 4.241   | 0.633   | Open Manhole   | 500           |
| 1.006 | 6.000  | 2.3   | 8    | 2.650   | 1.650   | 0.850   | Sealed Manhole | 500           |
| 1.007 | 6.800  | 19.4  | 9    | 2.500   | 1.300   | 1.050   | Sealed Manhole | 1200          |
| 1.008 | 12.800 | 85.3  |      | 2.000   | 1.150   | 0.700   | Open Manhole   | 0             |

#### Simulation Criteria for Storm

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

Number of Input Hydrographs 0    Number of Offline Controls 0    Number of Time/Area Diagrams 0  
Number of Online Controls 1    Number of Storage Structures 3    Number of Real Time Controls 0

#### Synthetic Rainfall Details

|                       |                   |                       |        |
|-----------------------|-------------------|-----------------------|--------|
| Rainfall Model        | FSR               | Profile Type          | Summer |
| Return Period (years) | 100               | Cv (Summer)           | 0.750  |
| Region                | England and Wales | Cv (Winter)           | 0.840  |
| M5-60 (mm)            | 19.900            | Storm Duration (mins) | 30     |
| Ratio R               | 0.350             |                       |        |

|                                                                |                                           |                                                                                     |
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| Innovyze                                                       | Network 2019.1                            |                                                                                     |

Storage Structures for Storm

Tank or Pond Pipe: 1.001

Manning's N 0.030 Invert Level (m) 4.304

| Depth (m) | Area (m <sup>2</sup> ) | Depth (m) | Area (m <sup>2</sup> ) | Depth (m) | Area (m <sup>2</sup> ) |
|-----------|------------------------|-----------|------------------------|-----------|------------------------|
| 0.000     | 20.0                   | 0.500     | 20.0                   | 0.501     | 0.0                    |

Tank or Pond Pipe: 1.003

Manning's N 0.030 Invert Level (m) 4.284

| Depth (m) | Area (m <sup>2</sup> ) | Depth (m) | Area (m <sup>2</sup> ) | Depth (m) | Area (m <sup>2</sup> ) |
|-----------|------------------------|-----------|------------------------|-----------|------------------------|
| 0.000     | 24.0                   | 0.500     | 24.0                   | 0.501     | 0.0                    |

Tank or Pond Pipe: 1.005

Manning's N 0.030 Invert Level (m) 4.257

| Depth (m) | Area (m <sup>2</sup> ) | Depth (m) | Area (m <sup>2</sup> ) | Depth (m) | Area (m <sup>2</sup> ) |
|-----------|------------------------|-----------|------------------------|-----------|------------------------|
| 0.000     | 32.0                   | 0.500     | 32.0                   | 0.501     | 0.0                    |

Volume Summary (Static)

Length Calculations based on True Length

| Pipe Number | USMH Name | Manhole Volume (m <sup>3</sup> ) | Pipe Volume (m <sup>3</sup> ) | Storage Structure Volume (m <sup>3</sup> ) | Total Volume (m <sup>3</sup> ) |
|-------------|-----------|----------------------------------|-------------------------------|--------------------------------------------|--------------------------------|
| 1.000       | 1         | 0.207                            | 0.009                         | 0.000                                      | 0.216                          |
| 1.001       | 2         | 0.210                            | 9.009                         | 0.000                                      | 9.219                          |
| 1.002       | 3         | 0.212                            | 0.191                         | 0.000                                      | 0.403                          |
| 1.003       | 4         | 0.214                            | 11.011                        | 0.000                                      | 11.225                         |
| 1.004       | 5         | 0.217                            | 0.279                         | 0.000                                      | 0.496                          |
| 1.005       | 6         | 0.220                            | 15.015                        | 0.000                                      | 15.235                         |
| 1.006       | 7         | 0.223                            | 0.097                         | 0.000                                      | 0.320                          |
| 1.007       | 8         | 0.196                            | 0.105                         | 0.000                                      | 0.301                          |
| 1.008       | 9         | 1.357                            | 0.216                         | 0.000                                      | 1.573                          |
| Total       |           | 3.056                            | 35.932                        | 0.000                                      | 38.988                         |

|                                                                |                                           |                                                                                     |
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| Innovyze                                                       | Network 2019.1                            |                                                                                     |

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

#### Simulation Criteria

Areal Reduction Factor 1.000    Additional Flow - % of Total Flow 0.000  
 Hot Start (mins) 0    MADD Factor \* 10m³/ha Storage 2.000  
 Hot Start Level (mm) 0    Inlet Coefficient 0.800  
 Manhole Headloss Coeff (Global) 0.500    Flow per Person per Day (l/per/day) 0.000  
 Foul Sewage per hectare (l/s) 0.000

Number of Input Hydrographs 0    Number of Offline Controls 0    Number of Time/Area Diagrams 0  
 Number of Online Controls 1    Number of Storage Structures 3    Number of Real Time Controls 0

#### Synthetic Rainfall Details

Rainfall Model    FSR M5-60 (mm) 19.500 Cv (Summer) 0.750  
 Region England and Wales    Ratio R 0.350 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 150.0  
 Analysis Timestep 2.5 Second Increment (Extended)  
 DTS Status ON  
 DVD Status ON  
 Inertia 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) 100  
 Climate Change (%) 40

| PN    | US/MH Name | Storm      | Return Period | Climate Change | First (X) Surge | First (Y) Flood | First (Z) Overflow | Overflow Act. | Water Level | Surcharged Depth |
|-------|------------|------------|---------------|----------------|-----------------|-----------------|--------------------|---------------|-------------|------------------|
|       |            |            |               |                |                 |                 |                    |               | (m)         | (m)              |
| 1.000 | 1          | 180 Winter | 100           | +40%           | 100/15 Summer   |                 |                    |               | 4.653       | 0.233            |
| 1.001 | 2          | 180 Winter | 100           | +40%           |                 |                 |                    |               | 4.653       | -0.152           |
| 1.002 | 3          | 180 Winter | 100           | +40%           | 100/120 Winter  |                 |                    |               | 4.653       | 0.059            |
| 1.003 | 4          | 180 Winter | 100           | +40%           |                 |                 |                    |               | 4.653       | -0.132           |
| 1.004 | 5          | 180 Winter | 100           | +40%           | 100/60 Winter   |                 |                    |               | 4.653       | 0.081            |
| 1.005 | 6          | 180 Winter | 100           | +40%           |                 |                 |                    |               | 4.653       | -0.105           |
| 1.006 | 7          | 180 Winter | 100           | +40%           | 100/15 Summer   |                 |                    |               | 4.653       | 0.262            |
| 1.007 | 8          | 120 Winter | 100           | +40%           | 100/15 Summer   |                 |                    |               | 2.650       | 0.850            |
| 1.008 | 9          | 120 Winter | 100           | +40%           | 100/15 Summer   |                 |                    |               | 2.500       | 1.050            |

| PN    | US/MH Name | Flooded Volume (m³) | Flow / Cap. (l/s) | Pipe Flow (l/s) | Status     | Level    |
|-------|------------|---------------------|-------------------|-----------------|------------|----------|
|       |            |                     |                   |                 |            | Exceeded |
| 1.000 | 1          | 0.000               | 0.00              | 0.0             | SURCHARGED |          |
| 1.001 | 2          | 0.000               | 0.00              | 3.2             | OK         |          |
| 1.002 | 3          | 0.000               | 0.04              | 1.9             | SURCHARGED |          |
| 1.003 | 4          | 0.000               | 0.00              | 4.2             | OK         |          |
| 1.004 | 5          | 0.000               | 0.07              | 3.5             | SURCHARGED |          |
| 1.005 | 6          | 0.000               | 0.01              | 5.5             | OK         |          |

|                                                                |                                           |                                                                                     |
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| Innovyze                                                       | Network 2019.1                            |                                                                                     |

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

| PN    | US/MH<br>Name | Flooded        |                               | Pipe          |             | Status | Level<br>Exceeded |
|-------|---------------|----------------|-------------------------------|---------------|-------------|--------|-------------------|
|       |               | Volume<br>(m³) | Flow / Overflow<br>Cap. (l/s) | Flow<br>(l/s) |             |        |                   |
| 1.006 | 7             | 0.000          | 0.04                          | 4.0           | SURCHARGED  |        |                   |
| 1.007 | 8             | 0.000          | 0.14                          | 4.8           | FLOOD RISK* |        | 24                |
| 1.008 | 9             | 0.000          | 0.06                          | 1.1           | FLOOD RISK* |        | 24                |

## Outfall 3 Network

|                                                                |                                           |                                                                                     |
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| Innovyze                                                       | Network 2019.1                            |                                                                                     |

# STORM SEWER DESIGN by the Modified Rational Method

## Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - England and Wales

|                                      |        |                                       |       |
|--------------------------------------|--------|---------------------------------------|-------|
| Return Period (years)                | 100    | PIMP (%)                              | 100   |
| M5-60 (mm)                           | 19.900 | Add Flow / Climate Change (%)         | 40    |
| Ratio R                              | 0.350  | Minimum Backdrop Height (m)           | 0.200 |
| Maximum Rainfall (mm/hr)             | 50     | Maximum Backdrop Height (m)           | 1.500 |
| Maximum Time of Concentration (mins) | 30     | Min Design Depth for Optimisation (m) | 1.200 |
| Foul Sewage (l/s/ha)                 | 0.000  | Min Vel for Auto Design only (m/s)    | 1.00  |
| Volumetric Runoff Coeff.             | 0.750  | Min Slope for Optimisation (1:X)      | 500   |

Designed with Level Soffits

## Time Area Diagram for Storm

| Time<br>(mins) | Area<br>(ha) | Time<br>(mins) | Area<br>(ha) |
|----------------|--------------|----------------|--------------|
| 0-4            | 0.098        | 4-8            | 0.036        |

Total Area Contributing (ha) = 0.134

Total Pipe Volume (m<sup>3</sup>) = 79.065

|                                                                |                                           |                                                                                     |
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| Innovyze                                                       | Network 2019.1                            |                                                                                     |

Manhole Schedules for Storm

| 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) |
|---------|-----------|--------------|---------------|--------------------|-------------|---------------------------|------------------------|-------------|---------------------------|------------------------|---------------|
| 1       | 2.800     | 0.900        | Open Manhole  | 500                | 1.000       | 1.800                     | 225                    |             |                           |                        |               |
| 2       | 2.800     | 0.915        | Open Manhole  | 500                | 1.001       | 1.885                     |                        | 1.000       | 1.885                     | 225                    |               |
| 3       | 2.800     | 0.960        | Open Manhole  | 500                | 1.002       | 1.840                     | 225                    | 1.001       | 1.840                     |                        |               |
| 4       | 2.800     | 1.000        | Open Manhole  | 500                | 1.003       | 1.800                     | 225                    | 1.002       | 1.800                     | 225                    |               |
| 5       | 2.700     | 1.100        | Open Manhole  | 500                | 1.004       | 1.600                     | 225                    | 1.003       | 1.600                     | 225                    |               |
| 6       | 2.500     | 1.200        | Open Manhole  | 1200               | 1.005       | 1.300                     | 225                    | 1.004       | 1.300                     | 225                    |               |
|         | 2.020     | 0.870        | Open Manhole  | 0                  |             | OUTFALL                   |                        | 1.005       | 1.150                     | 225                    |               |

No coordinates have been specified, layout information cannot be produced.

|                                                                |                                           |                                                                                     |
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### PIPELINE SCHEDULES for Storm

#### 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) |
|-------|----------|-----------|---------|-------------|-------------|-------------|---------------|--------------------|
| 1.000 | o        |           | 1       | 2.800       | 1.800       | 0.675       | Open Manhole  | 500                |
| 1.001 | →\_/     |           | 2       | 2.800       | 1.885       | 0.464       | Open Manhole  | 500                |
| 1.002 | o        | 225       | 3       | 2.800       | 1.840       | 0.735       | Open Manhole  | 500                |
| 1.003 | o        | 225       | 4       | 2.800       | 1.800       | 0.775       | Open Manhole  | 500                |
| 1.004 | o        | 225       | 5       | 2.700       | 1.600       | 0.875       | Open Manhole  | 500                |
| 1.005 | o        | 225       | 6       | 2.500       | 1.300       | 0.975       | 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) |
|-------|------------|-------------|---------|-------------|-------------|-------------|---------------|--------------------|
| 1.000 | 1.200      | 80.0        | 2       | 2.800       | 1.885       | 0.690       | Open Manhole  | 500                |
| 1.001 | 22.000     | 488.9       | 3       | 2.800       | 1.840       | 0.509       | Open Manhole  | 500                |
| 1.002 | 1.000      | 25.0        | 4       | 2.800       | 1.800       | 0.775       | Open Manhole  | 500                |
| 1.003 | 9.600      | 48.0        | 5       | 2.700       | 1.600       | 0.875       | Open Manhole  | 500                |
| 1.004 | 15.000     | 50.0        | 6       | 2.500       | 1.300       | 0.975       | Open Manhole  | 1200               |
| 1.005 | 12.900     | 86.0        |         | 2.620       | 1.150       | 0.645       | Open Manhole  | 0                  |

#### Simulation Criteria for Storm

|                                 |       |                                     |               |
|---------------------------------|-------|-------------------------------------|---------------|
| Volumetric Runoff Coeff         | 0.750 | Additional Flow - % of Total Flow   | 0.000         |
| Areal Reduction Factor          | 1.000 | MADD Factor * 10m³/ha               | Storage 2.000 |
| Hot Start (mins)                | 0     | Inlet Coefficient                   | 0.800         |
| Hot Start Level (mm)            | 0     | Flow per Person per Day (l/per/day) | 0.000         |
| Manhole Headloss Coeff (Global) | 0.500 | Run Time (mins)                     | 60            |
| Foul Sewage per hectare (l/s)   | 0.000 | Output Interval (mins)              | 1             |

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

#### Synthetic Rainfall Details

|                       |                   |                       |        |
|-----------------------|-------------------|-----------------------|--------|
| Rainfall Model        | FSR               | Profile Type          | Summer |
| Return Period (years) | 100               | Cv (Summer)           | 0.750  |
| Region                | England and Wales | Cv (Winter)           | 0.840  |
| M5-60 (mm)            | 19.900            | Storm Duration (mins) | 30     |
| Ratio R               | 0.350             |                       |        |

|                                                                |                                           |                                                                                     |
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| Innovyze                                                       | Network 2019.1                            |                                                                                     |

Online Controls for Storm

Hydro-Brake® Optimum Manhole: 6, DS/PN: 1.005, Volume (m³): 1.9

Unit Reference MD-SHE-0061-2000-1500-2000  
Design Head (m) 1.500  
Design Flow (l/s) 2.0  
Flush-Flo™ Calculated  
Objective Minimise upstream storage  
Application Surface  
Sump Available Yes  
Diameter (mm) 61  
Invert Level (m) 1.300  
Minimum Outlet Pipe Diameter (mm) 75  
Suggested Manhole Diameter (mm) 1200

| Control Points            | Head (m) | Flow (l/s) | Control Points            | Head (m) | Flow (l/s) |
|---------------------------|----------|------------|---------------------------|----------|------------|
| Design Point (Calculated) | 1.500    | 2.0        | Kick-Flo®                 | 0.545    | 1.3        |
| Flush-Flo™                | 0.269    | 1.6        | Mean Flow over Head Range | -        | 1.5        |

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

| Depth (m) | Flow (l/s) | Depth (m) | Flow (l/s) | Depth (m) | Flow (l/s) | Depth (m) | Flow (l/s) | Depth (m) | Flow (l/s) |
|-----------|------------|-----------|------------|-----------|------------|-----------|------------|-----------|------------|
| 0.100     | 1.3        | 0.800     | 1.5        | 2.000     | 2.3        | 4.000     | 3.1        | 7.000     | 4.1        |
| 0.200     | 1.5        | 1.000     | 1.7        | 2.200     | 2.4        | 4.500     | 3.3        | 7.500     | 4.2        |
| 0.300     | 1.6        | 1.200     | 1.8        | 2.400     | 2.5        | 5.000     | 3.5        | 8.000     | 4.3        |
| 0.400     | 1.5        | 1.400     | 1.9        | 2.600     | 2.6        | 5.500     | 3.6        | 8.500     | 4.5        |
| 0.500     | 1.4        | 1.600     | 2.1        | 3.000     | 2.7        | 6.000     | 3.8        | 9.000     | 4.6        |
| 0.600     | 1.3        | 1.800     | 2.2        | 3.500     | 3.0        | 6.500     | 3.9        | 9.500     | 4.7        |

|                                                                |                                           |                                                                                     |
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Storage Structures for Storm

Tank or Pond Pipe: 1.001

Manning's N 0.030 Invert Level (m) 1.885

| Depth (m) | Area (m <sup>2</sup> ) | Depth (m) | Area (m <sup>2</sup> ) | Depth (m) | Area (m <sup>2</sup> ) |
|-----------|------------------------|-----------|------------------------|-----------|------------------------|
| 0.000     | 172.0                  | 0.450     | 172.0                  | 0.451     | 0.0                    |

Volume Summary (Static)

Length Calculations based on True Length

| Pipe Number | USMH Name | Manhole Volume (m <sup>3</sup> ) | Pipe Volume (m <sup>3</sup> ) | Storage Structure Volume (m <sup>3</sup> ) | Total Volume (m <sup>3</sup> ) |
|-------------|-----------|----------------------------------|-------------------------------|--------------------------------------------|--------------------------------|
| 1.000       | 1         | 0.177                            | 0.028                         | 0.000                                      | 0.205                          |
| 1.001       | 2         | 0.180                            | 75.725                        | 0.000                                      | 75.905                         |
| 1.002       | 3         | 0.188                            | 0.020                         | 0.000                                      | 0.208                          |
| 1.003       | 4         | 0.196                            | 0.362                         | 0.000                                      | 0.558                          |
| 1.004       | 5         | 0.216                            | 0.563                         | 0.000                                      | 0.779                          |
| 1.005       | 6         | 1.357                            | 0.489                         | 0.000                                      | 1.846                          |
| Total       |           | 2.314                            | 77.186                        | 0.000                                      | 79.501                         |

|                                                                |                                           |                                                                                     |
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| Innovyze                                                       | Network 2019.1                            |                                                                                     |

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

Simulation Criteria

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

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

Synthetic Rainfall Details

Rainfall Model    FSR M5-60 (mm) 19.500 Cv (Summer) 0.750  
 Region England and Wales    Ratio R 0.350 Cv (Winter) 0.840

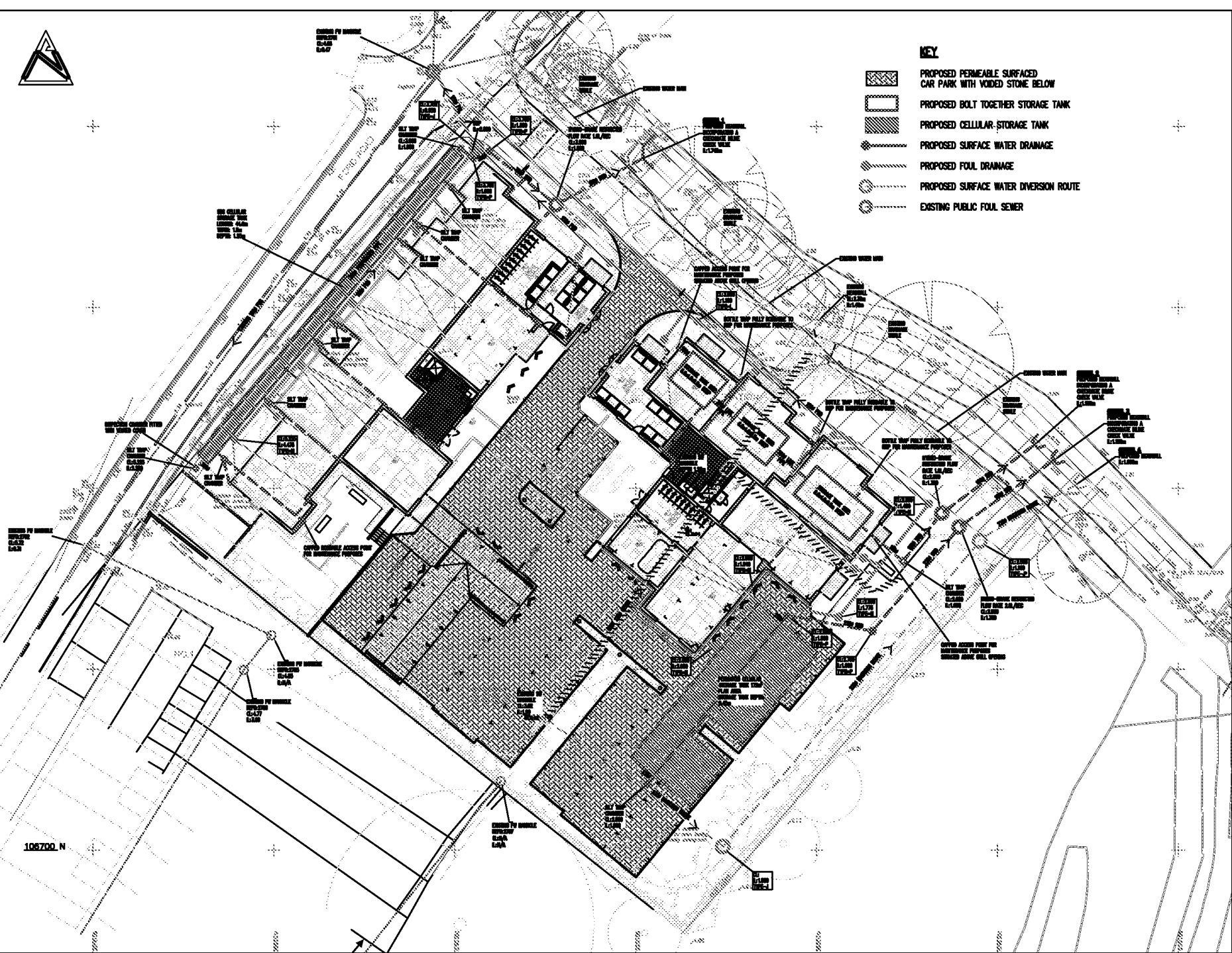
Margin for Flood Risk Warning (mm) 150.0  
 Analysis Timestep 2.5 Second Increment (Extended)  
 DTS Status ON  
 DVD Status ON  
 Inertia Status ON

Profile(s) Summer and Winter  
 Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440  
 Return Period(s) (years) 100  
 Climate Change (%) 40

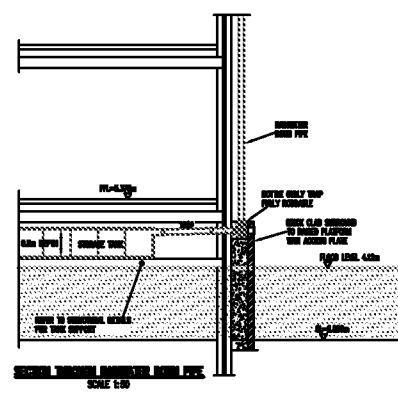
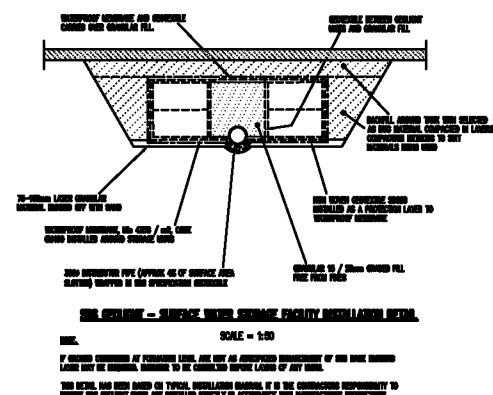
|       |              |       |               |                | Water Surcharged   |                 |
|-------|--------------|-------|---------------|----------------|--------------------|-----------------|
| PN    | US/MH Name   | Storm | Return Period | Climate Change | First (X) Surge    | First (Y) Flood |
|       |              |       |               |                | First (Z) Overflow | Overflow Act.   |
|       |              |       |               |                |                    | Level (m)       |
|       |              |       |               |                |                    | Depth (m)       |
| 1.000 | 1 360 Winter |       | 100           | +40%           |                    | 2.082           |
| 1.001 | 2 360 Winter |       | 100           | +40%           |                    | -0.043          |
| 1.002 | 3 360 Winter |       | 100           | +40%           | 100/180 Winter     | 2.082           |
| 1.003 | 4 360 Winter |       | 100           | +40%           | 100/60 Winter      | 0.017           |
| 1.004 | 5 360 Winter |       | 100           | +40%           | 100/15 Summer      | 2.097           |
| 1.005 | 6 360 Winter |       | 100           | +40%           | 100/15 Summer      | 0.072           |
|       |              |       |               |                |                    | 2.115           |
|       |              |       |               |                |                    | 0.290           |
|       |              |       |               |                |                    | 2.126           |
|       |              |       |               |                |                    | 0.601           |

| Flooded |            |                          | Pipe        |                | Level      |            |
|---------|------------|--------------------------|-------------|----------------|------------|------------|
| PN      | US/MH Name | Volume (m <sup>3</sup> ) | Flow / Cap. | Overflow (l/s) | Flow (l/s) | Status     |
| 1.000   | 1          | 0.000                    | 0.00        |                | 0.0        | OK         |
| 1.001   | 2          | 0.000                    | 0.00        |                | 7.1        | OK         |
| 1.002   | 3          | 0.000                    | 0.11        |                | 3.3        | SURCHARGED |
| 1.003   | 4          | 0.000                    | 0.05        |                | 3.1        | SURCHARGED |
| 1.004   | 5          | 0.000                    | 0.04        |                | 2.8        | SURCHARGED |
| 1.005   | 6          | 0.000                    | 0.03        |                | 1.6        | SURCHARGED |

## Site Drainage Plan



**AN ADDITIONAL STORAGE VOLUME OF 164m<sup>3</sup> IS PROVIDED WITHIN THE PERMEABLE PAVING SUB-BASE STORAGE STONE (30% VOID RATIO) BASED ON A DEPTH OF 400mm. THIS WILL HELP COMPENSATE FOR THE FLUMAL FLOOD WATER**



|       |             |        |
|-------|-------------|--------|
| 1:200 | NJ          | Feb 20 |
|       | MS          |        |
| -     | EX-063-1000 | A      |

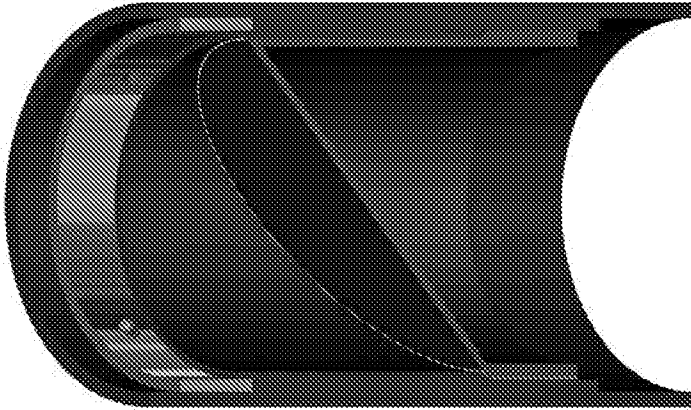
## Checkmate Inline Check Valve

# CHECKMATE® INLINE CHECK VALVES

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## INSTALLATION, OPERATION AND MAINTENANCE MANUAL

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The revolutionary design of the CheckMate® Inline Check Valve provides superior backflow prevention and odor mitigation in stormwater, CSO and SSO outfalls. The CheckMate's® custom-engineered, all-rubber unibody design eliminates costly backflow from oceans, rivers and interceptors. The valve's unique elastomer fabric and wire reinforced design provides a proven record of maintenance-free performance, cost savings and results that no other inline check valve can match. The CheckMate® is built to suit all your site-specific and flow needs.

The CheckMate® has a 100% fabric and elastomer construction that eliminates corrosion problems. Because the CheckMate® is made with a unibody construction, there are no mechanical components that trap debris, corrode or fail.

The CheckMate® Valve's inherent flexibility virtually eliminates seating problems. The CheckMate® remains in the closed position until forward differential pressure opens it. The fabric-reinforced elastomer CheckMate® Valve seals around silt and small debris, preventing unwanted backflow.

The major advantage of the CheckMate® Valve is its extremely low headloss. The CheckMate® can open to a near full pipe diameter. This maximizes flow capacity of the outfall, which is particularly beneficial in low-lying areas where limited driving head is available.

Tideflex® Technologies recommends pinning all CheckMate® Valves for added security and stability. CheckMate's® effectively have a zero face-to-face dimension because they fit completely inside of the pipe. No modification of piping is required provided adequate pipe length exists.

### **IMPORTANT**

Please take a moment to **review this manual**. The improper installation or use of this product may result in personal injury, product failure, or reduced product life. Tideflex® Technologies can accept NO liability resulting from the improper use or installation of this product. If you have any questions or problems, please call the customer service department at (412) 279-0044. We appreciate your comments. Thank you for choosing Tideflex® Technologies.

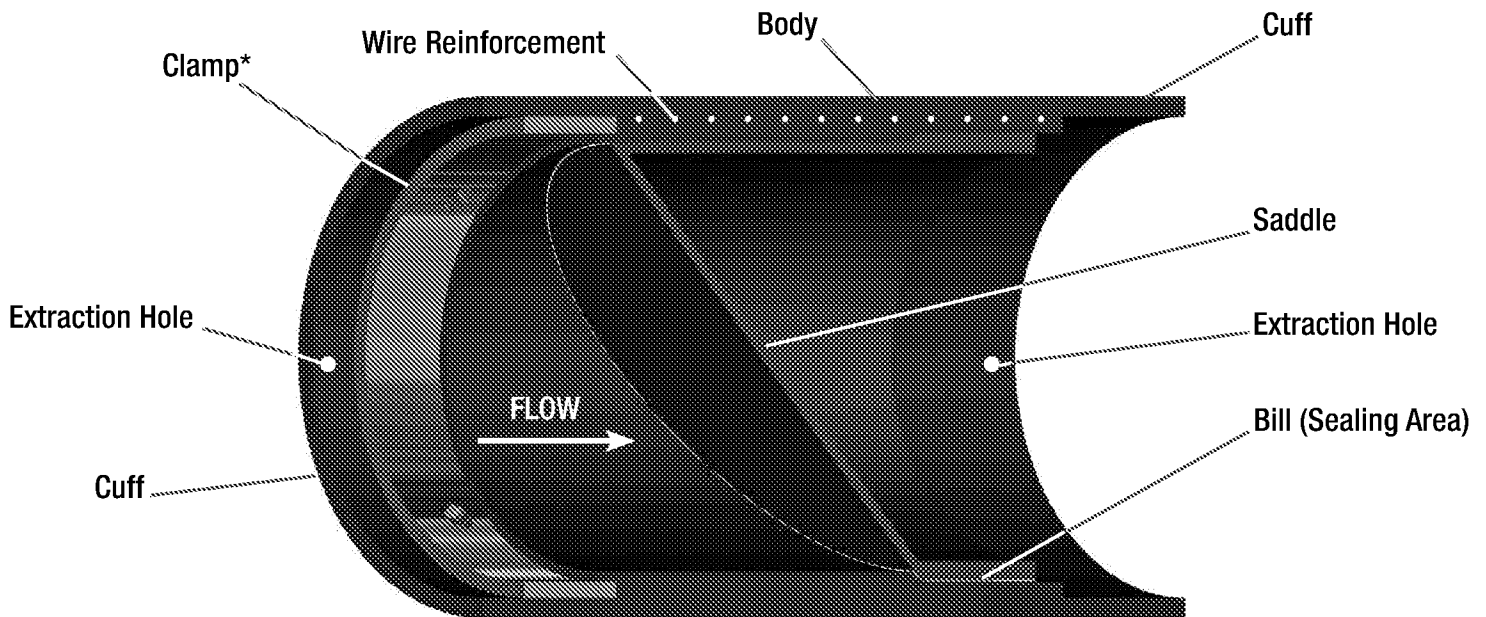
# CheckMate® Installation Procedure

**NEVER...**  
Install the valve at an angle

**NEVER...**  
Use Sharp Tools on Rubber

**NEVER...**  
Exceed Design Back Pressure

**NEVER...**  
Install the Valve Backwards



\*Clamps are installed in the upstream or downstream cuff, depending upon the application. The illustration above is shown clamped upstream.

## CHECKMATE® INSTALLATION

### 1. Product Shipping

Valve sizes 2" - 18" are furnished with one clamp. Valves 20" - 60" ship with two clamps. 72" valves ship with three clamps.

**NOTE:** A clamp is installed on each end of the valve to keep the valve's shape during transit and storage. Once the installation orientation is determined the CheckMate® valve will be clamped from either the upstream or downstream side. **For valves with two or three clamps, they can be installed onto the same side of the valve and offset from each other, as illustrated in Figure 1.**

### 2. Unpacking & Lifting

Do not use sharp tools when unpacking this product as it may damage the valve.

For larger CheckMate® valves, the valve should be lifted with either a sling or with supports around the O.D. at each side of the valve to ease the installation procedure. Do not place an object through the valve in order to lift.

**CAUTION:** Do not try to bend, collapse or fold the valve in order to facilitate the installation as this will cause permanent damage and will not allow the valve to return to a fully round shape.

### 3. Inspection of Pipe I.D.

Check the inside diameter (I.D.) of the pipe section for rough or damaged areas. The inside surface should be uniform and relatively smooth. Long gouges or cracks in the pipe may allow water to pass and should be filled prior to installation. Do not attempt to install a CheckMate® in a smaller pipe I.D.

### 4. Pipe I.D. Measurements

The pipe I.D. is to be checked in the field. It should be a consistent diameter for the length of valve and should not be out of round. When there is a +/- tolerance on the pipe I.D., the CheckMate® Valve should be ordered to the smallest pipe I.D.. Then, rubber adhesive strip can be applied to both CheckMate® cuffs to build the cuff O.D. up to the actual pipe I.D. See procedure in #5.

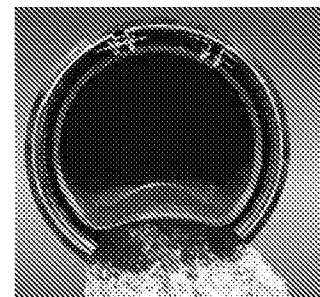


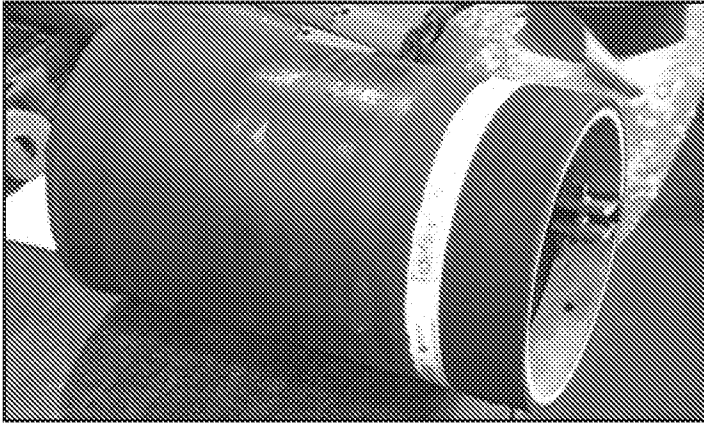
Figure 1 – Clamps shown installed on the same side of valve

# CheckMate® Rubber Adhesive Strip Build Up Procedure

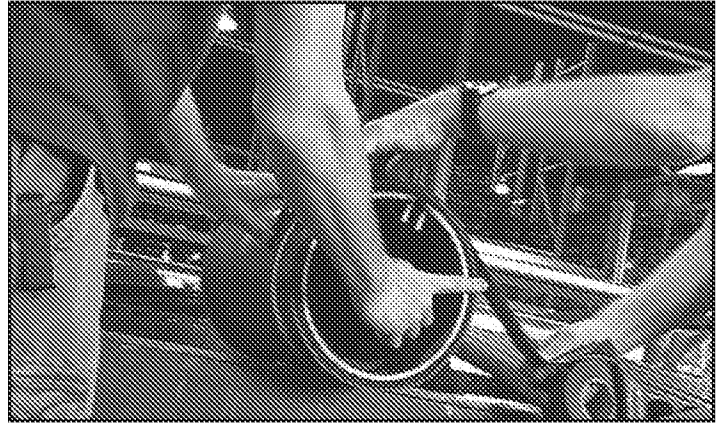
## 5. Rubber Adhesive Strip Build up

When valve O.D. is smaller than the pipe I.D., one-sided rubber adhesive strip is used to build up the O.D. of both CheckMate® cuffs to the actual pipe I.D.

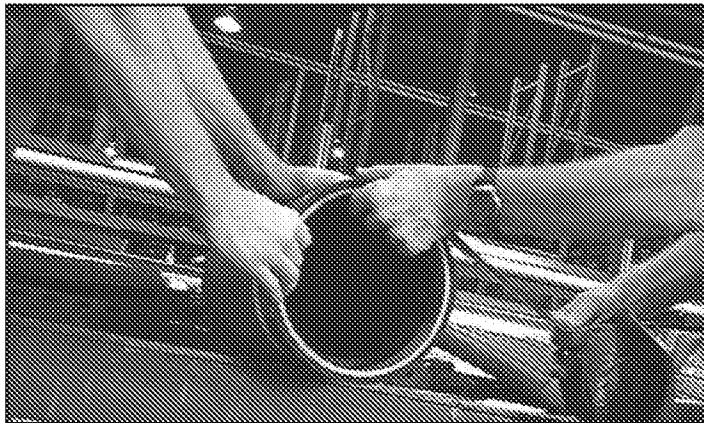
**NOTICE:** Clean and dry the exterior of the valve prior to beginning rubber adhesive strip build up procedure.



**STEP A:** Place the valve on a solid, flat surface with the clamped end hanging slightly over the edge of the surface.



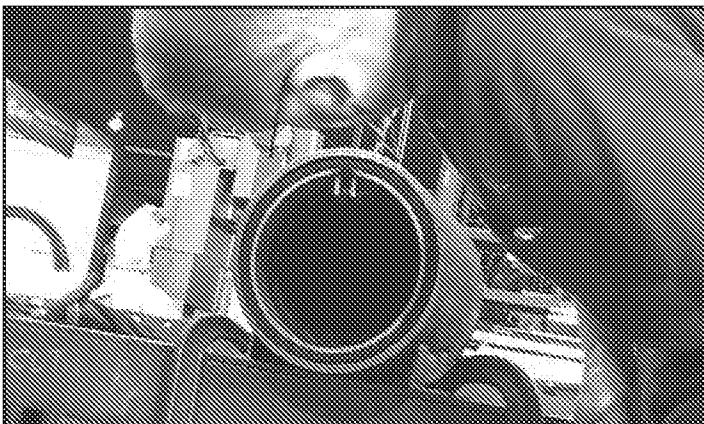
**STEP B:** Slowly rotate the valve while firmly pressing the rubber adhesive strip onto itself in concentric layers until valve O.D. is equal to or a fraction smaller than pipe I.D.



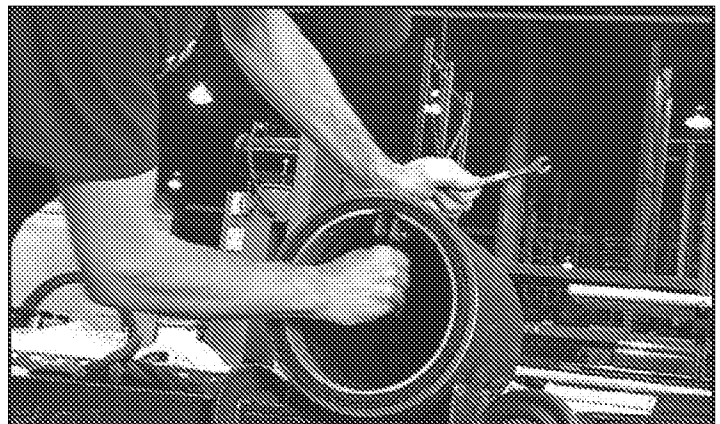
**STEP C:** Repeat steps A and B on the opposite side of the valve to ensure uniformity of the CheckMate's® O.D. is consistent and matches the pipe I.D.



**STEP D:** Lubricate the valve and rubber adhesive strip surface. Slide valve into pipe. Ensure the area marked TOP is in the 12:00 position.



**STEP E:** Check O.D. of the valve to ensure it fits snugly into the I.D. of pipe. If loose, add another layer(s) of the rubber adhesive strip.



**STEP F:** Once in place, tighten the clamp to secure it against the pipe and compress the rubber adhesive strip.

# CheckMate® Installation Procedure

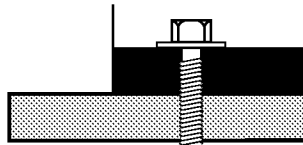
## 6. Preparation

The CheckMate® Valve uses expanding clamp(s) to exert pressure outwards on the walls of the valve to wedge it in place within the pipe. The walls of the pipe should be clean and free of debris prior to installation.

The valve should be inserted fully into the pipe so that no part of the cuff or bill extends outside the pipe. Ensure that the valve is not slanted at an angle with the bill pointing upwards or downwards. The valve centerline should be parallel to the pipe centerline.

Tidflex® Technologies recommends pinning the CheckMate® Valve on all installations. See below.

Four pre-drilled holes are provided in each expansion clamp. At least one clamp should be pinned. On exposed pipe, holes can be drilled through the valve and pipe, and a bolt run through secured with a nut. For buried pipe, silicon or similar sealant should be used to seal bolts.



## 7. Lubrication

The outside of the valve can be lubricated with a water-based lubricant prior to inserting the valve into the pipe. If the taping procedure has been used, the surface of the tape can be lubricate to aid insertion.

**CAUTION:** Do not use petroleum-based lubricants on this product or on the vulcanized rubber tape.

## 8. Plumb Lines and Arrows

The CheckMate® Valve arrives with a “top” arrow, “flow” arrow and plumb lines, marked in white, at the 12:00 and 6:00 position of the valve. Utilize this marking to orient the valve in the pipe, as well as to ensure the valve is oriented correctly in pipe section.

## 9. Valve Orientation

The CheckMate® Valve must be installed in a horizontal pipe. Valves 4" – 18" (nominal) are supplied with a single clamp. The clamp turnbuckle should be oriented at top dead center as delineated by the plumb line.

Valves 20" – 60" (nominal) are supplied with two clamps. The turnbuckles should be oriented 45° from the top center plumb line.

The 72" is supplied with three clamps. The turnbuckle for one clamp to be at top center. The other clamps to be 45° to each side of top center.

## 10. Insertion Into Pipe

Clamp to support the shape of the cuff should be hand tight and should be extended outward, but only tight enough to loosely keep the shape of the cuff during installation.

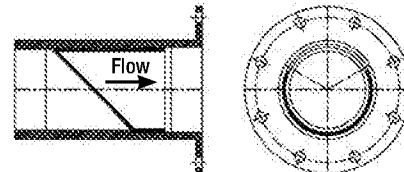
**CAUTION:** If you expand the clamp excessively at this step it will hinder or prevent the CheckMate® valve being fully inserted into the pipe.

## CheckMate® Clamping Diagrams

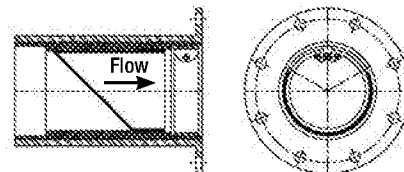
Downstream Clamp



Downstream Flanged



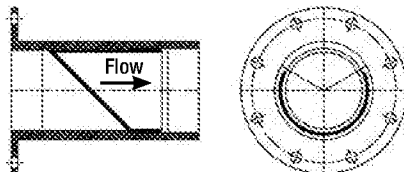
Downstream Flanged Thimble Insert



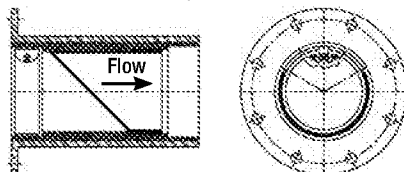
Upstream Clamp



Upstream Flanged



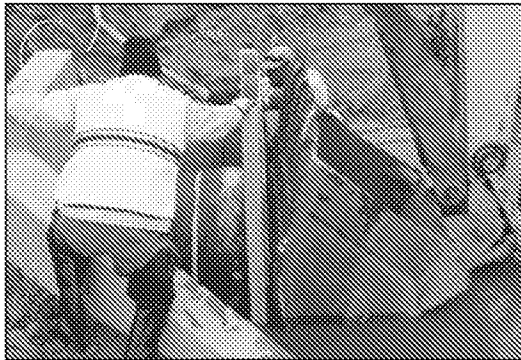
Upstream Flanged Thimble Insert



## 11. Pallet Push for Larger CheckMate® Valves

Larger CheckMate® valves can be pushed into the pipe utilizing the shipping pallet. The pallet should be placed perpendicular to the valve being inserted into the pipe. Then, with assistance from an excavator, push with consistent even force against the shipping pallet to insert the CheckMate® valve into the pipe.

See the image to the right for the suggested positioning and usage of the excavator's shovel assistance for larger-sized CheckMate® valves. Clamps must be installed to prevent damage to cuff.

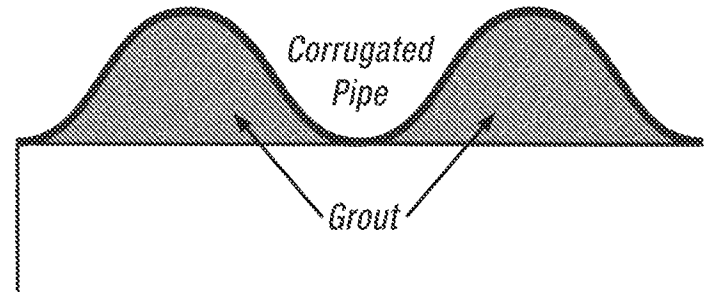


Pallet Push method for installing CheckMate® Valve

## 12. Corrugated Pipe and Smooth Wall (PVC, HDPE) Pipe Installation

For installation on corrugated pipe, it is recommended that the corrugations be filled with hydraulic cement (or similar material) that will provide a smooth I.D.

For smooth wall pipe, it is recommended that the valve be pinned.



CheckMates® can be made for any pipe I.D.  
Built to fit in sizes from 3" to 78".

Flange shape and bolt pattern can be customized.  
Flangeless thimble inserts are available.

| CHECKMATE® VALVE  |                        |             |                 |             |                  |            |             |                        |        |        |      |
|-------------------|------------------------|-------------|-----------------|-------------|------------------|------------|-------------|------------------------|--------|--------|------|
|                   | NOMINAL PIPE SIZE I.D. |             | OVERALL LENGTH* |             | NUMBER OF CLAMPS | CUFF DEPTH |             | BACK PRESSURE RATING** |        | WEIGHT |      |
|                   | Inches                 | Millimeters | Inches          | Millimeters |                  | Inches     | Millimeters | Feet                   | Meters | Lbs    | Kg   |
| Low Pressure      | 3                      | 75          | 5.1             | 130         | 1                | 1.5        | 38          | 5                      | 1.5    | 1.5    | 0.7  |
|                   | 4                      | 100         | 7.9             | 201         | 1                | 1.5        | 38          | 5                      | 1.5    | 1.5    | 0.7  |
| Standard Pressure | 3                      | 75          | 5.1             | 130         | 1                | 1.5        | 38          | 85                     | 26.0   | 3      | 1.4  |
|                   | 4                      | 100         | 7.9             | 201         | 1                | 1.5        | 38          | 85                     | 26.0   | 3      | 1.5  |
|                   | 5                      | 125         | 9.5             | 241         | 1                | 1.5        | 38          | 83                     | 25.3   | 4      | 2    |
|                   | 6                      | 150         | 11.0            | 279         | 1                | 2.0        | 51          | 83                     | 25.3   | 9      | 4    |
|                   | 7                      | 175         | 12.8            | 325         | 1                | 2.0        | 51          | 79                     | 24.1   | 11     | 5    |
|                   | 8                      | 200         | 15.2            | 386         | 1                | 2.0        | 51          | 79                     | 24.1   | 13     | 6    |
|                   | 9                      | 225         | 15.4            | 391         | 1                | 2.0        | 51          | 75                     | 22.9   | 17     | 8    |
|                   | 10                     | 250         | 16.1            | 409         | 1                | 2.0        | 51          | 71                     | 21.6   | 20     | 10   |
|                   | 12                     | 300         | 19.8            | 503         | 1                | 2.0        | 51          | 68                     | 20.1   | 37     | 17   |
|                   | 14                     | 350         | 25.8            | 655         | 1                | 4.0        | 102         | 64                     | 20.0   | 110    | 50   |
|                   | 16                     | 400         | 28.6            | 726         | 1                | 4.0        | 102         | 60                     | 18.3   | 133    | 52   |
|                   | 18                     | 450         | 31.0            | 787         | 1                | 4.0        | 102         | 56                     | 17.1   | 143    | 65   |
|                   | 20                     | 500         | 42.1            | 1069        | 2                | 8.0        | 203         | 53                     | 16.2   | 223    | 102  |
|                   | 24                     | 600         | 47.5            | 1207        | 2                | 8.0        | 203         | 45                     | 13.7   | 304    | 137  |
|                   | 30                     | 750         | 54.9            | 1395        | 2                | 8.0        | 203         | 38                     | 11.6   | 500    | 227  |
|                   | 36                     | 900         | 62.3            | 1582        | 2                | 8.0        | 203         | 30                     | 9.1    | 828    | 376  |
|                   | 42                     | 1050        | 70.6            | 1793        | 2                | 8.0        | 203         | 26                     | 7.9    | 1423   | 646  |
|                   | 48                     | 1200        | 78.0            | 2007        | 2                | 8.0        | 203         | 23                     | 7.0    | 1801   | 817  |
|                   | 54                     | 1350        | 86.4            | 2195        | 2                | 8.0        | 203         | 17                     | 5.2    | 2700   | 1225 |
|                   | 60                     | 1500        | 96.8            | 2459        | 2                | 9.0        | 229         | 15                     | 4.6    | 3315   | 1504 |
|                   | 72                     | 1800        | 119.0           | 3023        | 3                | 12.0       | 305         | 13                     | 4.0    | 6100   | 2767 |
|                   | 78                     | 1950        | 119.0           | 3023        | 3                | 12.0       | 305         | 13                     | 4.0    | 7000   | 3176 |

\*Shorter lengths available.

\*\*Back pressure measured from pipe invert.  
Higher back pressure ratings available. Consult factory.

### 13. Flanged Valve Bolt Torques

The valve end with the rubber flange shall be installed using the backup rings provided. The sleeve split should be installed facing downstream, with the split in the vertical position.

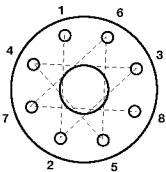
The installation bolt torque on the end flange bolts are listed in the table below.

#### RECOMMENDED MINIMUM BOLT TORQUE

| Valve Size | Bolt Size    | Torque (ft*lb.) |
|------------|--------------|-----------------|
| 1"         | 1/2" - 13NC  | 20              |
| 1-1/2"     | 1/2" - 13NC  | 20              |
| 2"         | 5/8" - 11NC  | 30              |
| 2-1/2"     | 5/8" - 11NC  | 40              |
| 3"         | 5/8" - 11NC  | 40              |
| 4"         | 5/8" - 11NC  | 30              |
| 5"         | 3/4" - 10NC  | 40              |
| 6"         | 3/4" - 10NC  | 30              |
| 8"         | 3/4" - 10NC  | 40              |
| 10"        | 7/8" - 9NC   | 40              |
| 12"        | 7/8" - 9NC   | 50              |
| 14"        | 1" - 8NC     | 50              |
| 16"        | 1" - 8NC     | 50              |
| 18"        | 1-1/8" - 7NC | 30              |
| 20"        | 1-1/8" - 7NC | 30              |
| 24"        | 1-1/4" - 7NC | 40              |
| 30"        | 1-1/4" - 7NC | 30              |
| 36"        | 1-1/2" - 6NC | 40              |
| 42"        | 1-1/2" - 6NC | 50              |
| 48"        | 1-1/2" - 6NC | 55              |
| 54"        | 1-3/4" - 5NC | 60              |
| 60"        | 1-3/4" - 5NC | 80              |
| 72"        | 1-3/4" - 5NC | 100             |

Torque values are suggested minimum values.

Torque all flange bolts in a star pattern, first to 50% of tabulated values, then retorque to 100% of tabulated values. If greater torque is required, continue retorquing in increments of 50% of tabulated values. Use of a high quality anti-seize compound on all bolt threads is recommended.



Always use a "star" pattern when bolting a check valve.

Variables such as the surface finish on bolt threads, type of anti-seize compound used, and surface finish of the mating flanges all have an effect on the minimum torque required to obtain a leak-tight flange seal.

During installation you may need to retorque the flange bolts several times for a proper seal. This will overcome any leaks due to the cold flow of the rubber sleeve flange.

# CheckMate® Installation Notes

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1. It is important that the CheckMate® is installed level within the pipe. The CheckMate® may "gap open" if installed improperly.
2. The sealing area of the CheckMate® must have room to expand outwards, while bottom of the sealing area rises. The area around the sealing area must be kept free of debris to allow the bill to close in order for the valve to seal properly.
3. The CheckMate® effectively reduces the inside diameter of the pipe in which it is installed, creating a restriction. It may also create a "ledge" inside the pipe, causing standing water.
4. Back pressure in excess of the back pressure rating may cause valve failure.
5. Should the conditions that the CheckMate® was designed for change, (line pressure, back pressure, chemical compatibility) the performance of the valve may suffer.
6. CheckMate® Valves must be installed in true round pipe which is concentric across the entire length. Out of round pipe may cause the sealing area of the valve to distort and gap, which will cause the valve to leak.

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## MAINTENANCE

### Inspection

Valves should occasionally be inspected for damage, wear, and buildup of debris. The frequency of the inspections should be determined by the severity of the service and the environment in which it operates.

The clamps should be checked for proper tension, and be sure that the inside of the valve is free of debris. Soft marine growth is normal on valves in submerged applications. Because hard marine growth such as barnacles will not bond well to the CheckMate®, they can be easily removed. Also insert pins to ensure they are tight.

## STORAGE

If your CheckMate® is to be stored for a period of time prior to installation, the following storage guidelines will help to preserve the valve and assure a trouble-free installation:

1. Store in a clean, cool, dry location. Avoid exposure to light, electric motors, dirt, or chemicals.
2. Store valve vertically on floor or pallet.
3. Store valve to prevent other items from contacting check sleeve to prevent possible damage.
4. Store this manual with the valve, so that it is readily available at time of installation.

## TROUBLESHOOTING GUIDE

### Sleeve Inverted or Distorted

1. Excessive back pressure, water surge, or water hammer.

### Leaking Around Perimeter of Valve

1. Tighten clamp.
2. Check for cracks and holes in surface of pipe.
3. If taped, check tape to ensure the pipe I.D. has been fully sealed

### Backflow

1. Debris lodged inside bill.

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## TIDEFLEX® TECHNOLOGIES WARRANTY

WARRANTIES - REMEDIES - DISCLAIMERS - LIMITATION OF LIABILITY

Unless otherwise agreed to in writing signed by Tideflex® Technologies, all Products supplied by Tideflex® Technologies will be described in the specifications set forth on the face hereof.

THE WARRANTIES SET FORTH IN THIS PROVISION ARE EXCLUSIVE AND IN LIEU OF ALL OTHER WARRANTIES WHETHER STATUTORY, EXPRESS OR IMPLIED (INCLUDING ALL WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE AND ALL WARRANTIES ARISING FROM COURSE OF DEALING OR USAGE OR TRADE).

Tideflex® Technologies Products are guaranteed for a period of one year from date of shipment, against defective workmanship and material only, when properly installed, operated and serviced in accordance with Tideflex® Technologies' recommendations. Replacement for items of Tideflex® Technologies manufacture will be made free of charge if proved to be defective within such year; but not claim for transportation, labor or consequential damages shall be allowed. We shall have the option of requiring the return of the defective product to our factory, with transportation charges prepaid, to establish the claim and our liability shall be limited to the repair or replacement of the defective product, F.O.B. our factory. Tideflex® Technologies will not assume costs incurred to remove or install defective products nor shall we incur back charges or liquidated damages as a result of warranty work. Tideflex® Technologies does not guarantee resistance to corrosion erosion, abrasion or other sources of failure, nor does Tideflex® Technologies guarantee a minimum length of service, or that the product shall be fit for any particular service. Failure of purchaser to give prompt written notice of any alleged defect under this guarantee forthwith upon its discovery, or use, and possession thereof after an attempt has been made and completed to remedy defects therein, or failure to return product or part for replacement as herein provided, or failure to install and operate said products and parts according to instructions furnished by Tideflex® Technologies, or failure to pay entire contract price when due, shall be a waiver by purchaser of all rights under these representations. All orders accepted shall be deemed accepted subject to this warranty which shall be exclusive of any other or previous warranty, and shall be the only effective guarantee or warranty binding on Tideflex® Technologies, anything on the contrary contained in purchaser's order, or represented by any agent or employee of Tideflex® Technologies in writing or otherwise, not withstanding implied warranties. TIDEFLEX® TECHNOLOGIES MAKES NO WARRANTY THAT THE PRODUCTS, AUXILIARIES AND PARTS ARE MERCHANTABLE OR FIT FOR ANY PARTICULAR PURPOSE.



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