

8. Ecology and Green Infrastructure

8.1 Introduction

Protected habitats and green space may place constraints on the locations of housing growth and associated water infrastructure. Constraints may be directly related to the suitability of land for development but also indirect impacts on habitats such as the effects of pollution and abstraction. The latter have been considered in relation to existing drivers such as the Habitats Directive Review of Consents and Restoring Sustainable Abstractions programmes in previous sections of this report. Other potential ecological constraints on housing growth such as the presence of protected species are addressed through the planning process, requiring detailed site information which is beyond the scope of this study.

Development of water infrastructure provides opportunities for the creation of green infrastructure and habitats. Although ecological benefits and new green space may result from water infrastructure as a ‘secondary’ benefit of meeting engineering requirements (e.g. the development of attenuation ponds) they are likely to be enhanced if they are promoted at the design stage and integrated into the Green Infrastructure Strategy. Developing water infrastructure within the context of a Green Infrastructure Strategy would also allow it to be consistent with the natural features of the local environment and co-ordinate the approaches of different infrastructure providers (e.g. housing developers, water companies, internal drainage boards).

Coordination of this Water Cycle Strategy with the Green Infrastructure Study provides a means by which these issues can be explored which is the focus of this Section.

8.2 Constraints

Potential constraints on water infrastructure related to protected habitats (SACs, SPAs and SSSIs) are considered in the separate sections of this report on water resources (Section 5), water quality (Section 6) and flood risk (Section 7). Consideration of these issues to meet environmental legislation forms part of the normal asset management planning process by water companies, regulated by the Environment Agency. The key issues are briefly summarised below:

1. *Impact of groundwater abstraction on groundwater dependent ecosystems.* Maintaining water levels at wetland sites places constraints on the amount of water available for abstraction and potentially places limits on regional housing growth. Anglian Water, however, takes these issues into account in developing their Water Resource Management Plan and sufficient water is available to meet planned growth in the Borough of King’s Lynn and West Norfolk without harming wetland sites.
2. *Wastewater discharges and nutrient concentrations in rivers and wetlands.* Concentrations of nitrogen and phosphorus within the fresh water bodies in the Borough are generally high and exceed Water Framework Directive targets. Excessive nutrient concentrations can result in



eutrophication problems and reduce the ecological quality of the habitats. However, although these issues require further consideration they are unlikely to place a constraint on the planned housing growth in the Borough because the affected wastewater discharges are located on water bodies with relatively low habitat value (Flood Relief Channel) or low sensitivity to nutrient emissions (tidal River Ouse and the Wash).

In addition to protected habitats, water infrastructure has the potential to impact on wider biodiversity, protected species and habitat. Direct impacts on protected species and habitats related to the physical impact of housing development are assessed as part of the planning process whilst indirect impacts are largely controlled through existing legislation such as the Water Framework Directive and Habitats Directive.

8.3 Opportunities

Development of water infrastructure can provide significant opportunities to create new green infrastructure and habitats, particularly the development of SuDs. Developers and infrastructure providers generally take an active role in developing the ecological value of their land holdings and employ or commission ecologists with this in mind. Anglian Water, for example, has an active role in managing the many SSSIs on its land holdings. The WCS and Green Infrastructure Strategy, however, provide an opportunity to enhance and coordinate these activities to achieve more integrated green space. It also provides an opportunity to promote the objectives of Biodiversity Action Plans (BAP) through habitat creation and extending the ecological connectivity of sites suitable for BAP species.

8.3.1 Water Resources Infrastructure

Water resources infrastructure consists of surface reservoirs, treatment works, service reservoirs, water distribution pipes and pumping stations and the land holdings associated with these assets. With the exception of surface reservoirs of which there are none in the Borough of King's Lynn and West Norfolk, public access to these sites is restricted for public health, security and safety reasons. Opportunities for green infrastructure development are therefore limited.

8.3.2 Wastewater

Wastewater infrastructure consists of sewage treatment works, pumping stations and the sewerage network and the land holdings associated with the assets. Sewage works, in some cases have tertiary treatment lagoons, reed beds and grass plots which can have high ecological value and, in other parts of the region, have been designated as SSSIs. Anglian Water also has a policy of tree planting at these sites to reduce their visual impact on the surrounding area. Public access to wastewater assets is restricted for public health and safety reasons. Opportunities for green infrastructure and ecological development are, therefore, limited.



8.3.3 Flooding and Surface Drainage

The primary opportunity for green infrastructure and ecological development is in relation to surface drainage. This includes existing surface water drainage systems including those owned and operated by the local authorities and internal drainage boards as well as new drainage schemes that form part of new housing developments. Larger flood alleviation and flood storage schemes also provide opportunities for habitat and green space creation.

The Internal Drainage Boards and Local Authorities are actively engaged in promoting the ecological value of their surface drains and DEFRA have recently promoted these activities through Biodiversity Action Plans (to be produced by 2010)⁶. This involves an audit of existing biodiversity, prioritisation of habitats and species and the development of an action plan. The action plan is based on setting objectives, targets and indicators and may involve improvements to water level management plans, changes to management practices and habitat creation. Public access to traditional surface water drainage infrastructure is, however, limited for health and safety reasons.

Larger storage reservoirs may form part of surface drainage systems which provide opportunities for habitat creation. King's Lynn IDB's proposed storage area in the Gaywood River valley that forms part of the planned Gaywood development is an example of such infrastructure and proposals have been made to enhance the site to deliver a wider range of Green Infrastructure benefits. These include development of open space to enhance the health, social inclusion and education value of the site. The ecological value of the site will also be enhanced through the development of grazing marsh and reed bed habitat which would form the part of a wider ecological network of connected habitats.

The primary opportunity for Green Infrastructure development associated with new water infrastructure is the development of SuDs (see Section 7). The nature of the SuDs will vary depending on the geology and topography of the development sites in addition to the connectivity with local watercourses. However, they are likely to include:

- Surface drainage channels and water courses;
- Infiltration areas (where permeability of the substrate allows this) such as swales;
- Attenuation ponds,
- Wetland areas.

Although all of these features have intrinsic green infrastructure and ecological benefit these can be enhanced by careful design which should take into account the wider network of connected habitats and the nature of the landscape. The Green Infrastructure Study and WCS provides an opportunity to develop a framework for this design philosophy. At the Outline Stage of the WCS it is not possible to develop a detailed framework for the development of SuDs because the locations of the development sites and associated water infrastructure remain to

⁶ Internal Drainage Board Biodiversity Action Planning. A guide to producing IDB biodiversity action plans



be determined but this should form part of the Phase 2 WCS as well as the Green Infrastructure Strategy. General concepts are, however, outlined below.

1. **Landscape.** The Borough of King's Lynn is mainly located within a fenland landscape and the design of SuDs should be consistent with this environment and feature, for example, wetlands and grazing marshes. In contrast, the landscape in the eastern part of the Borough features more rolling countryside and the design approach should therefore be different, featuring for example open infiltration areas and tree planting.
2. **Channels and water courses.** The ecological value of channels and watercourses is dependent on their physical structure. Channels with meanders and variable profiles will create a more diverse habitat than traditional drainage structure although these need to be designed carefully to avoid increased flood risk. Low gradient banks provide greater opportunities for the development of riparian vegetation.
3. **Attenuation ponds.** Careful profiling of the shape of attenuation ponds increases the diversity of the habitat and supports the opportunity for the development of fringing reed beds and a greater diversity of aquatic plants. Reed beds are also likely to enhance the capacity of the ponds to improve the water quality of the drainage water before it is released to local water courses. Ideally reed beds should receive drainage water before entering the attenuation pond so that water quality within the pond is enhanced. Shading by trees also has a significant influence on the diversity of the fauna and flora that might develop within attenuation ponds.
4. **Wetlands and grazing marshes.** Communities that develop within wetland areas are primarily dependent on the water table level in relation to ground level. More diverse wetland will tend to be created if the land surface is undulating which will create a mosaic of water table levels. Drainage ditches within a wetland area can also be used to create more diverse water levels if designed carefully.
5. **Swales and open grass areas.** The features are aimed at increasing infiltration of drainage water to support groundwater recharge and the hydrological design needs to meet this objective which in turn defines the ecological opportunities. Open grassland is likely to form the main habitat in this environment.
6. **Sustainability of the design.** The ecological nature of a SuDs area depends on the hydrology of the area and requirements for active management such as scrub clearance. The ecological potential of the design will only be sustainable if these issues are considered at the design stage. For example a wetland area will quickly revert to scrub if the area is insufficiently wet or clearance is not actively carried out.
7. **Connectivity with other sites.** The nature of green space created by a SuDs scheme should take into account existing green infrastructure in the surrounding area to develop a network of habitats which would have enhanced ecological value compared to the individual elements (e.g. for mobile species).
8. **Multiple use.** SuDs designs also need to take into account the multiple uses of the site which includes public access and recreational opportunities such as fishing and boating which may



conflict with the ecological potential. These issues need to be considered within the context of the wider Green Infrastructure Strategy.

Development of a more integrated approach to the creation of Green Infrastructure requires continued engagement of stakeholders such as the water companies, Natural England, Norfolk Wildlife Trust and the Council who can play a role in coordinating these activities through the development of policy, guidance and stakeholder communication. This approach would build on the Biodiversity Supplementary Planning Guidance for Norfolk produced by the Norfolk Biodiversity Partnership.

