EXTENSION TO GLASSHOUSE INCLUDING WATER STORAGE CHANNEL AT COOKS ROAD, GOSBERTON, SPALDING, PE11 4PE.

SURFACE WATER DRAINAGE STRATEGY

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Revision A 8th June 2026 Downpipes and discharge pipes amended

Introduction

P C Thorold Ltd are due to apply for planning permission to extend the number of glasshouses on their site at Bank House Farm, Gosberton. There is an existing area of glasshouses of 8,142 square metres and the application will be for a further 19,734 square metres.

Previous Planning Applications

There was one glasshouse with an area of 2594 sm on this site prior 2012. A planning application (reference H08-0460-12) was submitted in 2012 and approved on 1st August 2012. This approved the erection of a further 7782 sm of glasshouses in three phases, although only 5548 sm were erected in 2012.

The planning application approved the discharge of the surface water through a 225mm diameter and a 300mm pipe into the existing dyke south of the glasshouses. This dyke discharges into the IDB drain and the application also approved the installation of a new culvert with a 125mm diameter pipe to attenuate the flow into the IDB drain.

Proposed Planning Application

The present application is for a further area of 19,734 square metres of glasshouses located west of the existing glasshouses and south of Cooks Road. An area of 8901 square metres has already been erected, and therefore it will be a retrospective application for these first two units and a normal application for the next phase. The application also includes for the construction of a butyl lined water storage lagoon 8.0 metres wide south of the existing and new glasshouses.

The surface water from both the existing and proposed glasshouses will be discharged into this lined storage lagoon and when the storage lagoon is full any additional surface water will overflow or be pumped into the existing discharge pipes and a new 300mm diameter pipe which will convey the surface water into the existing dyke south of glasshouses. The estimated volume of water that could be stored for re-use, assuming a depth of water in the storage dyke of 1.6 metres, is 2694 cubic metres. This is equivalent to approximately 100mm of rainfall on all of the existing and proposed glasshouses. As much as possible all of the water from the storage lagoons will be used for irrigation in the glasshouses.

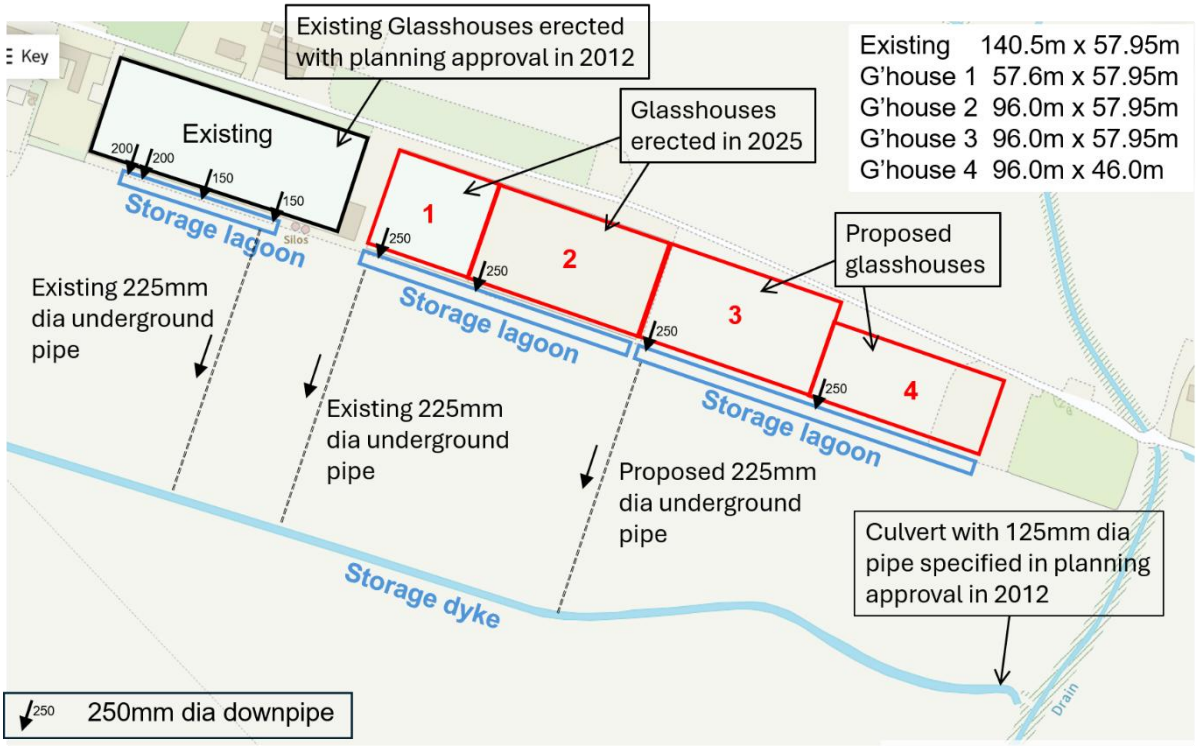
The surface water flowing into the dyke will flow eastwards towards the IDB drain which is east of the glasshouses. The approved 125mm culvert will attenuate the flow and it will be demonstrated that this will reduce the flow to an estimated 30 litres/second. The height of the backfill material to the culvert should be increased to 1.8 metres.

Areas of Existing and Proposed Glasshouses.

The areas of the existing and proposed glasshouses are shown below.

	Length (m)	Width (m)	Area (s.m.)
Existing	140.5	57.950	8,142
1	57.6	57.950	3,338
2	96.0	57.950	5,563
3	96.0	57.950	5,563
4	96.0	54.900	5,270
			27,876

Plan of Existing and Proposed Glasshouses



Design of Storage Dyke

The design of the storage dyke and control structure will assume that the storage lagoons will be full at the start of the design event. In practice this is unlikely to be the situation as P C Thorold are installing pumping equipment to store the additional water from the lagoon in tanks on the site. The design will therefore assume that all of the design rainfall will be discharged into storage dyke.

The flow into the IDB drain will be controlled either with the existing approved design of a small diameter culvert or by the installation of a Hydrobrake or similar flow control apparatus.

The table below shows a calculation of the storage volume required in a 1 in 100 year event, initially using the maximum flowrate of 42 litres/second used in the 2012 design.

Impermeable area to be drained				27876	sm		
Discharge Rate into IDB drain				42	litres/second		
Duration	Growth Factor Z1	M5 rainfall	Growth Factor Z2	100 Year Rainfall	Inflow	Outflow	Storage Required
5	0.37	7.4	1.98	14.7	408.44	12.60	395.84
10	0.52	10.4	1.98	20.6	574.02	25.20	548.82
15	0.63	12.6	1.98	24.9	695.45	37.80	657.65
30	0.8	16.0	1.97	31.5	878.65	75.60	803.05
60	1	20.0	1.93	38.6	1076.01	151.20	924.81
120	1.21	24.2	1.89	45.7	1274.99	302.40	972.59
240	1.45	29.0	1.86	53.9	1503.63	604.80	898.83
360	1.6	32.0	1.83	58.6	1632.42	907.20	725.22
600	1.79	35.8	1.81	64.8	1806.31	1512.00	294.31
1440	2.24	44.8	1.81	81.1	2260.41	3628.80	-1368.39
Time to empty =		6.43	hours		**SATISFACTORY**		

This calculation shows that in this event the maximum storage required would be 973 cubic metres and this would be in a 2 hour duration storm. The total inflow is shown as 1275 cubic metres.

The IDB requirement for this type of discharge is to allow for climate change by adding 40% to the volumes of the 1 in 100 year rainfall. The results for this are shown on the next page:

Impermeable area to be drained				27876	sm		
Discharge Rate into IDB drain				42	litres/second		
Duration	Growth Factor Z1	M5 rainfall	Growth Factor Z2	100 Year Rainfall + 40%	Inflow	Outflow	Storage Required
5	0.37	7.4	1.98	20.5	571.81	12.60	559.21
10	0.52	10.4	1.98	28.8	803.63	25.20	778.43
15	0.63	12.6	1.98	34.9	973.63	37.80	935.83
30	0.8	16.0	1.97	44.1	1230.11	75.60	1154.51
60	1	20.0	1.93	54.0	1506.42	151.20	1355.22
120	1.21	24.2	1.89	64.0	1784.99	302.40	1482.59
240	1.45	29.0	1.86	75.5	2105.08	604.80	1500.28
360	1.6	32.0	1.83	82.0	2285.39	907.20	1378.19
600	1.79	35.8	1.81	90.7	2528.83	1512.00	1016.83
1440	2.24	44.8	1.81	113.5	3164.57	3628.80	-464.23
Time to empty =		9.92	hours		**SATISFACTORY**		

This calculation shows that the maximum storage required would be 1500 cubic metres and this would be in a 4 hour duration storm. The total inflow is shown as 2105 cubic metres.

The storage dyke is taken to be 550 metres long, 2.5 metres deep and with a 600mm bed and 1:1 side slopes. The volumes of storage for various depths of water are shown below.

Water depth (m)	1.0	1.1	1.2	1.3	1.4	1.5
Volume (cu m)	880	1029	1188	1358	1540	1733

Therefore in a 1 in 100 year event the maximum water depth is estimated to be 1.05 metres and in a 1 in 100 year event with 40% increase the maximum water depth is estimated to be nearly 1.40 metres.

The estimated flows through the 125mm pipe are shown below:

Flow (litres/sec)	20	25	30	35	40
Water depth (m)	0.74	1.09	1.52	2.02	2.6

With storage depths of 1.4 metres the maximum flow through the 125mm pipe will only be 30 litres/second.

The estimated water depths will be recalculated using a lower discharge rate into the IDB drain of 30 litres/sec, and for the 1 in 100 year flows with 40% increase is shown on the next page.

Impermeable area to be drained				27876	sm		
Discharge Rate into IDB drain				30	litres/second		
Duration	Growth Factor Z1	M5 rainfall	Growth Factor Z2	100 Year Rainfall + 40%	Inflow	Outflow	Storage Required
5	0.37	7.4	1.98	20.5	571.81	9.00	562.81
10	0.52	10.4	1.98	28.8	803.63	18.00	785.63
15	0.63	12.6	1.98	34.9	973.63	27.00	946.63
30	0.8	16.0	1.97	44.1	1230.11	54.00	1176.11
60	1	20.0	1.93	54.0	1506.42	108.00	1398.42
120	1.21	24.2	1.89	64.0	1784.99	216.00	1568.99
240	1.45	29.0	1.86	75.5	2105.08	432.00	1673.08
360	1.6	32.0	1.83	82.0	2285.39	648.00	1637.39
600	1.79	35.8	1.81	90.7	2528.83	1080.00	1448.83
1440	2.24	44.8	1.81	113.5	3164.57	2592.00	572.57
Time to empty =		15.49	hours		**SATISFACTORY**		

With a maximum storage volume of 1673 cu metres the depth of water in the dyke would be approximately 1.45 metres.

The inflows for a 1 in 100 years with 40% increase shown above are unlikely to ever occur as the gutters and downpipes fitted to the glasshouses are generally not large enough to be capable of discharging this volume into the storage lagoon.

Conclusions and Recommendations

The provision of a 125mm culvert will be satisfactory to limit the flow into the IDB watercourse. It estimated that the maximum flow into the watercourse would be approximately 30 litres/second.

The level of the backfill on this culvert should be raised to 1.8 metres above the pipe.

As an alternative a Hydrobrake (or similar flow control apparatus) in a concrete chamber could be constructed and installed to control the flow into the IDB watercourse.

It is likely that a proportion of any large rainfall event will be stored in the proposed storage lagoons which will further reduce the flow into the IDB watercourse.

APPENDIX

Surface Water Drainage Proposal Approved in 2012

This planning application adds 3 new glasshouses to the existing one on the site, and the total area of the four glasshouses will be 10560 square metres.

The surface water from the existing glasshouse discharges through a 150mm downpipe into a 225mm pipe into an open dyke which is located approximately 100 metres south of Cooks Road. At the present time the surface water soaks away in this dyke as the downstream section to the east is dry.



Welland and Deepings IDB have stated that they will only allow a discharge of 1.4 cumecs per 1000ha into the IDB system, which gives a maximum discharge of 1.4 litres per second per ha.

As this dyke drains an area of approximately 30ha then the maximum allowable flow from the dyke into the IDB drain is

30 x 1.4 = 42 litres/second

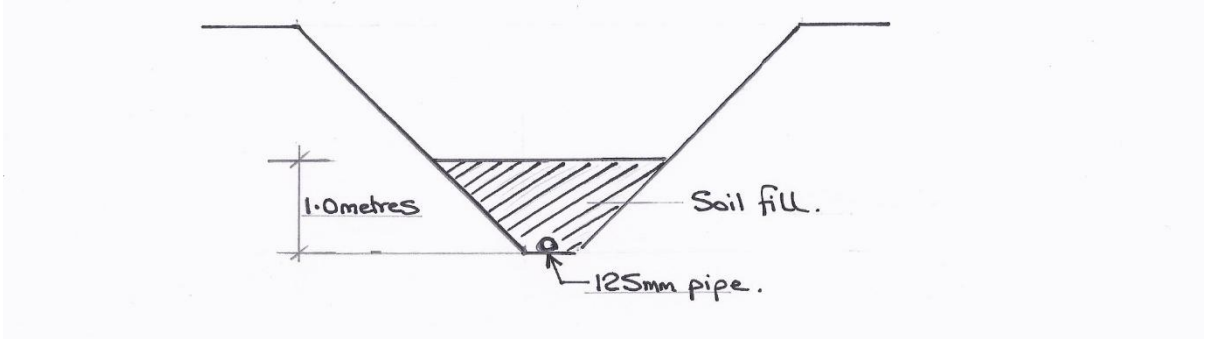
Using the modified rational method (calculations are shown in Appendix B) the maximum design volume that will be discharged from all of the glasshouses in a 1 in 100 year event is 672.8 cu metres in a 480 minute (8 hour) storm. Taking climate change into account then the volume is increased to 875 cu metres.

Therefore a storage volume of 875 cu metres needs to be provided.

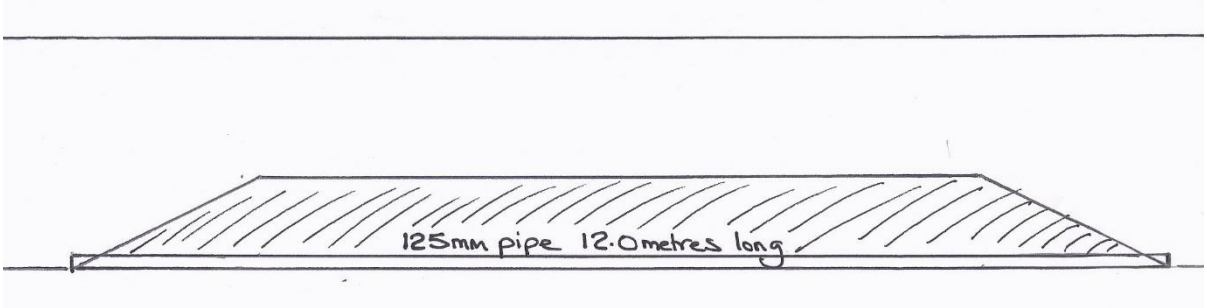
This will be provided in the straight section of the dyke south of the site. This dyke is 2.5 metres deep and with a 600mm bed and 1:1 side slopes. Therefore with a depth

of water of 1.0 metres the dyke will hold 1.6 cu metres / metre. This section of the dyke is 550 metres in length, giving a total storage volume of 880 cu metres. This calculation ignores the flow out before the dyke becomes full, so the actual storage is more than this.

Therefore it is recommended that a dam should be placed in the eastern end of the open dyke with a 125mm diameter pipe in the bottom to limit the flow into the IDB drain.



SECTION THROUGH DAM



SECTION ON CENTRE LINE OF DAM IN DYKE

The maximum flow in a 125mm diameter pipe 12.0 metres long with a 1.0 metre head is 42.4 litres / second, which is satisfactory.

The pipes carrying the surface water from the existing glasshouse discharge into the dyke south of the glasshouse through a 225mm discharge pipe. Although the 15 minute rainfall calculations give a maximum design intensity of 101.38 mm/hour (131.79 mm/hour with climate change) it is unlikely that the gutters and downpipes of the glasshouses will be capable of discharging more than 75mm/hour into the surface water system. Therefore the maximum design flow for the existing 225mm diameter discharge pipe is 55 litres/second, compared with the maximum flow that the pipe will discharge of 93.2 litres/second.

The maximum design flow from the new glasshouses will be 165 litres/second. It is recommended that a new 300mm pipe is constructed to discharge the water from the new glasshouses to the dyke. This pipe will be capable of discharging a volume of 170 litres/second.