

**PROPOSED AGRICULTURAL PACKHOUSE AT KINGFISHER
NURSERIES, LONG LANE, GEDNEY HILL, SPALDING, PE12 0PP**
DRAINAGE STRATEGY

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Introduction

A planning application is due to be submitted to South Holland District Council to construct an agricultural packhouse at Kingfisher Nurseries, Long Lane, Gedney Hill, Spalding. The area of the building will be 2600 square metres. The planning authority requires a drainage strategy to be submitted with the application.

There is a requirement that all new developments should incorporate SuDS in the design of the surface water disposal from the site. The developer in this case also wishes to store rainwater from the roof of this packhouse to use as irrigation in the Nursery.

The CIRIA SuDS Manual 2015 explains the philosophy of SuDS in Chapter 1 of the manual as follows:

The philosophy of sustainable drainage systems is about maximising the benefits and minimising the negative impacts of surface water runoff from developed areas.

The SuDS approach involves slowing down and reducing the quantity of surface water runoff from a developed area to manage downstream flood risk, and reducing the risk of that runoff causing pollution. This is achieved by harvesting, infiltrating, slowing, storing, conveying and treating runoff on site and, where possible, on the surface rather than underground. Water then becomes a much more visible and tangible part of the built environment, which can be enjoyed by everyone.

The Technical Standards for Sustainable Drainage produced by the Local Authority SuDS Officer Organisation (LASOO) states that generally the aim for should be to discharge surface water runoff as high up the following hierarchy of drainage options as reasonably practicable:

- 1) Into the ground (infiltration).
- 2) To a surface water body.
- 3) To a surface water sewer or highway drain.
- 4) To a combined sewer.

Site Investigation

No site investigations have been carried out and it is assumed that the percolation rate is very low on the site. Also the developer wishes to store the water for on site irrigation and therefore the surface water will be discharged into a surface water body. This will be a new lined storage lagoon located in the north eastern corner of the site. An outfall will be constructed to discharge the excess flow into the IDB drain on the eastern side of the site alongside Langary Gate Road.

Design of Surface Water Storage

The lagoon will be designed to store approximately 400 cu metres of water and above this will be a volume available to store the water from a 1 in 100 year event with 30%

increase for climate change. This volume will be worked out as follows for various storm durations:

Duration	M5_60min	Z1	M5-D	Z2	M100-D	Intensity mm/hour	Areal Factor	Areal Intensity mm/hour	Area (ha)	Volume cum/hr	Vol + 30% climate Change cum/hr	Total Volume cu m climate	Total Volume cu m	Volume litres/sec
15	24	0.64	15.36	1.98	30.41	121.65	0.94	114.35	0.26	297.3	386.5	96.6	74.3	82.6
30	24	0.81	19.44	1.97	38.30	76.59	0.95	72.76	0.26	189.2	245.9	123.0	94.6	52.6
60	24	1	24	1.93	46.32	46.32	0.96	44.47	0.26	115.6	150.3	150.3	115.6	32.1
120	24	1.2	28.8	1.89	54.43	27.22	0.97	26.40	0.26	68.6	89.2	178.5	137.3	19.1
240	24	1.42	34.08	1.86	63.39	15.85	0.97	15.37	0.26	40.0	52.0	207.8	159.9	11.1
360	24	1.57	37.68	1.83	68.95	11.49	0.98	11.26	0.26	29.3	38.1	228.4	175.7	8.1
600	24	1.74	41.76	1.81	75.59	7.56	0.98	7.41	0.26	19.3	25.0	250.4	192.6	5.3
1440	24	2.16	51.84	1.81	93.83	3.91	0.98	3.83	0.26	10.0	13.0	310.8	239.1	2.8
2880	24	2.5	60	1.81	108.60	2.26	0.98	2.22	0.26	5.8	7.5	359.7	276.7	1.6

It is initially proposed that consent will be requested from South Holland IDB for a discharge of 2.5 litres/second. Using this figure the required volume of storage can be calculated as follows:

Duration mins	Total Rainfall in Duration cu.m	Total Rainfall Volume cu m into storage facility	Outflow into IDB Drain at 2.5 litres/sec	Total Storage Required	Total Time to empty Soakaway hours
15	96.6	96.63	2.25	94.38	10.49
30	123.0	122.97	4.50	118.47	13.16
60	150.3	150.30	9.00	141.30	15.70
120	178.5	178.46	18.00	160.46	17.83
240	207.8	207.83	36.00	171.83	19.09
360	228.4	228.40	54.00	174.40	19.38
600	250.4	250.37	90.00	160.37	17.82
1440	310.8	310.80	216.00	94.80	10.53
2880	359.7	359.73	432.00	-72.27	-8.03

The size of the storage lagoon will be calculated to store $400 + 175 = 575$ cu m of water.

It will be necessary to construct a flow limiter between the storage lagoon and the IDB drain to limit the flow to 2.5 litres / second. If a 75mm pipe only is used then the maximum flow will be between 8 and 10 litres/second, and an average flow of 5 litres/second

Calculate Size of Storage lagoon

Excavate lagoon 2.0 metres deep with 10m x 10m base and 1.5:1.0 side slopes. Construct banks with spoil 1.0 metre high with 2.5 metre wide top with the spoil. Install a suitable liner to ensure the lagoon is watertight.

Total volume when water depth is 2.8 metres deep is given by:

$$\begin{aligned}\text{Volume} &= (10.0 \times 10.0 \times 2.8) + (4 \times 0.5 \times 2.8 \times 4.2 \times 10) + (4 \times 0.33 \times 4.2 \times 4.2 \times 2.8) \\ &= 280 + 235.2 + 65.2 = \underline{580.4 \text{ cum}}\end{aligned}$$

Total volume when water depth is 2.2 metres deep is given by:

$$\begin{aligned}\text{Volume} &= (10.0 \times 10.0 \times 2.2) + (4 \times 0.5 \times 2.2 \times 3.3 \times 10) + (4 \times 0.33 \times 3.3 \times 3.3 \times 2.2) \\ &= 220 + 145.2 + 31.6 = \underline{396.8 \text{ cum}}\end{aligned}$$

$$\text{Total volume between water depths of 2.2 and 2.8m} = 580.4 - 396.8 = \underline{183.6 \text{ cum}}$$

Therefore there is a storage volume of 396.8 cu m and a volume available to attenuate a 1 in 100 year event with 30% allowance for climate change of 183.6 cum.

Volume of excavation is given by:

$$\begin{aligned}\text{Volume} &= (10.0 \times 10.0 \times 2.0) + (4 \times 0.5 \times 2.0 \times 3.0 \times 10) + (4 \times 0.33 \times 3.0 \times 3.0 \times 2.0) \\ &= 200 + 120.0 + 23.8 = \underline{343.8 \text{ cum}}\end{aligned}$$

$$\text{Volume of banks} = 4 \times (4 \times 1) \times 21.5 = \underline{344 \text{ cum}}$$

Therefore the volume of soil excavated should produce sufficient material to form the banks.

Consultation with South Holland IDB

South Holland IDB were consulted on the proposals to discharge into the Board's Drain and made the following response:

This seems acceptable in principal providing the following is carried out:

- *The lagoon is kept at least 9metres from the Board's E13 Drury's Drain – South*
- *The applicant applies to the Board for relaxation of Byelaw 10 and enters into a Deed of Indemnity for the outfall constructed to the Board's specification. Paying all the Board's cost for setting up the deed and registering it with Land Registry.*
- *The applicant applies to the Board to discharge water to a watercourse and a surface water development contribution is paid (£7.55 a square metre x 2600m² = £19.630 reduced to a 20% payment of **£3,926** for a restricted discharge rate of no more than 10litres a second for the impermeable area of only 0.26Hectares. Ensuring no other areas are diverted in to the lagoon and only a 75mm diameter pipe is used for the overflow.*

Revised Design of Storage Lagoon

If the outfall pipe is 75mm diameter then outflow can be increased to 5 litres/second and the required storage is reduced to 143 cu metres.

Duration mins	Total Rainfall in Duration cu.m	Total Rainfall Volume cu m into storage facility	Outflow into IDB Drain at 5.0 litres/sec	Total Storage Required	Total Time to empty Soakaway hours
15	96.6	96.63	4.50	92.13	10.24
30	123.0	122.97	9.00	113.97	12.66
60	150.3	150.30	18.00	132.30	14.70
120	178.5	178.46	36.00	142.46	15.83
240	207.8	207.83	72.00	135.83	15.09
360	228.4	228.40	108.00	120.40	13.38
600	250.4	250.37	180.00	70.37	7.82
1440	310.8	310.80	432.00	-121.20	-13.47
2880	359.7	359.73	864.00	-504.27	-56.03

Total volume when water depth is 2.8 metres deep is given by:

$$\begin{aligned}\text{Volume} &= (10.0 \times 10.0 \times 2.8) + (4 \times 0.5 \times 2.8 \times 4.2 \times 10) + (4 \times 0.33 \times 4.2 \times 4.2 \times 2.8) \\ &= 280 + 235.2 + 65.2 = \underline{580.4 \text{ cum}}\end{aligned}$$

Total volume when water depth is 2.3 metres deep is given by:

Volume

$$= (10.0 \times 10.0 \times 2.3) + (4 \times 0.5 \times 2.3 \times 3.45 \times 10) + (4 \times 0.33 \times 3.45 \times 3.45 \times 2.3)$$

$$= 230 + 158.7 + 36.1 = \underline{424.8 \text{ cum}}$$

Total volume between water depths of 2.3 and 2.8m = $580.4 - 424.8 = \underline{155.6 \text{ cum}}$

Therefore there is a storage volume of 424.8 cu m and a volume available to attenuate a 1 in 100 year event with 30% allowance for climate change of 155.6 cum.

Details of Lagoon

