

# **Cooling Tower Water Recycling - Innovation Report**

**Bloomberg London**

103938/KW/010817  
Revision 01

**SWECO** 

Issue	Date	Reason for Issue	Prepared		Checked		Approved	
01	Aug 2017	For information (BREEAM 2014)	KW	08/17	TCF	08/17	AJD	08/17

**Cooling Tower Water Recycling - Innovation Report**

103938/KW/010817

Revision 01

**Sweco**

1 Bath Road  
Maidenhead  
Berkshire  
SL6 4AQ

+44 (0)1628 623 423

building.services@sweco.co.uk

sweco.co.uk/our-offer/building-services

© Sweco 2010 This document is a Sweco confidential document; it may not be reproduced, stored in a retrieval system or transmitted in any form or by any means, electronic, photocopying, recording or otherwise disclosed in whole or in part to any third party without our express prior written consent. It should be used by you and the permitted discloses for the purpose for which it has been submitted and for no other.

Registered Office: Sweco UK Limited, Grove House, Mansion Gate Drive, Leeds, LS7 4DN. Company Registration No 02888385

# Contents

1.	Executive Summary .....	4
2.	Introduction .....	5
2.1	Overview .....	5
2.2	The Problem.....	5
2.3	The Benefits .....	6
2.4	The Solution .....	6
3.	The Design .....	7
3.1	Recycling Strategy.....	7
4.	The Benefits .....	9
5.	Why Innovative? .....	10

## 1. Executive Summary

This report provides a summary of the **Cooling Tower Water Recycling** solution, also is an abstract from a BREEAM Innovation credit application for the North Building of the Bloomberg London development.

The development provides a mix of office and retail space in the City of London. Located between the Bank of England and St Paul's Cathedral, the site provides approximately 1 million square feet of sustainable office space, two new public spaces featuring specially commissioned works of art, a retail arcade that will reinstate an ancient Roman travel route, and an anticipated cultural hub that will restore the Temple of Mithras to its original site.

The application of cooling tower technologies result in a significant uplift in chiller efficiencies, through the process of rejecting heat to atmosphere via water. This process enables this heat rejection to occur at or near wet-bulb temperatures, instead of at the higher dry-bulb temperature in the case of air-cooled chillers, thus increasing overall chiller efficiency.

Despite this obvious benefit, the cooling towers' Achilles heel is that large quantities of water are required for them to operate as designed. Inevitably, this water is traditionally sourced from potable water sources, thereby increasing the demand for, and use of, potable water.

The **Cooling Tower Water Recycling** solution developed for Bloomberg London North employs innovative techniques that ensure **all** bleed off back-wash water that would be expelled to drainage in conventional cooling tower designs, is instead recycled. This is equivalent to over **two** Olympic-size swimming pools of potable water for each year of operation.

This innovative solution is believed to be unique for commercial office buildings in the UK, and should provide the industry with a strong case study that can help drive future development of these techniques. For these reasons, the **Cooling Tower Water Recycling** solution developed for Bloomberg London North is considered to be an innovation in sustainability and the environmental design of buildings.

**The *Cooling Tower Water Recycling* solution for Bloomberg London was awarded an Applied Innovation credit under the BREEAM 2014 New Construction (non-domestic) scheme**

## 2. Introduction

Bloomberg London is a new development in the City of London comprising two high-grade specification buildings (namely the North and South Buildings), with retail units at ground floor level. When completed, it will provide approximately 1,000,000 ft<sup>2</sup> of office and retail space and includes a new entrance to the London Underground at Bank station.



*Fig. 1* Location of the Bloomberg London Development

### 2.1 Overview

Bloomberg London North Building utilises cooling towers, located at roof level, to reject waste heat from the main chiller and combined cooling heating and power (CCHP) plant to atmosphere. The standard application of cooling towers makes use of mains water to reject this waste heat, with the bleed off back-wash from this process typically expelled through conventional drainage.

In order to lead the sustainable principles of the project, the design team for Bloomberg London recognised the need for achieving better and more efficient water usage systems, in order to reduce the consumption of potable water. To this end, a number of innovative solutions were developed and specified, including **Cooling Tower Water Recycling**.

### 2.2 The Problem

Tackling excessive water consumption is a priority for sustainable development. Potable water is used typically for all sorts of processes beyond the obvious and necessary requirement for those connected to human consumption. Processes at work in typical building designs that require the use of water include those connected to sanitary (e.g. WC flushing), as well as servicing HVAC systems.

Although cooling towers can result in a significant uplift in chiller efficiencies, the disadvantage remains that they require large quantities of water in order for them to

# 02

## Introduction

operate as designed. Inevitably, this water is traditionally sourced from potable water sources, thereby increasing the demand for, and use of, potable water. For development such as Bloomberg North Building, the quantities of potable water that would be needed to operate the cooling towers would be significant.

Other risk elements to using large amounts of potable water for mechanical systems include the exacerbation of the challenges associated with drainage, and the contribution to flooding risks.

In light of these concerns, the design team felt it necessary to develop solutions which, through their innovative approach, would significantly reduce the consumption of water.

### 2.3 **The Benefits**

Despite the challenges related to reducing water usage, the design team recognised at an early stage the potential benefits such solutions could bring. In summary, these benefits are:

- Significant reduction in the consumption of potable water for HVAC services
- Reduction in potable water costs
- Reduction in drainage costs
- Alleviation of pressures placed on ageing drainage systems
- The preservation of finite potable water supplies
- Significant contribution to reducing the risks associated with flooding

The potential benefits identified by the design team were assessed to be considerable. This acknowledgement led the team to explore how best these benefits could be realised. One of the solutions developed to this end was the ***Recycling of Cooling Tower Water***.

### 2.4 **The Solution**

The solution developed addresses the significant water consumption associated with operating cooling towers. The innovative technique recycles all the bleed off back-wash waste water from the cooling towers, to be used again in either the cooling towers themselves, or in other processes such as WC flushing.

This solution is in addition to other significant water saving measures that will reuse grey water sourced from systems such as hand-wash basins and cycle showers.

This innovative solution is believed to be the first of its kind in a commercial application in the UK.

## 3. The Design

The Bloomberg North Building utilises cooling towers for heat rejection purposes from the main chiller and CCHP plant.

Cooling towers operate by utilising the effects of evaporative cooling.

Whilst this results in significant increases in associated chiller efficiencies, the towers themselves consume large quantities of water.

A lot of this water is expelled to atmosphere, through its evaporation, and is often observable as a plume of water vapour.

There is however a significant quantity of water that is washed-back, to be expelled to drainage in conventional designs. This bleed off is typically around 20% of the total water consumption of cooling towers. These significantly amounts of water were identified as being valuable by-products that could be recycled.

### 3.1 Recycling Strategy

The back-wash water from the cooling towers will be recycled for use in both the cooling towers themselves, as well as for storage alongside other grey water (which will be harnessed from sources such as hand wash basins and cyclists' showers).

The anticipated approximate proportions of recycled cooling tower water will be as below.

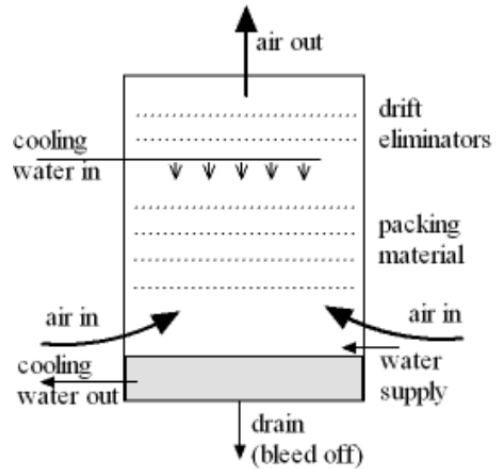


Fig. 1 Cooling tower operation

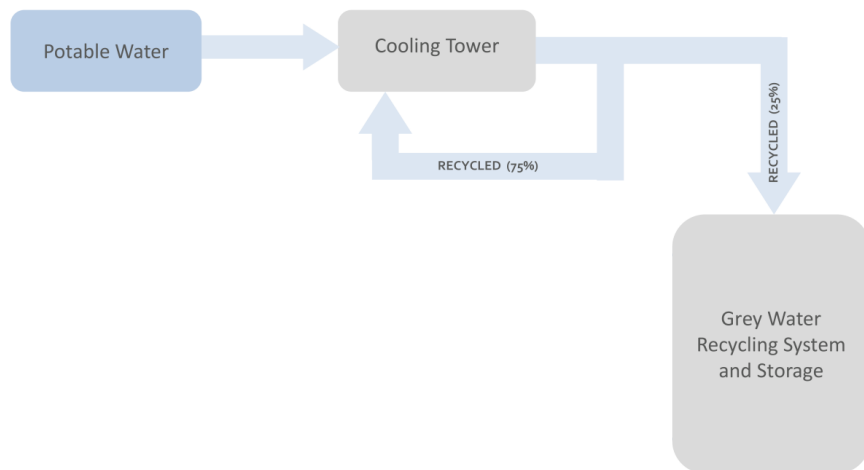


Fig. 2 Recycling of cooling tower waste water

# 03

## The Design

Grey water storage is located centrally in basement level B3 and will serve other water consuming processes that do not require the use of potable water, such as WC flushing.

It is anticipated that the savings in potable water will amount to:

- Over 5,200m<sup>3</sup> per year in potable water consumption for the cooling towers, equivalent to over **two** Olympic-size swimming pools
- Over 1,700m<sup>3</sup> per year in potable water consumption as contribution for the flushing of WCs

These significant reductions in the consumption of potable water will ensure Bloomberg London North Building delivers sustainability benefits throughout its operational life.



# 04

## The Benefits

### 4. **The Benefits**

The innovative nature of the **Cooling Tower Water Recycling** system developed for Bloomberg London North Building will generate significant benefits across a range of measures. In summary, these benefits are:

- Significant reduction in the consumption of potable water for HVAC services
- Significant reduction in the consumption of potable water for WC services
- Reduction in potable water costs
- Reduction in drainage costs
- Significant contribution to reducing the risks associated with flooding
- Providing a case study for the industry as a whole to enable further developments in this field, as well as demonstrate the applicability and benefits that can be accrued through this design

The variety of benefits is considerable in nature and will contribute to the delivery, both for current operation as well as in the future, of tangible sustainability benefits throughout the building's lifespan.

## 5. Why Innovative?

The design should be considered **Innovative** for the following reasons:

- A technique that is believed to be the **first** of its kind anywhere in the UK in a commercial application.
- The innovative solution will reduce the water consumption of Bloomberg London North building by over **two Olympic**-sized swimming pools, each and **every year**.
- The application of this technology will act as a **case study** for the wider industry, helping to drive innovations in the sustainable use of water.
- A significant contribution will be made to **reducing** the **risks** associated with drainage capacity and **flooding**.

	Innovative	Cooling Tower Water Recycling	Bloomberg North Building
Technique that is <b>first</b> of its kind in the UK	✓	✓	✓
Reducing water consumption by over <b>two Olympic</b> -sized swimming pools, <b>every year</b>	✓	✓	✓
<b>Case study</b> for the industry	✓	✓	✓
<b>Reducing</b> the <b>risks</b> associated with drainage and <b>flooding</b>	✓	✓	✓

The **Cooling Tower Water Recycling** solution for Bloomberg London should be considered innovative, and was awarded an Applied Innovation credit under BREEM 2014 New Construction (non-domestic) scheme