

# community flood plan

## Parishes and communities working together

Community or group	<b>COTTENHAM PARISH</b>	Address	<b>Parish Office, Community Centre, 250a High Street, Cottenham, CB24 8RZ</b>	
Floodline Quickdial Number	<b>0345 988 1188</b>	Which Environment Agency flood warnings are you registered to receive?	<b>Cottenham Lode</b>	
Local flood warning trigger i.e. when water reaches bottom of the bridge	<b>When water floods the meadows from Lode north of Old Rectory beside B1049 Twenty Pence Road</b>			

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Date	17/3/2018
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## 1A – Locations at risk of flooding: Flood warnings

From the information you have available, make a list of areas liable to flood and the level of warning which would affect them.

Area number	Location of risk	Trigger level	Actions
Area 1	The Holme North Fen Little North Fen	Flood warning issued for Cottenham Lode (flooding to water meadow north of Church from Lode)	Monitor Lode for breach or overtopping. Advise EA and IDB
Area 2	Land north of High Street, Two Mill Field, Fen Bridge Farm, North Fen and Ramphill Farm	Flood warning for Cottenham Lode High levels at Tenison Manor Old Rec Pond	Monitor Lode for breach or overtopping. Advise EA and IDB
Area 3	Oxholme Great North Fen Smithy Fen	Flood warning on Cottenham Lode	Monitor Lode for breach or overtopping. Advise EA and IDB
Area 4	Smithey Fen, Bullocks Haste Common, Setchel Drove Lockspit Hall	Flood warning for Cottenham Lode and/or Flood warning for Old West River	Monitor Lode and Old West River for breach or overtopping Advise EA and IDB
Area 5	Church End Cow Pastures, Mitchell Hill Common, Green End Cow Pastures, Chear Fen	Flood warning for Old West River or Cottenham Lode High levels in Beech Ditch	Inform IDB
Area 6	Eastlands Cottenham Pastures Dunstal Field	High water levels in Beech Ditch (IDB) or private ditches	Inform IDB Check culverts in IDB and private ditches
Area 7	Mill Field Church Field	Very high rainfall	Check ditch culverts and pipes under High Street
Area 8	Oakington Road NW/SE	Very high rainfall	Check ditch culverts

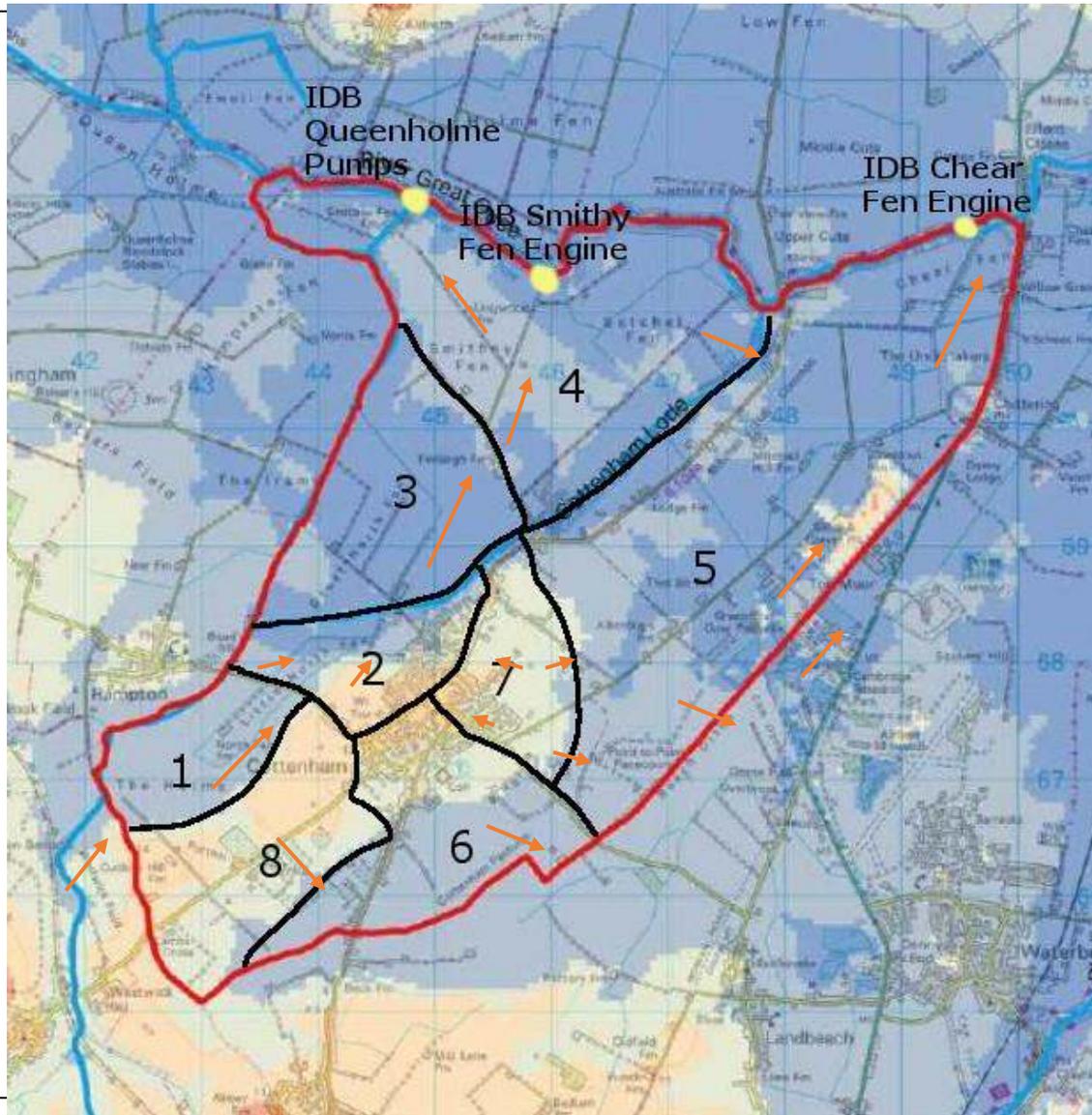
## 1B – Actions to be taken before a flood: Locations at risk of flooding / source of flooding

Insert details of areas at risk from flooding and the direction of flooding. Include maps and if possible, details of existing defences.

Area number	Location at risk	Source of flooding	Direction of flooding
Area 1	North Fen Farm The Holme Fen Bridge Farm	Breach or overtopping of Cottenham Lode Failure/Blockage of IDB or landowners ditches	To: Culvert at entrance to North Fen Farm, Rampton Road.
Area 2	Ramphill Farm, Two Mill field, Recreation ground, North side of High Street	Breach or overtopping of Cottenham Lode Failure/Blockage of IDB or landowners ditches.	To: Under Lode culvert at Fen Bridge Farm or at the Rectory to flood meadow to the north.
Area 3	Oxholme Great North Fen Smithy Fen	Breach or overtopping of Cottenham Lode Failure/Blockage of IDB or landowners ditches.	To: Queenholme Pumps via Burgess Drain and Smith Fen Engine Drain.
Area 4	Smithey Fen Setchell Drove Lockspit Hall Drove Bullocks Haste Common	Breach or overtopping of Cottenham Lode or Old West River. Failure/Blockage of IDB or landowners ditches.	To: Queenholme Pumps Soak Dyke or Chear Fen Pumps via Wing Drain and Soak Dyke.
Area 5	Church End Cow Pastures, Green End Cow Pastures, The Lots, Mitchell Hill Common/Chear Fen	Breach or overtopping of Cottenham Lode or Old West River. Failure/Blockage of IDB or landowners ditches.	To: Chear Fen Engine via Beech Ditch or Wing Drains.
Area 6	Eastlands Dunstal Field Cottenham Pastures	From Beech Ditch or other IDB or landowners ditches.	To: Beech Ditch via Culvert at Hay Lane/Beech Road junction.
Area 7	Mill Field Church Field	Drainage Ditches or pipes under High Street.	To: NW via pipes under High Street.
Area 8	NW/SE Oakington Road	Drainage Ditches.	To: SE towards Histon Road

## 1C – Actions to be taken before a flood: Map showing direction of flooding

Cottenham Parish showing sub-catchments 1 – 8, Internal Drainage Board pumps on northern boundary and direction of water flow (orange arrows).



## 2A – Actions to be taken during a flood: local flood actions

Identify local flood actions.

Area number	Location at risk	Action / trigger	Local action	Equipment required	Time required
Area 1	As described in 1A	Breach of Lode causing flooding	Notify EA and IDB. Consider preparing North Fen Farm for evacuation.	Phone Fluorescent Vests Buoyancy Aids	15 minutes
Area 2	As described in 1A	Breach of Lode causing flooding Old Rec Pond/ Tenison Manor	Notify EA and IDB	Phone	15 minutes
Area 3	As described in 1A	Breach of Lode causing flooding	Notify EA and IDB	Polythene sheeting Flood Sacks	15 minutes
Area 4	As described in 1A	Breach of Lode causing flooding Breach of Old West River	Notify EA and IDB Consider evacuation of properties.		15 minutes
Area 5	As described in 1A	Flooding from Old West River Cottenham Lode	Notify EA and IDB		15 minutes
Area 6	As described in 1A	Field/Property flooding from overflowing ditches	Notify IDB/ Landowners. Clear any blockages.		1 hour
Area 7	As described in 1A	Possible flooding of High Street	Notify Wardens/IDB	Hand Labour Possibly an Excavator	15 minutes
Area 8	As described in 1A	Field flooding	Notify landowners and IDB to assess problem.	Hand Labour Possibly an Excavator	15 minutes

## **APPENDIX – a) Cottenham parish Drainage and Flooding assessment**

## **Cottenham's Housing Need and possible supply 2017-2031: Drainage & Flooding**

### **1 Summary**

Cottenham is vulnerable to surface water flooding exacerbated by housing development.

To maintain safety, new developments need planning conditions or obligations to ensure:

- adequate surface water is retained on-site so that run-off rates do not exceed 1.1 litres / second / hectare of developed land
- further hardening of the site under future permitted development is either:
  - prevented, or
  - allowed for by using a, say, 10% uplift in the assumption of area developed
- the technical design should be approved independently by the Chief Engineer of the Internal Drainage Board before any works start
- an “enduring party” is contracted and funded to maintain the system in perpetuity, before any development starts.

### **2 Background**

Cottenham village is surrounded by land lying at or below 5 metres creating challenging conditions for surface water drainage via the Ely Ouse along its northern boundary. Much of the surface water from the surrounding fields and the higher land in the village is drained into the River Ouse by using pumps that extract water from the surrounding ditches and keep the water levels low.

Surface water from villages to the south-west is also brought through the parish in what is effectively an aqueduct – the Cottenham Lode – which also collects some surface water by gravity from the Church end of the village before flowing by gravity into the Ouse.

It is imperative to avoid flooding that the relative levels in the Ouse, Lode and ditches are managed carefully and the sluices of the Environment Agency and Pumping Stations of the Old West Internal Drainage Board are critical to that management.

All development hardens the ground surface allowing surface water to run off faster than in the undeveloped “green” field. To avoid flooding, measures are necessary to store water on a developed site during a storm event, only allowing the water to run off at or below the pre-development rate. In Drainage Board districts, pumping capacity was raised after the 1947 flooding to handle run-off rates of 350 gallons per second per acre of developed land (equivalent of 1.1 litres per second per hectare of developed land) based on experience developing runways in World War II and research at the Cambridge University Farm and elsewhere.

It is possible that rainfall levels have increased significantly since the 1930s research and it is now imperative that runoff rates from new developments in the fen-edge area are held below 1.1 litres per second per hectare (the metric equivalent of 350 gallons per second per acre) by a combination of on-site retention storage and off-site run-off restrictors, such as hydrobrakes, with enough margin to compensate for further site hardening due to urban drift (usually 10%) and increased rainfall caused by climate change (possibly as much as 100%).

This article how the measures suggested on three proposed developments in Cottenham may be inadequate to prevent a significant flood event.

## Introduction

Cottenham village lies scarcely 10 metres above sea level. Most of the surrounding area is at or below 5 metres above sea level.

A once in 100 year storm event (fig.1) could cut Cottenham off from its neighbouring villages as waters from the Great Ouse and/or Cottenham Lode inundate the low-lying areas all round Cottenham.

- Families could individually be safe but marooned apart with children at school – youngsters in Cottenham, teenagers in Cambridge or Impington – and parents out of the village.
- Communications and power cannot be depended on – the mobile communications on which we depend would probably fail within a few hours if power is also lost.

In 2016, Cottenham Parish Council’s Drainage & Flood Working Party identified the risk and prepared an informative postcard for residents.



# Flood Care

Floods may be unlikely but:

**Have a plan:**

- Improve your flood-proofing
- Decide what you’d do if you and family were separated by a flood
- Make sure your family knows the plan

**Know who to contact:**

If life is at risk **ALWAYS** contact emergency services 999, otherwise:



Source of problem	Responsible Agency	Contact number
Great Ouse or Cottenham Lode	Environment Agency	0800 807060
Public Highways gullies etc.	Cambridgeshire County Council	0345 0455212 (office hours; or 0845 988 1188 )
Foul or surface water Sewers	Anglian Water Services	03457 145145
Unknown source	South Cambs District Council	03450 450 063 (office hours or 0845 988 1188 )
Water supply pipes	Cambridge Water	01223 706050

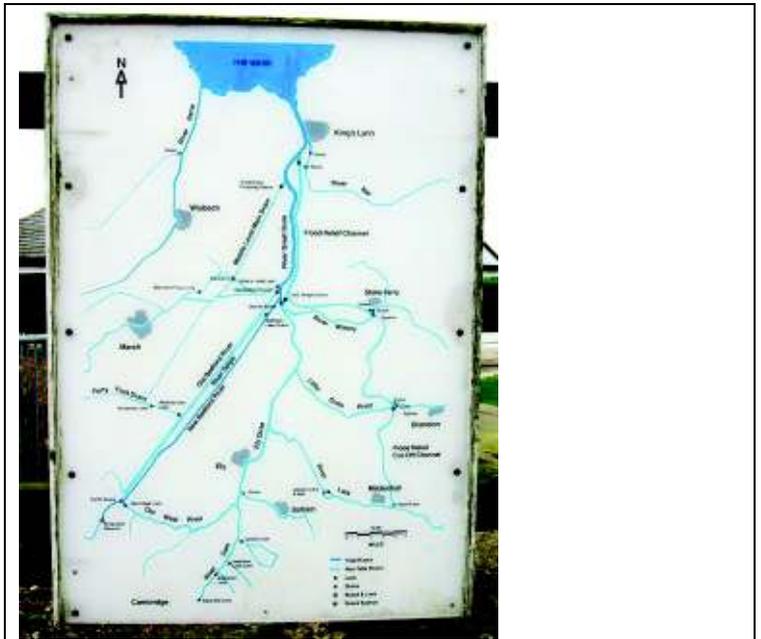
**Fig. 1: “Flood Care” information postcard**

## The challenge

The fen-edge landscape is essentially flat, creating “big skies” but making drainage challenging as water is likely to meander from low to lower points on its journey over several days to the sea.

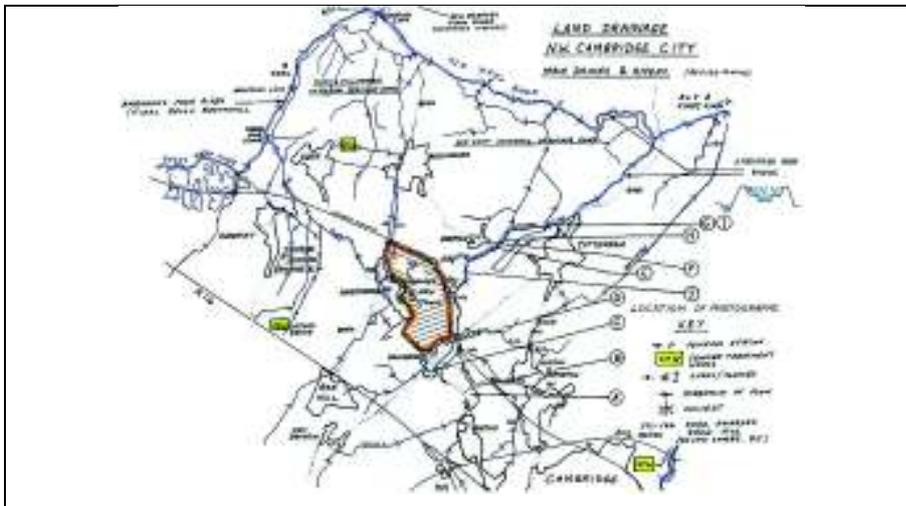
Surface water drainage from around Cottenham to the Wash relies on three elements:

- Gravity – the main rivers and watercourses that discharge to the Wash at King’s Lynn
- High level flood storage – the South and Middle levels introduced by Vermuyden in the 17<sup>th</sup> Century
- Low level systems of Main Drains and Pumping Stations, managed by Internal Drainage Boards (IDBs), discharging into the Environment Agency’s embanked Main Rivers



**Fig. 2: Surface water from Cottenham (in SW) has a long way to travel northwards to the Wash**

Adequate on-site water storage combined with controlled outflow systems and long-term maintenance are essential if surface water from new developments is not to inundate the area.



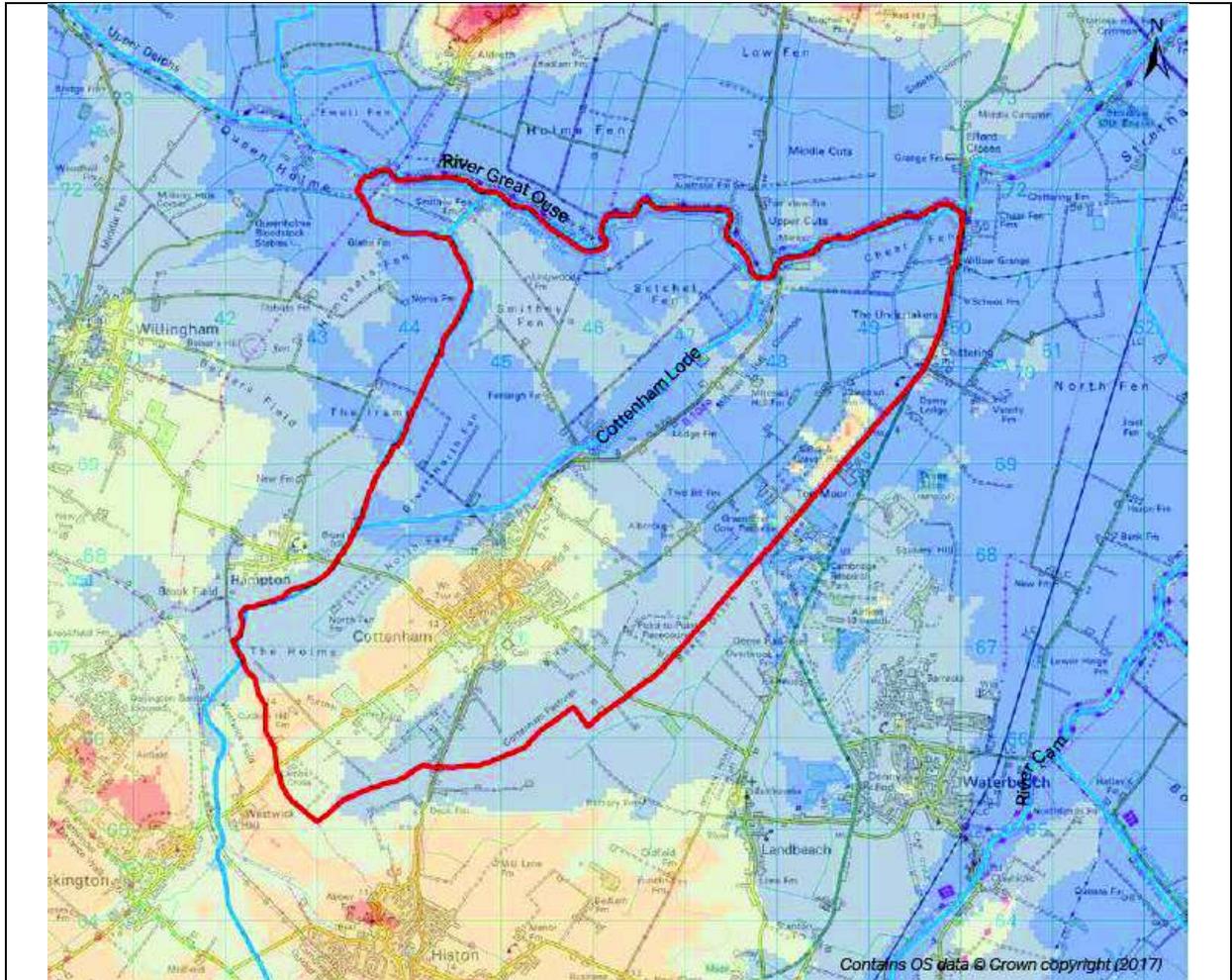
**Fig.3: Northstowe has a “last resort” overflow into Cottenham Lode**

Most of Cottenham is critically dependent on the embanked **Cottenham Lode** and the **Great Ouse** (or **Old West River** as it is known where it passes along Cottenham’s northern boundary).

Both these waterways catch surface water from villages far to the west and south-west.

The **Northstowe** development to the south-west of Cottenham incorporates an extensive surface water drainage system (“sustainable urban drainage system” – SUDS) but its “overflow” is via Cottenham Lode.

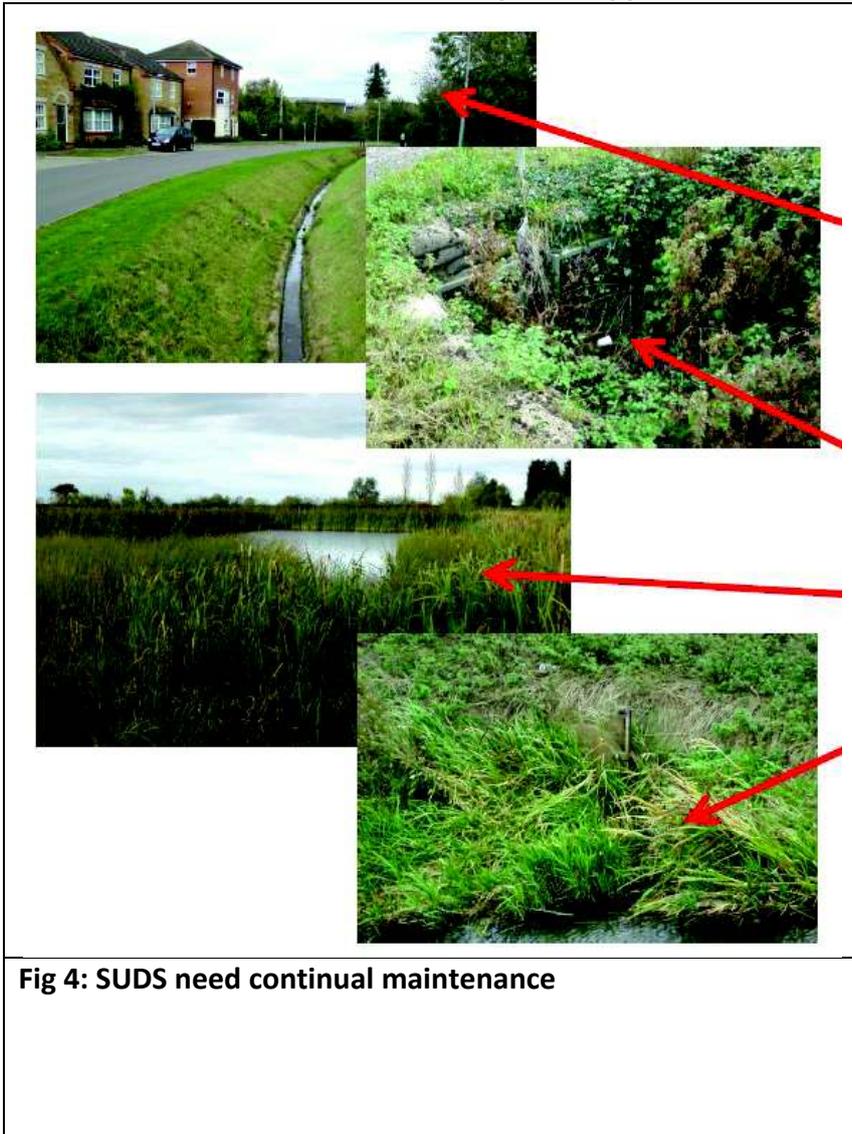
## Topology & Hydrology



Cottenham's Topology & Hydrology

## Problems experienced

Persimmon's Tenison Manor development applied SUDS which was neglected



- Surface water collected from street-side drains flows into open ditches on Tenison Manor and on, via regulating systems, to Cottenham Lode
- Ditch culverts alongside Broad Lane became blocked without regular clearing.
- Retention ponds intended to store storm surges became weed-bound, losing capacity
- Hydrobraking systems and flap valves limiting the discharge rate became choked and/or failed

Although the estate is not yet adopted some 15 years after its completion, recent restoration work has secured operation of the SUDS after the neglect (Fig.4) since installation around 2001. This demonstrates the importance of an enduring party being responsible for the system maintenance.

Problems with the installation itself are believed to have caused a flooding event (Fig.5) in 2001.



**Fig.5: Flooding of Cottenham Lode in 2001**

Cottenham village may lie on relatively high land around 10 metres above sea level but it is the IDB Pumping Station at Queenholme that removes run-off water from the ditches draining the “lowlands” to the west of Cottenham, and the Station at Chear Fen that removes run-off water from the ditches draining the “lowlands” to the east of Cottenham. The Lode itself mostly carries water in its embanked channel by gravity from higher villages in the southwest to the Old West River (or Great Ouse).

## The Drainage Board

The **Old West Internal Drainage Board** was originally constituted in 1842 and its District is located to the north west of Cambridge. The District has the Old West River (Ely Ouse or Great Ouse) forming the northern boundary.

A considerable area of “highland” (above the 20 ft contour), including Cottenham, is drained to and depends upon, the Board’s pumped “lowland” catchment.

The Pumping Stations have capacity limited to the equivalent of 1.1 litres / second / hectare of ground they drain or about 350 gallons per acre per hour. The capacity figure arises from a review after the 1947 floods concluded that the installed pumping capacity was not enough to keep the water levels in the drains. The limit appears to be based on peak run-off rates measured by Bailey Denton and on arable, heavy soil land at the Cambridge University Farm in the 1930s with about 300 mm of seasonal rain (about 3,000 m<sup>3</sup> per hectare).

Today’s long term average rainfall is around 600 mm in the east of England, implying that the Pumping Stations may need another upgrade.

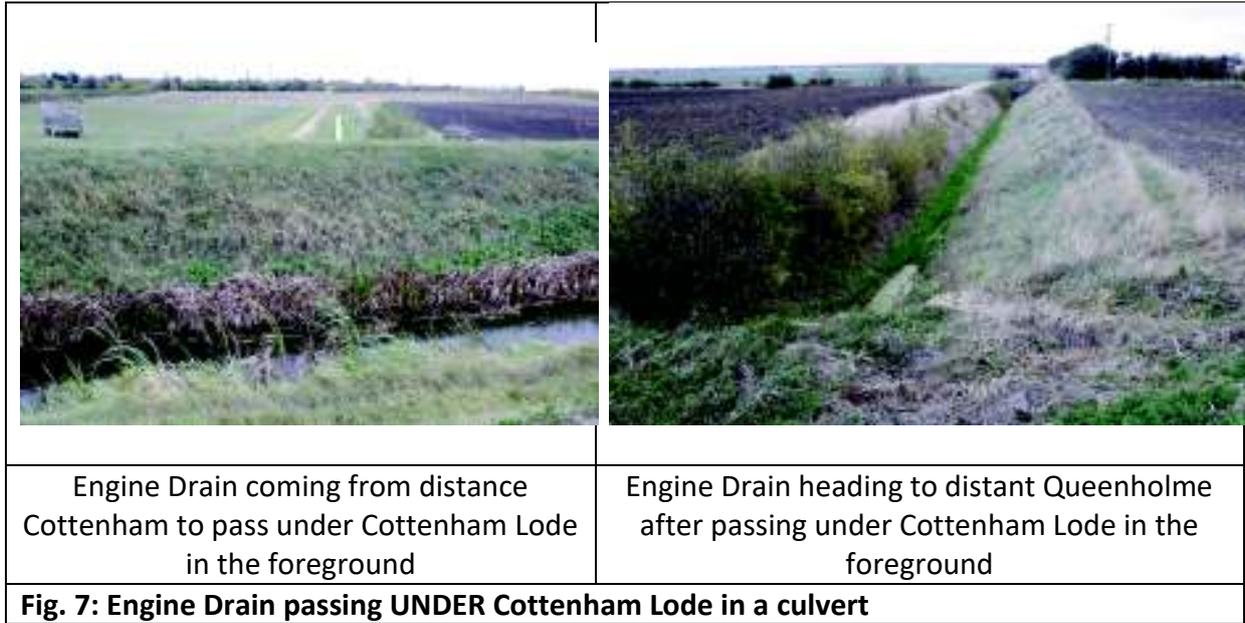
Catchwater Drain flows UNDER the Cottenham Lode in a culvert and, via the Engine Drain to the IDB pump at Queenholme where it is lifted into the embanked Great Ouse.

PPG ID:7 requires a 1/100 year event plus 40% to be absorbed on site.



**Fig. 6: Old West Main Drains**

**Catchwater Drain** is drained northward into Engine Drain which passes UNDER Cottenham Lode in a culvert



Engine Drain is pumped into the Old West River (Great Ouse) by the IDB Pumping Station at **Queenholme**

## The major local developments

### Gladman



**Fig.8: Gladman Development's application site**

The **Gladman** site ( Application S/1818/15/OL or S/1411/16/OL) lies close to the flood plain. N-W run-off from the site flows into the IDB's Catchwater Drain flowing from SW to NE. Outflows into the Drain must be restricted to the IDB limit of 1.1 litres / second / hectare of developed land (around 5 litres / second in this case)

### County Estates



**Fig9: County Farms' application site**

The **County Farms** site (S/2876/16/OL) also lies close to the flood plain. N-W run-off from the site flows into the IDB's Catchwater Drain flowing from SW to NE and Engine Drain flowing northward. Outflows into the Drain must be restricted to the IDB limit of 1.1 litres / second / hectare of developed land (also around 5 litres / second in this case)

## Gladman



**Fig.10: The Gladman site**

Developing 3.7 hectares of the **Gladman** site (S/1818/15/OL and S/1411/16/OL) will increase surface water run-off. This is acknowledged to need storage and attenuation to bring run-off below the IDB's permitted 1.1 litres / second / hectare run-off rate.

This appears to need a minimum long-term assured pond capacity of nearly 5,000 m<sup>3</sup> to limit flow towards Catchwater Drain in the NW. Assuming levels are retained at no more than 1.2 metres, this requires around 4,000m<sup>2</sup> (0.4 hectare) of surface area. A pond of this size would sacrifice a substantial portion of the land designated for woodland. The on-site pond capacity appears to be only around 2,400m<sup>3</sup>.

Nearly half of the surface water flows SE, yet there appears to be minimal attenuation of flows towards an area known (EA Surface Water Flood Risk map) to be vulnerable to surface water flooding.

The pond and the hydrobrake necessary to limit flow into the Catchwater Drain will also require a long-term maintenance arrangement with an enduring party.

## Persimmon



**Fig. 11: The Persimmon site**

Developing 4.5 hectares of the **Persimmon** site (S/1606/16/OL) will increase surface water run-off. This is acknowledged to need storage and attenuation to bring run-off below the IDB's permitted 1.1 litres / second / hectare run-off rate.

This appears to need a minimum long-term assured on-site surface water storage capacity of around 1,800 m<sup>3</sup> (assuming 100y + 40%) to limit flow off-site.

The site design includes a total of around 1,000m<sup>2</sup> of 0.6m depth soakaways or infiltration basins, which appears inadequate.

RSK appears to misunderstand (3.4) the role of the Environment Agency's Cottenham Lode in relation to the Old West Internal Drainage area. Much of Cottenham's surface water is drawn, via lower level ditches, the IDB's Catchwater Drain and Engine Drain, to the IDB pumping station at Queenholme, not the Smithy Fen engine. That pumping station lifts the water into the Ouse.

An extensive array of sustainable drainage techniques is proposed on-site, although it is not clear how these can be maintained in perpetuity, especially against urban creep as householders develop property in future.

The "last resort" overflow appears to be an uncontrolled flow into the ditch alongside Oakington Road. This is outside the Internal Drainage Board (IDB) area but run-off eventually flows into IDB drains and requires limitation to the equivalent of 1.1 litres / second / hectare to allow this water to be recovered into the Great Ouse via IDB Main Drains and Pumping Stations.

The pond and the hydrobrake necessary to limit flow into the Catchwater Drain will also require a long-term maintenance arrangement with an enduring party.

## County Estates



**Fig. 12: County Farms**

Surface water flows naturally through Les King Wood, a community woodland, that forms and screens the north-west boundary of the site, into the IDB's Catchwater Drain along the north-west site boundary.

Developing 6.3 hectares of the **County Farms** site (S/2876/16/OL) site will increase surface water run-off.

The appears, due to the poor infiltration conditions, to need a minimum long-term assured pond capacity of around 2,500 m<sup>3</sup>.

requiring some form of storage and attenuation to bring it below the IDB's permitted 1.1 litres / second / hectare run-off rate.

Assuming levels are retained at no more than 0.6 metres, this requires around 5,000m<sup>2</sup> (0.5 hectare) of pond surface area at least 9 metres distant from the IDB Drain. A pond of this size would sacrifice a substantial portion of the Les King Wood, with woodland a scarce resource in fen-edge countryside.

## 11 References

- 1 Cottenham draft Pre-submission Neighbourhood Plan
- 2 Cottenham Village Design Statement 2007
- 3 Cottenham Vision Plan Survey 2014
- 4 Cottenham Neighbourhood Plan Survey
- 5 Cottenham NP "7 Issues" Survey
- 6 CNP Evidence paper E1: Housing need and supply
- 7 CNP Evidence paper E2: Brownfield sites
- 8 CNP Evidence paper E3: Rural exception sites and Community Land Trust
- 9 CNP Evidence paper E4: Recreation Ground
- 10 CNP Evidence paper E5: Village Hall
- 11 CNP Evidence paper E6: Nursery
- 12 CNP Evidence paper E7: Medical Centre
- 13 CNP Evidence paper E8: Village Heritage & Character
- 14 CNP Evidence paper E9: NP Golden Thread
- 15 CNP Evidence paper E10: Burial Ground extensions
- 16 CNP Evidence paper E11: Drainage & Flooding
- 17 CNP Evidence paper E12: Design
- 18 CNP Evidence paper E13: Traffic & Transport
- 19 CNP Evidence paper E14: Community Transport
- 20 CNP Evidence paper E15: Play
- 21 CNP Evidence Paper E16: Surveys to Key Issues
- 22 AECOM Heritage& Character assessment
- 23 AECOM Housing needs assessment
- 24 AECOM Sites assessment