# BREEAM International New Construction 2016

## Data Centre Annex- Pilot v0.0

## Revised issues and supporting information – SD233 – Annex 1

# Contents

# Introduction and scope

The BREEAM International New Construction 2016 scheme can be used to assess the environmental life cycle impacts of new buildings at the design and construction stages. 'New Construction' is defined as development that results in a new standalone structure, or a new extension to an existing structure, which will come into operation or use for the first time upon completion of the works.

These annexes assess the design and construction of new-build data centres and data centre extensions against the SD233: BREEAM International NC 2016 manual.

- Annex 1 contains new and revised issues that completely replace issues within SD233, and also includes background information and useful definitions.
- Annex 2 is an overview of all changes to the technical criteria within SD233. In most cases it contains minor modifications to existing technical issues, however where these are major changes, it refers to Annex 1 for the full text.

Both annexes **must be used** in conjunction with the SD233: BREEAM International NC 2016 manual for all assessments.

## What is a data centre?

CLC/TR 50600-99-1:2019 defines a data centre as a:

*Structure, or group of structures, dedicated to the centralised accommodation, interconnection and operation of information technology and network telecommunications equipment providing data storage, processing and transport services together with all the facilities and infrastructures for power distribution and environmental control together with the necessary levels of resilience and security required to provide the desired service availability.*

## Types of data centre

### Data centre types assessed

This annex is designed to assess any data centre where the operator has control over the design, construction and operation of the building and M&E systems. These typically include:

**Co-location**
A data centre where the owner of the building rents out space, power and cooling for customers to place and operate their own IT equipment.

**Enterprise**
A data centre entirely owned and operated by an organisation.

**Hyperscale**
Large facilities carrying out demanding and scalable computing loads. Many hyperscale operators provide data centres for cloud computing, search engine and social media services. The term refers only to the size of the facility, not its function or how it is operated.

**Managed service provider**
A data centre where the operator owns and operates their own IT equipment and sells processing capacity as a service.

**Network operator**
A data centre whose primary purpose is the delivery and management of broadband services to the operator's customers.

### Data centre types excluded

**Co-location customers**
**Managed service providers in co-located space**
Customers of co-location data centres who only have control over their own IT equipment.

**Mobile data centres**
Portable and deployable data centres built as self-contained modules.

**Data centres serving other functions with majority impacts**
This annex is not designed for the assessment of facilities where the principal function and majority environmental impact is not focused on data centre operation. For instance, this includes server rooms and IT facilities in offices. Where this is unclear please contact BRE Global for a scheme classification.

# Assessment boundaries

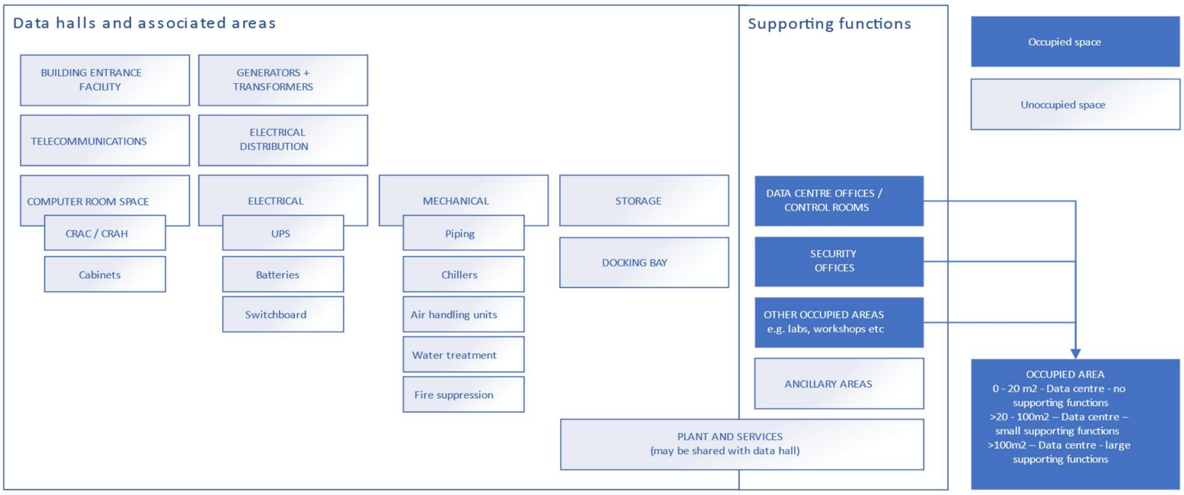


*Figure 1: Assessment boundaries*

The assessment is split between the **data hall** and **supporting functions**.

- The data hall contains all IT equipment and supporting infrastructure required for its normal operation.
- The supporting function are the occupied, staffed areas of the building and all associated functions and services.

Criteria within this annex will often differentiate between data halls and supporting functions. In all cases all relevant criteria must be achieved for relevant credits to be awarded.

## New extensions to existing data centres

This criteria annex can be used to assess new extensions to existing data centres.

- Where the extension is connected to services and facilities in the existing building, the assessment is carried out against the performance of the existing services, or on a site-wide basis (depending on the BREEAM issue)
- Where the extension is a standalone construction, the assessment is carried out against the services and facilities in the extension only.

## Assessment of IT equipment

While this annex focuses on the building and building services which can play a significant role in facilitating IT equipment efficiency, the assessment of IT equipment is out of scope of this document.

It is recommended that, where relevant, operators follow the full guidance relating to IT equipment in CLC/TR 50600-99-1:2019, CLC/TR 50600-99-2:2019 and consider becoming a member of the EU Code of Conduct for Data Centre Energy Efficiency scheme.

For further details on participation within this scheme, please refer to the end of this document.

# Assessment types

Assessments are differentiated in three ways, and may be in any combination of the below:

## Size of supporting function

There are three supporting function levels assessed is this annex:

- **No supporting function**
- **Small supporting function**
- **Large supporting function**

Use the table as a guide to determine the most appropriate assessment type:

| | No supporting function | Small supporting function | Large supporting function |
|---|---|---|---|
| On-site security staff | Yes | Yes | Yes |
| On-site data centre staff | No - staff only on site when physical changes / maintenance is required. | Yes | Yes |
| Occupied area (NIFA) | Approx. 0 – 20 m2 | Approx. 20 - 100 m2 | Over 100 m2 |
| Example scenario | Unmanned facility with only security presence and a small security office. | Facility with a small office for permanent on-site staff. | Facility with larger offices for permanent on-site staff. May incorporate other functions e.g. laboratories or manufacturing. |

*Table 1: Characteristics of supporting function sizes*

The categories are given as a guide only and reflect the typical level of human occupancy in the data centre facility which, in turn, impacts on the weightings and applicable credits for the Health & Wellbeing and Transport categories. It is up to the assessor and design team to determine the most appropriate classification to apply to the assessment, and a degree of judgement may be used where the supporting function does not exactly meet the requirements above.

Further details on the impact on weightings can be found in the Building Development Details section of SD233 – Annex 2.

## Fit-out level

There are two fit-outs levels assessed in this annex:

- **Fully fitted**
- **Fully fitted with shell and core supporting functions**

Data hall criteria do not change depending on the fit-out level chosen. This document assumes that all data halls are fitted with the required mechanical, electrical, security, fire and environmental protection systems necessary for the installation of IT equipment, without construction of any additional infrastructure by tenants or occupiers.

This annex cannot not assess shell and core data halls which only contain partially completed or capped services. However, supporting functions may be assessed against shell and core criteria where appropriate.

| Fit-out option | Data halls | Supporting functions |
|---|---|---|
| Fully fitted | Assessed against data hall criteria in this annex. | Assessed against fully fitted criteria in the technical manual. |
| Fully fitted with shell and core supporting functions | | Assessed against shell and core criteria in the technical manual. Relevant fully fitted credits in technical manual are omitted. |

*Table 2: Data centre fit-out levels*

## Cooling system strategy

Data centres may use either open or closed loop cooling to cool IT equipment.

**Open loop cooling**
Open loop cooling systems utilise evaporative cooling, which may mean significant water consumption. Specific criteria have been written in this annex to deal with water consumption as an industrial process, and the water weighting is increased to recognise this.

**Closed loop cooling**
Closed loop cooling does not use evaporative cooling, and results in minimal water loss. In this scenario most of the standard criteria in the technical manual applies in the water section.

Please refer to SD233 – Annex 2 and to the new issues in this document for more information on the modifications to the criteria.

# Other assessment types

## Mixed use developments

Data centres within a mixed-use development/building can be assessed using this annex, provided the data centre area is separable from the other mixed-use elements of the building.

## Refurbishment, or part new-build / part refurbishment projects

This annex cannot assess the refurbishment or retro-fit of data centres. New-build extensions to refurbishment projects may be assessed.

## Similar buildings on the same site

It is possible to assess multiple similar data centres on one site. Please refer to *GN10 Assessing mixed-use schemes and developments with multiple buildings or units on the same site* for further guidance.

# Weightings

In all data centre assessments, the relative weighting of the Energy category is significantly increased to reflect the primary focus on energy efficiency of this annex. However, both the supporting function size and cooling system strategy modify other weightings and applicable credits related to the Water, Health and Wellbeing and Transport categories. Therefore, fixed weightings are not possible and must be calculated individually for each facility by BRE. Once a project is registered and all relevant building details have been entered into the online scoring and reporting tool, please contact BRE Global confirming the country of assessment to define custom weightings.

# Alignment with CLC/TR 50600 series

This annex uses the terms and definitions of the CLC/TR 50600 series of standards. This is a series of standards that take a holistic approach to the design and construction of data centres and addresses a wide range of considerations such as construction, power, cooling, resilience and management.

CLC/TR 50600-99-1:2019 for energy efficiency is based on the EU Code of Conduct for Data Centre Energy Efficiency (EU CoC), a freely available best practice guide to energy efficiency in data centres. These are parallel documents whose meaning and intended outcome are identical. However, their exact wording may differ, and they follow different update and revision cycles.

For the purposes of robustness and clarity, where requirements between the two documents differ, the CLC/TR standard should be used as the absolute reference when determining compliance against the requirements in Ene 01. These are approved at an international level, localised into multiple languages, and are available from national standards bodies.

Nonetheless, where design teams have a strong preference for using the EU CoC, performance in Ene 01, it may be used. Evidence needs to be provided which fully cross-references the requirements of the two documents, and it must be demonstrated that the intent of the requirements are identical and have been achieved.

The EU Code of Conduct for Data Centre Energy Efficiency is available in English and can be downloaded at:

https://e3p.jrc.ec.europa.eu/publications/2019-best-practice-guidelines-eu-code-conduct-data-centre-energy-efficiency

## Participating in the EU CoC

Operators wishing to become a participant in the EU CoC can apply by reviewing the following supporting documentation.

- Introductory Guide
- Participant Guidelines
- Endorser Guidelines

The introductory guide clarifies the roles of Participant and Endorser, and both guideline documents include registration forms which can be sent to:

**Paolo Bertoldi**

European Commission - DG JRC
TP 450, I-21020 Ispra (VA), Italy
Tel. +39 0332 78 9299 (secretary 9145)
Fax. +39 0332 78 9992

E-mail: paolo.bertoldi@ec.europa.eu

An application will be evaluated within 40 working days of receipt.

# Relevant definitions

This section is split into four parts:

- **Abbreviations**
- **General definitions** - used in relation to BREEAM criteria and requirements in this annex.
- **Energy** – definitions relevant for the assessment of data centre energy efficiency.
- **Water** – definitions relevant for the assessment of water stewardship.

These definitions span multiple issues and are placed here to avoid unnecessary duplication. New terms relevant to Pol 06 are relevant only to that issue and are provided separately there.

## Abbreviations

**ASHRAE**
American Society of Heating, Refrigeration, and Air Conditioning Engineers

**CRAC / CRAH**
Computer Room Air Conditioning / Computer Room Air Handling

**DC**
Data Centre

**ERF**
Energy Re-use Factor

**EU CoC**
EU Code of Conduct for Data Centre Energy Efficiency

**IoT**
Internet of Things

**IT / ICT**
Information Technology / Information and Communications Technology

**NT**
Network Telecommunications

**PDU**
Power Distribution Unit

**PUE**
Power Usage Effectiveness

**UPS**
Uninterruptible Power Supply

**HVAC**
Heating Ventilation and Air Conditioning

**RE**
Renewable Energy

**REF**
Renewable Energy Factor

**WUE**
Water Usage Efficiency

 

# General definitions

**Best available technology**
A method, technique or procedure that has been shown by research and experience to produce optimal results, and that is established or proposed as being suitable for widespread adoption.

**Data centre criteria annex**
This document allows the assessment of the design and construction of new-build data centres and data centre extensions against the SD233: BREEAM International NC 2016 manual. These documents should be used in conjunction with the BREEAM International New Construction 2016 manual.

**Data hall**
For the purpose of the BREEAM assessment, this includes the 'computer room space' (see Energy definition) and all associated infrastructure required for its operation.

**Disclosure**
Making data or information available to external stakeholders. These may be the general public or specific stakeholders such as regulators, neighbours, customers or civil society representatives. The disclosure should be in a form that is comprehensible and accessible to the target stakeholders in terms of format, detail, terminology and language. Examples include press releases, sustainability reports, company website or sending directly to target stakeholders. *Source: Alliance for Water Stewardship 2.0*

**Fully fitted (supporting function)**
New build works which include:

- Fabric and structure.
- Core services (services that supply multiple areas and/or tenants and will generally be centralised plant).
- Local services (services that supply a specific area and may connect into the distribution systems from the core services within the tenanted area).
- Interior design (finishes, partitions, fittings).

**Fully fitted (data hall)**
Data halls fitted with all mechanical, electrical, security, fire and environmental protection systems necessary for the installation of IT equipment, without construction of any additional infrastructure by tenants or occupiers.

**Manual**
In this annex, this refers to the SD233: BREEAM International New Construction 2016 scheme manual.

**Occupied space**
A room or space within the assessed building that is likely to be occupied for 30 minutes or more by a building user.

**Relevant specialist**
This term is used within the criteria to designate the appropriate specialist who is suitably competent to advise the design team on achieving the intent of the criteria. Depending on the issue, this term encompasses, but is not limited to:

- Building services specialist
- Cooling specialist
- M&E consultant
- Water consultant

**Resilience (structure and fabric)**
The ability of a building, structural system or material to withstand an incident (e.g. accidental, exceptional loading or other incident) without experiencing an undue degree of damage or decrease in performance, such that progressive collapse, loss of performance or a disproportionate degree of damage occurs. The ability of a structure to withstand an increased burden of weather, increased pressure or hazards associated with climate change.

Examples of increased pressures or hazards include:

- Solar radiation.
- Temperature variation.

- Water or moisture.
- Wind.
- Precipitation, e.g. rain and snow.
- Extreme weather conditions: high wind speeds, flooding, driving rain, snow, rainwater ponding.
- Subsidence or ground movement.

**Shell Only**
Only new build works to the fabric, substructure and superstructure of the building, including:

- External walls, windows, doors (external), roof, core internal walls, structural floors.
- Hard and soft landscaping areas (where present and within the scope of works).

**Shell and Core**
As Shell Only, plus core building services. Core building services relate to the installation of central or communal transport systems, water systems, fit-out of common areas, central mechanical and electrical systems, including HVAC, but without local fitting of systems within tenant areas. The systems will typically be centralised with capped-off distribution to each tenanted area (for future connection as part of a tenant's fit-out works).

**Supporting functions**
Function areas provided to support the principal function (data centre) and its occupants. A supporting function does not operate wholly independently of the principal function.

These include:

- Reception and waiting areas.
- Office areas (including meeting and training rooms).
- Workshops, classrooms, laboratories.
- Staff catering / kitchen facilities.
- Restrooms, WCs and changing facilities.
- Ancillary areas e.g. staff storage, waste management areas, circulation space.

The above list is not exhaustive but serves to indicate the type of areas covered by the scope of this annex. Where a proposed building contains a small additional function or area that is not listed above, the building can still be assessed using this scheme. If in doubt, BRE Global should be contacted for advice.

Note 1: The net internal floor area of these spaces is used as a proxy for the occupancy of the data centre and is used to determine the relative weightings of the Hea and Tra categories.

# Energy Definitions

These definitions are sourced from the CLC/TR 50600 series of standards and are relevant for the assessment of the Energy category. The sources for other definitions relevant to the Energy category, but not sourced from 50600 series, are defined where relevant.

## Data centre performance metrics

**PUE (power usage effectiveness)**

$$\text{PUE} = \frac{E_{\text{DC}}}{E_{\text{IT}}}$$

**$E_{DC}$:** Total data energy consumption (annual) in kWh
**$E_{IT}$:** IT equipment energy consumption (annual) in kWh

PUE is a standard measure of a data centre's energy efficiency as a ratio of overall data centre energy consumption vs IT equipment energy consumption.

*Source: CLC/TR 50600-4-2:2016 + A1:2019*

**WUE (water usage effectiveness)**

$$\text{WUE} = \frac{\text{Annual Water Usage}}{\text{IT Equipment Energy}}$$

WUE is a measure of the efficiency of net water use within a data centre, measured in l/kWh.

A new ISO KPI is currently being drafted which will expand on WUE to encompass different boundaries for this metric and expand its scope beyond the data centre facility.

*Source: https://www.thegreengrid.org/en/resources/library-and-tools/238-Water-Usage-Effectiveness-%28WUE%29%3A-A-Green-Grid-Data-Center-Sustainability-Metric-*

**ERF (energy re-use factor)**

$$ERF = \frac{E_{\text{Reuse}}}{E_{\text{DC}}}$$

**$E_{Reuse}$:** Energy from the data centre (annual) that is used outside of the data centre and which substitutes partly or totally energy needed outside the data centre boundary.
**$E_{DC}$:** Total data centre energy consumption (annual).

ERF measures the extent to which waste energy from the data centre (usually in the form of heat) can be re-used for other uses.

*Source: CLC/TR 50600-4-6:2019 (This is currently a draft standard designated as 19/30393060 DC, and contents are subject to change)*

**REF (renewable energy factor)**

$$\text{REF} = \frac{E_{\text{ren}}}{E_{\text{DC}}}$$

**$E_{ren}$:** Renewable energy in kWh owned and controlled by a data centre (i.e. any energy for which the data centre owns the legal right to the environmental attributes of renewable generation) including that:

a) generated on-site of the data centre and whose legal rights to the environmental attributes of RE are retired in the data centre (so, that is no longer a contractual instrument to be traded, or that is no longer a possession of the last owner or the renewable certificate system administrator).
Note 1: "Retired" is an official term that means "consumed".
b) obtained by procurement of RE certificates and retired in the data centre.
c) portion of utility electricity, defined as RE. This is provided the data centre has obtained documented written evidence from the source utility provider(s) of the energy supplied, for the reporting period in question.
Note 2: This excludes RE generated in a data centre site but whose legal rights to the environmental attributes of RE were sold to other parties or the market.
BREEAM note: b and c are not currently recognised in the BREEAM family of schemes.

**$E_{DC}$:** The total data centre energy consumption (annual) in kWh.

REF measures the proportion of energy consumed by the data centre that is renewable, generated either on-site or off-site.

*Source: CLC/TR 50600-4-3:2016 / A1:2019*

## Relevant definitions

**Access floor**
System consisting of completely removable and interchangeable floor panels that are supported on adjustable pedestals connected by stringers, to allow the area beneath the floor to be used by building services.

**Adiabatic cooling**
Adiabatic cooling is a cooling system that is using the evaporative cooling principle to reduce the air temperature.

**Airflow pathway**
Route taken by air to reach a specific point.

**Availability**
Ability of an item to be in a state to perform a required function under given conditions at a given instant of time or over a given time interval, assuming that the required external resources are provided.

**Cabinet**
Enclosed construction for housing closures and other information technology equipment. See also 'rack'.

**Capacity (total)**
Maximum capacity the data centre was designed for at full use in terms of e.g. space, power and cooling.

**Capacity (used)**
The data centre´s actual capacity used by the IT and facility in terms of e.g. space, power and cooling.

**Capacity management**
Process for monitoring, analysis, reporting and improvement of capacity.

**Co-location data centre**
Data centre in which multiple customers locate their own network(s), servers and storage equipment.
Note 1: The support infrastructure of the building (such as power distribution and environmental control) is provided as a service by the data centre operator.

**Comfort environmental controls**
Controls which produce an environment which is appropriate for the effective performance of personnel in a given space

**Computer room space**
Area within the data centre that accommodates the data processing, data storage and telecommunication equipment that provides the primary function of the data centre.
BREEAM Note: In this criteria annex the term ‘data hall’ is synonymous with this definition.

**Computer Room Air Conditioning / Air Handling (CRAC / CRAH)**
Equipment that provides cooling airflow volumes into a computer room as a means of environmental control.

**Control room space**
Area within the data centre used to control the operation of the data centre and to act as a central point for all control and monitoring functions.

**Cooling economiser**
System to enable the use of cool external conditions to provide cooling to internal data centre spaces without the use of mechanical cooling or refrigeration.

Note 1: Also referenced as “free cooling”.
Note 2: Free cooling / economised cooling designs take advantage of cool ambient conditions to meet part or all of the facilities’ cooling requirements so that the dependency on any form of mechanical cooling including compressors is reduced or even removed entirely, which can result in significant energy reduction.
Note 3: The opportunities for the utilisation of free cooling are increased in cooler and dryer climates and where increased temperature set points are used. Where refrigeration plant can be reduced in size (or eliminated), operating and capital cost are reduced, including that of the required supporting electrical infrastructure.
Note 4: Free cooling can be retrofitted to some facilities.

**CLC/TR 50600 series**
A compilation of recommended practices for improving the energy management (i.e. reduction of energy consumption and / or increases in energy efficiency) of data centres. *Source: British Standards Institute*
BREEAM note: The CLC/TR 50600 series is a series of standards that take a holistic approach to the design and construction of data centres.

It addresses a wide range of considerations such as construction, power, cooling, resilience and management. For consistency, the terms and definitions used in this criteria annex are aligned with this set of standards.

**Data centre**
Structure, or group of structures, dedicated to the centralised accommodation, interconnection and operation of information technology and network telecommunications equipment providing data storage, processing and transport services together with all the facilities and infrastructures for power distribution and environmental control, together with the necessary levels of resilience and security required to provide the desired service availability.

Note 1: A structure can consist of multiple buildings or spaces with specific functions to support the primary function.
Note 2: The boundaries of the structure or space considered the data centre which includes the information and communication technology equipment and supporting environmental controls can be defined within a larger structure or building.

**Direct liquid-cooled ICT equipment**
ICT equipment that is cooled by a direct flow of liquid into an equipment cabinet or directly to the ICT equipment chassis to provide cooling rather than the use of moving air.

**Downtime (planned)**
Period of time during which a system or sub-system does not provide functional capability whilst it undergoes maintenance or is switched off to test the response of a related system or sub-system.

**Downtime (unplanned)**
Time taken, following a failure of functional capability, to repair the relevant infrastructure together with the "re-boot" time necessary to recover functional capability following that repair.

**Electrical space**
Area within the data centre used for housing facilities to deliver and control electrical power to the data centre spaces (including switchboards, batteries, uninterruptible power supplies (UPS) etc.)

**EU Code of Conduct for Data Centre Energy Efficiency**
[The EU Code of Conduct] has been created in response to the increasing energy consumption in data centres and the need to reduce the related environmental, economic and energy supply security impacts. The aim is to inform and stimulate data centre operators and owners to reduce energy consumption in a cost-effective manner without hampering the mission critical function of data centres. The Code of Conduct aims to achieve this by improving understanding of energy demand within the data centre, raising awareness, and recommending energy efficient best practices and targets. *Source: EU Joint Research Council*
BREEAM note: It is free to download and view here: https://e3p.jrc.ec.europa.eu/publications/2019-best-practice-guidelines-eu-code-conduct-data-centre-energy-efficiency

**Exhaust air temperature**
The temperature of the air leaving the data centre building or the temperature of the air leaving the heat load.

**Free cooling**
See 'cooling economiser.'

**Generator space**
Area used for housing the installation of electrical power supply generation equipment together with associated storage of fuels or energy conversion equipment.

**Heat load**
Thermal power that is produced.

**Hot aisle / cold aisle**
Construction of cabinets and containment intended to prevent the mixing of ICT equipment intake and exhaust air within computer room space(s).

**Hyperscale data centre**
- A Hyperscale (or Enterprise Hyperscale) data centre is a facility owned and operated by the company it supports.
- They offer robust, scalable applications and storage portfolio of services to individuals or businesses.
- Hyperscale computing is necessary for cloud and big data storage.
- Has anywhere from 500 Cabinets upwards, and at least 10,000sq ft. in size.
- Usually have a minimum of 5,000 servers linked with an ultra-high speed, high fibre count network. *Source: AFL Hyperscale*

BREEAM note: There is currently no clear definition of a hyperscale data centre, but they represent the largest data centres on the market, carrying out demanding and scalable computing loads such as cloud computing, search engines and social media.

**Information communication technology equipment**
Information technology (IT) and network telecommunications (NT) equipment providing data storage, processing and transport services.

**Infrastructure (data centre)**
Technical systems providing functional capability of the data centre (e.g. power distribution, environmental control and physical security).

**IT load**
Electrical consumption of all the information technology equipment measured at its input terminals including all on-board integrated supplies and cooling fans.

**Managed service (provider)**
Data centre operated to provide a defined set of services to its clients either proactively or as the managed service provider (not the client) determines that services are needed.

**Mechanical space**
Area that is used for housing mechanical equipment and infrastructure that provides environmental control for the data centre spaces (including chillers and water treatment, air handling and fire suppression systems).

**Modular construction**
Method which uses standardized prefabricated construction elements.

**Network operator data centre**
Data centre that has the primary purpose of the delivery and management of broadband services to the operator's customers.

**Power Distribution Unit**
A device fitted with multiple outputs designed to distribute electric power from the UPS to racks of computers and networking equipment located within a data centre.

**Primary distribution equipment**
Equipment which is required to manage, control and convert incoming power supplies (primary, secondary and, where appropriate, additional) in a form suitable for distribution by secondary distribution equipment.

**Primary supply**
Principal power supply that provides power to the data centre under normal operating conditions.

**Rack**
Open construction, typically self-supporting and floor-mounted, for housing closures and other information technology equipment.

**Relative humidity**
Ratio, expressed as a percentage, of the vapour pressure of water vapour in moist air to the saturation vapour pressure with respect to water or ice at the same temperature.

**Renewable energy source**
Energy source not depleted by extraction as it is naturally replenished at a rate faster than it is extracted.
Note 1: Renewable energy source excludes recovered or wasted energy.
Note 2: Organic fractions of municipal waste may be considered a renewable energy source.
Note 3: Whether the energy stored in a technical system is renewable or not depends upon the nature of the renewable energy source.
BREEAM Note: BREEAM does not consider the use of nuclear energy to be renewable.

**Resilience (data centre)**
Capacity to withstand failure in one or more of the ICT equipment or data centre infrastructures.

**Return air temperature**
Temperature of the air re-entering the environmental control system e.g. the air handling unit.

**Secondary supply**
Power supply independent from, and that is continuously available to be used to provide power to the data centre following the disruption of, the primary power supply.
Note 1: a second feed to a separate transformer from the same grid is not a secondary supply

**Set-point**
Desired or target value (maximum or minimum) for either temperature or humidity.

**Supply air temperature**
Temperature of the air entering the IT equipment.

**Telecommunications**
Branch of technology concerned with the transmission, emission, and reception of signs, signals, writings, images, and sounds, that is, information of any nature by cable, radio, optical, or other electromagnetic systems.

**Transformer space**
Area used for housing equipment necessary to convert primary electrical circuits to levels appropriate for connection to the equipment within the premises or individual buildings within the premises.

**Uninterruptible Power System (UPS)**
System for maintaining continuity of load power in case of input power failure.

Note 1: Continuity of load power occurs when voltage and frequency are within rated steady-state and transient tolerance bands and with distortion and interruptions within the limits specified for the load. Input power failure occurs when voltage and frequency are outside rated steady-state and transient tolerance bands or with distortion or interruptions outside the limits specified for the UPS.

# Water Definitions

These definitions are largely sourced from the Alliance for Water Stewardship v2.0, however some have been edited for brevity. The sources for other definitions relevant to the Water category, but not from AWS are defined where relevant.

**Abstraction**

The process of taking or extracting water from a natural source (rivers, lakes, groundwater aquifers, etc.) for various uses, from drinking to irrigation, treatment, and industrial applications. *Source: Water 2050.*

**Catchment**
The geographical zone in which water is captured, flows through and eventually discharges at one or more points. The concept includes both surface water catchment and groundwater catchment.

A surface water catchment is defined by the area of land from which all precipitation received flows through a sequence of streams and rivers towards a single river mouth, as a tributary to a larger river, or to the sea.

A groundwater catchment is defined by geological structure of an aquifer and groundwater flow paths. It is replenished by water that infiltrates from the surface. It has vertical thickness (from a few metres to 100s of metres) as well as area. Depending on local conditions, surface and groundwater catchments may be physically separate or interconnected.

"Catchment of origin" refers to a catchment, distinct from the site's catchment(s), where a product or service is manufactured or sourced. It may be anywhere from an adjacent catchment to the other side of the world.

Alternative terms are watershed, basin and river basin.

**Cooling system (closed loop or open loop)**
Closed loop: A cooling system which encloses water completely inside a sealed system and does not evaporate water to dissipate heat.
Open loop: A water-based cooling system which relies on evaporation of water to dissipate heat.
*Source: BREEAM.*
BREEAM note: In this annex, the terms 'closed loop' and 'open loop' refer only to the use of water as a heat transfer medium. Air cooled systems can also be considered closed or open loop, however air flow management is assessed in Energy, and is not considered in the Water category of this annex.

**Discharge**
Water-related discharge from a site, including drainage, wastewater (effluent), used cooling water and irrigation surplus. The quality of discharged waters may range from good to polluted, depending on its origin, its use, and treatments applied.

**Groundwater**
Water below the surface of the Earth stored in pore spaces and fractures within rock or layers of sand and gravel (aquifers). In water resources management the term more specifically applies to water that can be extracted at a viable rate, quantity and quality for human use (with or without treatment). Saline water or water contained in rocks of very low permeability is not conventionally considered groundwater.

**Infrastructure (water)**
Includes all manmade equipment and infrastructure for the abstraction, delivery, storage, treatment and provision of water supply, and for the collection, treatment and discharge of wastewater. It includes boreholes, surface water intakes, pipes, canals, control systems, water tanks and water treatment systems. It may include wetland treatment systems for wastewater. For municipal supply, it includes the distribution system.

**Internet of Things (IoT)**
The interconnection via the Internet of computing devices embedded in everyday objects, enabling them to send and receive data. *Source: Oxford English Dictionary.*

**Make-up water**
Water which is added to compensate for losses, especially losses caused by evaporation.

**Raw water**
Water that has not been purified. *Source: Merriam-Webster dictionary.*
BREEAM Note: Raw water is water found in the environment that has not been treated and does not have any of its minerals, ions, particles, bacteria, or parasites removed. Raw water includes rainwater, ground water, water from infiltration wells, and water from bodies like lakes and rivers.

**Shared water challenge**
A water-related issue, concern or threat shared by the site and one or more stakeholders within the catchment(s). Examples include physical water scarcity, deteriorating water quality and regulatory restrictions on water allocation.

**Site**
The site is the physical area over which the implementing organisation owns or manages land and carries out its principal activities. In most cases it is a contiguous area of land but may also include physically separated but nearby areas (especially if in the same catchment).
BREEAM note: for a data centre, the 'site' is typically represented by the fenced area encompassing all its buildings, parking and storage areas. Where the organisation operates its own water sources and/or wastewater plant, these should also be considered part of the 'site'.

**Stakeholder**
Any organisation, group or individual that has some interest or 'stake' in the implementing organisation's activities, and that can affect or be affected by them. The four main categories of stakeholder are:

- Those who impact on the organisation.
- Those on whom the organisation has (or is perceived to have) an impact.
- Those who have a common interest.
- Neutral - those with no specific link, but with whom it is relevant to inform.

Of most relevance to water stewardship are stakeholders associated with water use and dependency, but engagement should not be limited to these.

**Wastewater**
Used water of reduced quality discharged from a site. It is usually contaminated in its raw state, but should be treated, either on site, or delivered (by pipe or truck) to an authorised wastewater treatment facility. Treated wastewater should be legally compliant and of a high enough quality to present no risk to the receiving water body (or land where applicable). Safe or treated wastewater may be re-used on site, or by other users to reduce original water demand and/or wastewater discharge volumes. Examples of re-use include irrigation of gardens or crops, washing vehicles and other uses not demanding high quality water.

**Water body**
A large physical entity of water, from which many water sources may abstract water. For surface water, this includes rivers, lakes, canals and reservoirs. For groundwater, it is the aquifer.

**Water scarcity**
The lack of sufficient available water resources to meet the demands of water usage within a region for environmental and human needs. Physical water scarcity is when there is insufficient water in natural water bodies. It may be a natural condition (e.g. in arid regions) or may result from excessive water abstractions for human uses. Economic water scarcity is when there is insufficient supply to humans when water is naturally abundant. It is a result of under investment in water supply infrastructure, whether due to poverty or mismanagement.

**Water efficiency**
Water efficiency is the concept of using less net water for an equivalent purpose or volume of production. Methods to improve water efficiency include: technology (e.g. drip irrigation), leakage reduction, re-use and recycling of wastewater.

**Water Framework Directive**
The purpose of the Water Framework Directive is to establish a framework for the protection of inland surface waters, transitional waters, coastal waters and groundwater which:

(a) prevents further deterioration and protects and enhances the status of aquatic ecosystems and, with regard to their water needs, terrestrial ecosystems and wetlands directly depending on the aquatic ecosystems;
(b) promotes sustainable water use based on a long-term protection of available water resources;
(c) aims at enhanced protection and improvement of the aquatic environment, inter alia, through specific measures for the progressive reduction of discharges, emissions and losses of priority substances and the cessation or phasing-out of discharges, emissions and losses of the priority hazardous substances;
(d) ensures the progressive reduction of pollution of groundwater and prevents its further pollution, and
(e) contributes to mitigating the effects of floods and droughts

The EU Water Framework Directive-Integrated river basin management for Europe: https://ec.europa.eu/environment/water/water-framework/index_en.html". *Source: Water 2050.*

**Water (mass) balance**
An assessment of all water flows and storage volumes of an entity. The assessment should measure all water inflows, throughflows, outflows, water storage volume and changes in storage.

The first step is to identify and map each component, and then to quantify it. These are combined into the water balance equation, which should balance (at least approximately):

*water outflow = water inflow + change in storage*

Sustainable water balance is the condition whereby ongoing water use in the catchment has no long-term negative impact on the natural environment and legitimate water users. It is typically assessed on an annual timescale.

For a sustainable balance, total net water abstractions do not exceed natural replenishment of water bodies, while also ensuring water bodies maintain viable flows and water levels to sustain themselves, and the species that depend on them, in a healthy condition. A condition where outflows are consistently larger than inflows is a non-sustainable water balance.

**Water quality**
The quality of a natural water body in terms of physical, chemical and biological parameters. The relevant quality standards are defined by national or local regulation and guidelines. Where these are absent, then international standards and guidelines should be applied. Good water quality status is where it meets the requirements of native flora and fauna, and for human needs where applicable.

**Water source**
The physical structure from which a water supply is abstracted from a water body. For groundwater, it may be a natural spring, a borehole or water well. For surface water, it is a ‘water intake’. It can also include the immediate surrounding zone of the main water body, in effect, the zone that feeds the point of abstraction. It may apply to multiple abstraction points where they are associated, for example, a well field.

**Water stewardship**
The use of water that is socially and culturally equitable, environmentally sustainable and economically beneficial, achieved through a stakeholder-inclusive process that includes both site- and catchment-based actions.

**Water use**
Water used by the site for any purpose. It is important to distinguish the different concepts of total and net water use:

Total water use (or total water withdrawal) is the total amount of incoming water supply. However, a proportion of this water is usually returned to the local or regional water cycle. Water may be returned as irrigation losses or where wastewater is treated to a high quality and returned to a nearby water body. This can offset some of the impact of the original water abstractions.

Net water use is the amount that is not returned locally. Losses may be from evapotranspiration (in agriculture), evaporative losses from cooling systems or reservoirs, or water that leaves a manufacturing site in finished product. Net water use is the most important for considering impacts within the catchment, and often significantly less than total use.

# Man 06 Reporting and Disclosure

| Number of credits available | Minimum standards |
|---|---|
| 2 + 1 exemplary (open loop) | No |
| 1 + 1 exemplary (closed loop) | No |

## Aim

To facilitate the open disclosure of data centre performance metrics.

## Context

Disclosure can:

- Improve understanding of data centre water and energy use.
- Develop a robust, consistent and transparent dataset for the industry.
- Help develop data centre best practise guidance.

Although metrics such as PUE are widely used within the industry, it often goes unreported or is not publicly disclosed, and understanding of operational water use for data centres is also very limited. A lack of data can inhibit the development of future key performance indicators for the data centre industry.

## One credit – Energy disclosure

1. A commitment is made for the disclosure of the following data, post-occupation and for a minimum duration of three years:

1a. operational PUE.
1b. total facility and (if separately metered) data hall energy consumption.
1c. total renewable energy generated via dedicated private wire.
1d. total renewable energy received via the grid or district network.
1e. operational ERF (if applicable).
1f. data hall capacity (available and occupied), in terms available space, power and cooling.
1g. free cooling hours achieved.

2. The owner commits to disclosing this information at least once every three months, and compares how this relates to previous disclosures.

3. The data shall be publicly available and included in internal environmental reports.

4. Analysis of the data is carried out to check the building is performing as designed.

5. Set targets or appropriate actions for optimising energy consumption and monitor progress towards these (e.g. make necessary adjustments to system control, inform building user behaviours).

## One credit – Water disclosure (open loop cooling only)

This credit is scoped out for data centres with closed loop cooling systems.

6. A commitment is made for the disclosure of the following data, post-occupation and for a minimum duration of three years:

6a. WUE.
6b. Alternative water sources (where Wat 06 is targeted).

7. The owner commits to disclosing, at least once every three months, the quantity and quality of water usage in the data centre and how this relates to previous water use disclosures.

8. The data shall be publicly available and included in internal environmental reports.

9. Analysis of the data is carried out to check the building is performing as designed.

10. Set targets or appropriate actions for optimising water consumption and monitor progress towards these (e.g. make necessary adjustments to system control, inform building user behaviours).

## Exemplary credit – Third party disclosure

10. Achieve criteria 1-10.

11. The owner shall commit to the annual disclosure of data centre energy AND water use to an independent third-party organisation.

12. The owner shall provide written confirmation that a financial budget and resources will be made available to meet the annual disclosure requirements, such as completing questionnaires and providing supporting evidence, for five years after building occupation.

## Methodology

### Key metrics

Please refer to the Definitions section of this document for additional information on calculation methodology and additional information.

### Reporting PUE

PUE is classed into three categories:

- $PUE_1$ (basic resolution) is measured typically at the UPS output (or equivalent)
- $PUE_2$ (intermediate resolution) is measured typically at the PDU output
- $PUE_3$ (advanced resultion) is measured typically at IT equipment level

CLC/TR 50600 4-2:2016 + A1:2019 recommends the following resolutions based on expected PUE

- over 1.5 - $PUE_{1-3}$
- 1.2 to 1.5 - $PUE_{2-3}$
- less than 1.2 - $PUE_3$

Due to potential technical and IT equipment constraints BREEAM sets no requirements on the PUE category used, however the PUE category must be reported when disclosing.

### Reporting renewable energy

Criteria 1c and 1d separates the reporting of renewable energy into:

- Energy delivered via private wire arrangement (e.g. on-site or near-site renewables)
- Energy delivered via the grid (e.g. energy purchased or delivered from off-site renewables)

BREEAM does not currently recognise purchased renewable energy, or energy delivered without the use of a dedicated private wire arrangement, as contributing towards building performance.

However, for the purposes of this issue, both categories above must be reported. Where operators use the REF metric (which makes no distinction between the categories) a breakdown of energy received from the two categories above must be used in the report.

### Disclosure

The data centre facility manager and relevant specialist are required to compile energy and water usage data. The structure and method of data disclosure shall be consistent across all years and enable comparison across different periods of time.

Data should be presented, where possible, in a manner which is understandable to a wider audience beyond data centre professionals.

Where relevant, key findings from the water risk report in Wat 05 Shared Water Challenges shall also be included as background information to this disclosure credit.

Where Wat 06 Alternative Water Source is targeted, data should be provided on the source, volume and percentage of this source which off-sets data centre water consumption.

### Exemplary credit - Third party disclosure

The owner should commit to recording any third party disclosure information as appendices in the Building User Guide, see Man 04 Commissioning and Handover. The methodology and calculations required for disclosure shall be determined by the requirements of the third party. Where the data centre does not use any water for its IT operations, the third party disclosure may be carried out on the basis of energy consumption only.

An example of a third party organisation for disclosure is the Carbon Disclosure Project (www.cdp.net), which requires the annual submission of a detailed questionnaire.

## Schedule of evidence required

| Ref | Design stage | Post-construction stage |
|---|---|---|
| 1-9 | Commitment for disclosure.<br>As-designed energy performance data.<br>As-designed water performance data (N/A if closed loop cooling system) | Initial post-occupation energy performance data.<br>Initial post-occupation water performance data (N/A if closed loop cooling system)<br>If no data available, as design stage.<br>Disclosure outputs e.g. company website or internal reports. |
| 10-12 | Documentation confirming membership or participation in third party disclosure organisation.<br>Confirmation of financial budget for disclosure. | As design stage. |

# Ene 01 Reduction of energy use and carbon emissions

| Number of credits available | Minimum standards |
|---|---|
| 18 + 4 exemplary | Yes |

## Aim

To recognise and encourage data centre facilities designed to minimise operational energy demand via energy efficiency measures.

## Assessment scope

This issue assesses both data halls and supporting functions. Data halls are assessed against Checklist A8 (found within SD233 – Annex 2), supporting functions are assessed against the base manual.

## Minimum standards

| Min. standard | Data halls | Supporting functions |
|---|---|---|
| Excellent | Achieve 8 credits against data hall criteria.<br>Achieve 'Resilience level and provisioning' and 'airflow management and design' credits | Energy performance equivalent to:<br>$EPR_{INC}$ of 0.36 *or*<br>6 credits with Checklist A5 |
| Outstanding | Achieve 12 credits against data hall criteria.<br>Achieve 'Resilience level and provisioning' and 'airflow management and design' credits | Energy performance equivalent to:<br>$EPR_{INC}$ of 0.6 *or*<br>10 credits with Checklist A5 |

To ensure consistency in the design and construction of both data halls and supporting functions, the minimum standards for both data halls and supporting functions must be achieved e.g. if data halls achieved the requirement for Outstanding, but supporting functions achieved Excellent, the overall minimum standard achieved is Excellent.

No credits are awarded for supporting functions in a data centre assessment, the assessment of supporting functions defines minimum standards only.

## Up to eighteen credits, up to four exemplary credits – data hall energy efficiency

1. Achieve the requirements of Checklist A8 for:

1a. Physical building layout
1b. Resilience level and provisioning
1c. Selection and deployment of new power equipment
1d. Airflow management and design
1e. High efficiency cooling system
1f. CRAC / CRAH equipment
1g. Free and economised cooling
1h. Re-use of data centre waste heat

## Minimum standards only – supporting function energy efficiency

2. Achieve $EPR_{INC}$ of 0.36 *or* 6 credits via Checklist A5 to achieve Excellent minimum standard OR
3. Achieve $EPR_{INC}$ of 0.6 *or* 10 credits via Checklist A5 to achieve Outstanding minimum standard.

## Methodology

### CLC/TR 50600-99-1: 2019

This issue directly references *PD CLC/TR 50600-99-1:2019 Information technology. Data centre facilities and infrastructures. Recommended practices for energy management*.

To achieve the relevant credits, all listed practices in each section must be achieved and evidenced. Partial compliance with a section will not result in the award of credits.

Some sections contain expected practices which may not be relevant to certain data centre types or scenarios. These are clearly marked in Checklist A8 and may be omitted where evidence is provided that these practices are not relevant.

Where the practice uses the word 'consider' such as in 'Consider installing variable speed fans…' the requirement in this issue is that such listed systems are installed, unless it is evidenced that any installation would not contribute to overall data hall energy efficiency and has been discounted on this basis.

For the full wording of the requirements, refer to the standard.

### Calculating supporting function energy efficiency

Supporting function performance can be calculated using either methodologies for Option 1 or Option 2, available in the technical manual.

When using Option 1 in the technical manual a separate, new standard building pre-assessment for the supporting function only must be created within BREEAM Projects to allow the calculation of the $EPR_{INC.}$ Option 2 may be assessed without the need for a new pre-assessment.

## Schedule of evidence required

| Ref | Design stage | Post-construction stage |
|---|---|---|
| 1 | Relevant design specification clauses confirming details of compliance with each requirement in Checklist A8.<br>Where relevant: feasibility studies, simulation models, justification for omissions of any requirements signed by relevant specialist. | As-built drawings and specification demonstrating compliance with the criteria.<br>Site inspection confirming installation. |
| 2-3 | Refer to the technical manual's evidence requirements for Ene 01. | |

# Wat 02 Water monitoring

| Number of credits available | Minimum standards |
|---|---|
| 1 (closed loop) | No |
| 2 (open loop) | No |

## Aim

As technical manual.

## Assessment scope

This issue is applicable to both open and closed loop cooling systems.

## Two credits (open loop) / one credit (closed loop) – metering and monitoring

1. Specify a water meter on all externally sourced water supplies (i.e. excluding rainwater or grey-water collection systems within the building) to each building; this includes mains supplies and instances where water is supplied via a borehole or other private source.

2. When connecting to an existing water network, a leak detection survey shall be carried out to investigate potential leaks between the building and site boundary.

3. A relevant specialist prepares a water metering strategy which incorporates all water and wastewater demand.

4. Water meters are on all water inflow and outflow pipes for all water uses (potable, reuse and industrial use).

5. All water meters are connected to the data centre building management system to allow central monitoring and management of water demands.

6. A permanent automated water leak detection functionality is integrated into the system that is capable of alerting facilities management and building occupants to the leak OR an inbuilt automated diagnostic procedure is incorporated for detecting leaks.

## Methodology

### Connection to an existing network

If the data centre is connected to an existing water network, a leak detection investigation is carried out on all water pipes within the site. Detection and fixing of leaks will help reduce unaccounted water use. The leak detection should be carried out both at pre- and post-construction, as pipe damage may occur during construction.

### Metering strategy

A metering strategy shall be designed and implemented that ensures a water meter is installed to measure all uses of water within the site boundary, both internal and external to the data centre. The use of a water metering trial and water mass balance study can help inform the strategy which shall include the following information:

- The locations and types of meter specified.
- The use of water being metered and approximate volumetric demand.
- The likely chemical composition of all non-potable water uses.

## Metering capabilities

Installed meters must have the following capabilities:

Open and closed loop systems:

a. Ultrasonic or electro-magnetic technology to measure water flow and quantity. Mechanical meters do not meet credit requirements.
b. An appropriate communication protocol (e.g. Modbus) for bi-directional communication of water use data within an advanced metering infrastructure (AMI) environment.

Open loop systems only:

c. Ability to utilise the LoRaWAN network to enable potential IoT integration.
d. Able to measure and communicate the chemical composition of non-potable water
e. Able to measure, monitor and communicate the temperature of discharge water via the meter or an additional connected temperature sensor.

The relevant specialist is required to provide justification for the omission of any capabilities (i.e. confirmation how they are not applicable).

## Water mass balance study

Overall, the water balance study is an assessment of:

- Water inflows (e.g. incoming water supply and rainwater).
- Through flows (water that passes through the cooling system).
- Outflows (e.g. wastewater, blow-down water, greywater and evaporative water).
- Onsite water storage and changes in storage (e.g. make-up water supply and attenuated stormwater).

The water balance study enables the facilities management team to gain a comprehensive understanding of water use in relation to the water metering strategy and data centre operation. This detailed understanding will help identify problems or faults in water use, and importantly, help identify if there are potential opportunities to modify the overall water use design in order to reduce water demand. This is relevant to all data centres, especially those in regions of high water risk.

This assessment can be in the form of a schematic diagram, spreadsheet or incorporated into design drawings and reference specific water meters in the system. A typical water mass balance diagram could include:

- Water source.
- Approximate quantities.
- Type of water use on the site.
- Water discharge flows.
- Quantities.
- Temperatures.

For additional information on how to carry out a water mass balance study see:
http://www.wrap.org.uk/sites/files/wrap/WRAP_Tracking_Water_Use_to_Cut_Costs.pdf

## Water metering trial

The use of a water metering trial can be used to help inform the overall metering strategy. A trial can be undertaken by the use of non-intrusive (clamp-on) meters to simulate the subsequent installation of intrusive (in-line) meters with equivalent technical specification. As an example, the metering trial may include the following aspects:

- Checking different pipe locations to optimise metering configuration and that meters are accessible.
- Testing the suitability of different metering technologies and compatibility with the BMS so that it has the capacity and capability to process data received.
- Ensuring the level of detail in the output data is meaningful to enable an understanding of water use.
- Proposing a methodology of replacing non-intrusive meters with intrusive meters without comprising the operational use of the data centre.

Importantly, if the use of a trial approach is adopted, the client is required to commit to the installation of intrusive meters following the outcome of the metering trial. All metering work must be commissioned before submission of the post-construction review to BRE Global Limited for certification.

## Schedule of evidence required

| Ref | Design stage | Post-construction stage |
|---|---|---|
| All | Water metering strategy<br>Water metering trial summary (if undertaken) or similar<br>Water mass balance diagram and report (if undertaken) or similar<br>Design drawings / specifications | BREEAM assessor's site report showing compliant installation of intrusive meters<br>Updated water mass balance diagram and report post-commissioning (if undertaken) or similar |

# Wat 04 Water efficient equipment

| Number of credits available | Minimum standards |
|---|---|
| 1 | No |

## Aim

As technical manual.

## Context

The primary use of water in data centres is for cooling, and this can use a significant volume of water. Evaporative cooling processes are the most common approach. The incoming water supply (make-up water) is used for replacing water lost due to evaporation, and to flush and remove chemical build-up in pipework. The specification of cooling systems with water efficient processes can help to reduce water demand, the quantity of chemicals discharged from the site and can help lower the operational costs of the data centre.

## Assessment scope

The criteria in this issue is applicable to open loop cooling systems only. Closed loop cooling systems must follow the criteria in the technical manual.

## One credit – Water efficient cooling systems

1. At concept design, a feasibility report, produced by the relevant specialist, identifies at least three options for water efficient cooling systems with the lowest make-up and overall water demand. The options must not compromise system performance.

2. The most water efficient option is specified. Clear justification by the relevant specialist must be provided where this is not possible.

3. A non-technical summary of the cooling system, with schematic diagrams, is included in the building user guide.

## Methodology

It is the responsibility of the relevant specialist to compare and justify the specified cooling systems against the criteria above. The report must clearly highlight any potential conflicts of interest that the relevant specialist has in connection with the proposed system, such as affiliations with product manufacturers. Where the most water efficient option is not specified, the justification given must be made on the basis of functional requirements and not purely from a financial basis. It is recommended that the three options are explored with reference to the water mass balance study described in the Wat 02 methodology.

## Schedule of evidence required

| Ref | Design stage | Post-construction stage |
|---|---|---|
| All | Cooling system options appraisal.<br>Design drawings / specifications. | BREEAM assessor's site report showing compliant installation of chosen cooling system. |

# Wat 05 Shared water challenge

| Number of credits available | Minimum standards |
|---|---|
| 4 | No |

## Aim

To understand the impacts of the data centre on the security and quality of supply for other users of shared water supplies and minimise the resultant negative impacts on other user's operations / amenities.

## Context

Understanding shared water challenges can:

- Improve understanding of potential water issues and risks in the data centre catchment area.
- Identify opportunities for collaboration in the use and allocation of water.
- Mitigate any water-related challenges and develop alternative approaches.
- Contribute to corporate social responsibility reporting requirements.

The use of water is a shared catchment challenge and can provide opportunities for collective action in the catchment. Engagement with stakeholders at the concept stage can help identify potential issues such as security of water supply, water quality and the likelihood of increased water demand. In addition, engagement with stakeholders can help identify opportunities for collaboration to help reduce water demand, identify potential methods of systems integration (such as sharing harvested rainwater) and improve overall discharge water quality and freshwater ecology.

## Assessment scope

This issue is applicable to open loop cooling systems only, and N/A for closed loop systems.

## One Credit – Water risk report

1. By concept design stage, a water risk report is produced by a relevant specialist to assess risks and opportunities in the data centre site and wider catchment area. The report shall consider water risk at both the catchment and at a country level.

## Two credits – Key stakeholder identification and engagement

2. At concept design stage, identify and document key stakeholders that currently have (or will have by the operational start of the data centre) a shared water challenge within the site catchment area.

3. Meet with identified stakeholders to discuss the proposed data centre and potential water challenges with a view to minimising negative impacts and maximising positive ones. Agree actions between all parties.

## One credit - Managing water risk

4. Achieve criterion 1.

5. Based on the water risk report, the data centre is constructed in a location defined by the relevant specialist as low water risk.

### OR

6. Achieve criterion 1-3.

7. Where the data centre is located in an area defined by the relevant specialist as medium or high water risk, evidence is provided that water risks will be managed for the data centre and all stakeholders identified in criteria 2 and 3, and any agreed actions outlined in criterion 3 carried out.

## Methodology

### Water risk report

The water risk report shall assess the catchment area for the water supply (or supplies) to the data centre. Normally, this is in the same region or catchment as the data centre itself. However where this is not the case the risk report must assess the relevant catchment area of origin.

There are several websites that report water risk in different countries and regions. One example is the Water Risk Filter developed by WWF and partners. It enables users to compare how levels of water risk differ between countries and regions due to factors such as water availability, precipitation and water quality issues. The availability and granularity of data varies considerably depending on the location being investigated, and there are other water risk websites and tools that have more detailed information on certain locations and countries.

The relevant water specialist must write a report describing the level of water risk for the proposed data centre location and provide the findings to the client and project team. The report shall reference data from a minimum of two water risk filter websites with preference given to websites that specialise in the country in question. The evaluative report shall include consider, as a minimum, the following:

a. The overall level of water risk and explanation of the factors that input to the overall risk score.
b. The specialist's view of the potential current and future risks and mitigation measures relevant to the operation of a data centre.
c. The details of the water risk filter websites reviewed and justification for their selection, including comment on the credibility of data and robustness of the water risk filter.
d. The level of data granulation available for the proposed data centre location.
e. Details of any supplementary research regarding the water risk of the site, such as academic publications or industry publications.

### Key stakeholder identification

The client and design team must identify potentially affected stakeholders using a methodology appropriate to the location and context. Gathering data on the different stakeholder groups can be carried via a desktop review and consultation with local businesses, governmental departments and community groups.

Key stakeholder groups with most relevance or interested in water issues can be prioritised based on:

- Geography: Stakeholders closest to the site or within the same local catchment area are likely to feel the most impact from water abstraction, even where the supply is from a municipal network.
- Interest: The level of interest the group has in local water issues.
- Impact: How could the group be affected by data centre water abstraction, and how their actions and influence could potentially affect data centre operations.

And may include for example:

- Critical water users (such as hospitals).
- Industrial users.
- Agricultural users.

- Domestic and non-household water users.
- Recreational water users.
- Indigenous communities.
- Non-government organisations (NGO's) focused on water issues.
- Government departments.
- Water supply bodies and regulators.
- Natural environment bodies and interest groups (including but not limited to natural water and marine water environments).

Following the identification of key stakeholders, the shared water challenges can be identified and the potential impact of data centre water use can be identified.

Where existing statutory requirements for engagement with local authorities and water bodies exist, the requirements still apply. The intent of this credit is to expand the scope of engagement beyond the above, to reach a broader group of stakeholders and identify further opportunities for addressing shared water challenges.

## Key stakeholder engagement

The engagement should be held in a manner that avoids any form of bias. Where engaging in person, use of a neutral venue and independent facilitator could be considered.

The agenda should include, but is not limited to:

a. Anticipated water demand of the data centre and potential effect on proposed water sources.
b. Potential measures to reduce water demand and increase efficiency.
c. Details of existing water quantity and quality discharged to water bodies (if applicable).
d. Request for information and experience of water related issues, such as water shortages, over-abstraction, regional variance in precipitation, flooding, conflict surrounding water issues, water quality and freshwater ecology within the catchment.
e. Details of existing schemes, initiatives and research projects related to shared water challenges in the data centre catchment area.
f. Discussion on opportunities for collaboration on water-related issues, such as the use of excess captured rainwater for adjacent users.

Meeting minutes and actions shall be circulated to all attendees for comments and feedback.

Where these requirements overlap with statutory requirements (e.g. environmental impact assessments), evidence from this can be used towards demonstrating compliance with these credits, however the project team must demonstrate that through this process no affected stakeholders have been omitted.

Where stakeholders fail to respond to, or refuse to engage with the project team, the credits may still be awarded where evidence is provided that all reasonable efforts have been made towards engaging with all identified stakeholders.

## Managing water risk

The operator must demonstrate that clear actions have been agreed with relevant stakeholders to mitigate any additional water risks posed by data centre water consumption, including any commitments that these measures will be carried out once the data centre is operational.

At design stage these measures are intended to inform the operator's approach to the Water category and LE 06 Freshwater Ecology.

Where there are no relevant stakeholders, or relevant stakeholders do not engage with the operator, evidence for managing water risks for the data centre only will be accepted.

## Schedule of evidence required

| Ref | Design stage | Post-construction stage |
|---|---|---|
| 1 | Water risk report<br>Outputs from at least two water risk filter online tools / websites | As design stage. |
| 2 - 3 | Documentation / correspondence identifying key stakeholders<br>Stakeholder meeting minutes and actions OR correspondence confirming efforts made to engage with stakeholders | As design stage. |
| 4 - 5 | Water risk report | As design stage |
| 6 - 7 | Data cross referencing data centre location with water risk report.<br>OR<br>Stakeholder meeting minutes and actions.<br>Relevant evidence showing actions taken to manage water risk for all key stakeholders, based on actions agreed during stakeholder engagement. | As design stage. |

# Wat 06 Alternative water sources

| Number of credits available | Minimum standards |
|---|---|
| 2 + up to 2 exemplary (open loop only) | No |

## Aim

To reduce municipal water consumption by encouraging the specification of alternative water sources.

## Context

Given the relatively high water use in the data centre sector, the use of non-municipal water supplies can in some cases:

- Reduce water demand and improve resilience.
- Reduce surface water flooding through rainfall attenuation.
- Encourage water use innovation in the data centre sector.

Technology and innovation related to on-site wastewater treatment systems and rainwater harvesting systems have advanced considerably in the last decade. Treating water on-site has several benefits including providing a water supply for use in industrial processes, reducing demand on water company wastewater treatment plants increases security of water supply. In addition to rainwater, non-potable water can be abstracted from adjacent industrial units that discharge process water, or from a water treatment plant, re-using water which would otherwise become an additional burden on municipal wastewater treatment. Overall, on-site wastewater treatment has the potential to reduce water risk for the data centre, the water catchment and reduce wastewater load on existing piped infrastructure.

## Assessment scope

This issue is applicable to open loop cooling systems only. Issue N/A to closed loop cooling systems.

## One credit – Feasibility

1. A feasibility study is prepared by a relevant specialist, identifying opportunities for potential alternative water sources and best available technologies.

## One credit – Rainwater harvesting

2. Achieve criterion 1.

3. An on-site rainwater harvesting system has been designed and implemented which offsets at least 5% of non-potable use for both data hall cooling and supporting function water use.

4. The following documentation is produced:
   4a. Evidence of a long-term (minimum 10 years) maintenance and support agreement contract to help ensure the technology remains in-use.
   4b. Non-technical guidance explaining how the technology operates for inclusion in the Building User Guide.

## Up to two exemplary credits – Alternative water source

5. Achieve criterion 1.
6. Achieve Wat 05, Low Water Risk OR Managing Water Risk credit.

### One exemplary credit – Raw water system

7. Based on the feasibility report and best available technology appraisal, a system which abstracts or uses 'raw water' (excluding rainwater) is implemented.

### OR

### Two exemplary credits – Wastewater system

8. Based on the feasibility report and best available technology appraisal, a waste water re-use system utilising wastewater as a by-product from another process unrelated to data centre cooling is implemented.

9. The system used to demonstrate compliance with criteria 6 or 7 above offsets a at least 5% of non-potable use for both data hall cooling and supporting function water use.

10. The following shall be provided for either system type implemented:
    10a. Evidence of a long-term (minimum 10 years) maintenance and support agreement contract to help ensure the technology remains in-use.
    10b. Non-technical guidance explaining how the technology operates for inclusion in the Building User Guide.
    10c. A case-study on the water system made publicly available on the date centre website.

## Methodology

### Feasibility

The feasibility report should include consideration of alternative raw water sources such as rainwater and surface water bodies, or wastewater sources such as discharge water from on-site or near-site industrial processes. The report must include the following considerations:

a. All potential water sources are identified on-site or within reasonable proximity to the data centre.
b. If potential water sources are discounted, the study shall justify their exclusion for reasons not based solely on financial cost.
c. Options appraisals for identified solutions and best available technology based on environmental, social and economic factors.

Consideration of any off-site water sources must also include:

d. Evidence of consultation with local water and wastewater company where applicable.
e. Evidence of consultation with catchment stakeholders where applicable.
f. Potential challenges and solutions to the use of the water source, such as access rights, abstraction licences, and water quality issues.

Evidence from Wat 05 Shared water challenge may be used in this feasibility study.

### Rainwater harvesting

The rainwater harvesting system shall be designed and specified by a relevant specialist to meet country and region-specific standards and apply relevant and current best practise guidelines. Where no standards exist, apply the standards listed in Wat 01 of the technical manual.

Before draining into the municipal drainage network, any excess water which exceeds demand should be re-directed into either:

a. A SUDS attenuation scheme (if applicable).
b. Offsetting water usage in the local area (if available).

Where the feasibility study has reviewed and excluded rainwater harvesting as a viable option, this credit is scoped out.

## Exemplary criteria – alternative water source

The alternative water source may use either raw water or wastewater.

'Raw water' is water found in the environment that has not been through any treatment process prior to abstraction. Raw water includes ground water, water from infiltration well, and water from bodies like lakes and rivers. This will normally require some form of treatment before it can be used in building services systems to remove sediments and contaminates that could impact on system effectiveness and efficiencies. The term 'raw water' includes rainwater, but assessment of this is treated separately in the 'Rainwater harvesting' credit, so for these exemplary credits, rainwater is excluded.

Wastewater is defined as used water of reduced quality discharged from a site, arising either from sanitation use or as a by-product of another process.

The alternative water source system specified shall be a direct reflection of the findings and recommendations of the feasibility report. Water reuse in data centres is an innovative approach and such a system is likely to require ongoing maintenance and support to help ensure the systems remains operable and reliable. This shall be evidenced by a contractual agreement between the data centre owner and suitably qualified contractor.

# Schedule of evidence required

| Ref | Design stage | Post-construction stage |
|---|---|---|
| 1 | Feasibility report | As design stage. |
| 2-4 | Design drawings / specifications. | BREEAM assessor's site report showing compliant installation.<br>Contractual agreement for on-going maintenance and support. |
| 5-10 | Relevant permissions and agreements from affected stakeholders for use of alternative water source.<br>Design drawings / specifications. | BREEAM assessor's site inspection and report showing compliant installation.<br>Contractual agreement for on-going maintenance and support. |

# LE 06 Freshwater Ecology

| Number of credits available | Minimum standards |
|---|---|
| 4 (see assessment scope) | No |

## Aim

To prevent ecological damage arising from data centre wastewater discharge, and to identify opportunities for freshwater ecological enhancement.

## Context

Discharge water from an industrial process can greatly affect freshwater ecology by the introduction of harmful pollutants and through altering ambient water temperature. According to UNESCO, water quality is a major challenge during the 21st century, affecting human health, food production and ecosystem functions (https://en.unesco.org/waterquality-iiwq/wq-challenge).

## Assessment scope

This issue is only applicable to data centres that discharge wastewater into local water bodies.

## One credit – Good water quality

1. The quality of all water discharged from the site to water bodies meets local regulatory standards of 'good water quality.'

2. In locations where water quality regulatory requirements do not exist, the client engages a relevant specialist to identify equivalent regulatory requirements that are applicable and relevant to the site catchment.

## One credit – Excellent water quality

3. Achieve criterion 1.

4. The quality of all water discharged from the site to water bodies improves local regulatory standards of 'good water quality.'

## One credit – Freshwater ecology recommendations

5. Achieve criterion 1.

6. The client engages a suitably qualified ecologist (SQE) at concept design stage to advise on measures to enhance and protect the freshwater ecology of the affected water bodies.

7. The SQE has provided a report stating recommendations, with timeframes, for measures to enhance and protect the freshwater ecology of affected water bodies.

# One Credit - Freshwater ecology implementation

8. The client commits to the allocation of a ring-fenced budget to finance the implementation of recommendations made in criteria 6 and 7.

9. The recommendations are carried out within the time-frames stated by the SQE.

If no opportunities for improvement were identified in the Freshwater Ecology Recommendations credit, and this has been confirmed in peer review, this credit is scoped out.

# Methodology

## Good water quality

The quality of the discharge water cannot feasibly be tested until the site is commissioned and operational. However, at design stage, evidence is required to show that the anticipated quality of discharge water is based on system design specifications and meets local regulatory requirements. Integral to the commissioning process (see Man 04 Commissioning and Handover) the discharge water quality and temperature shall be tested in accordance with relevant standards and best-practise guidance.

In locations where local and relevant regulatory water quality standards do not exist, a relevant specialist shall be engaged to report on the following:

a. Confirmation that no relevant water quality standards exist.
b. Examples of best-practise guidance for water quality standards in a local geographical context, if available.
c. Recommendations for equivalent water quality standards sourced from an EU country that adheres to the principles of the Water Framework Directive.
d. Justification supporting the recommended equivalent standards.

## Excellent water quality

The relevant specialist shall provide evidence to show how the proposed system will provide an increased level of water quality compared to regulatory standards, and this evidence is peer reviewed by another relevant specialist. Examples of justification can be: percentage improvement in water quality, potential benefits to freshwater ecology, aesthetic quality of water or benefits to the wider ecological environment.

## Freshwater ecology recommendations

The SQE is required to define the boundary of assessment. This may extend beyond the site boundary to include the section of watercourse potentially affected by the data centre and any areas with the greatest opportunities for improving local freshwater ecology. In addition, the SQE is required to liaise with relevant authorities to seek opportunities for alignment with existing or planned projects.

All recommendations made by the SQE shall be supported by robust evidence. If no opportunities for improvement have been identified, the SQE will be required to provide evidence that this opinion has been peer reviewed by another SQE, to ensure that any opportunities for improving the water body have been correctly identified.

## Freshwater ecology implementation

Recommendations made shall be implemented at the appropriate project stage and duration, as stipulated by the SQE. To ensure all recommendations are implemented, the client shall provide a letter of commitment to ensure financial funds are available to implement the recommendations during the project construction, and post-commissioning and building handover. The SQE shall also be contractually retained by the client to monitor and carry-out water quality sampling for a minimum of 12 months after occupation of the data hall.

If no opportunities for improvement were identified in the Freshwater Ecology Recommendations credit, and this has been confirmed in peer review, this credit is scoped out.

## Schedule of evidence required

| Ref | Design stage | Post-construction stage |
|---|---|---|
| 1 - 2 | Local water regulations OR relevant EU regulations defining levels of pollutants.<br>Design calculations identifying chemical concentration and temperature of discharge water. | As design stage.<br>Commitment to carry out water quality testing post-occupation. |
| 3 - 4 | Local water regulations OR relevant EU regulations defining levels of pollutants.<br>Design calculations identifying chemical concentration and temperature of discharge water.<br>Relevant specialist's justification for improved water quality beyond regulatory standard. | As design stage.<br>Commitment to carry out water quality testing post-occupation. |
| 5 - 7 | Ecologist's recommendations<br>Ecologist's justification for no opportunities for improvement, signed by peer reviewer. | As design stage. |
| 8 - 9 | Client's letter of commitment confirming funding.<br>SQE contractual agreement. | As design stage. |

# Pol 06 Local air quality

| Number of credits available | Minimum standards |
|---|---|
| 2 + 1 exemplary | No |

## Aim

To reduce harmful emissions resulting from on-site or near-site power generation.

## Context

The servicing, maintenance and operation of internal combustion plant for the generation of power can negatively impact health and local air quality. This issue recognises efforts to reduce harmful emissions arising from this through either control of emissions or through innovative technologies.

## Assessment scope

The standard credits in this issue assesses the local generation of primary and secondary (i.e. backup) supply using internal combustion technologies and via dedicated private wire. Generation sources connected via the grid are not assessed in this credit issue, because this focuses on emissions in the local area surrounding the data centre.

All generators within the assessment boundary with a combined total rated thermal input of ≥1 $MW^{th}$ are included. Individual generators <1 $MW^{th}$ can be excluded from this assessment and will not contribute towards meeting the 1MWth threshold.

In addition to generators, the exemplary credit encompasses other generation technologies.

Generation sources expected to run ≤50 hours per year (i.e. for servicing and maintenance only) are exempted.

## Two credits – control of emissions

1. Achieve the emissions limits shown in Table 3.

| Pollutant ($mg/Nm^3$) | Type of plant | Gas oil | Liquid fuels other than gas oil | Natural gas | Gaseous fuels other than natural gas |
|---|---|---|---|---|---|
| **$SO_2$** | Engines<br>Gas turbines | - | 120 | - | 15<br>40 (biogas) |
| **$NO_x$** | Engines | 190 | 190<br>225 (diesel engines ≤20MWth ≤1200rpm) | 95 | 190 |
| | Dual fuel engines | - | 225 | 190 | - |
| | Gas turbines<br>above 70% load | 75 | 75 | 50 | 75 |
| **Dust** | Engines<br>Gas turbines | - | 10<br>20 (engines 1-5MWth) | - | - |

*Table 3: Emission limit values*

## Exemplary credit – ultra-low emissions

2. The power generation strategy results in zero, or near zero emissions of $NO_X$, $SO_2$ and dust.

## Methodology

### Calculating emissions

Emissions are calculated based on manufacturer's emissions data and must be combined for the entire generator set where multiple generators are covered within the assessment boundary.

The rated thermal input can be obtained from the manufacturer and is the maximum fuel input of the generator expressed in terms of the energy of the fuel going into the system. It should not be confused with the electrical output of the generator system, which can be calculated from:

$$Rated\ thermal\ input\ W^{th} = \frac{Electrical\ output\ W^{e}}{Generator\ efficiency\ \%}$$

### Ultra-low emissions

The intent of the ultra-low emissions credit is to recognise any technology that may eliminate, or almost eliminate, any emissions of harmful pollutants compared to the levels in Table 3. Given that the nature of any technology achieving this is likely to be innovative, benchmarks have not been set and the methodology of how this is achieved is not prescribed in this annex. Where it is not clear whether the outcome of criterion 2 has been achieved, please contact BRE Global for further discussion.

## Schedule of evidence required

| Ref | Design stage | Post-construction stage |
|---|---|---|
| 1 | Design specifications, emissions calculations. | As design stage. |
| 2 | As criteria 1, evidence demonstrating how generation technology was determined, and level of improvement over existing best available generation technology. | As design stage plus site confirmation of installed technology. |

## Additional information

### Relevant definitions

**Dual fuel engine**
An internal combustion engine which uses compression ignition and operates according to the diesel cycle when burning liquid fuels, and according to the Otto cycle when burning gaseous fuels.

**Dust**
Particles, of any shape, structure or density, dispersed in the gas phase at the sampling point conditions which may be collected by filtration under specified conditions after representative sampling of the gas to be analysed, and which remain upstream of the filter and on the filter after drying under specified conditions.

**Engine**
Gas engine, diesel engine or dual fuel engine.

**Fuel**
Solid, liquid or gaseous combustible material.

**Gas oil**
a) Any petroleum-derived liquid fuel falling within CN codes 2710 19 25, 2710 19 29, 2710 19 47, 2710 19 48, 2710 20 17 or 2710 20 19; or (b) any petroleum-derived liquid fuel of which less than 65 % by volume (including losses) distils at 250 °C and of which at least 85 % by volume (including losses) distils at 350 °C by the ASTM D86 method.

**Gas engine**
An internal combustion engine which operates according to the Otto cycle and uses spark ignition to burn fuel.

**Gas turbine**
Any rotating machine which converts thermal energy into mechanical work, consisting mainly of a compressor, a thermal device in which fuel is oxidised in order to heat the working fluid, and a turbine; this includes both open cycle and combined cycle gas turbines, and gas turbines in cogeneration mode, all with or without supplementary firing.

**$SO_2$**
Sulphur dioxide.

**$NO_X$**
Nitric oxide and nitrogen dioxide.

 