



# Waste Water Study

Woodsford Farm Sites,  
Crossways, West Dorset

September 2012

Prepared for:  
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UNITED  
KINGDOM &  
IRELAND



## REVISION SCHEDULE

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Based on the findings of this report, the allocated development on the Woodsford Farms sites at Crossways would not contribute additional nitrate (N) loadings to Poole Harbour. Mitigation provided by the reduction in N fertiliser application to agricultural land would offset the additional N that would be discharged from treatment of wastewater from the development. There would be an overall net reduction of approximately 87 kg/year.

It can therefore be concluded that there is no reason, in terms of water quality effects and N discharge levels, why the development allocated on the Woodsford Farms sites at Crossways, within the West Dorset, Weymouth and Portland draft Local Plan, should not proceed.

**Summary of change to N run-off from the proposed development**

|  | kg/year |
|--|---------|
| N loading created by the proposed development                              | 2,477   |
| N run-off reduction from taking the proposed sites out of agricultural use | 2,564   |
| Net change in N run-off  | -87     |

## INTRODUCTION

This report has been prepared in support of three Woodsford Farm sites at Crossways, West Dorset, which have been allocated for development within the West Dorset, Weymouth and Portland Pre-submission draft Local Plan. The three sites are located on the urban edge of Crossways, a village approximately 8 km east of Dorchester, in the catchment of the River Frome. The three sites are referred to as:

- Site 1: Woodsford Fields;
- Sites 2: Land to the west of Frome Valley Road; and
- Site 3: The Hanger site.

The sites lie within a Nitrate Vulnerable Zone (NVZ), which has been designated to protect the features of Poole Harbour Special Protection Area (SPA), SSSI and Ramsar site, into which the River Frome flows. The Harbour was designated to protect the large numbers of wading birds and waterfowl; at least 14 species of bird regularly attain levels in excess of 1% of their total British population. However, the Harbour suffers from nutrient enrichment, particularly from nitrogen (N) (which is usually the limiting factor in saline waters) and as such is periodically subject to excessive algal growth during the summer months. Natural England notes the following with regards to nutrient enrichment and algal growth in Poole Harbour:

*'Estuarine Feature Macro-algal mats with a biomass exceeding 2KG/m<sup>2</sup> can have a detrimental effect on the benthic invertebrate populations living within intertidal sediments. An assessment of algal mat data collected by the Environment Agency in July 2008 and 2009 found over 10% the intertidal mudflat had >2kg/m<sup>2</sup> of algal cover. Using this criteria this unit is unfavourable in terms of nutrient enrichment. Recovery depends on sufficient measures being taken to reduce the nutrient load into Poole Harbour so as to ensure that features of the site are in favourable condition with respect to effects from nutrient enrichment.'*<sup>1</sup>

It is proposed that the allocated development would be served by the existing Dorchester sewage treatment works (STW), which discharges treated effluent to Poole Harbour via the River Frome. Any additional flows treated by the STW would result in additional nitrate loading discharged from the STW, which could exacerbate the existing problems caused by elevated N levels in Poole Harbour.

In light of the above issues, Woodsford Farms wished to explore options for sustainable development at the three sites they control at Crossways, to meet the requirements for no increase in the N discharged to the Harbour. This report should be read with reference to the precedent set by the Duchy of

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<sup>1</sup> <http://www.sssi.naturalengland.org.uk/special/sssi/reportAction.cfm?report=sdrt13&category=S&reference=1000110>, accessed 26062012

Cornwall's Phases 3 and 4 Poundbury development in Dorchester, which was granted planning permission in September 2011.

The Planning Committee report<sup>2</sup> for the Phase 3 and 4 Poundbury developments noted an objection raised by Natural England:

*'the application failed to provide sufficient information to be able to satisfactorily demonstrate that any additional nutrient loading on Dorchester sewage treatment works, alone or in combination with other proposed plans or projects, would not have an adverse impact on the Poole Harbour Special Protection Area (SPA) / Ramsar site; and*

*the applications would increase the wastewater loading on Dorchester sewage treatment works and in the absence of improved treatment or other mitigation would act to increase nutrient loading and pressure on water quality in the River Frome SSSI'.*

In order to overcome this objection, the Duchy of Cornwall provided the following mitigation:

*'The Duchy of Cornwall is committed to permanently changing the management of its landholdings to reduce levels of nitrogen discharging to the River Frome to a level that fully offsets the estimated increase of 3.7 Tonnes/yr nitrogen resulting from the development, unless or until alternative mitigation is put in place, and thereby achieve nutrient neutrality'<sup>3</sup>.*

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<sup>2</sup> Development Control Committee report 1/D/09/001363, 15 September, 2011

<sup>3</sup> Poundbury, Dorchester Phases 3&4, Environmental Statement (Volume 3) Duchy of Cornwall, 2011.

# 1 WASTE WATER TREATMENT AND DISPOSAL FROM THE PROPOSED DEVELOPMENT ON THE WOODSFORD FARMS SITES

## 1.1 Wastewater generation

The draft Local Plan allocates between 1,200 and 1,500 new dwellings and 7.2 ha of employment land at Crossways. Although the distribution of development across all the allocated strategic sites at Crossways is still to be determined, for the purposes of this initial assessment, for the three Woodsford Farms sites we have assumed the following:

- Site 1: 400 dwellings;
- Sites 2: 170 dwellings; and
- Site 3: 5.1 ha of employment land (this site is specifically allocated for employment use).

The estimated flow rate from the proposed development is approximately 220 m<sup>3</sup>/d; the breakdown and derivation of flow is provided in Table 1 below.

**Table 1: Estimation of Sewage Flow Rate from Woodsford Farms Development<sup>4</sup>**

| Site  | Type of Development                                  | No. of units | Estimated person/unit | Flow rate L/person/d <sup>5</sup> | Flow rate m <sup>3</sup> /d |
|---|--|--------------|-----------------------|-----------------------------------|-----------------------------|
| Site 1: Woodsford Fields                      | Dwellings  | 400          | 2.1                   | 125 <sup>5</sup>                  | 105                         |
| Site 2: Land to the west of Frome Valley Road | Dwellings  | 170          | 2.1                   | 125                               | 44.6                        |
| Site 3: The Hanger Site                       | Employment   | 430          | 1                     | 50                                | 21.5                        |
| New community facilities                      | Pub, shop, health centre, school, community hall etc | N/A          |                       |                                   | 49                          |
|   |  |              |                       | <b>Total</b>                      | <b>220</b>                  |

Information was requested from Wessex Water<sup>6</sup> on the current consent to discharge and measured dry weather flow (DWF) at Dorchester STW

<sup>4</sup> Estimation is based on indicative type of development and number of dwellings proposed only and is an estimation

<sup>5</sup> This equates to 120 litres per head per day in accordance with the Part G of the Building Regulations, plus an estimated 5 litres per head per day for external water consumption i.e. gardening, car washing etc

<sup>6</sup> Gillian Sanders, Wessex Water, personal communication, 4<sup>th</sup> July 2012

## 1.2

**Table 2: Dorchester STW – current situation.**

| Biological treatment                                     |                 |
|--|-----------------|
| Dry Weather Flow (m <sup>3</sup> )                       | 9,450           |
| Current PE   | 31,883 (summer) |
| Flow to Full treatment (l/s)                             | 294             |
| 95%ile Max. conc. of BOD (mg/l)                          | 25              |
| Absolute Max. conc. of BOD (mg/l)                        | 50              |
| 95%ile Max. conc. of Ammoniacal Nitrogen (mg/l)          | 5               |
| Absolute Max. conc. of Ammoniacal Nitrogen (mg/l)        | 20              |
| An. Mean Max. conc. of Total P (mg/l)                    | 1               |
| 95%ile Max. conc. of Suspended Solids (mg/l)             | 30              |
| Settled Storm Sewage                                     |                 |
| Dry Weather Flow (m <sup>3</sup> )                       | 9,450           |
| Storm/Emergency discharge                                |                 |
| Dry Weather Flow (m <sup>3</sup> )                       | 3,900           |
| Measured values  |                 |
| Mean measured STW average daily flow (m <sup>3</sup> /d) | 8,534           |

## 1.3

### Effects on Dorchester STW discharge

Dorchester STW is currently consented to treat a DWF of 9,450 m<sup>3</sup>/d. The measured STW average daily flow is 8,534 m<sup>3</sup>/d, which leaves 916 m<sup>3</sup>/d of the consented DWF available for additional flows. The estimated flow from the proposed development is 220 m<sup>3</sup>/d and could therefore be accommodated within the existing DWF consent at Dorchester STW (subject to Wessex Water approval). As the additional flow from the proposed development is less than 3% of the current DWF, it is probable that the STW would also have the required process capacity to treat the additional flow from the proposed development, although this would need to be confirmed by discussion with Wessex Water.

The connection to Dorchester STW would be subject to Wessex Water's agreement and further study on the existing plant process capability.

## 1.4

### Total Nitrogen Loading

For this assessment, it is assumed that the proposed development sewage would be treated to meet the N current effluent quality of within range of 9 – 13 5mg/l prior to discharge to the River Frome.

The Dorchester STW annual N loading data for 2011 was provided by Wessex Water<sup>7</sup>. Extrapolating from the current average flow of 8,534m<sup>3</sup>/d and the 2011 N load of 80.61 - 111.5 t/yr<sup>8</sup>, an additional 220 m<sup>3</sup>/d of treated wastewater

<sup>7</sup> Dave Ogborne, Planning Liaison Manager, Wessex Water, pers. comm., 15<sup>th</sup> August 2012

<sup>8</sup> Table 6.5 Investigations Report : DM# 1452696

discharged from the proposed development would result in an additional N load of between 2,080 and 2,875 kg/year – an annual average of 2,477 kg/year.

**Table 3: Estimated N loading for Dorchester STW & proposed development**

| Development  | Assumed N Effluent Concentration <sup>9</sup> (mg/l) | N (kg/year)                                  |
|--|--|--|
| Existing Dorchester STW                                  | 9 - 13   | 80,610 – 111,500<br>(assumed average 96,055) |
| Proposed development (Crossways)                         | 9 - 13   | 2,080 – 2,875 (assumed average 2,477)        |
| Total N loading (proposed development + Dorchester STW)  | -  | 82,690 – 114,375<br>(assumed average 98,532) |
| Average N loading  | -  | 71,577                                       |
| Estimated percentage additional N load to Dorchester STW | -  | <3 %   |

<sup>9</sup> A typical biological nutrient removal plant should be able to produce TN effluent of 10 -15 mg/L under normal operation condition

## 2 COMPARISON OF NITROGEN LOADINGS FROM CURRENT VS PROPOSED LAND USE

### 2.1 Current nitrogen run-off from agricultural land

During the last 50 years and more, developments in the use of N fertilisers have played a very important role in creating the highly productive crop management systems which have made modern day agriculture such a success. N fertiliser use has increased significantly along with the yield and quality of most crops. However, the high solubility of N fertilisers, which is a contributing factor in their success in increasing crop yields, also leads to excess nitrate not taken up by crops being leached from agricultural land in surface water run-off.

The arable modelling was undertaken using the ADAS NITCAT model<sup>10</sup>. This is an established annual timestep tool which models N loss from crop rotations, and has been used previously to support government agri-environment policy. The modelling of losses from the alternative long term amenity grassland used the N-Cycle model<sup>11</sup>.

The input parameters used for the tools were based on the location and management of Woodsford Farm. The five year rotation consisted of the following crops:

- Winter Wheat receiving 220 kg N/ha
- Maize receiving 116 kg N/ha
- Winter Wheat receiving 220 kg N/ha
- Winter Rye receiving 146 kg N/ha
- Oilseed Rape receiving 250 kg N/ha

The nitrogen quantities applied were taken from information provided by Woodsford Farm managers, and were all applied as manufactured fertiliser (i.e. no manures or slurries were applied). The N application splits and timings were derived from a mixture of farm data and standard Defra fertiliser recommendations (RB209). The climate data used in this work were derived from the 1961-1990 averages (which is a standard dataset used to represent average weather conditions in the UK). Where some data were not available, default assumptions were made based on standard agricultural practices and agronomic performance.

The estimated losses from the three sites are given in Table 4 below.

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<sup>10</sup> Lord EI. 1992. Modelling of nitrate leaching: Nitrate Sensitive Areas. *Aspects of Applied Biology* **30**:19-28.

<sup>11</sup> Scholefield D, Lockyer D, Whitehead D, Tyson K. (1991) A model to predict transformations and losses of nitrogen in UK pastures grazed by beef cattle. *Plant and Soil* **132**:165-177.

**Table 4: Estimated nitrate run-off rates**

| Site  | Nitrate loss (kg/year) |
|---|------------------------|
| Site 1: Woodsford Fields                      | 1,031                  |
| Site 2: Land to the west of Frome Valley Road | 448                    |
| Site 3: The Hanger site                       | 714                    |

These nitrate losses represent an average of the five year rotation, with losses on any particular field in any particular year varying on the point in the rotation. The three arable fields were at different points in the same 5 year rotation. Losses will be greater in some years than others depending on the stage in this rotation, However, averaged over the whole 5 year rotation, then the mean annual nitrate losses per unit area will be similar for all three fields – around 51.5 kg N/ha per annum.

## 2.2 Suitable Accessible Natural Green Space

The proposed development at Crossways will need to provide Suitable Accessible Natural Green Space (SANGs) land, given the proximity to the Dorset Heaths SPA. For the three Woodsford Farms sites the required SANG land is set out in Table 5 below.

**Table 5: SANG requirements**

| Site  | Dwellings  | SANG required (Ha.)<br>(8ha. per 1,000 population) |
|---|------------|--|
| Site 1: Woodsford Fields                      | 400        | 7.0  |
| Site 2: Land to the west of Frome Valley Road | 170        | 3.0  |
| Site 3: The Hanger site                       | 0          | N/A  |
| <b>Total</b>                                  | <b>570</b> | <b>10</b>  |

The SANG required for the allocated development on the Woodsford Farms sites would need to be at least 10 ha. However, the proposed SANG which has been identified to the north of the railway line adjacent to Site 1, has a natural boundary area comprising 14 ha.

Approximately 6.8 ha of the proposed SANG comprises woodland and land not actively used for agricultural purposes. However, 7.2 ha of the proposed SANG land would be taken out of agricultural use and converted to amenity grassland, which would not be subject to fertiliser application. Using the same methodology as for the three proposed development sites, the SANGs land would give a net reduction in N run off of approximately 371 kg/year.

## 2.3 Effect of proposed development on nitrogen loadings

There would be a maximum estimated reduction in N run-off from the allocated development of 2,564 kg/year. The proposed development would produce an estimated 220 m<sup>3</sup>/d. of wastewater, which is estimated to create an average additional N loading of 2,477 kg/year. This would be offset by the reduction in N runoff caused by taking the three allocated Woodsford Farm sites, plus the additional SANG land (7.2 ha), out of agricultural use, which **would result in a net reduction of 87 kg/year.**

### 2.3.1 *Potential ecological effects on Poole Harbour*

The Habitats Regulations Assessment (HRA) of the South West RSS was undertaken in February 2007, with an update published in July 2008. The HRA could not conclude that no adverse effects would occur with regard to Poole Harbour as a result of the proposed growth within the RSS. Although the Government has announced its intention to revoke the Regional Strategies through the Localism Act 2011, the conclusions of the HRA in relation to Poole Harbour are still considered relevant here; particularly given the National Planning Policy Framework states within paragraph 218 that 'local planning authorities may also continue to draw on evidence that informed the preparation of regional strategies to support Local Plan policies, supplemented as needed by up-to-date, robust local evidence'. The HRA noted specific issues in Poole Harbour with nutrient enrichment.

An update to the 2007 HRA was provided in 2010 by the HRA of Purbeck District Council's Core Strategy pre-submission consultation<sup>12</sup>. The 2010 HRA noted that one effect of the higher nutrient levels in the Harbour is the growth of macro-algal mats (mostly *Ulva* and *Enteromorpha* spp.) covering the intertidal flats. Surveys carried out in 2010<sup>13</sup> showed that seven of 80 mudflat sites surveyed in Poole Harbour had over 70% cover of macro-algal growth. The HRA could not conclude that that no adverse effects would occur with regard to Poole Harbour and it noted that in order to ensure additional STW discharges arising from proposed developments would not have an adverse effect on the Poole Harbour, mitigation measures such as the installation of nutrient stripping at one or more STWs, or measures to reduce nutrient inputs to the Harbour from other point or diffuse sources would be required.

In addition to the above HRAs, Wessex Water has also carried out investigations relating to nitrogen discharges into Poole Harbour in conjunction with the Environment Agency. The investigations were due to report in March 2012, but the findings were not available for the purposes of this report.

While the results of Wessex Water's investigations could not be considered in this assessment, it is assumed from the 2007 and 2010 HRA that the situation with regards to Poole Harbour has not changed since Natural England raised

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<sup>12</sup> Purbeck Core Strategy pre-submission consultation Habitats Regulation Assessment, Footprint Ecology & David Tyldesley and Associates, 2010

<sup>13</sup> Intertidal invertebrates and biotopes of Poole Harbour SSSI and survey of Brownsea Lagoon, A report to Natural England, Bournemouth University, Herbert, R., Stillman, R.A., Ross, K. & Hubner, R, 2010

its objection to the Poundbury development, i.e. no increase in N levels as a result of development would be permitted.

### SUGGESTED MITIGATIONS MEASURES

The West Dorset, Weymouth & Portland Draft Local Plan Pre-Submission Draft<sup>14</sup> was agreed by West Dorset District Council and Weymouth & Portland Borough Council for consultation in June and July 2012. The Local Plan is the main basis for making decisions on planning applications and covers the period until 2031.

To protect the Poole Harbour Special Protection Area from nutrient loading the draft Local Plan contains Policy ENV2: Wildlife and Habitats, which states:

*i) Nationally or internationally designated wildlife sites (including proposed sites and sites acquired for compensatory measures), and protected species will be safeguarded from development that could adversely affect them.*

*ii) Development will not be permitted unless it can be ascertained that it will not lead to an adverse effect upon the integrity of the Dorset Heaths International designations. The following forms of development (including changes of use) will not be permitted within a 400m buffer around protected heathland:*

- *Residential (C3 or C4 of the Use Classes Order) development that would involve a net increase in homes;*
- *Tourist accommodation including built tourist accommodation, caravan and camping sites;*
- *Sites providing accommodation for Gypsy and Traveller and Travelling Show People (permanent and transit); and*
- *Equestrian-related development that may directly or indirectly result in an increased adverse impact on the heathland.*

*Between 400 metres and 5km of a protected heathland, new residential development (C3 or C4 of the Use Classes Order) will be required to take all necessary steps on site to avoid or mitigate any adverse effects upon the internationally designated site's integrity or, where this cannot be achieved within the residential development, to make a contribution towards mitigation measures designed to avoid such adverse effects taking place. Measures will include:*

- *Provision of open space and appropriate facilities to meet recreation needs and deflect pressure from heathland habitats;*
- *Heathland support areas;*
- *Warden services and other heathland management;*
- *Access and parking management measures; and*
- *Green infrastructure.*

*iii) Development will not be permitted unless it can be ascertained that it will not lead to an adverse effect upon the integrity of the Poole Harbour International designations. New development will be required to incorporate*

<sup>14</sup> West Dorset, Weymouth & Portland Draft Local Plan Pre-Submission Draft , Weymouth & Portland Borough Council, 2012

*measures to secure effective avoidance and mitigation of the potential adverse effects of nutrient loading on the ecological integrity of the Poole Harbour internationally designated sites.*

*iv) Elsewhere, development that would adversely affect nature conservation interests, including Sites of Nature Conservation Importance, Local Nature Reserves, ancient woodlands, veteran trees and hedgerows, and key wildlife corridors will be resisted.*

*v) Development of major sites will be expected to demonstrate no net loss in biodiversity, through the retention or restoration of habitats and features within the site, the planting of trees and woodlands, the management of open space for biodiversity, and taking opportunities to help connect and improve the wider ecological networks.*

Section iii of this policy requires that mitigation measures be implemented to prevent adverse effects from nutrient loadings.

As discussed in section 2.3 above, a net reduction in N run-off of 87 kg/year would result from the allocated development on the Woodsford Farms sites at Crossways.

It should be noted that woodland planting will likely take place in the near future by Woodsford Farms on other Estate land along the River Frome. Dorset Wildlife Trust and Natural England have indicated that woodland creation along the River would reduce run-off of sediments and nutrients from the surrounding farmland.

The requirements of Policy ENV2 of West Dorset, Weymouth & Portland Draft Local Plan Pre-Submission Draft<sup>15</sup> can therefore be met.

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<sup>15</sup> West Dorset, Weymouth & Portland Draft Local Plan Pre-Submission Draft , Weymouth & Portland Borough Council, 2012