APPENDIX 10.2
WATER RESOURCE ADDENDUM

Technical Note

Project: Cambridge North

Subject: Water Resources Addendum

Client:	Brookgate Land Ltd.	**Version:**	Rv0
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Date:	25th February 2022	**Approved:**	Amy Evans

1 Introduction

1.1.1 PJA has been commissioned by Brookgate Land Ltd to undertake a review of the water resource status of the supporting catchment and water supply infrastructure to understand emerging approaches to water neutrality and what potential measures could be delivered to move towards achieving this.

1.1.2 This Water Resources Addendum has been prepared to support the Flood Risk and Drainage chapter from the ES for the new mixed-use development at Cambridge North ahead of Local Policy and a Water Neutrality Strategy.

1.2 Site Location

1.2.1 The proposed Site is predominantly brownfield (previously developed) in nature with some surrounding vegetated areas. Currently, most of the Site is derelict, however the southern area comprises of the North Cambridge Train Station, a hotel, amenities and associated temporary car parking facilities.

1.2.2 To the north of the Site, the Tarmac Cambridge Quarry is situated, beyond which is the A14 and Milton Country Park. To the north-west of the development, the Cambridge Business Park is located and to the south-west lies the Nuffield Road Allotments. The railway line is situated to the east of the development boundary line.

1.2.3 The nearest Environment Agency Main River is the River Cam located approximately 400m to the east of the Site.

1.2.4 The Site's OS national grid reference is 547419,260815.

1.2.5 A Site Location Plan is available below in Figure 1-1.

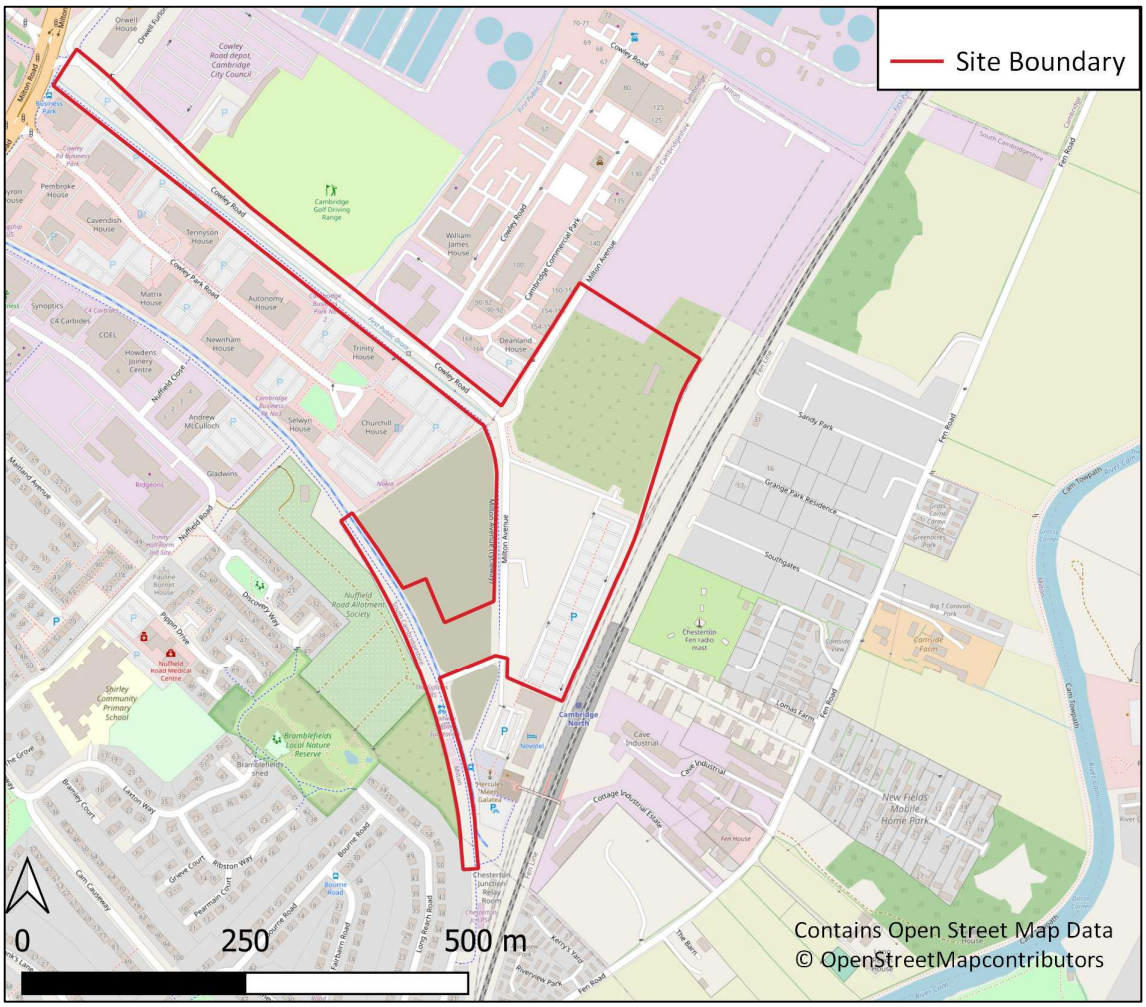

Figure 1-1: Site Location Plan

1.3 Water Supply & Availability

1.3.1 The Site lies within Cambridge Water's 'Water Resource Zone' (WRZ). Figure 1-2 shows the extent of the Cambridge Water's WRZ and the proposed Site location, respectively.

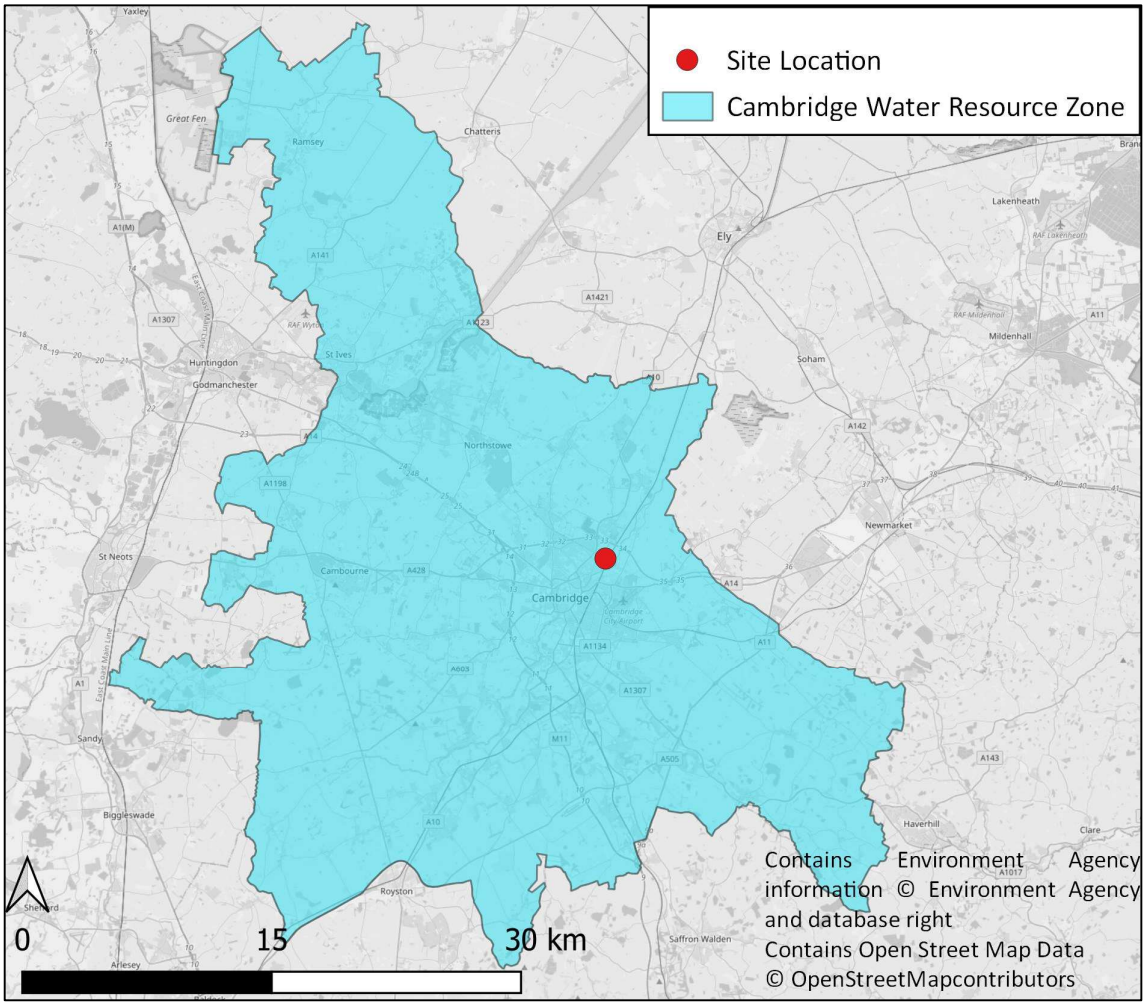

Figure 1-2: Cambridge Water Resource Zone

1.3.2 Within this WRZ, water resources are wholly supplied from groundwater sources. The Cambridge Water Resource management plan[1] states 97% of supply comes from chalk aquifers with the remaining 3% abstracted from greensand aquifers.

1.3.3 Water is taken from the aquifers using 26 boreholes from across the region with drinking water provided from 36 service reservoirs and water towers. Cambridge Water also has several emergency bulk supply points along their border so resources can be shared if the need arises.

[1] https://www.cambridge-water.co.uk/media/2546/final-wrmp-2019-cambridge-water-oct20.pdf

1.3.4 To understand water supply within the area, the Greater Cambridge Integrated Water Management Study[2] was produced alongside the emerging Greater Cambridge Local Plan[3]. The Environment Agency, Cambridgeshire County Council, Cambridge Water, Anglian Water and Natural England were consulted within this study.

1.3.5 The findings of this report state that the current level of water abstraction from the chalk aquifers is thought to be unsustainable, with potential to cause further environmental damage. Furthermore, it is suggested that abstraction will need to be reduced significantly to safeguard natural river flow within the catchment.

1.3.6 As there is no capacity to increase groundwater abstraction, future water demand and supply will need to be balanced in other ways, including greater water efficiency from new developments. Cambridge Water should also investigate reducing leakages and finding new sustainable water sources to ensure there is not increased environmental implications due to future growth.

1.3.7 For development to continue, the Greater Cambridge Integrated Water Management Study suggests new development will need to be 'water neutral'. This means the development must not create loss in existing headroom which is defined as *"the buffer between supply and demand to cater for uncertainties in the overall supply and demand balance to help water companies achieve its chosen level of service".* There shall also be no increased abstraction above current levels to prevent further detrimental environmental impacts. Full water neutrality will be reliant on actions by Cambridge Water who will be supported by Water Resources East, to offset net increases in water demand.

2 Policy Review

2.1 National Planning Policy Framework

2.1.1 The revised National Planning Policy Framework (NPPF) was published by the Ministry of Housing, Communities and Local Government in July 2018 and was updated in 2021. The NPPF'S Planning Practice Guidance (PPG) supports the Framework and is an online resource that is frequently updated.

2.1.2 Within paragraph 20 of the NPPF, it states that strategic policies should be produced for the pattern, scale and quality of development and make sufficient provision for infrastructure,

[2] https://www.greatercambridgeplanning.org/media/1391/gclp-strategic-spatial-options-assessment-integrated-water-management-study-nov2020.pdf
[3] https://greatercambridgeplanning.org/media/1419/greater-cambridge-local-plan-november-2020-water-briefing.pdf

including water supply. Paragraph 153 also states that a proactive approach to Climate Change should be adopted and should consider the long-term effects for water supply.

2.1.3 Therefore, Cambridge Water will need to work towards reducing water consumption within the WRZ alongside making sure new development is water neutral.

2.2 The Emerging Water Resources Regional Plan Eastern England 2022

2.2.1 The Water Resources Regional Plan Eastern England was produced in January 2022 to inform individual statutory water companies' draft Water Resource Management Plans being published in late 2022/2023. Together the plans aim to deliver the investment needed across England and Wales for more sustainable and resilient water supplies for the future.

2.2.2 The focus of the regional plan follows the key components of:

- Recovery, enhancement and protection;
- Demand Management;
- Infrastructure Options;
- Water company infrastructure options and;
- Identifying, encouraging, and facilitating water innovations.

2.2.3 The plan states that there will be significant focus on household and non-household water efficiency and demand management, particularly linked to smart metering and leakage reductions. This includes taps, cisterns and rainwater/reuse systems. The region would also like to investigate innovation around the tariffs of water and focus on water sharing opportunities using international learning.

2.2.4 The report also states that water supply will need to be investigated with the growing demand for water as the population of the region increases. Strategies for the supply of water include:

- Transfers from local water companies E.g. Anglian Water and Cambridge Water;
- The production of a strategic reservoir system;
- The Introduction of reuse schemes and next generation desalinisation linked to green hydrogen pilots and;
- Catchment investigation and planning.

2.3 Cambridge Water Draft Water Resources Management Plan 2019

2.3.1 The Water Resources Management Plan[4] was produced by Cambridge Water in 2019 to set out management goals for supply and demand over the next 25 years (2020-2045). The company aim to:

- Reduce total leakage across the network by 2ml/d (2 million litres per day) from the 2019-2020 performance commitment level of 13.5ml/d. The 15% reduction will be achieved through active leakage control. Cambridge Water would also like to investigate the use of developing a live network where data can help identify leaks more quickly.
- Aim to educate customers around the benefits of installing a water meter and hope to encourage an additional 500 households a year for the next ten years to switch to a water meter. Smart meter options are being investigated by Cambridge Water to help customers monitor and control their water usage.
- Work with developers to explore incentives for new sites to include rainwater harvesting and grey water recycling.
- A further reduction of 6ml/d in the volume of water taken from the environment will be made to reduce deterioration.
- Continue to liaise with their neighbouring WRZ's (Anglian Water and Affinity Water) to further explore the long-term resilience of water supplies in the region.

2.3.2 The management plan produced by Cambridge Water is a strategy mostly to reduce water consumption from the WRZ in the long term. However, there have been advances made towards making new developments as efficient as possible through the use of rainwater harvesting and grey water recycling. For new developments to be 'Water Neutral' it is vital that Cambridge Water work alongside developers to combat water supply issues within the Cambridge WRZ.

[4] https://www.cambridge-water.co.uk/media/2546/final-wrmp-2019-cambridge-water-oct20.pdf

3 Water Neutrality Strategy

3.1 Definition

3.1.1 The Environment Agency define water neutrality as "For every new development, the predicted increase in total water demand on the region due to the development should be offset by reducing demand in the existing community"

3.2 Approach

3.2.1 There are three steps to achieving water neutrality as shown in Figure 3-1 below. These three steps are:

1 Reducing water use by making the new development as water efficient as possible;

2 Installing water reuse systems such as rainwater harvesting or grey water recycling and;

3 Offsetting any remaining demand in the existing local region.

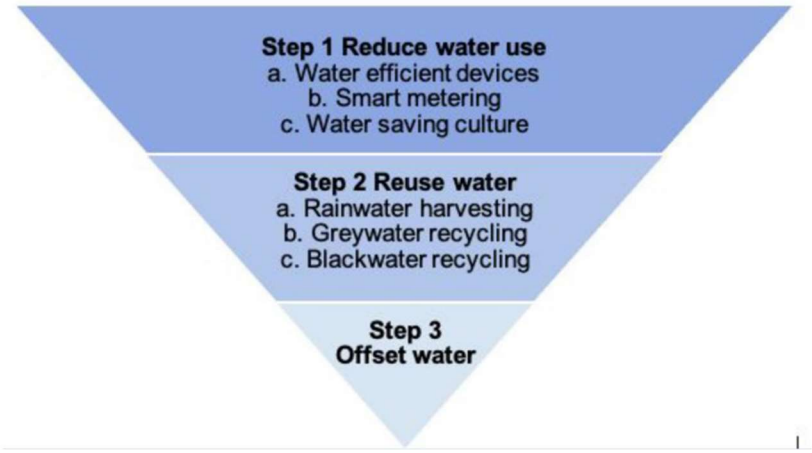

Figure 3-1: Water Neutrality Hierarchy[5]

3.3 Reduction of Water Demand & Water Efficiency Measures

3.3.1 The first and most important step to achieving water neutrality is to ensure that water is used as efficiently as possible. This is done by fitting homes with efficient products and designing

5 https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/291739/scho1009bqzt-e-e.pdf
Waterwise Water Efficiency Strategy for the UK January 2021

them to encourage water saving behaviours. The smaller the water demand of a building due to its design and fittings, the less water is needed to be reused and offset.

3.3.2 The measures outlined in the Emerging Water Resources Regional Plan Eastern England and the Cambridge Water Draft Water Resources Management Plan will help individual developments to reduce water consumption. This includes such measures as; reducing leakages from the network, installing water meters, installing aerated taps, low flushing toilets and the introduction of rainwater reuse systems for watering plants and gardens.

3.3.3 A mandatory water efficiency labelling system for water using products, similar to the scheme already in place for energy using products, would enable quick and easy identification of the most efficient water appliances and underpin minimum product and building design standards. Unfortunately, a water label is not yet in widespread use, as it is not mandatory in the UK for products to be tested and for a label to be displayed at the point of sale.

3.3.4 A Per Capita Consumption (PCC) of approximately 85 litres a day can be achieved by installing water efficient fittings, metering and changing behaviours, such as not leaving the tap running when brushing teeth, using eco settings on the washing machine and dishwasher and by using a water butt in the garden.

3.3.5 The development at Cambridge North could consider installing such appliances from the outset within each home as part of the development build. However, this would not guarantee the use of such appliances for the lifetime of the development and occupants could replace old or inoperative appliances with non-water efficient fittings and appliances. This could be overcome by providing the homeowner with a 'user guide' and the commitment to achieving a water neutral household and development.

3.3.6 Water demand can also be reduced through fitting meters (especially smart meters, which measure water usage and provide regular readings to the customer), helping track water consumption.

3.3.7 Meters can help support and encourage behavioural change by showing homeowners their water usage and cost, where the customer could potentially be penalised financially if the rate of water consumption went beyond 137l/h/d. This strategy has been trialled within the Cambridge Water WRZ as stated within the Draft Water Resources Management Plan and is hoped that the use of smart meters will be rolled out to help mitigate against water scarcity.

3.3.8 Getting buy-in from the householder to accept water efficient fittings and adopt good water saving behaviours in a new build home is essential. A culture of water saving and understanding

the value of water resources will be critical to ensure devices are accepted and remain in place within the new development.

3.4 Water Reuse

3.4.1 Once water use is reduced to an ambitious level, water reuse should be considered throughout the development. Water reuse generally refers to the capture, treatment (if required) and use of alternative water supplies for non-potable purposes. It includes rainwater and surface water harvesting, greywater recycling (typically consisting of used water from baths, showers and hand basins, where approximately 1/3 of average household water usage comes from) and wastewater recycling.

3.4.2 Water reuse technologies have the potential to save significant amounts of water. For example, 24% of water in the home is used for flushing the toilet and 4% externally in the garden meaning a water reuse system could save at least a quarter of demand if it was installed for these purposes. Depending on its treatment quality and the system installed it could also be used for an additional 12% of water for washing clothes. These systems can also be used within commercial buildings for communal toilets and facilities.

3.4.3 Waterwise commissioned an independent review of the costs and benefits of Rainwater Harvesting (RWH) and Grey Water Recycling (GWR) options in the UK[6] and identified that the supply and demand balance for the individual building or development needs to be considered in order to choose the correct type of system. For example, it was demonstrated that a RWH system resulted in a total net financial benefit regardless of the development type or size whereas a GWR system only became financially beneficial to service larger, non-residential building types as shown in Figure 3-2.

[6] Independent review of the costs and benefits of rainwater harvesting and grey water recycling options the UK; Ricardo Energy & Environment Sept 2020

Yield	Example building types	Costs (CAPEX + OPEX; '000 £)	Total water cost savings ('000 £)	Private net benefits ('000 £)	Societal benefits ('000 £)	Total net benefit ('000 £)
Low (<500m³)	Smaller households (such as retired people or young adults), small commercial shops.	£ 45	£ 5	-£ 40	2	**-£ 37**
Small (500 – 1,500m³)	Larger households (potentially families).	£ 100	£ 52	-£ 48	£18	**-£ 30**
Medium (1,500 – 4,000m³)	Retail and commercial stores, leisure centres, some offices.	£ 120	£ 108	-£ 13	£34	**£ 25**
Large (4,000 – 10,000m³)	Large commercial settings such as shopping centres, multi-unit offices or flats.	£ 170	£ 190	£ 21	£67	**£ 88**
Significant (>10,000m³)	High rise offices or blocks of flat, hotels, multi-purpose developments.	£ 270	£ 780	£ 510	£275	**£ 787**

Figure 3-2: Costs & Benefits of Installing a GWR System in a Building Based on the System's Yield.

3.4.4 It should be noted that the storage of this water would be required in addition to any attenuation required for surface water drainage at the development Site.

3.5 Offsetting

3.5.1 Finally, the remaining water demand requirement for the new home or developments which cannot be satisfied with non-potable sources needs to be offset. This can be done by investing in schemes that save water in the local region such as retrofitting existing buildings with water efficient devices or water reuse systems.

3.5.2 The water saved through these schemes needs to be equal to the residual mains water usage of the new development to achieve water neutrality. The offset schemes also need to be within the same water resource zone as the new development.

3.5.3 For example, as shown in Figure 3-3, if the PCC of a new house was 138 litres, water efficiency and water reuse measures could reduce water to a PCC of 80 litres, then the last 80 litres could

be offset by saving water in existing homes and buildings, bringing the overall water demand impact to zero.

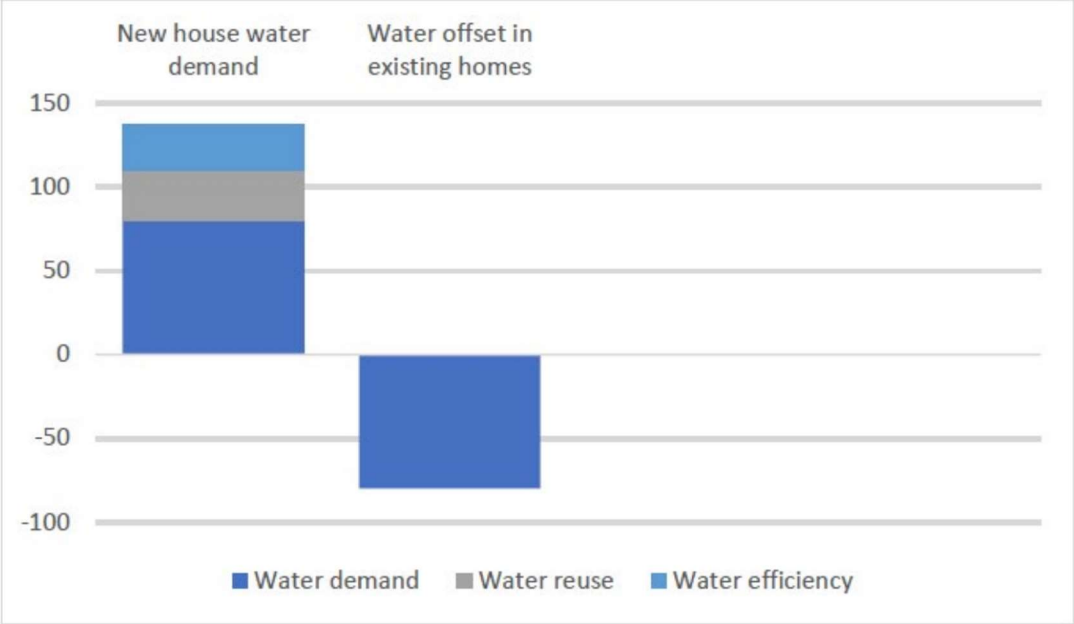

Figure 3-3: Water Offsetting (based on average water demand of 1381/h/d in a new home)

3.5.4 Offsetting is usually carried out in partnership with other organisations, like a water company, council, businesses, or charity. Some options for offsetting schemes are as follows:

- Funding water efficiency audits and retrofits for existing homes (e.g. through water companies) or for existing businesses.
- Donating/paying a fee to a housing association to retrofit their homes.
- Offsetting by retrofitting school buildings to improve water efficiency.
- Reducing leakage such as in schools, public buildings, businesses or homes (note, the offsetting through reducing leakage should not include planned works by water companies).
- Retrofitting water reuse schemes such as in public buildings or schools.

3.5.5 Offsetting activities should be supported by awareness campaigns and promoting water saving behaviours. The installation of smart meters can also help encourage water saving behaviours and provide information on how much water is being used. The cost of offsetting will vary depending on the method used and the total water footprint of the new development.

3.5.6 Non-domestic buildings can also be retrofitted to generate offsetting savings as well as reducing leakage (beyond water company planned works). This may be particularly relevant for larger scale developments or site locations where the number of homes in the region available to be retrofitted is limited. There may be certain cases where water neutrality of a sizeable development is not possible, because the amount of water cannot be offset in the same water resource zone. Assessments should therefore be carried out to measure the offset potential of a development, and options to firstly reduce water use explored.

3.5.7 Natural England advises that, like all forms of mitigation, offsetting should be delivered before the impact from the development has occurred. The impact is caused due to increased abstraction which is driven by increased water consumption. The impact of water consumption therefore only occurs on occupancy and as such it is reasonable that the offsetting for a specific development should occur before occupancy.

3.5.8 The offsetting of water is in its infancy and liaison with Cambridge Water and the Lead Local Flood Authority should be made to determine how a drive towards water neutrality can be achieved.

3.6 Summary of the 3 Step Approach

3.6.1 The following table summarises the measures that should be taken under each step to work towards water neutrality.

Table 3-1: Summary of the 3 Steps

Step 1: Reduce water				
Toilets	Cistern displacement devices (toilet hippos)	Retrofit flush devices to dual flush	Fix leaking toilets	
Taps	Tap inserts (aerators)	Low flow restrictors	Push Taps	Infrared taps
Showers / Baths	Low flow shower heads (<8 l/min)	Shower Timers	Reduced bath frequency & volume	
Outdoors	Hosepipe flow restrictors	Hosepipe siphons/irrigation systems	Water butts	Mulches and composting to keep soil moist
Smart Meters	Leakage information	Encourage behavioural change	Innovative tariffs	Saving estimates
Water Saving Culture	Promotion campaigns	Self-audits	Education in schools	Poster/leaflets/websites
Step 2: Reuse Water				
Rainwater Harvesting	Small scale water butts	RWH system for individual homes and buildings	Large scale surface water harvesting	

Step 1: Reduce water				
Greywater Harvesting	Small systems for individual homes	Larger scale systems for commercial and mixed-use sites		
Step 3: Offsetting				
Offsetting	Carry out retrofits	Funding a partner to carry out retrofits	Finding and fixing leaks	

3.6.2 Driving towards water neutrality should be achieved over a set period, such as 10 or 20 years, and assessed at various stages of the build (e.g. planning and design, as constructed, and ongoing monitoring once the homes have been built and are occupied). Note, that water efficiency measures may deteriorate over time, so may need ongoing maintenance or replacement to maintain water neutrality. However, who takes on the responsibility for auditing the efficiency of these systems in each building and maintenance, including retrofitted systems, is presently unclear.

3.7 Water Neutrality Statement

3.7.1 A neutrality statement should be prepared which includes a water budget for the development and should demonstrate how it is working towards neutrality, and will, therefore, not have an adverse effect on the existing water resources. This is achieved through a combination of minimising water use within new developments and offsetting of residual water (identified within the budget).

3.8 How Long will Water Neutrality be Required?

3.8.1 It is likely that achieving water neutrality will be important for as long as the adverse impacts from water supply abstraction continues, particularly with regards to climate change. This may well remain the case until the aquifers in question are restored to favourable conservation status.

3.8.2 It should be possible to phase out the requirement for water neutrality once a sustainable long-term water supply has been secured for the region. However, current expectations are for new developments to be water neutral within the Cambridge Water WRZ and it is currently understood that housing up to 2045 is included within the water neutrality calculations from the Water Resources Management Plan.

4 Conclusions and Recommendations

4.1.1 This Technical Note has been prepared to explore the issue of Water Neutrality with respect to a new mixed-use development at Cambridge North. The requirement for working towards Water Neutrality has arisen because of increased water scarcity within the eastern region of the country and the interim water management study suggesting that the current level of water abstraction from the chalk aquifers is thought to be unsustainable, with potential to cause further environmental damage.

4.1.2 Cambridge has a policy targeting a daily per capita consumption of 137 litres per person per day to help reduce the impact of new development on water supply aquifers in the area. However, this is insufficient to address the problem that already exists, and any new development would further compound the current problem. Water Neutrality aims to address this by directing new developments to consider a three-step approach to include a reduction in water usage, re-use of water within the development and offsetting new water use, by reducing consumption elsewhere ("water reduce, water re-use and offsetting").

4.1.3 The reduction in water usage can be managed through the installation of low water usage appliances, low flush toilets (or vacuum sewerage systems) and the installation of smart meters. Re-use of water at a private residential level includes measures such as the installation of water butts, with more substantive rainwater harvesting being more suited to collections of residential buildings, larger apartment schemes and/or retail, commercial or educational facilities. Grey water recycling is also more cost effective for larger multiple occupancy or large non-residential buildings. All such features will need to be considered across the proposed development to help meet the requirements of Water Neutrality.

4.1.4 However, it is evident that any new development will ultimately increase water supply demands, even if all practical measures are taken to reduce and re-use to limit Per Capita Consumption (PCC). As such, Water Neutrality also includes for an offsetting mechanism that effectively means new development contributing to the retrofitting of measures to existing development, such as the installation of smart meters or the retrofitting of rainwater harvesting and/or grey water recycling to existing buildings. The aim would be to reduce PCC elsewhere within the same Water Resource Zone to offset the increase in water usage from the new development. This would essentially be a form of roof tax to fund improvements elsewhere in the Water Resource Management Area.

4.1.5 The specific details of offsetting requirements cannot be defined at this stage. The requirement is for the Local Authority to develop and publish a strategy identifying which parts of their

administrative area would most benefit from this offsetting and by undertaking research into the most cost-effective ways of delivering this retrofitting. These cost estimates would then be used to determine offset contributions rates from new development. It is understood that such a strategy is yet to be defined.

4.1.6 It is recommended that a neutrality statement be prepared as part of the development at Cambridge North, providing a commitment to follow the reduce, re-use and offset mantra through the installation of appropriate measures across the site.

5 Limitations

5.1 Purpose

5.1.1 This document has been prepared for Brookgate Land Ltd for their sole and specific use.

5.1.2 PJA Civil Engineering Ltd. accepts no responsibility or liability for any use that is made of this document other than by Brookgate Land Ltd for the purposes for which it was originally commissioned and prepared.

5.1.3 The conclusions and recommendations contained herein are limited by the availability of background information and the planned use for the Site.

5.1.4 Third party information has been used in the preparation of this report, which PJA Civil Engineering Ltd, by necessity assumes is correct at the time of writing. Whilst all reasonable checks have been made on data sources and the accuracy of the data, PJA Civil Engineering Ltd accepts no liability for same.

5.1.5 PJA Civil Engineering Ltd. has no liability regarding the use of this report except to Brookgate Land Ltd.

5.2 CDM

5.2.1 The revised Construction (Design and Management) Regulations 2015 (CDM Regulations) came into force on April 2015 to update certain duties on all parties involved in a construction project, including those promoting the development. One of the designer's responsibilities under clause 9 (1) is to ensure that the client organisation, in this instance Brookgate Land Ltd, is made aware of their duties under the CDM Regulations.

5.3 Copyright