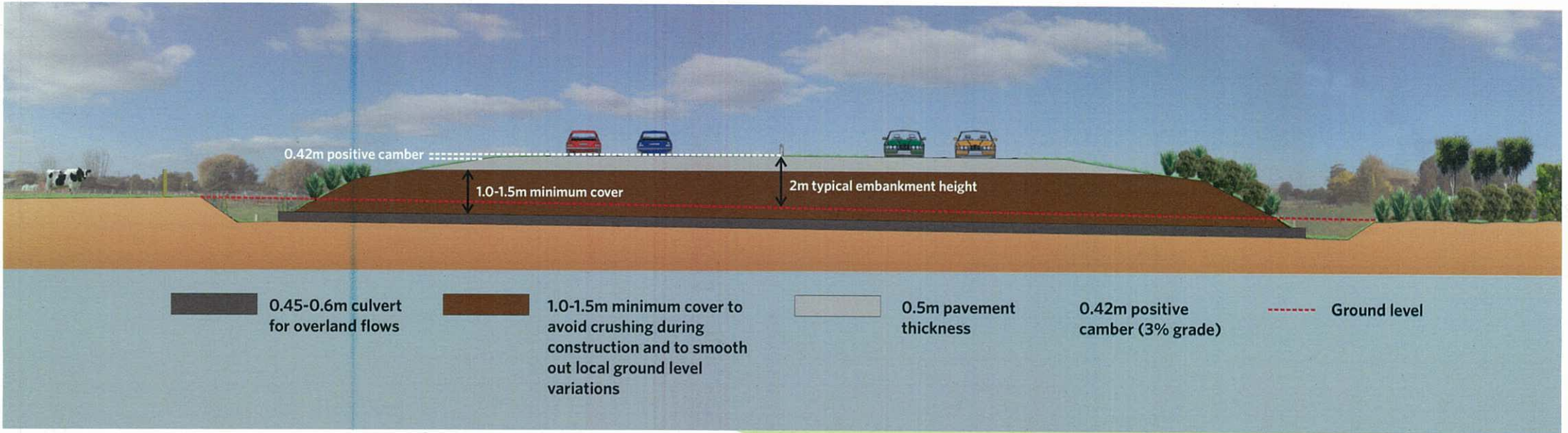


Typical Cross Section Showing Overland Flow Culvert Arrangement

## Cambridge Bypass

**Swale calculations (infill sections)**

Note rainfall events account for 3C increase in temperature for predicted climate change

**ASSUMES RUNOFF ENTIRE ROADWAY INCLUDING SWALE (post-pre development case)**

C pre = 0.2
C post = 0.95

| | Length(m) | pavement width(m) | swale width(m) | (m2) |
|---|---|---|---|---|
| Total area (half road + swale) | 100 | 14 | 14 | 2800 |

**Pre Development**
100yr event

| durations (mins) | depth (mm) | I (mm/hr) | Total Area (m2) | Weighted Average Runoff C (pre dev) | Q (l/s) | Volume (m3) |
|---|---|---|---|---|---|---|
| 10 | 30.4 | 182.4 | 2800 | 0.200 | 28.4 | 17.0 |
| 30 | 49.8 | 99.6 | 2800 | 0.200 | 15.5 | 27.9 |
| 60 | 68.1 | 68.1 | 2800 | 0.200 | 10.6 | 38.1 |
| 120 | 84.7 | 42.4 | 2800 | 0.200 | 6.6 | 47.5 |
| 360 | 119.8 | 20.0 | 2800 | 0.200 | 3.1 | 67.2 |
| 720 | 149.0 | 12.4 | 2800 | 0.200 | 1.9 | 83.3 |
| 1440 | 185.5 | 7.7 | 2800 | 0.200 | 1.2 | 103.5 |
| 2880 | 214.8 | 4.5 | 2800 | 0.200 | 0.7 | 121.0 |

| | Length(m) | pavement width(m) | swale width(m) | (m2) | |
|---|---|---|---|---|---|
| Total area (half road + swale) | 100 | 14 | 14 | 2800 | (assumes 95% runoff on swale area) |

**Post Development**
100yr event

| durations (mins) | depth (mm) | I (mm/hr) | Total Area (m2) | Weighted Average Runoff C (post dev) | Q (l/s) | Volume (m3) |
|---|---|---|---|---|---|---|
| 10 | 30.4 | 182.4 | 2800 | 0.575 | 81.6 | 48.9 |
| 30 | 49.8 | 99.6 | 2800 | 0.575 | 44.5 | 80.2 |
| 60 | 68.1 | 68.1 | 2800 | 0.575 | 30.5 | 109.6 |
| 120 | 84.7 | 42.4 | 2800 | 0.575 | 19.0 | 136.5 |
| 360 | 119.8 | 20.0 | 2800 | 0.575 | 8.9 | 193.2 |
| 720 | 149.0 | 12.4 | 2800 | 0.575 | 5.5 | 239.6 |
| 1440 | 185.5 | 7.7 | 2800 | 0.575 | 3.4 | 297.5 |
| 2880 | 214.8 | 4.5 | 2800 | 0.575 | 2.0 | 347.8 |

**Post - Pre**

| durations (mins) | Q (l/s) | Volume (m3) | Infiltration Area (m2) | Infiltration Volume (m3) | Swale Storage (m3) | Time to soak away Just through infiltration area (hrs) |
|---|---|---|---|---|---|---|
| 10 | 53.2 | 31.9 | 200 | 1.0 | 30.9 | 5.2 |
| 30 | 29.1 | 52.3 | 200 | 3.0 | 49.3 | 8.2 |
| 60 | 19.9 | 71.5 | 200 | 6.0 | 65.5 | 10.9 |
| 120 | 12.4 | 89.0 | 200 | 12.0 | 77.0 | 12.8 |
| 360 | 5.8 | 126.0 | 200 | 36.0 | 90.0 | 15.0 |
| 720 | 3.6 | 156.2 | 200 | 72.0 | 84.2 | 14.0 |
| 1440 | 2.2 | 194.0 | 200 | 144.0 | 50.0 | 8.3 |
| 2880 | 1.3 | 226.8 | 200 | 288.0 | -61.2 | -10.2 |

| | Swale | length (m) | width (m) | (m2) |
|---|---|---|---|---|
| Infiltration | Area = | 100 | 2 | 200 |

**Infiltration** design rate = 0.5 l/m2/min

Note average percolation rate (along infiltration swale section) is 2 l/m2/min
Allowing for areas with less permeable and for swale clogging, 0.5l/m2/mim is a conservative value to use

Using Manning's calculator n=0.03

| side slopes 1 in ?? | bottom width (m) | water depth (m) | top width (m) | Q (m3/s) | V (m/s) H/K | Area (m2) | Volume per 100m (m3) | Volume * per 100m "wedge" (m3) |
|---|---|---|---|---|---|---|---|---|
| 1.5 | 2 | 1 | 5.0 | | | 3.50 | 350 | 88 |
| 1.5 | 2 | 0.9 | 4.7 | | | 3.02 | 302 | 75 |
| 1.5 | 2 | 0.7 | 4.1 | | | 2.14 | 214 | 53 |
| 1.5 | 2 | 0.5 | 3.5 | | | 1.38 | 138 | 34 |
| 2 | 2 | 1 | 6.0 | | | 4.00 | 400 | 100 |
| 2 | 2 | 0.9 | 5.6 | | | 3.42 | 342 | 86 |
| 3 | 2 | 1 | 8.0 | | | 5.00 | 500 | 125 |
| 3 | 2 | 0.8 | 6.8 | | | 3.52 | 352 | 88 |
| 3 | 2 | 0.5 | 5.0 | | | 1.75 | 175 | 44 |

* Estimated = 100 * depth/2 * ((top width+ bottom width)/2)/2