SEDIMENTATION LAKE
MIN ToB 222.75
BANKS 1:3
FREEBOARD 300mm
STORAGE ABOVE WL 800mm
WL 221.65
PERMANENT DEPTH 900mm
BASE OF POND IL 220.75

LAKE
MIN ToB 222.00
BANKS 1:3
FREEBOARD 300mm
STORAGE ABOVE WL
800mm
WL 220.90
PERMANENT WL 900mm
BASE OF POND IL 220.00

GL 230.00

300Ø PVC-U OVERFLOW
INLET 221.65
OUTLET 220.80
ALTHON H4C
HEADWALL AT
INLET & OUTLET

300Ø PVC-U OVERFLOW
INLET 220.90
ALTHON H4C
HEADWALL AT INLET

EXISTING DITCH
TIE IN AT 219.56

ALTHON H10C
PRECAST HEADWALL
IL 221.00

CLV2
1800Ø
CL 227.50
IL 226.50

CLV1
1800Ø
CL 230.00
IL 228.00

Appendix C

Flow Calculations

Design Settings

Rainfall Methodology	FEH-22	Minimum Velocity (m/s)	1.00
Return Period (years)	100	Connection Type	Level Soffits
Additional Flow (%)	0	Minimum Backdrop Height (m)	0.200
CV	0.750	Preferred Cover Depth (m)	1.200
Time of Entry (mins)	4.00	Include Intermediate Ground	✓
Maximum Time of Concentration (mins)	30.00	Enforce best practice design rules	✓
Maximum Rainfall (mm/hr)	50.0		

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
DB-M	1.550	4.00	230.000	1050	282795.014	632906.161	0.300
S34	0.000		230.000	1050	282788.909	632905.587	0.900

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
1.000	DB-M	S34	6.132	0.600	229.700	229.100	0.600	10.2	300	4.02	50.0

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
1.000	4.945	349.5	210.1	0.000	0.600	1.550	0.0	168	5.161

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.000	6.132	10.2	300	Circular	230.000	229.700	0.000	230.000	229.100	0.600

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.000	DB-M	1050	Manhole	Adoptable	S34	1050	Manhole	Adoptable

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
DB-M	282795.014	632906.161	230.000	0.300	1050	0 ←			
						0	1.000	229.700	300
S34	282788.909	632905.587	230.000	0.900	1050	1	1.000	229.100	300

Simulation Settings

Rainfall Methodology	FEH-22	Skip Steady State	x	2 year (l/s)	7.4
Summer CV	0.750	Drain Down Time (mins)	240	30 year (l/s)	16.3
Winter CV	0.840	Additional Storage (m³/ha)	20.0	100 year (l/s)	20.3
Analysis Speed	Normal	Check Discharge Rate(s)	✓	Check Discharge Volume	x

Storm Durations

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

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
2	0	0	0
30	41	0	0
100	41	0	0
200	41	0	0

Pre-development Discharge Rate

Site Makeup	Greenfield	Growth Factor 30 year	1.99
Greenfield Method	FEH	Growth Factor 100 year	2.48
Positively Drained Area (ha)	1.000	Betterment (%)	0
SAAR (mm)	1094	QMed	7.4
Host	1	QBar	8.2
BFIHost	0.514	Q 2 year (l/s)	7.4
Region	1	Q 30 year (l/s)	16.3
QBar/QMed conversion factor	1.111	Q 100 year (l/s)	20.3
Growth Factor 2 year	0.90		

Node S34 Online Orifice Control

Flap Valve	x	Design Depth (m)	0.800	Discharge Coefficient	0.600
Replaces Downstream Link	✓	Design Flow (l/s)	12.7		
Invert Level (m)	229.100	Diameter (m)	0.083		

Node DB-M Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	229.700	Slope (1:X)	9999.0
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)		Depth (m)	
Safety Factor	2.0	Width (m)	79.000	Inf Depth (m)	
Porosity	0.30	Length (m)	185.000		

Results for 2 year Critical Storm Duration. Lowest mass balance: 99.92%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
480 minute winter	DB-M	336	229.750	0.050	29.7	184.6184	0.0000	OK
360 minute winter	S34	288	229.761	0.661	14.0	0.5727	0.0000	OK

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
960 minute winter	DB-M	1.000	S34	14.3	0.366	0.041	0.2370	
360 minute winter	S34	Orifice		11.3				251.8

Results for 30 year +41% CC Critical Storm Duration. Lowest mass balance: 99.92%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
480 minute winter	DB-M	456	229.852	0.152	77.9	639.1561	0.0000	OK
480 minute winter	S34	456	229.852	0.752	13.1	0.6512	0.0000	OK

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
30 minute summer	DB-M	1.000	S34	18.1	0.644	0.052	0.2667	
480 minute winter	S34	Orifice		12.1				429.8

Results for 100 year +41% CC Critical Storm Duration. Lowest mass balance: 99.92%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
480 minute winter	DB-M	464	229.893	0.193	95.6	826.0405	0.0000	OK
480 minute winter	S34	464	229.893	0.793	13.4	0.6866	0.0000	OK

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	DB-M	1.000	S34	21.9	0.709	0.063	0.2624	
480 minute winter	S34	Orifice		12.5				448.8

Results for 200 year +41% CC Critical Storm Duration. Lowest mass balance: 99.92%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
600 minute winter	DB-M	570	229.922	0.222	90.4	954.9905	0.0000	OK
600 minute winter	S34	570	229.921	0.821	13.7	0.7111	0.0000	OK

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	DB-M	1.000	S34	20.3	0.739	0.058	0.2793	
600 minute winter	S34	Orifice		12.7				529.3

Appendix D

Standard Drainage Details

PCC MANHOLE
DEPTH TO SOFFIT OF PIPE GREATER THAN 1.5m

ACCESS COVER (SEE NOTES 1 & 2)

BED AND HAUNCH TO MH COVER AND FRAME (SEE NOTE 15)

PRECAST REINFORCED CONCRETE COVER SLAB WITH 675mm SQ OPENING. BEDDED ON A PREFORMED MASTIC JOINTING STRIP OR CLASS M1 OR M2 MORTAR

STEP RUNGS 675mm MAX FROM COVER LEVEL TO FIRST STEP

CONSTRUCTION JOINTS IN CONCRETE SURROUND DISPLACED 150mm MINIMUM ABOVE OR BELOW JOINT IN CHAMBER SECTIONS

PRECAST CONCRETE MANHOLE RINGS PLAIN ENDED SEGMENTS AT COVER AND REDUCING SLABS, ALL JOINTS TO BE SEALED WITH A PREFORMED MASTIC JOINTING STRIP OR M1 MORTAR

CONCRETE BENCHING TO BE BROUGHT UP TO A DENSE SMOOTH FACE, NEATLY SHAPED AND FINISHED TO ALL BRANCH CONNECTION. MIN THICKNESS TO BE 20mm

C16/20 CONCRETE BASE WITH S.R. CEMENT

CONCRETE BLOCKS, OR PRECAST CONCRETE COVER FRAME SEATING RINGS OR CLASS B ENGINEERING BRICKWORK 2-4 COURSES ON CLASS M1 MORTAR

CHAMBER HEIGHT MIN 900mm

C16/20 CONCRETE SURROUND 150mm THICK WITH SD.R CEMENT TO BE VIBRATED TO FORM WATERTIGHT SEAL

MIN 50mm, MAX 300mm BETWEEN TOP OF PIPE AND UNDERSIDE OF PRECAST SECTION

WHERE BENCHING IS LESS THAN 450mm WIDE SLOPE SHALL BE 1 IN 10. WHERE MORE THAN 450mm WIDE SLOPE SHALL BE 1 IN 30

THE BOTTOM PRECAST SECTION TO BE BUILT INTO THE BASE CONCRETE MIN 75mm

675 MAX
300
300
SIZE VARIABLE (SEE NOTE 3)
500 MIN
225 MIN
225 TO BARREL

PCC CHAMBER
DEPTH TO SOFFIT OF PIPE LESS THAN 1.0m

CLASS B ENGINEERING BRICKWORK OR PRECAST CONCRETE SEATING RINGS BEDDED ON CLASS M1 MORTAR, MINIMUM OF 2 COURSES, MAX 4NR

PRECAST CONCRETE HEAVY DUTY COVER SLAB

GEN 3 CONCRETE SURROUND MINIMUM 150mm. THICK WITH S.R.CEMENT

BENCHING SLOPE TO BE 1 IN 10 TO 1 IN 30

HIGH STRENGTH CONCRETE TOPPING TO BE BROUGHT UP TO A DENSE SMOOTH FACE NEATLY SHAPED AND FINISHED TO ALL BRANCH CONNECTIONS (MINIMUM THICKNESS 20mm.)

GEN 3 CONCRETE BASE SLAB WITH S.R. CEMENT

INVERTS TO BE GENERALLY FORMED USING CHANNEL PIPES

675X675mm DUCTILE IRON MULTIPLE COVER TO BS EN 124 AND OF A NON-ROCKING DESIGN CLASS B125 IN PEDESTRIAN AND COMPARABLE LOCATIONS. (SEE NOTE 3).

M1 OR POLYESTER RESIN MORTAR BED AND HAUNCHING TO MANHOLE COVER AND FRAME

675X675mm. MINIMUM OPENING IN COVER SLAB

THE BOTTOM CHAMBER SECTION TO BE BUILT INTO BASE CONCRETE MIN. 75mm.

DISTANCE BETWEEN TOP OF PIPE AND UNDERSIDE OF P.C. CHAMBER TO BE 50mm MIN. 300mm MAX

225mm. TO BARREL OF PIPE

675
1050

PCC CHAMBER
DEPTH TO SOFFIT OF PIPE 1.0m TO 1.5m

CLASS B ENGINEERING BRICKWORK OR PRECAST CONCRETE SEATING RINGS BEDDED ON CLASS M1 MORTAR, MINIMUM OF 2 COURSES, MAX 4NR

PRECAST CONCRETE HEAVY DUTY COVER SLAB

GEN 3 CONCRETE SURROUND MINIMUM 150mm. THICK WITH S.R.CEMENT

BENCHING SLOPE TO BE 1 IN 10 TO 1 IN 30

HIGH STRENGTH CONCRETE TOPPING TO BE BROUGHT UP TO A DENSE SMOOTH FACE AND FINISHED TO ALL BRANCH CONNECTIONS (MINIMUM THICKNESS 20mm.)

GEN 3 CONCRETE BASE SLAB WITH S.R. CEMENT

INVERTS TO BE GENERALLY FORMED USING CHANNEL PIPES

675X675mm DUCTILE IRON MULTIPLE COVER TO BS EN 124 AND OF A NON-ROCKING DESIGN CLASS B125 IN PEDESTRIAN AND COMPARABLE LOCATIONS. (SEE NOTE 3).

M1 OR POLYESTER RESIN MORTAR BED AND HAUNCHING TO MANHOLE COVER AND FRAME

675X675mm. MINIMUM OPENING IN COVER SLAB

THE BOTTOM CHAMBER SECTION TO BE BUILT INTO BASE CONCRETE MIN. 75mm.

DISTANCE BETWEEN TOP OF PIPE AND UNDERSIDE OF P.C. CHAMBER TO BE 50mm MIN. 300mm MAX

225mm. TO BARREL OF PIPE

675
1050
500 min.
225 min.

CHARCON CATCHPIT INSPECTION CHAMBER INCORPORATING FLOW CONTROL AND DEBRIS DEVICE

600 x 600 MIN CLEAR OPENING

HEAVY DUTY DUCTILE IRON COVER AND FRAME TO BSEN124 GRADE D400, WITH 600X600MM CLEAR OPENING, BEDDED ON CLASS M1 MORTAR

COVER LEVEL VARIES

HEAVY DUTY PRECAST RC COVER SLAB TO BS5911

PRECAST CONCRETE CHAMBER RING TO BS5911

PERMAFILTER

FLEXIBLE JOINT

OUTGOING PIPE INVERT LEVEL VARIES

SEE ORIFICE FLOW CONTROL DETAILS

50MM THK BLINDING CONCRETE GRADE C10P

2 COURSES CLASS B ENGINEERING BRICKWORK, BEDDED ON CLASS M1 MORTAR

FLEXIBLE JOINT

INCOMING PIPE INVERT LEVEL VARIES

150MM THK CONCRETE SURROUND GRADE C20P

200MM THK CONCRETE GRADE C20P BASE

1 LAYER OF A393 MESH REINFORCEMENT (BOTTOM) WITH 70MM COVER

1050MM
300MM MIN

HEADWALL - PIPES LESS THAN 300MM DIAMETER

PITCHING STONE OR OTHER LOCAL MATERIAL SET ON 150 ST4 CONCRETE BED, BATTER TO CONFORM WITH BANK IF REQUIRED

SECTION

FLOW

PLAN

PIPE BEDDING DETAILS

GRANULAR BED AND SURROUND CLASS 'S'

CONCRETE BED AND SURROUND CLASS 'Z'

BC+600 MAX
300
150

NOTES:

1. THE OUTFALL PIPE SHALL PROJECT A MINIMUM OF 50 BEYOND THE HEADWALL TO ALLOW THE DISCHARGE TO BE SAMPLED.

2. WHERE REQUIRED SLOTS / BRACKETS SHOULD BE CAST INTO OR FIXED EITHER SIDE OF THE OUTFALL PIPE TO ALLOW POLLUTION CONTROL OFFICERS TO PLACE BOARDING OVER AND LIMIT DISCHARGE DURING A POLLUTION INCIDENT.

3. IF THE DEPTH OF COVER TO THE TOP OF THE PIPE IS LESS THAN 450, PROTECTION OF THE PIPE MAY BE NECESSARY.

4. GRILLES ON OUTFALLS SHALL BE AVOIDED UNLESS THERE ARE EXCEPTIONAL CIRCUMSTANCES.

5. OUTFALLS SHALL DISCHARGE DOWNSTREAM OF BRIDGES / CULVERTS WHERE POSSIBLE.

DRAINAGE BLANKET

300mm
SUB-BASE 63-10mm CLEAN STONE
Ø150 PERFORATED DRAIN
SUBGRADE
75mm
IMPERMEABLE GEO-MEMBRANE

GRADING OF LOWER SUB-BASE STONE

SIEVE SIZE	% PASSING
100mm	100
80mm	80-100
60mm	60-80
40mm	30-50
20mm	0-20
10mm	0-5

TYPICAL INSPECTION CHAMBER
SCALE 1:20

TEMPORARY CAP MANHOLE SHAFT DURING CONSTRUCTION

FLEXIBLE SEAL

MINIMUM INTERNAL DIMENSION 450mm DIAMETER OR 450mm x 450mm

WELL COMPACTED BEDDING MATERIAL USED AS BACKFILL EXCAVATION WIDTH VARIES DEPENDING ON DEPTH

JOINTS BETWEEN BASE AND SHAFT TO HAVE WATERPROOF SEALS

GRANULAR BEDDING MATERIAL

ROUND DUCTILE IRON COVER & FRAME TO BS EN 124:1994 GRADE B125 SECURED WITH CLIPS SUPPLIED

ACCESS RESTRICTED TO 350mm DIAMETER OR 300mm x 300mm IF DEPTH OF CHAMBER TO INVERT IS > 1m

225mm DEEP CONCRETE PLINTH TO SUPPORT FINISH

SITED IN HARD LANDSCAPED AREAS SUBJECT TO LIGHT VEHICLE LOADING

TEMPORARY CAP MANHOLE SHAFT DURING CONSTRUCTION

FLEXIBLE SEAL

MINIMUM INTERNAL DIMENSION 450mm DIAMETER OR 450mm x 450mm

WELL COMPACTED BEDDING MATERIAL USED AS BACKFILL EXCAVATION WIDTH VARIES DEPENDING ON DEPTH

JOINTS BETWEEN BASE AND SHAFT TO HAVE WATERPROOF SEALS

GRANULAR BEDDING MATERIAL

ROUND DUCTILE IRON COVER TO BS EN 124:1994 GRADE A15 & FRAME SECURED WITH CLIPS SUPPLIED

TOPSOIL

ACCESS RESTRICTED TO 350mm DIAMETER OR 300mm x 300mm IF DEPTH OF CHAMBER TO INVERT IS > 1m

SITED IN SOFT LANDSCAPED AREAS