EVIDENCE BASE: CHAPTER 9: WATER, SEWERAGE AND DRAINAGE CAPACITY

Report to Corpusty & Saxthorpe Parish Council on Green Issues and Drainage Capacity

In Corpusty & Saxthorpe as Relevant to The Neighbourhood Plan

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1 Drainage

Drainage consists of the collection of surface water (from run-off caused by rainfall) and foul water (generated by human usage of water) for treatment and disposal. Until the advent of the Building Regulations in 1976, and even more recently, it was commonplace for surface water and foul sewage to be combined on a domestic level and piped together to the local sewage treatment works for treatment and discharge back into the environment.

From the mid-1990's local the Building Regulations began to give detailed guidance on the construction of soakaways in order to divert surface water away from the foul drain networks and prevent the overload of sewage treatment works.

Since the early2000's best practice for all new developments of more than a single dwelling is the use of Sustainable Urban Drainage Systems (SUDS). It is incumbent upon the developer to avoid large scale collection of surface water, but rather to allow infiltration back into the environment by a combination of permeable surfaces, swales, ditches and ponds, or piped directly into an appropriate water course.

1.1 The Wastewater Collection System in Corpusty, Saxthorpe and Little London

The foul drains of Corpusty and Saxthorpe are arranged so that wastewater flows by gravity as far as the pumping station on the southeast side of the village green opposite the shop. Wastewater from Little London is pumped to this same point, and the combined effluent is then pumped directly to the "Corpusty" Sewage Treatment Works (actually it is situated down Monks Lane in Saxthorpe on the southeast side of the bypass).

In theory there are no surface water drains connected into the sewer system in the villages. However, as previously stated, surface and foul waters continue to be routinely combined on older properties in the villages. Along with natural infiltration into the sewer network, a proportion of the total wastewater flowing into the Sewage Treatment Works therefore arises from surface water run-off.

1.2 Corpusty Sewage Treatment Works

The purpose of a sewage treatment works is to treat wastewater before it can be discharged "safely" back into the environment without causing harm to the surrounding ecology. This means reducing both the solid content and the bacterial content, both of which would absorb significant quantities of oxygen if discharged into a watercourse without treatment, thereby depriving fish and other aquatic organisms of the oxygen they require to survive. The relevant parameter is the Biological Oxygen Demand (BOD), measured in milligrams per litre of effluent (mg/l).

Some more sophisticated sewage treatment plants (but not Corpusty) also specifically aim to reduce ammoniacal nitrogen, releasing it harmlessly into the atmosphere as nitrogen gas.

It is important to note that the reduction of pathogens, i.e. bacteria and viruses which are harmful to humans, is not generally among the objectives of sewage treatment in the UK, and not specifically among the objectives of the Corpusty Sewage Treatment Works.

The Corpusty Sewage Treatment Works consists of a physical screen (Pre-treatment) a settling tank (Primary Treatment) and a biological trickle filter (Secondary Treatment).

The extent to which wastewater must be treated is dictated by the requirements of the Environment Agency (EA) in the form of a site-specific Permit to Discharge, and is dependent on the ecological sensitivity of the discharge site and the capacity of the receiving watercourse to dilute the effluent to an acceptable level – it follows that a large river can accommodate effluent of a lower standard than a small stream.

The current EA Permit to Discharge for Corpusty Sewage Treatment Works allows for the Dry Weather Flow Discharge (meaning the average daily flow during 7 consecutive days without rain following 7 days during which the rainfall did not exceed 0.25mm on any one day) of up to 108 m3/day of effluent of BOD < 30mg/l into the River Bure, effective from 1st April 2004.1

Monitoring of this discharge, in accordance with the Permit to Discharge, is by a continuous on-site measurement and recording system at the treatment works, and also random sampling at the discharge outlet to the River Bure, grid reference TG 11804 29847.

For design purposes, Anglian Water Services (AWS) calculate flows based on an assumption of 150 litres per person per day. There are 308 households in Corpusty, Saxthorpe and Little London. Let us assume that 90% are connected to mains drainage and average occupancy is 2.3 people per household. The daily dry weather wastewater flow would therefore be of the order of 96m3/day.

On top of the Dry Weather Flow, AWS assume an extra 10% to allow for surface water through infiltration or collected directly in combined sewers. If this were added to the Permit to Discharge, the average permitted daily flow would be 119m3/day.

I inspected the discharge point and made approximate discharge measurements using a bucket and stopwatch as follows:

Date	Time	Conditions	Discharge (litres/minute)	Equivalent daily discharge (m3/day)

Wed 12th Nov	12.15pm	Dry	54	78
Fri 14th Nov	8.00am	Dry	102	147
Fri 14th Nov	12.15pm	Wet, after significant rainfall	300	432

These measurements should be taken as indicative rather than representative, but they do suggest a higher level of infiltration of surface waters than expected.

I noted that the discharge point was free of algae and excessive weed growth, a qualitative indicator that the effluent is not significantly altering the natural ecological balance of the river.

1.3 Proposed Development between Norwich Road and Adams Lane

The proposed development consists of 18 dwellings on a site between Norwich Road and Adams Lane in Corpusty, as identified in the North Norfolk District Council Site Allocations Plan.[2]

There is a foul sewer running from the bottom (southeast) end of Adams Lane through the development site and connecting into the main sewer on Norwich Road between Bure House and The Bungalow, with an easement preventing construction within 3 metres either side. This sewer would either have to be avoided, or re-routed with the permission of Anglian Water Services (AWS) under Section 185 of the Water Industry Act 1991.

Discharge of foul water from the development would be into the main sewer running along Norwich Road towards the pumping station adjacent to the Village Green, the capacity of which to accommodate the increased flow arising out of a development of 18 new dwellings would be the subject of an assessment at the planning stage. Although AWS are not statutory consultees on planning applications, they are normally consulted, and make comment upon, applications for 10 or more dwellings.

There is likely to be sufficient capacity in the existing sewer network to accommodate the proposed development.[3]

As for the capacity of the Sewage Treatment Works and the Permit to Discharge, "There is sufficient capacity at Corpusty Water Recycling Centre [Sewage Treatment Works] to treat the foul flows from this new development site".[3] Although this statement is contrary to the statement in the North Norfolk District Council Site Allocations Plan[2], it is supported by the Water Infrastructure Statement published by North Norfolk District Council in March 2010.[4]

Regardless of the above, it is not permitted for developers to contribute to the cost of improvements or increased capacity of treatment plants, which is a matter solely for Anglian Water Services to resolve and finance.

Surface waters will not be permitted under any circumstances to enter the foul sewer network, and will have to be managed in accordance with the National SUDS Standards and Building Regulations Part H. Although the underlying geology of the area does not readily lend itself to infiltration of surface waters[5], the developer will be expected to demonstrate adherence to these standards, and to devise methods of handling surface waters accordingly.

1.4 Potential Developments southwest of Adams Lane and Elsewhere

One or two new houses here or there is very unlikely to have a significant impact on the either the sewer network or the Sewage Treatment Works.

Regarding the potential development of 20 new houses on the southeast side of Adams Lane, comments from Anglian Water3 suggest that they don't regard the capacity of the Sewage Treatment Works as being that close to the limit. However, only they would be able to give the definitive answer, upon being consulted during the planning process.

Discharges from the Sewage Treatment Works into the River Bure are monitored by the Environment Agency in accordance with the Permit to Discharge. It is unlikely the EA would tolerate any breach of the Permit.

There are brown trout in the river around Corpusty, the highest biological indicator of oxygenated water available, and therefore proof of absence of pollution from poorly treated sewage effluent.

Furthermore there is no bloom of either algae or weed at the discharge point from the Sewage Treatment Works into the River Bure, again proof that nutrients from poorly treated sewage are not present

The sewer network, if in need of upgrading, would be the subject of negotiation between AW and the developer at the planning stage.

2 Green Issues

Before considering renewable energy technologies it is important to make reference to the hierarchy of the three 'R's:

- Reduce
- Re-use
- Recycle

As individuals and communities we should first be striving to reduce our consumption of energy and materials – it makes sense both economically and environmentally. Examples might include lift-sharing schemes, lower wattage lights (both at home and on the streets), wearing more clothes in winter!

After reducing consumption we should be looking for ways to re-use materials in their present state, for example using "bags for life", or by passing them onto others, informally or through a community swap shop.

Finally, materials which have reached the end of their life but have an intrinsic value should be recycled, for example through the green bin system or the community recycling banks.

None of the above is anything other than common sense, but it is so often ignored.

2.1 Domestic Renewable Energy

The introduction of small scale renewable energy technologies is enshrined in national, regional and local policies, and in the case of North Norfolk District Council it is Policy EN7 of the Local Development Plan Core Strategy which applies. Appropriate technologies are permitted and encouraged where there are no significant adverse effects on the surrounding landscape, historical features, residential amenity, highway safety, designated nature conservation or biodiversity.6

Renewable energy technologies are also encouraged in new developments through government's "Code For Sustainable Homes".7

Many of the technologies outlined below attract government subsidies, either the Feed-in Tariff (FiT) for electricity generation or the Renewable Heat Incentive (RHI) for heat generation, provided the equipment and the installers are both registered on the approved lists.

2.1.1 Solar Thermal (hot water from the sun)

Solar thermal systems convert daylight into heat, usually in the form of hot water, with the aid of dark plates or tubes, ideally mounted on a south-facing roof. They are most efficient in direct sunlight but will also produce significant results on bright cloudy days. A heat exchanger is usually incorporated into the system in the shape of an extra coil in the hot water cylinder.

Though not universally appropriate (due to space, roof orientation etc.) solar thermal technology is widely regarded as the most efficient and cost effective renewable energy technology. The single drawback, if it be seen as such, might be the aesthetic appearance of the panels.

A typical domestic system will cost £3,000 - £5,000 and will pay for itself in 8 – 11 years.

2.1.2 Solar Photvoltaic (electricity from the sun)

The appearance of solar photovoltaic (PV) systems on the roofs of buildings in the community has come about largely due to the inception in April 2010 of a central government subsidy known as the Feed-in Tariff (FiT). Owners of systems are paid at a preferential rate to generate electricity, over and above the normal cost of electricity bought on the open market, for a guaranteed 20 year period. As take-up of the subsidy has increased, both the cost of production (and therefore of purchase) of these systems and the rate of subsidy has decreased accordingly.

As with solar thermal, the aesthetics of solar PV systems are a matter of personal taste. Suffice to say, they shouldn't be viewed in isolation, but in comparison with the alternatives, be they fossil fuel, nuclear, wind, hydro-electric or tidal generation.

The payback period for a solar photovoltaic system in Norfolk, in terms of carbon deficit during manufacture versus carbon saving during operation, is approximately 3 years, after which the system becomes a net saver of carbon emissions when compared with burning of fossil fuels to generate the equivalent electrical energy.

The payback period in financial terms depends upon the prevailing FiT at the time of installation, and also the orientation and pitch of the array of panels.

2.1.3 Wind Turbine

The basic principles of wind energy generation have been with us for many years. The issue of economies of scale are particularly relevant, both in terms of size and numbers of turbines. Also of relevance is appearance and impact on the landscape, which have ample capacity to divide communities.

However, in considering the harnessing of the wind for electricity generation, it must be born in mind the alternatives, be they fossil fuel, nuclear, tidal or solar. There are valid arguments against all forms of electricity generation, but rarely does one hear people saying they can do without it.

2.1.4 Biomass Boiler

Biomass boilers burn fuels such as wood, wood pellets and straw, which give off the same quantity of carbon (in the form of CO2) during combustion as they have absorbed during growth. Thus they are carbon neutral as long as transport costs are ignored.

The main considerations with these technologies are fuel storage, which demands significant covered space, and automation. While pellet boilers generally incorporate a degree of automation, such as self-ignition and timed heating periods, wood and straw boilers are manual in most respects.

2.1.5 Micro Hydroelectric Generation

Generation of electricity using the power of flowing water.

Though there are examples in North Norfolk of micro hydroelectric generation, most notably at the Mill in Itteringham, the technology is on the margins of viability in our landscape, where water tends to move slowly, if in reasonably large volumes.

The important consideration in micro hydroelectric generation is the energy of water at a particular height which can be released when the water falls to a lower height, called the ‘head’. The head is of far greater significance than the volume, so a small stream which is fed into a narrow pipe with a drop of 30 metres down to a small turbine will offer better prospects than a river which drops 2 metres into a large diameter pipe.

2.1.6 Ground Source Heat Pump (GSHP)

The temperature of the ground at 1.5 metres below the surface is around 12^0C, summer and winter. A Ground Source Heat Pump consists of a large loop of pipework filled with a water/antifreeze mix and buried beneath the ground to extract heat from the earth, which then passes through a secondary heat exchanger to produce a quantity of water at around 45^0C. Clearly the limitation of such a system is the land area required (although borehole variants are available at a substantially greater cost).

Since GSHPs require a source of electrical energy to function, the ratio of the output energy to input energy is termed the Coefficient of Performance, or CoP, and is typically of the order of 3 – 5, so for every kWh of electrical energy needed to run the system, 3 – 5 kWh of heat is produced.

GSHPs are particularly suited to properties with underfloor heating, which requires lower temperatures for efficient operation than radiators.

2.1.7 Air Source Heat Pump (ASHP)

Air Source Heat Pumps tend to have a lower CoP than GSHPs, at 2 – 3 and so are more costly to run for the same performance levels. Their main disadvantage, however, is the noise generated during operation as they are effectively air conditioning units run in reverse.

As with GSHPs, for optimal performance ASHPs are best coupled with underfloor heating systems.

2.1.8 Biofuels

Biofuels such as biodiesel and bioethanol, made from rapeseed and other plant oils, offer advantages over conventional fossil fuels in that they are renewable, even if not truly carbon neutral. However, their production on any scale is dependent on good agricultural land and is therefore limited to the fortunate few. Furthermore, the use of agricultural land for fuel production rather than food production is a contentious issue with which a significant proportion of the population might disagree.

2.1.9 Anaerobic Digestion

As with biofuels, anaerobic digestion, which produces methane for combustion in electricity generation, involves the use of agricultural land for the purpose of crop production other than for food. While it can be considered a renewable source of electricity, it involves significant transport movements and is likely to be opposed by a significant proportion of the population.

2.2 Community Schemes

Of the renewable energy technologies outlined above, it is only solar PV and wind generation which could be considered to be viable at a community level. In reality both these schemes amount to money-making ventures and would have no intrinsic benefit to the community other than income (which is neither to over- or under-valued). It will be as much about politics as it is about science or finance as to whether such schemes gain acceptance within the community.

2.2.1 Community Solar PV

When considering suitable locations for the mounting of a community solar PV system, it is apparent that only one building in Corpusty and Saxthorpe is truly owned by the community (as opposed to the Church of England or Norfolk County Council), namely the Village Hall.

The village hall has a large south-facing roof, measuring approximately 23 metres x 7 metres and pitched at 12^{o} to the horizontal, making it eminently suitable for solar PV. Such a roof could accommodate a solar PV array of 23kW capacity, capable of generating around 19,000 kWh of electricity per year.

It is not possible to give an indicator of the cost and potential return of such a system without going into more detail with specific suppliers.

2.2.2 Community Wind Turbine

Finding an acceptable site for a community wind turbine presents challenges, more from a socio-political point of view than a technical one. In terms of land availability at a suitable elevation, the curtilages of the village hall are the obvious choice. However, proximity to nearby dwellings and a natural antipathy towards wind turbines from a significant proportion of society would make this a proposition not to be undertaken lightly.

Again, without consultation with suppliers it isn't possible to give an indication of the potential outlay and returns of a community wind turbine.

2.2.3 Community Woodlands

Unlike the technologies referred to above, community-owned woodlands bring tangible benefits to their owners, other than straight income. They can not only provide a secure and not-for-profit source of firewood and timber for other uses, but can serve to bring community members together through amenity use, leisure and shared experience, as well as enhancing wildlife and biodiversity within the community.

Furthermore, since woodlands need a certain level of management, there are potential employment opportunities for members of the community.

Of course, obtaining the land and coordinating the volunteers need to get a community woodland off the ground would be no easy task, but the benefits for generations to come would repay the effort many times over.

References

1. Permit to Discharge No. AW4NF238X, Environment Agency, 16th December 2003

2. North Norfolk District Council, Site Allocations Development Plan, February 2011.

3. Sue Bull, Planning Liaison Manager, Anglian Water Services, private communication, 17th November 2014.

4. Water Infrastructure Statement, Site Specific Proposals Draft Plan, North Norfolk District Council Local Development Framework, March 2010.

5. Millard Consulting, Suitability of Sustainable Drainage Across The NNDC Area, March 2008.

6. North Norfolk District Council, Local Development Framework Core Strategy, adopted 2008

7. Department for Communities and Local Government, Code For Sustainable Homes, Technical Guide, November 2010