CHAPTER 15 – WATER SUSTAINABILITY REVIEW (2015)

Executive Summary

Purpose of this report

GA Pet Food Partners (GA) operates a pet food manufacturing, storage and distribution facility at Plocks Farm, Liverpool Road, Bretherton, Leyland, Lancashire, PR26 9AX. This Water Sustainability Assessment has been prepared to accompany the planning application for Plocks Farm, as outlined in issued GA Pet Food Partners updated ten year development plan, which revises and outlines all aspects of continued development at the site up to 2025. This report provides an updated and revised assessment to that found in Chapter 15 - “Review of Sustainable Water Management” Environmental Statement, Planning Application Reference 09/00738/FULMAJ.

This water sustainability review has been prepared to accompany a planning application for Plock’s Farm, covering the proposed new development in the updated ten year development plan. It provides an up-dated and revised assessment to that found in the existing 2009 EIA Environmental Statement. The assessment has been prepared in the context of site specific compliance to the discharge consent and Environmental Permit, the water management conditions in the Chorley Borough Council planning permissions, and the principles of sustainable water resource management adopted by the UK Water Industry.

The development proposed by the company is intended to support an increase in production of 100 percent. This would increase the existing average daily demand for process water from 105 m\(^3\)/day to 210 m\(^3\)/d (doubling the current demand for 40 m\(^3\)/d of mains water to 80 m\(^3\)/d). No changes in process water use efficiency are proposed at this point. The potential rainwater yield is also set to increase by the same scale as the development will double the size of the roof areas. The addition of a new meat kitchen, ingredients kitchen and covered yard, fridge building and raw materials store, and a new CHP station will increase roof dimensions from 26,163 m\(^2\) to 51,542 m\(^2\).

Currently the company uses mains water (supplied by United Utilities) in its production processes. As with all commercial sites in the UK the company pays per unit of mains water supplied. This is an overhead that the company will be able to drastically reduce, if not eliminate completely, by accessing and optimising use of available rainwater. Reducing demand for mains water has wider environmental benefits including reducing pressure on water resources in the supply area, and reducing the energy and other resource costs associated with abstracting, treating, and distributing water to customers.

This review updates a previous review undertaken by Entec (now Amec Foster Wheeler) in 2009 (Appendix A). It recognises the changes to the development plans and the requirement to:

1) maximise the use of rainwater that can be captured from the building roofs and low risk yard areas for reuse within the food production process, and;

2) Store rainwater runoff from high risk yard areas, prior to anaerobic digestion on site.

The plan is to isolate differing water qualities to minimise unnecessary treatment. This assessment presents the viable options in terms of rainwater storage capacity considering a range of different scenarios as specified by GA associated with the future development of the site.

It is concluded that the understanding of water use and the water cycle on site and the level of its management is high. There is an advanced level of instrumentation installed throughout the site and water flows are monitored on a near real time basis and managed within an Information System. There is currently a high level of water reuse on site with two waste water treatment plants in operation. Some rainwater is collected and used but the potential for this is currently limited by the existing storage capacity. When the main water storage facilities and capacity of the system are exceeded, valuable water is lost to the River Douglas.

A rainfall runoff and storage model has been developed that assesses the continuous storage requirement based on the daily runoff generated from rainfall over the 30 year period and the demand required. The runoff generated from rainfall and storage requirements was investigated for five different scenarios:
1. Potential runoff generated ('yield') and storage assessment in relation to existing roof area and existing demand for water;

2. Potential rainwater yield and storage assessment in relation to the roof area of the new buildings (Ingredients Kitchen, Larder, Fridge and Meat Kitchen) (taking into account the increased demand for water from the doubling in production);

3. Potential yield and storage assessment in relation to the existing low-risk yard areas and existing demand;

4. Potential yield and storage assessment in relation to the proposed low-risk yard areas and new car park area and proposed demand; and

5. Potential yield and storage assessment in relation to the high risk yard areas post development (linked to the development of the anaerobic digestion unit that will also be part of the new development).

This assessment has provided an evaluation of different sizes of storage that could be installed at Plocks Farm. The approach taken was to maximise the capture of runoff, rather than to target long term average runoff volumes generated. A final decision on storage size would depend on the economic benefit assessment being undertaken and the space available, but storage tanks of 2,500 m$^3$, 700 m$^3$ and 1,400 m$^3$ (roof, low risk, and high risk) would be likely candidates for the scenarios outlined in sections 15.3.2, 15.3.3, and 15.3.4 respectively. A key opportunity for retaining water within the system is to reduce or capture the moisture being lost by evaporation from the bio-beds. Installation of a technology to condense and capture the water or changes to process to reduce evaporation should be investigated.
Chapter 15 Water Sustainability Review

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15.1 INTRODUCTION

15.1.1 This chapter addresses the water sustainability issues as part of the Environmental Statement for GA Pet Food Partners (GA), to accompany the planning application for Plocks Farm, as outlined in GA’s updated ten year development plan. It updates a previous review carried out in 2009 (Entec, 2009).

15.1.2 GA has an objective to further improve the efficient and sustainable use of water on site. This will be demonstrated by a reduced requirement for mains water supply and higher utilisation of surface water runoff that currently exceeds the on-site storage capacity and is discharged into the River Douglas. Information on the existing site and the proposed development is presented in Section 15.2.

15.1.3 This chapter is structured by section to deliver against the following list of objectives:

- Section 15.2: Understand the water use and site water cycle:
  - Review the current Plocks Farm water cycle, together with the proposals for water collection, storage and re-use;
  - Collect data from Plocks Farm on current and proposed water sources and water usage for the different processes at the facility, including cooling and wash water requirements;

- Section 15.3: Collate external rainfall data to calculate water storage options to reduce mains use:
  - Obtain records of long-term daily rainfall from the closest meteorological station to the site;
  - Assess the availability of stored surface water and harvested rainwater from roofs and buildings (through analysis of this long term rainfall series) for re-use within the process e.g. cooling and dilution of recycled water and other potential uses to minimise importation of mains water;

- Section 15.4: Audit the water and wastewater budget for the plant:
  - Provide a brief review of the water balance with a view to optimising water use;

- Section 15.5: Relate the proposals to existing legislative requirements and best practice.

15.1.2 Scope of this review

15.1.2.1 This review updates the earlier water sustainability review by Entec in 2009 (the original document is included in full in Appendix A) by examining the proposed changes to the development plans and their implications in relation to regulatory compliance and the application of sustainability principles. Proposed measures include the potential substitution of mains water with rainwater for process usages, and the use of rainwater to augment dilution of wastewater effluent. Together these measures form an on-site integrated water management system, linking sustainable use of resources, surface water management and flood risk mitigation, and wastewater discharge and environmental water quality. Flood Risk Management is covered in Chapter 12.

15.1.2.2 Specifically this review focuses on the volume of rainwater that is available to be collected from the existing development and the additional volume that would be generated by the introduction of additional hard standing areas (a new car park and expansion of ‘low risk’ yards) and additional building roof surface areas. It is intended to collect rainwater for reuse within the food production process through two separate systems: firstly from the roof surfaces and secondly from the low risk yard areas and car park. Collection systems will be designed to retain the relatively high quality non-potable rainwater for use with minimal treatment. The assessment quantifies what proportion of the process use could be supplied by rainwater and the size of the collection tanks required to support this.
15.1.2.3 It is intended to increase the available waste treatment facilities through the installation of an on-site Anaerobic Digester at the northern end of the Site. Associated operational changes will include collecting surface water from the high risk yard prior to treatment via the Anaerobic Digester (plus an excess collection tank) to support dilution of treated process wastewater prior to discharge into the River Douglas. As a result the total size of the ‘high risk’ yard area is planned to increase from roughly 7,091 m² to around 13,854 m².

15.1.2.4 This review presents the viable rainwater storage capacity options after considering a range of water demand scenarios associated with production activity across the future developed site. It also provides a high level indication of the financial savings that could be achieved by reducing demand for mains water. This review does not include a detailed assessment of the economic, environmental, and social cost and benefits of the on-site integrated water management proposals.

15.1.2.5 Nor does the assessment take into account the potential impact of climate change on the annual rainfall profile, total annual rainfall, or on changes in rainfall intensity.

15.1.3 Data and information

15.1.3.1 Rainwater volumes and storage capacity options are assessed using rainfall data provided by the Met Office. Industry recognised methods are used to calculate potential yield and a bespoke model has been developed to calculate the performance of storage capacities to meet forecast demand. Data and information used in this study has been either provided by GA or sourced from the Met Office. Date used in this study is summarised in Table 15.1 below.

Table 15.1 Data used in the water sustainability assessment

<table>
<thead>
<tr>
<th>Data</th>
<th>Source</th>
<th>Analysis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Site water cycle schematic</td>
<td>Amec Foster Wheeler</td>
<td>Schematic identifies the direction and flow of water inputs, process uses, and outputs. This information was inferred from a site visit and provides context for the assessment.</td>
</tr>
<tr>
<td>Site water cycle data</td>
<td>GA Pet Food Partners</td>
<td>Provides indication of input, process, and output volumes from existing information system which captures monitoring data.</td>
</tr>
<tr>
<td>Site production data</td>
<td>GA Pet Food Partners</td>
<td>Tonnage sold compared against water demand over the same period to generate approximations of volume of water used per tonne output sold. This is used to create an annual water demand profile against which the runoff volumes are assessed.</td>
</tr>
<tr>
<td>Existing and proposed building (roof) dimensions and hard standing areas</td>
<td>GA Pet Food Partners</td>
<td>Used to calculate rainwater harvesting yield.</td>
</tr>
<tr>
<td>Daily rainfall data (mm) from Holmeswood rain gauge – 7.5km to the southwest of the Plocks Farm site</td>
<td>Met Office © Crown Copyright Met Office 2015</td>
<td>A 30 year data was sources from the Met Office. This is used to calculate rainfall runoff volumes from roof and yard areas. This provides greater granularity in the assessment compared to that undertaken in 2009 (Appendix A sections 4.1.1 and 4.1.4).</td>
</tr>
</tbody>
</table>
15.1.4 Data quality and limitations

15.1.4.1 This assessment was made based on the following:

- The relationship between tonnage data and water demand data was assessed on the following basis. Twelve months of tonnage (factory production) data were provided, but only nine months of this data (Sept 2014 to May 2015) overlaps with the water balance data. The tonnage data has several parameters but for this assessment, GA advised that the examination should be limited to the 'total tonnage sold' parameter.

- The Met Office rainfall data is based on a historical 30 year period of record (1985 – 2014) as measured at the Holmeswood rain gauge. The impact of climate change on future rainfall patterns and total amounts has not been taken into consideration. Reasons for this are twofold: firstly, the assessment is only looking ten years ahead, and secondly, there is uncertainty surrounding the impact of current climate on local rainfall patterns and volumes. Consideration and analysis of these aspects is beyond the scope of this project.

- Disclaimer: Historical daily rainfall data (30 years) has been provided by the Met Office for use in this assessment. Amec Foster Wheeler cannot be held responsible for the accuracy of the rainfall data provided.
15.2 ON-SITE WATER USE INFORMATION

15.2.1.1 The Existing Site Layout Plan and Proposed Development Masterplan for Plocks Farm is provided in Appendix B. This figure identifies the different buildings including main processing sites, scrubbers, bio beds, the two water treatment works, hard-standing yards, storage lagoon and water storage tanks. These yard areas have been categorised by GA into ‘high risk’ and ‘low risk’ areas to reflect the level of contamination to water and the necessary treatment that would be required for subsequent reuse. The plan clearly distinguishes between the existing and proposed site layout, highlighting the proposed site configuration of new buildings and car park areas.

15.2.1.2 GA has a comprehensive knowledge of water use on site and the level of its on-site water management is high. There is a high degree of instrumentation installed throughout the site and water flows are monitored on a near real time basis and managed within an Information System. This Information System provides a schematic of water flows and, once combined with the monitoring data, a water balance can be derived. Information in this report is based on a site visit conducted in June 2015 and subsequent information provided by GA to Amec Foster Wheeler.

15.2.1.3 Key points relating to current water use on the site are as follows:

- There are two sources of water on site: mains water, and that derived from the capture of roof and yard runoff. Whilst the company does have a licence from the Environment Agency to abstract water from an on-site borehole, this is unused due to the high iron content in the groundwater which is not fit-for purpose;

- Water on site is primarily used by the boilers, water use for cooling, water input to the scrubbers and bio-beds, for cleaning and, to a lesser extent, domestic-type water use;

- There is already a high degree of water reuse on site. The company monitors water flows around the site in its process uses and tracks its recirculation. Water used in the main factory processes and in the scrubbers undergoes initial treatment, temporary storage (balance tanks), and subsequent re-treatment before it is either diverted directly back to the factory and scrubbers or collected within a storage lagoon from which some water is reused for cooling, water is lost through evaporation, or the water is discharged into the River Douglas. The number of times water is reused is variable but monthly water cycle data provided by the company for the period September 2014 to May 2015 shows an average rate of 285 recirculations per month;

- The on-site ‘water cycle’ requires that ‘new’ water is introduced into the system to dilute the soluble salts that build up within the recycled water and to abate odour arising from the wet scrubbers. Currently, ‘new’ water is introduced from mains supply and it is this water that the development will replace with harvested rainwater;

- However, existing water storage capacity is limiting the potential to reuse water harvested on site, particularly as roof water is currently mixed with low risk yard water. This assessment examines the storage requirements for these two areas separately. This is critical to making best use of the two sources of water. Keeping the relatively higher quality non-potable rainwater separate from the lower quality non-potable low risk yard water impacts on the type and level of treatment that is applied to these volumes of water. Currently the main water storage facilities consist of the balance tank (300 m³) and the divert tank (800 m³) and when these are full (maximum 1,100 m³) the additional potential resource is lost to the River Douglas. In times of high-flow this can exacerbate flood risk (further information in this aspect is provided in Chapter 12);

- Water treatment is undertaken within two separate facilities in operation. The first (WWTW1), processes water from high risk areas on site, and output water from the main factory. This undergoes primary separation before being diverted to join water from lower risk areas before then being passed through the second MBR (Membrane Bioreactor) treatment facility (WWTW2) before being reused on site or discharged into the River Douglas when available storage is exceeded; and
The majority of water that is discharged into the River Douglas is treated at an on-site wastewater treatment plant and discharged in accordance with a Consent to Discharge as granted by the Environment Agency (under the Water Resources Act 1991, as amended by the Environment Act 1995). The exception to this is the excess runoff from roofs and low-risk yard areas that is currently diverted through a separator to the river when there is no further capacity available.

15.2.1.4 As part of the new development, it has been proposed that:

- Additional storage tanks will be installed to capture the high quality runoff from the proposed new buildings, low risk yards and the new car park area (Masterplan ref 53);
- An Anaerobic Digester (Masterplan ref 54) will treat runoff from the high risk yard areas.
15.3 STORAGE OPTIONS TO CAPTURE RAINFALL TO REDUCE MAINS USAGE

15.3.1 Contextual information

15.3.1.1 Roof and yard area data supplied to Amec Foster Wheeler by GA indicate that the development plans will more than double the total roof area (including the new car park) and yard areas. The specific changes for each area from existing to proposed total are listed in Table 15.2 and illustrated in Appendices C and D.

Table 15.2 Summary Changes in Roof and Yard Dimensions

<table>
<thead>
<tr>
<th></th>
<th>Existing</th>
<th>Proposed Masterplan 2015 (Total dimensions*)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Roof Area</td>
<td>26,740 m²</td>
<td>59,551 m²</td>
</tr>
<tr>
<td>Low Risk Yard Area</td>
<td>15,990 m²</td>
<td>26,163 m²</td>
</tr>
<tr>
<td>New car park</td>
<td>-</td>
<td>4,640 m²</td>
</tr>
<tr>
<td>High Risk Yard Area</td>
<td>7,091 m²</td>
<td>13,854 m²</td>
</tr>
</tbody>
</table>

*existing plus future additional development

15.3.1.2 The following analyses were undertaken:

- Potential runoff generated ('yield') and storage assessment in relation to existing roof area and existing demand for water;
- Potential rainwater yield and storage assessment in relation to the roof area of the new buildings (Ingredients Kitchen, Larder, Fridge and Meat Kitchen), taking into account the increased demand for water from the doubling in production;
- Potential yield and storage assessment in relation to the existing low-risk yard areas and existing demand;
- Potential yield and storage assessment in relation to the proposed low-risk yard areas and new car park area and proposed demand, and;
- Potential yield and storage assessment in relation to the high risk yards post-development.

15.3.1.3 Rainfall runoff rates from the roof areas and the low risk yards vary depending on rainfall quantity, the roof material, and other losses prior to collection and storage. For the purposes of these analyses the following coefficients have been applied:

- A runoff coefficient for roofs of 0.9 has been applied to account for evaporation and other losses (this is a standard industry practice figure but there is insufficient detail to apply material specific coefficients);
- A filter coefficient of 0.9 has been applied to account for loss of runoff in rainwater filters (this is recognised practice);
- A similar loss factor (0.9) has been applied to yard areas to account for other losses (e.g. leaky drains/tanks). Again this is recognised practice.

15.3.1.4 The volumes of runoff produced will be highly variable depending on rainfall. Figure 15.1 provides a record of daily rainfall at Holmeswood, the nearest rain gauge to the site and clearly identifies...
peak rainfall events. Daily totals of more than 20mm occur relatively frequently but are well above average. Across the 30 year period of record only ten days experienced rainfall of 40mm or more. A long-term (30 year) average monthly rainfall series is shown in Figure 15.1, revealing the seasonal rainfall variation that is typically experienced across the year.

**Figure 15.1  30 Year Rainfall Record at Holmeswood 1985 – 2015**

![30 Year Rainfall Record at Holmeswood 1985 – 2015](image)

Data used is supplied by the Met office © Crown Copyright Met Office 2015

**Figure 15.2  Long Term Average Rainfall – Monthly Totals**

![Long Term Average Rainfall – Monthly Totals](image)

Data used is supplied by the Met office © Crown Copyright Met Office 2015
15.3.2 Rainfall runoff and storage model

A rainfall runoff and storage model was developed to assess the continuous potential rainwater yield and associated storage capacity, recognizing the daily demand for water. The model is developed to test the performance of alternative storage capacities in terms of the number of days over the model timescale that the storage facility would be insufficient to collect the maximum yield, and the number of days it would be under-utilised. The model takes account of the volume of stored water at the end of the preceding day, the daily yield, and the daily demand for new water.

Data provided by GA indicates that approximately 40 m$^3$/day of mains water is used to feed the boilers at Plocks Farm. Current production is approximately 60,000 tonnes per annum but this is forecast to increase to 120,000 tonnes (an increase of approximately 100%) once the development is completed in 10 years. The demand for water is also expected to increase linearly and as a result, a water demand of 80 m$^3$/day is expected.

Excess runoff above the daily demand can then potentially be captured in storage (depending on the size of the store) and is available to meet demand the following day. Consideration was given to using the long term average rainfall series to undertake this assessment. The use of long term average rainfall would provide the average runoff that could be generated from different roof and yard areas. However, as the objective is to capture as much runoff as possible to substitute mains water, it was decided that the use of actual daily rainfall values would enable the peak rainfall events to be reflected in the model, and hence generate maximum daily runoff. This gives the potential for larger storage options to be identified which store more water at peaks but the storage could be well underutilized during lower rainfall periods. A screen shot of the rainfall runoff and storage model is shown in Figure 15.3.

![Screenshot of rainfall runoff and storage model](image)

Figure 15.3 Screenshot of rainfall runoff and storage model

The rainfall runoff and storage model tests the performance of various water storage volumes to meet a specified level of demand. Based on the 30 year daily rainfall series and demand profile provided by GA the model calculates the following:

- Actual number and percentage of days that the specified demand would be met;
- Actual number and percentage of days there would be a shortfall requiring mains supplement;
• Actual number and percentage of days where excess rainfall would not be captured in the roof rainwater harvesting system and lost to the river; and
• Average volume (m$^3$) of runoff lost per day.

### 15.3.3 Runoff generated and storage assessment from roofs

15.3.3.1 Water captured from the roofs will represent the highest quality non-potable water that can be collected on-site. This water is the primary source to replace the mains supply (40 m$^3$/d currently increasing to 80 m$^3$/d) used in the boilers. Tables 15.3, 15.4, and 15.5 summarise how different storage volumes would perform against the daily demand under the existing situation (i.e. if rainwater harvesting system was retrofitted), the capacity of the new roof buildings alone to provide the water to meet the future demand, and the storage options for the entire roof area. The results are presented as the percentage of days over the total 30 year daily series.

Existing roof area: 26,740 m$^2$

#### Table 15.3 Potential performance of existing roof runoff and storage volumes with a target of 40m$^3$/day

<table>
<thead>
<tr>
<th>Targeting 100% of factory demand:</th>
<th>100m$^3$</th>
<th>150m$^3$</th>
<th>200m$^3$</th>
<th>500m$^3$</th>
<th>1000m$^3$</th>
<th>2000m$^3$</th>
<th>2500m$^3$</th>
<th>5000m$^3$</th>
<th>10000m$^3$</th>
</tr>
</thead>
<tbody>
<tr>
<td>% of days demand would be met per year</td>
<td>58</td>
<td>64</td>
<td>69</td>
<td>84</td>
<td>93</td>
<td>98</td>
<td>99</td>
<td>99</td>
<td>100</td>
</tr>
<tr>
<td>% of days a shortfall would be experienced per year</td>
<td>42</td>
<td>36</td>
<td>31</td>
<td>16</td>
<td>7</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>% of days excess rainwater would be lost per year</td>
<td>22</td>
<td>20</td>
<td>19</td>
<td>14</td>
<td>12</td>
<td>10</td>
<td>10</td>
<td>9</td>
<td>9</td>
</tr>
<tr>
<td>Average m$^3$ lost per day</td>
<td>26</td>
<td>24</td>
<td>22</td>
<td>17</td>
<td>14</td>
<td>12</td>
<td>12</td>
<td>11</td>
<td>11</td>
</tr>
</tbody>
</table>

15.3.3.2 New roof area: 32,810 m$^2$. The assessment is repeated to examine if it would be possible to meet the entire demand (80 m$^3$/d) by collecting rainwater from the new roofs only. Table 15.4 shows that this would not be possible. Rainwater yield would need to be collected from all roofs to meet the 80m$^3$ demand (Table 15.5).
Table 15.4  Potential performance of ‘new roof only’ runoff and storage volumes with a target of 80m³/day

<table>
<thead>
<tr>
<th>Targeting 100% of factory demand:</th>
<th>500m³</th>
<th>1000m³</th>
<th>2000m³</th>
<th>2500m³</th>
<th>5000m³</th>
<th>10000m³</th>
<th>20000m³</th>
<th>30000m³</th>
</tr>
</thead>
<tbody>
<tr>
<td>% of days demand would be met per year</td>
<td>58</td>
<td>65</td>
<td>70</td>
<td>72</td>
<td>74</td>
<td>75</td>
<td>75</td>
<td>75</td>
</tr>
<tr>
<td>% of days a shortfall would be experienced per year</td>
<td>42</td>
<td>35</td>
<td>30</td>
<td>28</td>
<td>26</td>
<td>25</td>
<td>25</td>
<td>25</td>
</tr>
<tr>
<td>% of days excess rainwater would be lost per year</td>
<td>7</td>
<td>4</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Average m³ lost per day</td>
<td>11</td>
<td>6</td>
<td>3</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

Total future roof area: 59,550 m²

Table 15.5  Potential performance of total roof runoff and storage volumes with a target of 80m³/day

<table>
<thead>
<tr>
<th>Targeting 100% of factory demand:</th>
<th>500m³</th>
<th>1000m³</th>
<th>2000m³</th>
<th>2500m³</th>
<th>3000m³</th>
<th>5000m³</th>
<th>10000m³</th>
<th>20000m³</th>
</tr>
</thead>
<tbody>
<tr>
<td>% of days demand would be met per year</td>
<td>75</td>
<td>86</td>
<td>95</td>
<td>97</td>
<td>97</td>
<td>99</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>% of days a shortfall would be experienced per year</td>
<td>25</td>
<td>14</td>
<td>5</td>
<td>3</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>% of days excess rainwater would be lost per year</td>
<td>20</td>
<td>16</td>
<td>14</td>
<td>14</td>
<td>13</td>
<td>13</td>
<td>12</td>
<td>12</td>
</tr>
<tr>
<td>Average m³ lost per day</td>
<td>52</td>
<td>44</td>
<td>38</td>
<td>37</td>
<td>36</td>
<td>35</td>
<td>34</td>
<td>33</td>
</tr>
</tbody>
</table>

15.3.3.3 These results show rapidly diminishing returns beyond storage of 2,000 m³ under the existing situation and only a minor increase in performance between 2,500 m³ and 5,000 m³ under the developed scenario. The model indicates that storage would need to be doubled from 5,000 m³ to 10,000 m³ to achieve 100% performance (meeting the demand). However, even this would not be sufficient to capture all the available rainwater, as this is constrained by the demand (larger tanks will fill but remain full during longer term periods of heavy rainfall when runoff regularly exceeds demand). Section 15.3.5.3 identifies the opportunity to maximise utilisation of the large storage facility required to provide resilience against outage events at the Anerobic Digester. It would be
possible to capture all rainfall by linking the roof water collection outflow to the pre-AD storage facility.

15.3.3.4 A further factor, is that the existing lagoon is used to provide cooling water, as well as to store recycled water from within the factory. The new roof water storage facility will also be used for that purpose and so will need to be sized appropriately. GA has stated that this storage facility should be open top, making use of floating balls to prevent algae growth. GA has suggested that the size may need to be 3,000 m³, comprising a fairly low tank which will increase the surface area to optimise heat loss to the atmosphere (it is important that the water is cooled). The model suggests that 2,500 m³ capacity would be sufficient.

15.3.4 Runoff generated and storage assessment from low risk yard areas

15.3.4.1 As part of the development plans GA intends to separate the water flows from the roofs and low risk yard areas and collate the differing water qualities separately. A new car park is also to be built. This will support relatively small scale parking of domestic vehicles (i.e. non-industrial vehicles) and therefore the water quality of run-off generated from this new area of hard-standing is expected to be of a sufficient quality to be mixed with the runoff from the low risk yards. The area for the new car park is calculated from CAD drawings of the proposed site and included under the low risk yard area. Residual surplus water flows from the low risk areas is to be stored separately from the roof water and reused within the effluent treatment works to dilute the recycled water, enabling discharge to the River Douglas.

15.3.4.2 Tables 15.6 and 15.7 show how different storage volumes would perform against the objective to capture rainwater from the low risk yards (assuming that the rainfall from the roofs is being captured separately). The model recognises that the balance tank and divert tank will also continue to receive water outputs from the factory process, in essence reducing the headroom in the balance tanks for rainwater and increasing the demand for additional storage. To support the assessment the following assumptions have been applied to the distribution of recycled water (typically a total of 3,000 m³/day) within the components of the site water balance:

- 50% of the water being recycled will be in active use in the factory (1,500 m³),
- 50% will be equally divided between:
  - 12.5% will be in the first treatment facility (375 m³);
  - 12.5% will be in the balance tanks (375 m³);
  - 12.5% will be in the second treatment facility and header tank (375 m³); and
  - 12.5% will be in the storage lagoon (375 m³).

15.3.4.3 It is important that this assessment recognises the potential competition for storage from recycled water to avoid over-estimating the capacity of the alternative storage volumes.

<table>
<thead>
<tr>
<th>Targeting 100% of low risk yard runoff</th>
<th>100m³</th>
<th>150m³</th>
<th>200m³</th>
<th>300m³</th>
<th>400m³</th>
</tr>
</thead>
<tbody>
<tr>
<td>% of days all runoff would be collected</td>
<td>89</td>
<td>94</td>
<td>97</td>
<td>99</td>
<td>100</td>
</tr>
<tr>
<td>% of days residual flows would ‘overspill’</td>
<td>11</td>
<td>6</td>
<td>3</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Average overspill per day m³</td>
<td>9</td>
<td>5</td>
<td>3</td>
<td>1</td>
<td>0</td>
</tr>
</tbody>
</table>

15.3.4.4 The size of the future low risk yard area plus car park is: 15,990 m² + 10,173 m² + 4,640 m². The model assesses the storage volumes required to maximise collection of low risk runoff. It
assumes approximately 12.5% of the daily reuse volume will also be held in the balancing tank prior to onward flow to treatment.

Table 15.7 Potential performance of alternative storage volumes to capture low risk yard runoff post-development.

<table>
<thead>
<tr>
<th>Targeting 100% of low risk yard runoff</th>
<th>100m $^3$</th>
<th>150m $^3$</th>
<th>200m $^3$</th>
<th>300m $^3$</th>
<th>400m $^3$</th>
<th>500m $^3$</th>
<th>600m $^3$</th>
<th>700m $^3$</th>
</tr>
</thead>
<tbody>
<tr>
<td>% of days all runoff would be collected</td>
<td>78</td>
<td>85</td>
<td>89</td>
<td>95</td>
<td>97</td>
<td>99</td>
<td>99</td>
<td>100</td>
</tr>
<tr>
<td>% of days residual flows would ‘overspill’</td>
<td>22</td>
<td>15</td>
<td>11</td>
<td>5</td>
<td>3</td>
<td>1</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Average overspill per day m$^3$</td>
<td>32</td>
<td>23</td>
<td>16</td>
<td>9</td>
<td>5</td>
<td>3</td>
<td>2</td>
<td>0</td>
</tr>
</tbody>
</table>

15.3.4.5 The above results show that once the flows into the balance tanks from the water that is being recycled internally is taken into account, an additional storage volume of 700 m$^3$ would capture all the residual rainfall runoff generated in low risk areas (that cannot be accommodated in the balance tanks) for onward use to dilute water for treatment. Without this storage, this resource would be lost.

15.3.5 Runoff generated and storage assessment from all high risk yard areas.

15.3.5.1 Rainfall runoff from the high risk areas must be contained to comply with the site’s Environmental Permit. The plan is to store high risk yard water in advance of treatment in a 450 m$^3$/d anaerobic digestion (AD) plant. A storage facility is required to hold excess high risk water until it can be processed in that plant. The additional storage tank is required to cope with potential volumes associated with the highest magnitude event (as identified within the 30 year rainfall series). It is also required to provide storage resilience against the risk that the AD plant could break down for up to 3 days. Therefore, the storage facility will be required to accommodate at least 1,350 m$^3$. The resilience in the system does not extend to assuming a three day AD outage event coinciding with the highest magnitude rainfall event. The storage volume should cater for the maximum of these two situations.

15.3.5.2 The model assumes that the previous day’s AD contents will have been treated and discharged/reused and so there will be a daily capacity to store 450 m$^3$ of high risk yard runoff. Rainfall runoff volumes from the high risk yards are not permitted to run to waste to the River Douglas. On the basis of the 30 year rainfall sequence, the yard dimensions, and the lack of competition for storage from recycled water the 450 m$^3$ AD unit would be able to capture all the runoff 99.8% of the time. According to the model rainfall runoff does not provide a driver for additional storage. However, up to 1,400 m$^3$ day would be required to serve the outage resilience function.

15.3.5.3 A storage facility of 1,400 m$^3$ could remain empty most of the time. However, if the excess roof water is diverted into a 1,400 m$^3$ holding tank that would significantly reduce the number of days and the total volume of water being lost (section 15.3.3.3) and that could be used to further dilute the water for treatment. Figure 15.4 shows the impact on rainwater losses by utilising the large high risk resilience tank at times when there is no AD unit outage. It shows a considerable reduction in waste.
Figure 15.4 Comparison of roof water losses without and with diversion to a 1400m³ high risk water facility.
15.4 SITE WATER AND WASTEWATER BUDGET

15.4.1.1 A detailed assessment of the water balance was outside the scope of this assignment and is not included here. Instead, a simplified schematic of the water cycle at Plocks Farms is shown in Figure 15.5. The water inputs to the system come from mains supply and from runoff generated from rainfall onto the building roofs and yard areas. There are three key outputs identified which are: discharges to the river, evaporation from the bio-beds, and evaporation from the storage lagoon. The storage lagoon has a ball cover to minimise algae growth which affects the quality for reuse. There is considerable re-use of water within the system with water recirculating for the scrubbers, and for use as cooling.

Figure 15.5  Simplified schematic of water cycle at Plocks Farm.

15.4.1.2 Water flows at key process locations are monitored and recorded within the existing Information System. Summary data extracted from the Information System were provided by GA for a nine-month period and these provide an outline water balance for the site. The nine months data series indicates that currently mains water contributes two thirds of the input with surface runoff the remaining third. Total losses over the nine month period are 43,457 m$^3$ with 57% lost from discharges to river and the remaining being lost by evaporation from the bio-beds.

15.4.1.3 From a review of the data on evaporative losses it is noted that negative values are occasionally reported in the data series, suggesting that this data stream could be being used as a ‘catch all’ to balance the system. It is recommended that this area should be investigated further to understand why negative values are being reported. It is also likely that there will be other losses from leakages around the site in addition to evaporation, and this could be assessed by the evaluation of detailed meter data across the site.
15.4.1.4 There is a high level of water reuse on site. The volume of water that is reused varies monthly but over a 12 month monitored period the total volume was 7,318 m$^3$. This block of water is mixed with the daily input of freshwater and is recirculated on average 286 times per month. Therefore, without a recycling process the daily demand for water would be up to 20 m$^3$/day more than it is as existing.

15.4.1.5 A key opportunity for retaining water within the system is to capture or reduce the moisture being lost by evaporation from the bio beds. Installation of a technology to condense and capture the water being lost from the bio beds exhaust or changes to process to reduce evaporation should be investigated.

**Figure 15.6** 2014-2015 chart of total volumes recirculated per month and total number of recirculations.
15.5 CURRENT BEST PRACTICE

15.5.1 This assessment has provided an evaluation of different sizes of storage that could be installed at Plocks Farm. From the work undertaken, we would recommend:

- a 2,500 m³ tank is installed for roof water storage;
- a 700 m³ tank for the low risk yard water storage, and;
- a 1,400 m³ tank for the high risk yard water storage.

This is based on the economic benefits and available space, for the scenarios outlined in Sections 15.3.2, 15.3.3 and 15.3.4 respectively.

15.5.2 Rainwater harvesting systems are now subject to a Code of Practice established by British Standards (BS 8515:2009). This standard is intended to ensure consistency in quality, installation, testing, and maintenance of rainwater harvesting systems for non-potable (non-drinkable) water applications in the UK. Other sources of information and guidance include:

- BS 8515:2009
- CIRIA Publication C539: Rainwater and Greywater Use in Buildings - Best Practice Guidance
- WRAP/Envirowise EN896: Reducing Mains Water Use Through Rainwater Harvesting

15.5.2.1 Adherence to regulatory and best practice principles

The existing on-site water cycle at the site includes managing and using some of the incoming rainwater (stormwater) with mains water being used to supplement process use, various on-site temporary storage facilities, and ultimately treatment and discharge to the River Douglas. Whilst optimising rainwater as an asset that will be recycled and reused, discharge from the site will remain an important activity. The development plans include using the collected rainwater to further dilute the wastewater effluent (post treatment in the Anaerobic Digestion plant which is a part of the new development plan) further reducing risks of non-compliance with either the Discharge Consent and the Environmental Permit (overland leaks and spillage of high risk yard surface water into the environment).

15.5.2.2 GA’s development plans are designed to ensure continued compliance with its existing wastewater discharge consent. GA Farm’s discharge consent permits discharges of treated effluent from its existing on-site wastewater treatment works into the River Douglas. The River Douglas is a waterbody within the North West River Basin and is subject to the environmental objectives of the European Water Framework Directive. Water quality in this area is currently assessed as Poor (on the basis of invertebrate and Phytobenthos levels, and chemical quality) with an objective to reach ‘good overall status’ by 2027. The Directive requires ‘no deterioration’ in water quality of any of the sub-elements (biological, chemical, hydrological) and the implications of this for GA is that it must continue to comply within its existing permit. Actions to dilute the composition of its wastewater (and potentially the energy and chemical requirements) must be viewed positively.

15.5.2.3 BREEAM schemes highly value the role of rainwater harvesting in the water efficiency aspect of the accreditation and installation can also help developments gain planning permission by meeting site drainage requirements (ref Building Regulations Part H) as part of a sustainable drainage (SuDS) scheme.

15.5.2.4 Condition 8 of the Planning Permission states explicitly that surface water must drain separate to foul and further that no surface water will be allowed to drain to the foul sewer (the current and planned drainage systems comply with this). The rationale behind this is to minimise the stress on the sewerage network that is primarily intended to drain sewage to the municipal treatment works. Excess storm water volumes entering the network can exceed drainage capacity and lead to sewer flooding affecting homes and commercial properties, and increased incidence of spills into

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watercourses from Combined Sewer Overflows. In recognition of this problem Local Authorities have introduced policies into their Local Plans to control development on new sites.

15.5.2.5 Chorley Council has implemented this in Policy Numbers EP17 and EM2 of the Adopted Chorley Borough Local Plan Review. Furthermore a commercial discharge into the foul sewer would require a Trade Effluent Permit. GA’s development plan integrates compliance with the Planning Permit conditions and sustainability practices by i) collecting and recycling surface water to minimise demand on public water supply and therefore the reducing its contribution to the environmental pressures involved in abstracting water, and ii) collecting surface water and diverting all potential flow from the foul sewer.

15.5.2.6 BS 8515:2009 sets standards for the design, installation, quality of water, maintenance, and risk management of rainwater harvesting systems for both new-build projects and retro-fitted systems and so is applicable to both the current and future situations at the facility. It requires that storage tanks, (whether located above or below ground) must be watertight, avoid stagnation, resist microbial growth and be sited so as not to create an environment suitable for the growth of Legionella. Under the development, GA is proposing storage facilities at surface level. Diurnal flow rates around the site are expected to be rapid with a continuous circulation. However, the proposal to develop an open-air facility with a large surface area will still need to be assessed in relation to these requirements.

15.5.2.7 This assessment has determined optimal storage volumes based on general coefficients. These would need to confirmed prior to further design/construction to take into account the specific building materials used for the roofs, and the topographic details of the yard areas.

15.5.2.8 Roof outlets, guttering and pipework should be free-draining to avoid stagnation and contamination of the rainwater from other sources. BS 8515:2009 stipulates that a system must filter the rainwater before it “enters the main body of stored water” to prevent the accumulation of debris in the tank. The filter can be located at different points in the system depending on the specific harvesting system that is selected. Filter systems are subject to stringent criteria: they must be water and weather resistant, easily accessible for maintenance and have an efficiency of at least 90% (this factor has been applied in the rainwater runoff model). The main storage tank should be fitted with a calmed inlet to prevent debris settling and accumulating.

15.5.2.9 Figure 15.7 is taken from the Envirowise Rainwater Harvesting guidance document. It summarises the range of water quality requirements (high, medium, and low) for different purposes. Cooling, various cleaning, and process use associated with food are all applicable to Plocks Farm and can all be supplied with rainwater subject to appropriate treatment.

**Figure 15.7** Common uses for rainwater harvesting projects and associated treatments.
Rainwater is ideal for many uses, including cooling systems, as it has much lower concentrations of salts that can otherwise accumulate. The BS standard does not stipulate disinfection as a requirement but does encourage UV or chemical treatment if there is potential for increased human exposure or for applications within public buildings. At the site all recycled water is disinfected as it comes into contact with humans and food. Ultraviolet (UV) or chemical disinfection is not normally required for non-potable uses such as cooling or for cleaning non-food equipment.

Frequent water sampling is not necessary, although systems do require maintenance. Regular observation of water quality and equipment (e.g. filter systems) is recommended to ensure systems continue to operate effectively. Furthermore, BS 8515:2009 does stipulate that the back-up supply should be fitted with a backflow prevention device upstream of, or at the point of delivery where the two systems meet. This is to prevent back flow of harvested water contaminating the mains supply.

All pipework used in the rainwater harvesting system should be in a contrasting colour, or material, to mains pipework and labelled in accordance with Annex C of BS 8515:2009. Pipework should not be blue, but instead should be green or black and green. Pipework must also be robust enough to withstand the pressure of the system and sized to the specified flow rates.

The BS standard also specifies the types of pumps that can be used and the water levels that must be maintained; especially where pumps are installed inside of tanks. This is to prevent damage from air inflow, sediment or debris that may enter the system.

The modelling work has demonstrated that inevitably there will be times when the system is only partially full and other times when the volume of incoming rainwater will exceed the storage (and daily demand) capacity. The BS standard recognises this and requires that all storage tanks are fitted with an overflow facility. One possible option is to connect the overflow from the rainwater storage tanks to a diversion to the large high risk yards storage facility. The flow capacity of the overflow outlet pipe should be equal to, or greater than, the capacity of the inlet pipe. The high risk yard facility will need an overflow capacity, particularly for times when it is required to accommodate high volume flows resulting from an AD outage event. A sensor that diverts rainwater away from the unit during the infrequent occasions when it is full will prevent the risk of high risk water draining to excess.

As with the back-up supply, the overflow must prevent any backflow into the mains supply. It must also be designed to prevent vermin entering the system. Best practice design allows for the main tank to overflow at least twice a year. This removes any floating sediment that could build up and helps to ensure that stored water is of good quality. Control units and water quality and flow warning systems (e.g. to identify any pump failures) are also encouraged.

Rainwater systems should be installed in accordance with the manufacturer’s instructions and carried out by qualified personnel (typically authorised by the manufacturer). Before the system is handed over from the manufacturer it should be tested to ensure it is watertight with no cross-connections. All pipework and fittings should be tested to and comply with BS 6700:2006, 6.1.12.3. Electrical wiring should be tested to BS 7671.

**Funding and payback**

The capital cost of rainwater harvesting systems depends on the size of the system, whether it is being retrofitted or integrated into a new construction project, and the level of water treatment processes that may be required as part of the system (see water quality requirements). It is more expensive to retrofit rainwater harvesting systems than to invest in technology when the site drainage system is under construction.

Three systems are proposed for Plocks Farm: a 2,500 m³ facility to receive water from the existing and new roofs (this will involve an element of retrofitting drainage systems to the existing buildings); a new 700 m³ facility to capture low risk and car park runoff; and a new 1,400 m³ system to support the new AD unit and extended high risk yards. Construction and drainage works are intended to separate low risk and high risk yards and the installation of water collection systems at the same time as this will enable a financial saving (as opposed to retrofitting later).
15.5.3.3 Similarly operating costs will depend on the level of treatment and ongoing system pumping requirements. If water requires treatment to a high standard, cost and annual maintenance will be higher than a system requiring only low quality water. Generally, the systems with the fastest payback periods utilise large collection areas to supply a constant demand of general quality water. In certain commercial installations, the project payback can be as short as 2-3 years.

15.5.3.4 United Utilities currently charges water supplies to non-household customers across a range of metered tariff rates. It is not known which tariff system is applicable to GA and so an estimate of the financial savings that are currently being achieved by replacing mains water with recycled water has been based on the standing measured rate. For a potable supply this rate is assumed to be £1.681 per m$^3$ excluding standing charges and other fees. The total annual volume that would be reused (roughly 7,318 m$^3$) would be equal to a financial saving of £12,301. This assessment indicates that GA would be able to substitute the full 80 m$^3$/day potable mains supply with its own harvested water. The annual financial saving could be as much as £49,085 (assuming 80 m$^3$/day with a demand of 365 days per year). Standing charges may still be payable if GA decides to retain mains water to provide a back-up supply; this is recommended.

15.5.3.5 The Enhanced Capital Allowance (ECA) scheme enables businesses to claim 100% first year capital allowances in investment on rainwater harvesting equipment named in the Water Technology List. The following equipment is supported:

- monitoring and control equipment;
- rainwater filtration equipment;
- rainwater storage vessels, and;
- rainwater treatment equipment.

15.5.3.6 Further information and advice can be found at: https://www.gov.uk/government/publications/water-efficient-enhanced-capital-allowances (updated July 2015).

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15.6 CONCLUSIONS

15.6.1.1 This review updates the Entec (2009) EIA Environmental Statement, recognising the changes to the development plans. This includes maximising the reuse of rainwater that can be captured from the building roofs and low risk yard areas within the food production process, following minimal treatment, and the storage requirements to capture runoff from high risk yard areas. This assessment presents viable options in terms of rainwater storage capacity, considering a range of different scenarios associated with the future development of the site, as specified by GA.

15.6.1.2 There is a good understanding of the existing on-site water cycle, demand and reuse. This resource is monitored at a high level through extensive infrastructure and instrumentation installed throughout the site; water flows are monitored on a near real time basis and managed within an Information System.

15.6.1.3 Currently there is 7,318 m$^3$ of recycled water reuse on site per annum with two waste water treatment plants in operation. However, water storage is currently limiting potential water reuse on site. When the existing main water storage facilities and capacity of the system is exceeded, water is lost to the River Douglas.

15.6.1.4 We would recommend facilities are provided to store 2,500 m$^3$ of roof water from new and existing roofs, 700 m$^3$ of low risk yard areas, and 1,400 m$^3$ from high risk yard areas.

15.6.1.5 When completed the 2015 Master Plan will:

   i. Collect approximately 29,000 m$^3$ per annum of rain water falling on the roofs, and replace 80m$^3$/day mains water used in the onsite boilers;

   ii. Collect around 23,000 m$^3$ per annum of rain water falling on low risk yard areas which will then be treated and re-used 286 times within the process. It will then be discharged to the River Douglas, or lost by evaporation via the biobeds;

   iii. Collect roughly 10,600 m$^3$ per annum of rain water falling on the high risk yard areas which will be stored and contained. It will then be treated by anaerobic digestion, before forming part of the recycled water, which is eventually discharged to the River Douglas or lost by evaporation through the biobeds. In addition it the proposed system will collect 12,000 m$^3$ excess roof water runoff per annum.

15.6.1.6 A further opportunity for retaining water within the system may be to capture or reduce the moisture being lost by evaporation from the bio-beds. Installation of a technology to condense and capture the water or changes to process to reduce evaporation should be investigated, together with the quality and suitability of the water that would be achieved.
INTRODUCTION

1.1 Background

1.1.1 Golden Acres Pet Food Partners (GA Pet Foods) operate a pet food manufacture, storage and distribution facility at Plocks Farm, near Tarleton, Lancashire. The company proposes to undertake significant development of the site over the next ten years. The proposals have been designed to meet five principle objectives as detailed in Chapter 1. This development includes the construction of a large new Automated Finished Product Store (AFPS) as well as development of and improvements to various production and treatment processes on site, the details of which are set out in Chapter 5. Chorley Borough Council has determined that this development should be subject to an Environmental Impact Assessment (EIA).

1.2 Basis and Scope of this Review

1.2.1 The key water related issues in the EIA are flood risk management and pollution prevention and control, both during construction and site operation and as to whether the proposal has met the objectives. Issues of flood risk and drainage are covered in detail by a separate Flood Risk Assessment (FRA). Another consultancy, WEBS, have set out proposals for wastewater treatment at the site, which have been designed to ensure that wastewater effluent from Plocks Farm meet the discharge consent standards set by the Environment Agency. These two studies provide the context for this review of the water management proposals at the site.

1.2.2 All volumes of water quoted in this report are taken from the WEBS report 4, unless otherwise stated.

1.2.3 This review provides a holistic assessment of how GA Pet Foods propose to manage drainage sustainably whilst also minimising water use and maximising the use of non-potable sources of water including rainwater and recycled effluent. This review has been carried out following a site visit to Plocks Farm and a review of all related water management documents, as supplied by GA Pet Food Partners. Some additional research has been undertaken using internet searches.

1.3 Structure of this Review

1.3.1 Following this introduction, this review will summarise current operations, set out the key details of the proposed developments at Plocks Farm, with regard to water management issues, and review the extent to which ‘best practice’ sustainable water management measures have been included in the proposals. Based on this, a number of conclusions and recommendations are presented.

2. CURRENT OPERATIONS.

2.1 Sources and Uses of Water

2.1.1 Mains water, supplied by United Utilities, is used in the pet food production process, as a raw ingredient, for raising steam, and for cleaning the production plant. Mains water is also required for domestic-type uses by staff. Potable water quality is required; therefore the use of mains water for this purpose will need to continue.

2.1.2 Data presented in the WEBS report indicates an average daily mains water usage rate of 73 cubic metres per day (m3/d).

2.1.3 A borehole on site provides water for cooling, washing down floors and yard areas. In general terms, the borehole water is used in preference to mains water for these purposes, to minimise cost.

total volume that can be abstracted from the borehole is limited to 120 m3/d by the licence of this source.

2.1.4 The wet scrubbers are a key component of the odour control process at the site. Currently the wet scrubbers require on average about 80 m3/d, which is supplied from recycled water.

2.2 Water Treatment and Discharge

2.2.1 Wastewater from domestic-type water use at the site is discharged to a septic tank, from where it is collected and taken off site.

2.2.2 Wastewater from the production processes is treated at the on site wastewater treatment works (WWTW). This works also receives runoff from ‘high-risk’ yard areas – i.e. where runoff is likely to be contaminated with pet food ingredients or products. Recent modifications to the WWTW (conversion of SAF plant to MBR) have enabled the discharge of effluent from the site to the River Douglas within consent standards. These improvements should also allow the recycling of treated effluent for use in the wet scrubbers.

2.2.3 Rainwater runoff from ‘low-risk’ yard areas is passed through a settlement tank to separate any solids and floating oils and fats before discharge to the river. Existing roof water is discharged directly to the river.

3. OUTLINE OF PROPOSALS.

3.1 Changes to Water Requirements

3.1.1 The development plans for Plocks Farm will result in increased potable water demand of approximately 45 m3/d for additional production lines and a meat processing plant, as potable water is required for steam and where water comes into contact with the product during the process, and new wet scrubbers will require approximately 300 m3/d more water than used at present for water quality purposes (i.e. 375 m3/d instead of the current 80 m3/d). It is likely that smaller additional volumes will be required for domestic-type uses, however these small increases have not been considered here.

3.2 Water Reuse Proposals

3.2.1 The focus of the water reuse proposals is to meet the significant additional water requirements of the new wet scrubbers. In simple terms, it is proposed that treated effluent from the WWTW will be combined with runoff from roofs and low risk yard areas to provide the majority of water needed in the scrubbers.

3.2.2 Drainage from the new AFPS and all new buildings will be piped by gravity to a new wetland area to the north of the AFPS.

3.2.3 Drainage from the existing roofs and low risk yard areas is currently piped through a separator and then discharged to the river. It is proposed that will runoff will be collected and pumped into a proposed 1500 m3 holding lagoon to be known as the “yard water pond”.

3.3.3 Water from the new wetland area will be used to top-up the new yard water pond. Overflows from the wetland and yard water pond will be discharged to the river.

3.3 Proposed Water Management under Flood Conditions

3.3.1 The FRA sets out in detail the proposals for sustainable drainage under extreme rainfall conditions. It details how future 1 in 100 year rain storms (which include an allowance for increases due to climate change) will be managed on site. This will entail the use of the wetland area and the yard water pond, which will be constructed in such a way that any excess drainage will be stored in a depression in the ground around the pond until the flood condition has receded.
3.3.2 Site levels will be formed in such a way that any drainage in excess of the capacity of the drainage system will flow to these two "low-lying" areas.

4. REVIEW OF PROPOSALS.
4.1 A key consideration in reviewing the water reuse proposals is to assess whether sufficient volumes of water will be available to supply the new wet scrubbers. The sources of supply to the scrubbers will be:

- Process and high risk yard effluent;
- Recycled scrubber effluent; and/or
- Runoff from low risk yards and roofs.

4.1 Assumptions
4.1.1 A number of assumptions have been made to undertake this assessment:

- 200 m$^3$/d of wastewater from the scrubbers can be recycled for reuse (WEBS Report p44). With a total demand of 375 m$^3$/d, this means that 175 m$^3$/d of additional water supply for the scrubbers is required;
- Mains water supply following development is equal to the historic average (73 m$^3$/d) plus the additional 45 m$^3$/d estimated by WEBS – 118 m$^3$/d in total;
- Ten percent of the mains water is lost to the septic tank and a further 25 percent of mains water is lost in the production process – leaving 65 per cent to flow to the WWTW. Of this, a further ten percent is lost in sludge. Therefore 58.5 percent of mains water by volume ends up as final effluent – 69 m$^3$/d;
- Assuming all of the WWTW final effluent is reused in the wet scrubbers, there is still a requirement for 106 m$^3$/d, which will need to be supplied from runoff or from the borehole;
- The significant amount of recirculation of wet scrubber effluent has implications for water quality (COD), and so there is an optimal balance to be struck between the volumes of water being recycled (and recirculated) and maintaining acceptable water quality levels. It is assumed that the WEBS study has taken this into account (by setting an upper limit in COD of 300 mg/l).

4.1 Analysis
4.1.1 A simple analysis of long term annual (LTA) average rainfall and roof/yard area will provide an indication of the average daily runoff that will be generated. The Chorley Borough Council Supplementary Planning Guidance indicates a LTA rainfall value for the area of 877 mm.

4.1.2 Roof and yard area data supplied to Entec by Roger Bracewell (email dated 19/06/09) indicate a future (post development) total roof and yard area of just over 61,500 m$^2$. It is likely that runoff from high risk yard areas will contribute to this volume, but this has been excluded for this analysis for simplicity. The runoff rates from these areas will vary depending on their composition, and other losses. Therefore, the following factors have been applied:

- Runoff coefficients for tiled roofs, concrete and sedum are 0.8, 0.8 and 0.4 respectively to account for evaporation and other losses;
- A filter coefficient of 0.9 is typically applied to account for loss of runoff in rainwater filters;
- A similar loss factor (0.9) has been assumed for yard areas to account for other losses (e.g. leaky drains/tanks).
Table 1 Estimation of runoff volumes from roofs and yard areas

<table>
<thead>
<tr>
<th>Area</th>
<th>Area Now (m²)</th>
<th>Area Future (m²)</th>
<th>Runoff Coefficients</th>
<th>Runoff Now (m3/yr)</th>
<th>Runoff Future (m3/yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Roof</td>
<td>17,907</td>
<td>35,625</td>
<td>0.72</td>
<td>11,307</td>
<td>22,495</td>
</tr>
<tr>
<td>Sedum</td>
<td>0</td>
<td>9,900</td>
<td>0.315</td>
<td>0</td>
<td>3,126</td>
</tr>
<tr>
<td>LR Yard</td>
<td>12,290</td>
<td>15,980</td>
<td>0.72</td>
<td>7,760</td>
<td>10,090</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td></td>
<td>23,418</td>
<td>35,711</td>
</tr>
</tbody>
</table>

4.1.3 The total runoff from these areas is estimated to be approximately 35,700 m³/yr, equivalent to an average daily runoff of 98 m³/d. Therefore on average, there is sufficient runoff from the roofs and yards proposed in the development plans to make up most of the additional 106 m³/d required to maintain the 375 m³/d flow to the new wet scrubbers. However, the volumes that are available on a day to day basis will depend on rainfall patterns and storage volumes.

4.1.4 In order to undertake more detailed analysis of the contribution of rainwater systems to the demand for wet scrubbers, it is necessary to consider daily or weekly rainfall data. Entec has undertaken this analysis using ten years of daily rainfall data (1996-2006) for a similar site in Cheshire. It is recognised that rainfall patterns may differ, but by substituting data on roof area, storage volume and other key parameters, it is possible to undertake a rapid, indicative assessment for Plocks Farm.

4.1.5 A snapshot from the spreadsheet tool is presented below. This rapid assessment indicates that rainfall could provide around 70 per cent of 106 m³/d shortfall identified above, when the time-variable nature of rainfall and available storage is taken into account. The remaining volume would need to be supplied from the borehole on site. On average the borehole would need to supply approximately 11,000 cubic metres per year (30 m³/d), with around 28,000 cubic metres per year (77 m³/d) being provided by rainfall. Clearly, the variability in rainfall and storage means that some days the borehole would need to maintain a supply of around 106 m³/d, as the spreadsheet below indicates.
5. CONCLUSIONS AND RECOMMENDATIONS.

5.1.1 This assessment indicates that the proposals to use rainwater runoff to supply water to parts of the proposed new treatment systems at Plocks Farm are feasible. Based on this review, the proposals are considered to represent the best available use of rainwater harvested from the site.

5.1.2 Other studies have considered the feasibility of recycling effluent from the on-site WWTW for reuse in the odour control process. This study has not investigated the validity of any other analysis, but has assumed that such effluent reuse approaches are feasible.

5.1.3 The proposals for effluent reuse and rainwater harvesting are considered to be appropriate, and to represent 'best practice', in the context of the volumes of water required in the proposed odour control systems, and the likely volumes of effluent and rainwater runoff that will be generated once the development is complete. This report concludes that rainfall harvesting should be sufficient to provide around 70% of the make-up water required for the wet scrubbers, thereby minimising the amount of groundwater required from the borehole.
Appendix B
Existing Site Layout Plan and Proposed Development Masterplan
Appendix C
High Risk and Low Risk Areas Existing Site
Appendix D
High Risk and Low Risk Areas Proposed Site