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**Agrément Certificate**

**19/5685**

Product Sheet 2

## CONCRETE CANVAS GEOSYNTHETIC CEMENTITIOUS COMPOSITE MATS AND BARRIERS

### CC HYDRO

This Agrément Certificate Product Sheet<sup>(1)</sup> relates to CC Hydro<sup>(2)</sup> for use as a combined impermeable liner and protection layer for containment applications, such as secondary containment bund lining, channel lining, lagoon lining, and other containment applications such as new-build or remediation of existing infrastructure.

(1) Hereinafter referred to as 'Certificate'.

(2) CC Hydro is a registered trademark.

#### CERTIFICATION INCLUDES:

- factors relating to compliance with Building Regulations where applicable
- factors relating to additional non-regulatory information where applicable
- independently verified technical specification
- assessment criteria and technical investigations
- design considerations
- installation guidance
- regular surveillance of production
- formal three-yearly review.

#### KEY FACTORS ASSESSED

**Structural performance** — the product, when used in accordance with the requirements of this Certificate, will have adequate structural characteristics when used for containment applications (see section 6).

**Resistance to chemicals** — the product, if used in accordance with the requirements of this Certificate, when in contact with chemicals assessed in this Product Sheet will retain adequate strength to resist the anticipated loads and the designed long-term performance (see section 8).

**Durability** — when used in accordance with the requirements of this Certificate, the product may be considered to have a life expectancy in excess of 50<sup>(1)</sup> years for the primary containment of non-pollutants and secondary containment of other liquids (see section 11).

(1) Excludes the effects of adverse loading and abrasion.



The BBA has awarded this Certificate to the company named above for the product described herein. This product has been assessed by the BBA as being fit for its intended use provided it is installed, used and maintained as set out in this Certificate.

On behalf of the British Board of Agrément

Paul Valentine  
Technical Excellence Director

Claire Curtis-Thomas  
Chief Executive

Date of First issue: 6 August 2019

The BBA is a UKAS accredited certification body – Number 113.

The schedule of the current scope of accreditation for product certification is available in pdf format via the UKAS link on the BBA website at [www.bbacerts.co.uk](http://www.bbacerts.co.uk)  
Readers are advised to check the validity and latest issue number of this Agrément Certificate by either referring to the BBA website or contacting the BBA direct.  
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## Regulations

In the opinion of the BBA, the use of CC Hydro is not subject to the national Building Regulations.

### Construction (Design and Management) Regulations 2015 Construction (Design and Management) Regulations (Northern Ireland) 2016

Information in this Certificate may assist the client, designer (including Principal Designer) and contractor (including Principal Contractor) to address their obligations under these Regulations.

See section: *3 Delivery and site handling* (3.2, 3.4 and 3.5) of this Certificate.

## Additional Information

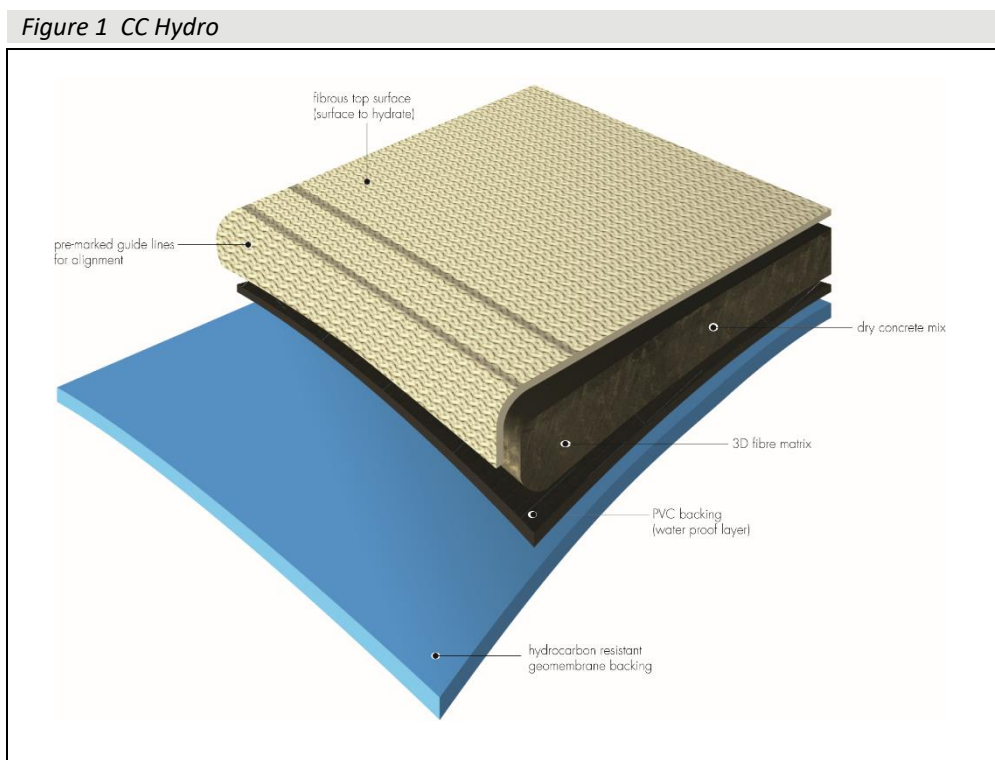
### CE marking

The Certificate holder has taken the responsibility of CE marking the product, in accordance with ETA 19/0086.

## Technical Specification

### 1 Description

1.1 CC Hydro is a flexible concrete filled geosynthetic, for use in a range of geotechnical applications (see Figure 1). The product consists of a three-dimensional fibre matrix containing a high early strength gain concrete mix that hardens when hydrated to form a thin, durable and waterproof concrete layer and is provided with a PVC backing to enable the waterproof capability, while the internal fibre matrix provides the tensile strength once the concrete is set and prevents any crack propagation. CC Hydro can be hydrated by either spraying or by being fully immersed in water. Once hydrated, the product has a working time of up to 2 hours and will set in 24 hours.



1.2 CC Hydro is available in two types: CCH5 and CCH8, and the properties are given in Table 1.

**Table 1 Properties of CC Hydro**

Product type	Concrete thickness (mm)	Bulk roll size (m <sup>2</sup> )	Roll width (m)	Mass (unset) (kg·m <sup>-2</sup> )	Concrete mean density (unset) (kg·m <sup>-3</sup> )	Change in density when set (%)
CCH5	5	150	1.0	8	1430-1540	+30 to 35
CCH8	8	100	1.0	13	1430-1540	+30 to 35

1.3 Ancillary items used with the product to form a CC Hydro system, but outside of the scope of this Certificate include:

- Edge fixings — the perimeter edges of the CC Hydro system must be captured to prevent water ingress or wind uplift. For soil substrates, CC Hydro material is secured in an anchor trench, which is then backfilled with poured concrete. For concrete/steel substrates, CC Hydro is secured using a gasket, stainless steel clamping bar and suitable mechanical fixings.

## 2 Manufacture

2.1 The product is manufactured from:

- a top polyester layer (incorporating pre-marked alignment guide) to contain the dry powder mix
- a three-dimensional fibre matrix containing a specially formulated dry concrete mix which hardens on hydration
- a high impermeability, chemically resistant PVC geomembrane backing bottom layer incorporating a high visibility welding strip allowing joints to be thermally-welded for on-site testing.

2.2 As part of the assessment and ongoing surveillance of product quality, the BBA has:

- agreed with the manufacturer the quality control procedures and product testing to be undertaken
- assessed and agreed the quality control operated over batches of incoming materials
- monitored the production process and verified that it is in accordance with the documented process
- evaluated the process for management of nonconformities
- checked that equipment has been properly tested and calibrated
- undertaken to carry out the above measures on a regular basis through a surveillance process, to verify that the specifications and quality control operated by the manufacturer are being maintained.

2.3 The management system of Concrete Canvas Ltd has been assessed and registered as meeting the requirements of BS EN ISO 9001 : 2015 by ACS Registrars Ltd (Certificate UK/01/0539489441).

## 3 Delivery and site handling

3.1 CC Hydro is available in bulk rolls. The quantity per roll differs depending on the thickness of the product.

3.2 All bulk rolls weigh between 1300 and 1400 kg and are supplied on 150 mm diameter cardboard cores. Bulk rolls are packed into a polythene bag that is vacuumed and thermally sealed. The whole pallet is wrapped with shrink-wrap.

3.3 Individual lengths and quantities are often packaged on request and always protected with a plastic bag, corrugated cardboard and shrink-wrap.

3.4 CC Hydro must be stored under cover in dry conditions away from direct sunlight and in the manufacturer's sealed packaging. It is not recommended to store in shipping containers in direct sunlight where temperatures may exceed 40°C for prolonged periods. If stored correctly, the product has a shelf life of 24 months.

3.5 All product bundles and rolls must be handled with care to avoid damage to coatings, and require suitable mechanical plant for lifting. An assessment must be made about the appropriate number of people required to lift the units to satisfy manual lifting limits.

## Assessment and Technical Investigations

The following is a summary of the assessment and technical investigations carried out on CC Hydro.

### 4 Use

4.1 CC Hydro is intended for use as a combined impermeable liner and protection layer for containment applications, such as secondary containment bund lining, channel lining, lagoon lining, and other containment applications such as new-build or remediation of existing infrastructure.

4.2 CC Hydro must be protected from debris and exposure to chemicals that the product is not designed for. The product must be inspected, maintained and repaired in accordance with section 10 in order to serve the design life given in section 11.

4.3 The product must only be used in areas with limited foot traffic for inspection, maintenance and repair.

4.4 Typical applications by product type are:

- CCH5 — applications generally have minimal requirements for abrasion and wear, will be exposed to flow velocities up to  $2 \text{ m}\cdot\text{s}^{-1}$ , are not designed to anticipate impact loads and are generally installed above a dense subgrade that will provide significant support, such as concrete or rock. Containment applications include but are not limited to: bund lining, slope protection, remediation of concrete containment structures
- CCH8 — applications would generally expect greater abrasion and wear requirements than CCH5, or they would be expected to be exposed to flow velocities up to  $8.6 \text{ m}\cdot\text{s}^{-1}$ , or have looser subgrades which may provide less support for the material (such as soil substrates). Containment applications include but are not limited to: channel lining, slope protection, bund lining, lagoon lining and remediation of concrete containment structures.

4.5 CC Hydro is applied as an impermeable liner and protection layer to an underlying structure/soil surface. This underlying structure/soil surface must be designed by a suitably qualified engineer in accordance with appropriate standards to support itself, the additional loading from the set CC Hydro and any in-service loading (such as water/liquid, wind, ice or external surcharge).

4.6 For hydraulic applications, the design of a CC Hydro system should be based on the principles of hydraulic engineering to determine the likelihood of CC Hydro material movement under hydraulic load. Intermediate anchoring such as check slots may be required to secure the CC Hydro material to the underlying surface.

4.7 Jointing — the CC Hydro material must be joined together to create a monolithic system. CC Hydro must be thermally welded together using either a manual or automatic thermal welding machine. Additional PVC geomembrane may be supplied separately for patch repairs or forming 'boots' around pipe penetrations. Suitable grout may also be used to cover the PVC geomembrane.

4.8 Hydration — CC Hydro material must be actively hydrated to ensure the set physical properties are achieved. Potable water can be used but is not necessary, raw/natural water and saltwater can be used. A minimum water quantity of  $3.5 \text{ l}\cdot\text{m}^{-2}$  is needed for CCH5 and a minimum water a minimum quantity of  $6 \text{ l}\cdot\text{m}^{-2}$  is needed for CCH8. CC Hydro cannot be over hydrated and an excess of water is always recommended. See section 13.8 for hydration guidance.

### 5 Practicability of installation

The product is designed to be installed by a competent contractor qualified in welding of geomembranes of level 1 to BS EN 13067 : 2012, CSWIP 7.4 and 7.5 or equivalent, and experienced with this type of product, and can be installed under normal site conditions.

### 6 Structural performance

6.1 The design of structures using the product should be carried out by a suitably qualified and experienced engineer considering the following concepts:

- overall stability of the structure to be lined in the product
- external stability of the structure to be lined in the product

- internal stability of the structure to be lined in the product
- substrate preparation to minimise voids underneath the product
- the product type required to accommodate anticipated loading and abrasion conditions
- the layup orientation of the product to provide shingling of overlap joints, enable practical installation and minimise material wastage
- an air-channel testing regime of thermally welded joints
- the edge (perimeter fixings) to prevent wind and water ingress beneath the product
- intermediate fixings (if required) to prevent material movement as a result of wind or hydraulic loading conditions
- project specific details such as accommodating pipe penetrations, junctions and baffling.

6.2 When installing on soft soil substrates, the product should not be trafficked during installation. If trafficking is required for future maintenance or inspection, the subgrade can be improved by placing and compacting gravel to improve the bearing capacity, a protective layer may be required over the product dependent on the traffic loads required.

6.3 Watercourse linings, weirs and/or other hydraulic or erosion protection structures may require special consideration in regards to scour, uplift, wave action, seepage etc. The Designer must ensure the design takes into consideration the water velocity, turbulence and abrasion resistance requirements. The channel flow characteristics may be calculated using the channel profile geometry and the Certificate holder’s published Manning’s numbers and maximum permissible velocity and allowable shear stress. Intermediate fixings may be required to prevent movement and uplift and these fixings must be specified by the Designer and have sufficient load bearing capacity and durability to satisfy the project requirements.

6.4 Where a cohesive material, eg clay, is retained, to reduce the risk of a build-up of hydrostatic pressure in these conditions it may be necessary to provide additional granular layers or a drainage mat beneath the product to allow water to drain away.

6.5 It is essential that CC Hydro lined projects are properly designed in accordance with the Certificate holder’s guidelines taking into account project specific requirements and site conditions. The Certificate holder can provide standard design details, case studies and installation guidelines on request to facilitate this process. The design must be carried out under the responsibility of a suitably qualified and experienced engineer.

6.6 On large structures where wind uplift forces may be significant, intermediate fixings may be required to prevent uplift (calculation of wind loads can be obtained using the methodology described in BS EN 1991-1-4 : 2005). Suitable intermediate fixings must not perforate the geomembrane layer of CC Hydro. Any CC Hydro perforated by intermediate fixings must be repaired in accordance with section 10.

6.7 Declared mean initial and final flexural strengths [tested at 24 hours (+/-4 hours) from hydration], static puncture resistances, pyramid puncture resistance, strength of internal linking fibres [dry (uncured) samples] of the product are presented in Table 2. Samples were prepared in accordance with ASTM D8030/D8030M-16 and (with the exception of flexural strengths as stated above) tested no earlier than 28 days from initial hydration.

*Table 2 Strength properties of CC Hydro*

Product type	Mean initial flexural strength (machine direction) (MPa)	Mean final flexural strength (machine direction) (MPa)	Static puncture resistance (kN)	Pyramid puncture resistance (kN)	Strength of internal linking fibres (kN·m)
CCH5	4.0	13.0	3.5	7.5	4.0
CCH8	4.0	13.0	4.5	10.0	4.5

6.8 The product was tested for dynamic puncture resistance determined in accordance with EN ISO 13433 : 2006. Samples were prepared in accordance with ASTM D8030/D8030M-16 and tested no earlier than 28 days from initial hydration. From the five samples tested per product range, the impact caused the concrete to crack, but the probe did not make a full penetration through the product. Therefore the perforation depth was recorded as zero.

## 7 Climatic performance (freeze/thaw resistance)

The freeze/thaw resistance of the hardened (cured) product is determined in accordance with BS EN 12467 : 2012 with two exceptions: the evaluation is based on flexural strength and the number of cycles has been increased from 100 to 240 to cover a durability of 120 years for the concrete matrix in erosion control applications. The product retained more than 95% of initial flexural strength and more than 86% of their final flexural strength.

## 8 Resistance to chemicals

The product has been tested in accordance with BS EN 14414 : 2004 (Methods A-D) with one exception: the flexural strength as per section 6.7 has replaced the tensile strength test determined in accordance with BS EN ISO 527-1 : 2012. The percentage of retained resistance was compared before and after exposure to Acid [10% solution H<sub>2</sub>SO<sub>4</sub>], Alkaline [Saturated suspension Ca(OH)<sub>2</sub>], Hydrocarbon [Solvation and Swelling (35% vol diesel, 35% vol paraffin, 30% vol lubricating oil HD30)] and Synthetic Leachate for methods A to D, respectively. In tests to method A, CCH5 and CCH8 retained 79% and 85% of their resistances respectively. In methods B to D, the product retained their whole resistance. The Certificate holder should be contacted to assess the suitability of CC Hydro for the secondary containment of project specific chemicals. Project specific chemical resistance testing may be required to confirm suitably.

## 9 Water and gas permeability

To find the water and gas permeability of the product, the geosynthetic barrier (geomembrane) component CCH5 and CCH8 was tested in accordance with EN 14150 : 2006 and ASTM D1434-82, 2015, respectively. The water permeability of the PVC geomembrane is  $1.0 \times 10^{-6} \text{ m}^3 \cdot \text{m}^{-2} \cdot \text{d}^{-1}$  or  $1.0 \times 10^{-11} \text{ m} \cdot \text{s}^{-1}$ . The gas permeability of the PVC geomembrane is  $5.0 \times 10^{-12} \text{ cm}^3 \cdot \text{cm} \cdot \text{cm}^{-2} \cdot \text{s}^{-1} \cdot \text{Pa}$ .

## 10 Maintenance and repair

Routine maintenance is not normally required, however, annual inspection must be carried out and if any damage is recognised appropriate repair must be undertaken as per the Certificate holder's specifications.

## 11 Durability

The product, if designed, installed and maintained in accordance with this Certificate, will have a design life in excess of 50 years for the primary containment of non-pollutants and secondary containment of other liquids. The product type must be specified considering the long-term likelihood of dynamic loading, abrasion, hydraulic loading and flow conditions by the appropriately qualified design engineer. Specification of the incorrect product type may adversely affect the design life.

## Installation

### 12 General

12.1 Due to the versatile nature of the product and the possible applications, the Certificate holder should be contacted for specific installation advice.

12.2 Prior to installation of the product the following installation details should be specified by the designer:

- the product type required.
- the layup orientation of the product (eg transverse or longitudinal for channels, vertical or horizontal for slopes)
- the edge (perimeter) fixing details and connection to existing infrastructure
- determine if intermediate fixings are required to suit the application and if so, determine the spacing and specification of fixing
- project specific details such as methods of sealing around penetrations, upstands, junctions and baffling
- air-channel testing regime of thermally welded joints.

The Installation Method Statement must be approved by the Designer prior to commencing installation of the product.

## 13 Procedure

### Subgrade Preparation

13.1 Placing of CC Hydro must be on a prepared subgrade free from angular rocks, roots, grass and vegetation. All foreign materials and protrusions must be removed, and all cracks and voids must be filled and the surface made level, or uniformly sloped. No rocks or other object larger than USCS (Unified Soil Classification System), SP (Poorly Graded Sand) or equivalent, must remain on the substrate in order to provide an adequate safety factor against puncture of the PVC Geomembrane during installation. Geotextiles may be used where necessary to compensate for irregular subgrades.

### Placing

13.2 Placing of CC Hydro must be in accordance with the Installation Method Statement approved by the Designer. The Installer must unroll the product using methods that will not damage it and will protect the underlying surface from damage (for example a spreader bar). If necessary the Installer must place temporary ballast (commonly sandbags along the leading edge) on the product, which will not damage it, to prevent wind uplift. The installer must arrange the CC Hydro layers so that joints are aligned in accordance with the engineering drawings and for hydraulic applications should be overlapped (shingled) in the direction of water flow, so water flows over joints. For hydraulic applications, this is facilitated by orienting the product so that the high visibility welding strip is facing towards the source of water flow. If necessary the Installer must place ballast, such as sandbags, on top of the laid product prior to hydration to ensure that it lies flat to the substrate on undulating ground to prevent voids from forming underneath the material. Personnel must not wear damaging shoes and trafficking of the product must be kept to a minimum to avoid staining of the surface, particularly with wet footwear prior to hydration. Smoking is not to be permitted on CC Hydro.

13.3 Heavy vehicular traffic must not be permitted directly on CC Hydro unless the subgrade has been prepared with sufficient CBR density to support vehicle traffic without causing rutting. In this case, rubber-tyre vehicles and trucks are acceptable on the un-hydrated CC Hydro if wheel contact is less than 55 kPa. In areas of heavy traffic the CC Hydro must be protected by placing adequate protective cover over the top of the material.

### Fixings – perimeter and intermediate fixings

13.4 Perimeter and intermediate ground fixings must be installed in conformance with the Designer's details and the following requirements:

- perimeter fixings — CC Hydro must be firmly secured to the ground around the perimeter of the installation in order to prevent movement and eliminate wind ingress which can result in material uplift. This must be achieved by capturing the product in a concrete anchor trench or by using ground pegs or earth percussion anchors combined with an anchor trench backfilled with aggregate or soil. CC Hydro may also be secured around its perimeter by fixing to existing concrete infrastructure using gasket, stainless steel clamping bar and mechanical fixings such as concrete anchor bolts
- intermediate fixings — any intermediate fixings required to prevent CC Hydro movement due to wind or hydraulic loading conditions must be installed in accordance with the specification and fixing density provided by the Designer. Intermediate fixings must have a durability equivalent to the working life of the CC Hydro in the application
- anchor trench backfill — the material used to backfill anchor trenches should be described as “non-erodible backfill” and dependent on the erosion forces that the material in the anchor trench will be subjected to over the design life of the product. For example, soil and vegetation may be suitable at the crest of a slope with no running water, in situ concrete may be necessary in the invert of a channel.

### Jointing

13.5 The Installer must undertake the thermal welding of joints in accordance with the Certificate holder's Installation Guide. All thermal welding must be under the supervision of the approved Installation Supervisor who must be responsible for the direct supervision of all other welders. The Installer must:

- unroll the product with the geomembrane side facing down
- lay adjacent panels of CC Hydro so as to overlap the exposed welding strip

- wipe the faces to be welded to remove any dirt or moisture; this will ensure an optimum weld
- complete a trial weld before commencement of field welding. Trial welds should be conducted as a minimum at the start of each day and preferably after every 4 hours of operation or following any period of machine shut down or change of operator
- follow the welding equipment manufacturer's recommendations on machine set-up; this may vary depending on ambient temperature and humidity
- weld a minimum length of 1.0m for each trial weld and pressure test the air channel in accordance with the Certificate holder's Installation Guide and section 13.9. If the trial weld fails, repeat the weld adjusting temperature and weld speed accordingly until the weld passes
- thermal welding of field joints must not commence until a trial weld has been satisfactorily completed
- thermal welding equipment with data logging capability to record welding parameters is highly recommended.

13.6 The Installer must not undertake welding in the following conditions:

- during rain or snow, unless proper precautions are made to allow the joint to be made on dry geomembrane material
- above saturated soil
- where there is ponded water on the soil surface beneath CC Hydro
- when there is excessive wind.

13.7 When welding CC Hydro on top of a soft substrate, the Installer must use a 'skid' (eg a strip of geomembrane), placed underneath the joint prior to welding in order to ease the path of the welding equipment and prevent it from 'digging-in' the ground. The Installer must undertake routine maintenance of the welding equipment in accordance with the equipment manufacturer's recommendations. Particular attention must be paid to the hot air nozzle which must be regularly cleaned with a wire brush to prevent the build-up of polymeric residue. For complex areas and junctions, the geomembrane may be jointed using a hand-held welder or using a chemical solvent. It is recommended to form 'boots' for pipe penetrations on site using a hand-held welder and slot nozzle. Concrete grout approved by the Designer may be used in tandem with thermal welding to aid with jointing around upstands or other infrastructure. On large projects, the Installer must cover the last strip of unhydrated CC Hydro (eg with a plastic tarpaulin) and raise it above ground level at the end of the day to protect it from moisture or rainfall which may cause partial hardening and impinge on the next phase of welding work.

### **Hydration**

13.8 A stiff brush may be used to clean the surface of CC Hydro prior to hydration in order to remove footprints and dust accumulation and to prevent staining on the set material. Hydration of CC Hydro must be undertaken by the Installer in accordance with the Manufacturers Hydration Guidelines.

### **Testing and quality assurance**

#### ***Non-destructive testing of joints***

13.9 The only way to prove CC Hydro joints are fully sealed is for the Installer to carry out non-destructive testing along the entire length of all field welded joints using air-channel testing to prove the strength and impermeability of the weld, prior to hydration. Testing must be in accordance with ASTM D7177 (modified) and the Certificate holder's Installation Guide. An appropriate test regime must be agreed between the Installer, Designer and Client considering the Certificate holder's recommendations.

### **Reporting**

13.10 The Installer must keep clear and accurate records in a report format acceptable to the Designer and Client including:

- inventory checklist
- CC Hydro installation — daily summary
- CC Hydro installation — non-destructive test report.



## **Jointing — repairs**

13.11 All discontinuities in the geomembrane (whether caused by damage or failure of the CC Hydro or welds to conform with Specification, or by sampling or testing or other factors) must be repaired by the Installer. If damaged CC Hydro cannot be satisfactorily repaired, it should be removed and replaced with acceptable material. The Installer must complete all repairs in conformance with the Certificate holder's guidelines.

## **Technical Investigations**

### **14 Tests**

Tests were carried out and the results assessed to determine:

- thickness as per BS EN 1849-2 : 2009 on dry (uncured) samples
- mass per unit area and density as per BS EN 1849-2 : 2009 on dry (uncured) samples
- flexural strength as per ASTM D8058, 2017
- static puncture resistance in accordance with BS EN ISO 12236 : 2006
- dynamic puncture resistance in accordance with BS EN ISO 13433 : 2006
- pyramid puncture resistance in accordance with BS EN 14574 : 2015
- strength of internal linking fibres in accordance with BS EN ISO 13426-2 : 2005, Test B
- resistance to chemicals to BS EN 14414 : 2004 (Methods A-D) with one exception: the flexural strength replaces the tensile strength test in accordance with BS EN ISO 527-1 : 2012
- weathering (UV) in accordance with BS EN 12224 : 2000
- microbiological resistance in accordance with BS EN 12225 : 2000
- leaching resistance in accordance with BS EN 14415 : 2004
- thermal ageing in accordance with BS EN 14575 : 2005
- abrasion resistance as per ASTM C1353, 2015
- freeze/thaw in accordance with BS EN 12467 : 2012 with amendments.
- water permeability in accordance with BS EN 14150 : 2006
- gas permeability as per ASTM D1434-82, 2015 [test is performed on the geosynthetic barrier (geomembrane) component only].

All cured samples were prepared in accordance with ASTM D8030.

### **15 Investigations**

15.1 The manufacturing process was evaluated, including the methods adopted for quality control, and details were obtained of the quality and composition of the materials used.

15.2 Site visits were carried out to assess the practicability, ease of handling and installation of the product under various site conditions.

## Bibliography

ASTM C1353/C1353M, 2015, *Standard Test Method for Abrasion Resistance of Dimension Stone Subjected to Foot Traffic Using a Rotary Platform Abrader*

ASTM D1434 – 82, 2015, *Standard Test Method for Determining Gas Permeability Characteristics of Plastic Film and Sheeting*

ASTM D8030/D8030M-16 : *Standard Practice for Sample Preparation for GCCM*

ASTM D8058, 2017, *Test Method to Determine the Flexural Strength of Geosynthetic Cementitious Composite Mats using the Three Point Bending test*

BS EN 1849-2 : 2009 *Flexible sheets for waterproofing. Determination of thickness and mass per unit area. Bitumen sheets for roof waterproofing*

BS EN 1991-1-4 : 2005 + A1 : 2010 *Eurocode 1 — Actions on structures — General actions — Wind actions*

BS EN 12224 : 2000 *Geotextiles and geotextile-related products. Determination of the resistance to weathering*

BS EN 12225 : 2000 *Geotextiles and geotextile related products – Methods for determining the microbiological resistance by a soil burial test*

BS EN 12467 : 2012 + A1 : 2016 *Fibre-cement flat sheets. Product specification and test methods*

BS EN 13067 : 2012 *Plastics welding personnel – Qualification testing of welders – Thermoplastics welded assemblies*

BS EN 14150 : 2006 *Geosynthetic barriers. Determination of permeability to liquids*

BS EN 14414 : 2004 *Geosynthetics. Screening test method for determining chemical resistance for landfill applications*

BS EN 14415 : 2004 *Geosynthetic Barriers – Test method for determining the resistance to leaching*

BS EN 14574 : 2015 *Geosynthetics. Determination of the pyramid puncture resistance of supported geosynthetics*

BS EN 14575 : 2005 *Geosynthetic barriers – Screening test method for determining the resistance to oxidation*

BS EN ISO 527-1 : 2012 *Plastics. Determination of tensile properties. General principles*

BS EN ISO 9001 : 2015 *Quality management systems — Requirements*

BS EN ISO 12236 : 2006 *Geosynthetics. Static puncture test (CBR test)*

BS EN ISO 13426-2 : 2005 *Geotextiles and geotextile-related products. Strength of internal structural junctions. Geocomposites*

BS EN ISO 13433 : 2006 *Geosynthetics. Dynamic perforation test (cone drop test)*

ETA 19/0086 *Concrete Canvas and Concrete Canvas Hydro*

### 16 Conditions

16.1 This Certificate:

- relates only to the product/system that is named and described on the front page
- is issued only to the company, firm, organisation or person named on the front page – no other company, firm, organisation or person may hold or claim that this Certificate has been issued to them
- is valid only within the UK
- has to be read, considered and used as a whole document – it may be misleading and will be incomplete to be selective
- is copyright of the BBA
- is subject to English Law.

16.2 Publications, documents, specifications, legislation, regulations, standards and the like referenced in this Certificate are those that were current and/or deemed relevant by the BBA at the date of issue or reissue of this Certificate.

16.3 This Certificate will remain valid for an unlimited period provided that the product/system and its manufacture and/or fabrication, including all related and relevant parts and processes thereof:

- are maintained at or above the levels which have been assessed and found to be satisfactory by the BBA
- continue to be checked as and when deemed appropriate by the BBA under arrangements that it will determine
- are reviewed by the BBA as and when it considers appropriate.

16.4 The BBA has used due skill, care and diligence in preparing this Certificate, but no warranty is provided.

16.5 In issuing this Certificate the BBA is not responsible and is excluded from any liability to any company, firm, organisation or person, for any matters arising directly or indirectly from:

- the presence or absence of any patent, intellectual property or similar rights subsisting in the product/system or any other product/system
- the right of the Certificate holder to manufacture, supply, install, maintain or market the product/system
- actual installations of the product/system, including their nature, design, methods, performance, workmanship and maintenance
- any works and constructions in which the product/system is installed, including their nature, design, methods, performance, workmanship and maintenance
- any loss or damage, including personal injury, howsoever caused by the product/system, including its manufacture, supply, installation, use, maintenance and removal
- any claims by the manufacturer relating to CE marking.

16.6 Any information relating to the manufacture, supply, installation, use, maintenance and removal of this product/system which is contained or referred to in this Certificate is the minimum required to be met when the product/system is manufactured, supplied, installed, used, maintained and removed. It does not purport in any way to restate the requirements of the Health and Safety at Work etc. Act 1974, or of any other statutory, common law or other duty which may exist at the date of issue or reissue of this Certificate; nor is conformity with such information to be taken as satisfying the requirements of the 1974 Act or of any statutory, common law or other duty of care.