



SPORT AND PLAY
international

HYDROFIELDS
WHERE NATURE MEETS NATURE

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Name	Rob Venneker
Email	info@sport-and-play.com or rob.venneker@sport-and-play.com
Contact	+43 676 31 66 960

AT A GLANCE

25%

LESS TIME

Within 4-6 weeks a full-sized field can be finished - from the first groundworks until completion of the top layer. You can save min. 25% in time.

100%

NATURAL MATERIAL

100% natural material, made of basalt stones and therefore 100% recyclable

20%

FASTER GROWTH

Water and oxygen encourages roots to grow deep and remain safely below ground, allowing the natural grass to become strong and fully established. The growing process is ca. 20% faster with Hydrorock.

50%

LESS FERTILIZERS

Fertilizers will not pass the Hydrorock layer and disappear into the soil, which results in ca. 50% less usage of fertilizers.

50%

LESS WATER CONSUMPTION

Compared to the current situation, 50% less water can be consumed with Hydrofields/ Hydrorock

94%

45 LITER /M2

Hydrorock can hold around 94% water of its cubic volume; that is 45 l/m².

0%

WATER STRESS

It is easy for natural grass to remove water/ oxygen from saturated stone wool as it is from stone wool that has given up 50% or even 70% of its moisture. Therefore, natural grass is not exposed to water stress

NO TRADITIONAL DRAINAGE SYSTEM

The fibers are laid down directionally and therefore Hydrorock functions as a drainage. Water is retained within the capillaries and moves rapidly between the panels and blocks through capillary action.

HYDROFIELDS – THE 3-in-1 HYBRID TURF SYSTEM

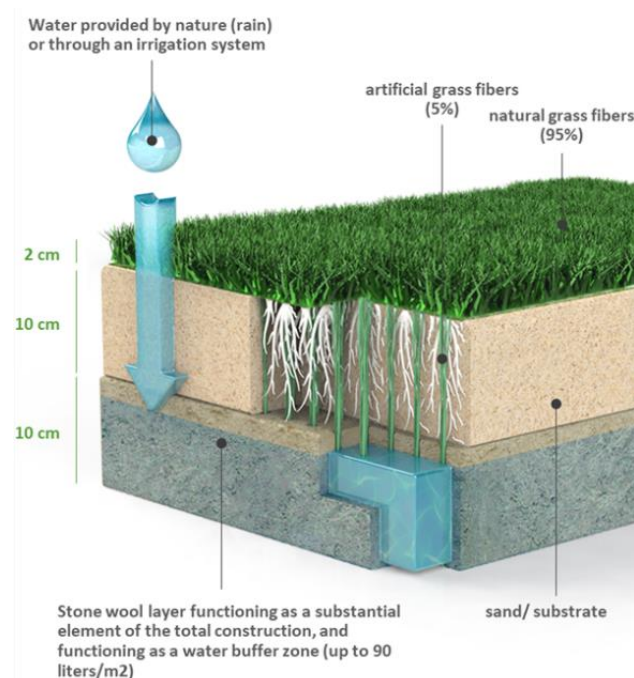
Reinforced or hybrid turf systems have been around in various formats since the 90s. The different concepts basically offer an artificial product integrated into natural grass on the basis that the amendment provides a reinforcement or stabilizing effect.

This so-called reinforced natural grass is a natural turf system that combines the playing quality of natural grass with the long lifespan of artificial turf.

Hydrofields is a patented hybrid system that consists of 3 main elements:

- a layer of sand/ substrate; and
- reinforcement through artificial grass fibers; and
- a growing layer

The latter makes this system matchless and differentiates Hydrofields from any other hybrid system.



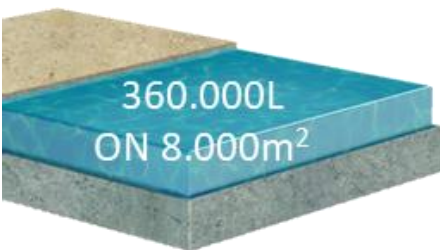
1 STONE WOOL



Hydrofields is primarily based on a growing layer of stone wool. Why stone wool? Well, in the first place because it is made of basalt stones and therefore an environmentally friendly and recyclable product. Secondly, because it is stone, it offers a high stability and retains its characteristics over time. But the main reason is its water management capacity: it can buffer 45 liters/m² of water without any effect on the dimensions and the (product and playing) characteristics.

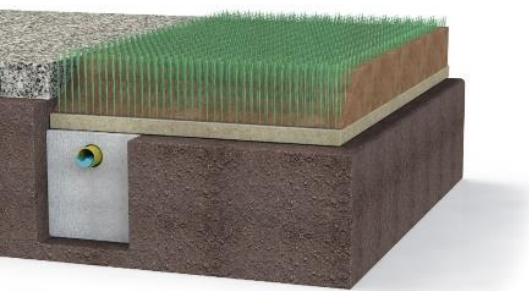
The panels have a load capacity of up to 8.000 kg/m² and therefore is a stable layer and a substantial part of the total construction of the natural grass field. Consequently, this leads to costs savings related to the overall construction (simple construction, no drainage system) and lower maintenance costs (such as efficient usage of water).

2 WATER MANAGEMENT



Hydorock is a stable supporting layer which functions at the same time as a water management system. Storage of water has no effect on the dimensions, product and playing characteristics. Fibers are cross-linked providing a slope causing the water to run off to the sides of the pitch “automatically”. Stone wool is resistant to humidity and climate impact, keeping its declared properties, shape and volume in the long term.

3 GROWING LAYER



- Hydorock stores water and provides oxygen to the root zone which are easy to remove and therefore natural grass is not exposed to water stress
- The availability of water and oxygen encourages roots to grow deep and remain safely below ground, allowing the natural grass to become strong and fully established, whereas the natural grass will grow in the rock wool and thus be even stronger

HYDROROCK - EVER SEEN ANYTHING LIKE IT BEFORE?

- Hydorock is a natural aquifer – just like a sponge soaking up water, a reservoir holding water, and a watering can releasing water
- Hydorock can hold around 94% water of its cubic volume – so a cubic metre of blocks hold around 940 litres of water
- Water is retained within the capillaries of Hydorock or moved in and out through them by water pressure differential between inside the block and the surrounding soil
- When the water pressure is equal between Hydorock and the soil, water is retained within the block
- As the moisture level of the soil drops as it dries, so does the water pressure and water is released from Hydorock into the soil
- If the water pressure of the soil is greater due to higher soil moisture level, water enters the Hydorock block
- Hydorock outperforms every other type of water management as a result of the blocks’ unique ability to support the weight of the water within them. This means that there is much lower hydrostatic pressure on the soil beneath, preventing compaction and enabling infiltration across the whole surface area of the bottom and four sides.

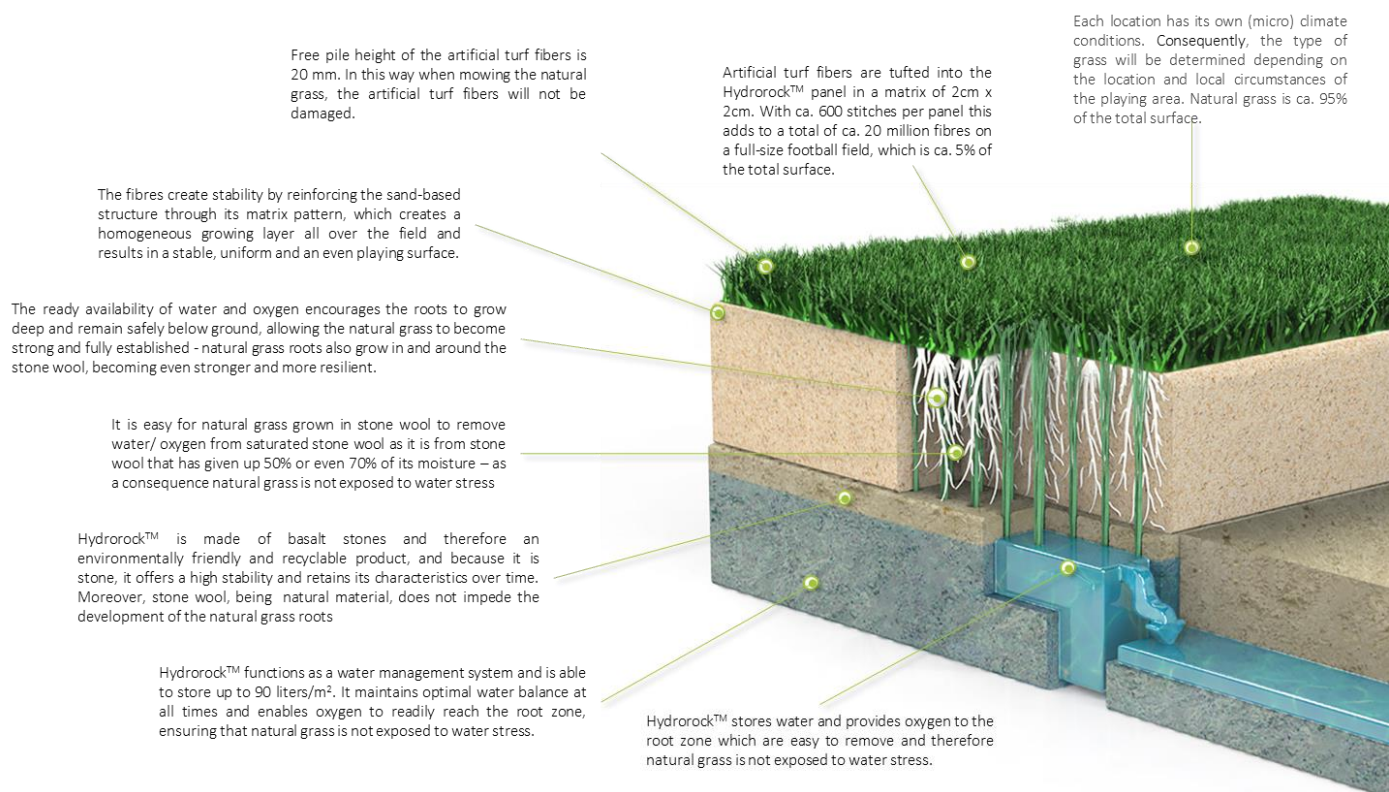
TRULY REINFORCED?

Most reinforced or hybrid systems are not truly a reinforcement of the natural grass.

Carpet based hybrid systems only deliver a stabilization in the top layer, but do not principally reinforce the natural grass. Due to the backing there is a disturbing layer that will not allow for the natural grass to grow in a uniform way all over the field. That is, on some parts of the field the natural grass will grow "through" the backing, on other parts it will not.

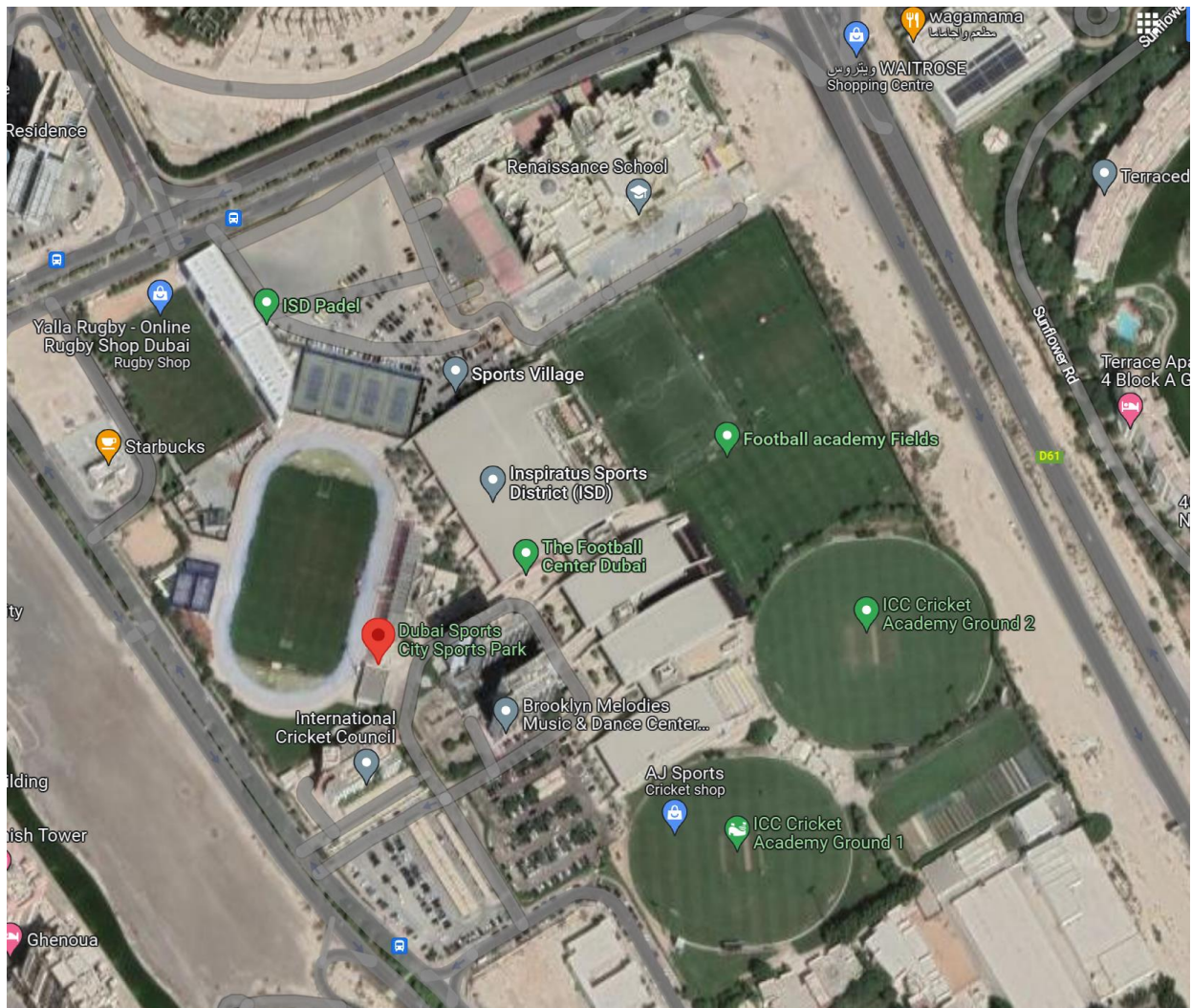
A stitched hybrid system functions much more efficient: there is no disturbing layer, and the growing layers are stabilized over a certain depth due to the artificial turf fibers providing a homogeneous environment for natural grass to grow in a uniform way all over the field. However, the matrix of fibres also result in an "armoured structure" causing the soil to compact and harden. Consequently, a very stringent maintenance schedule based on the activities on the field is absolutely necessary

One thing they all have in common: a visual reinforcement. Once the natural grass doesn't grow or is damaged, one will still see the green artificial turf fibers.



OBJECT INFORMATION

SITE ADDRESS



Dubai, United Arab Emirates

CLIMATE

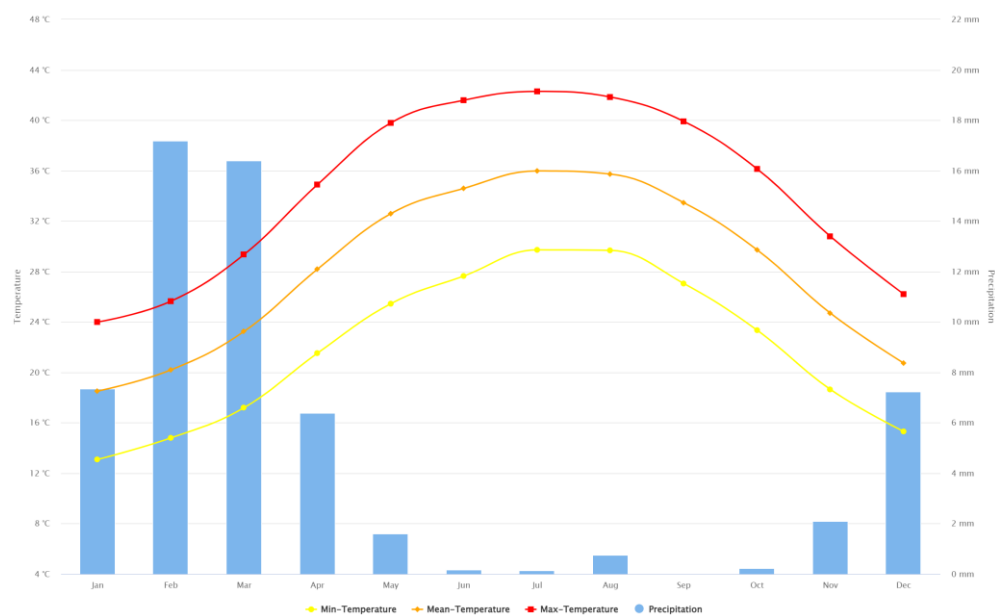
The UAE has an arid desert climate with only two main seasons, winter and summer separated by two transitional periods, respectively. The winter season (December to March) has a mean temperature ranging from 16.4°C to 24°C. The first transitional period (April to May) is distinguished by variability and rapid change in weather. Temperatures start to increase gradually over most regions during this period. The mean temperature during this season ranges from 26°C to 33.5°C. The summer season (June to September) is characterized by extremely high temperature which can be expected to climb up to 50°C, especially over the southern parts. Mean temperature during this season ranges from 32°C to 37.2°C.

HYDROFIELDS_PROJECT DUBAI_QUO23-RVE9000

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Summer rainfalls tend to be lower, particularly along the coastal areas, away from the mountains. The second transitional period (October to November) has a mean temperature ranging from 24°C to 30°C.

Rainfall is sparse and inconsistent in the UAE. The country averages between 140 – 200 mm of rainfall per year, with some mountainous areas experiencing up to 350 mm/year. The UAE is also prone to occasional, violent dust storms, locally known as shamal winds.



DESIGN RAINFALL

Peak average monthly rainfall of 17 mm occurs during January. Based on an average of 2 days precipitation in January, this would equate to 8,5 mm / day (for each day with precipitation). Unfortunately, no data are currently available on the frequency and severity of storm events i, however, for the purposes of design, the following is proposed: 34 mm rainfall (i.e. double of the average maximum total monthly precipitation) over a 2 hour period = 17 mm / hour.

Month	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
Average high in °C	24,3	26,1	29,4	34,3	38,8	40,8	42,1	42,3	39,9	36,3	30,8	26,3
Average low in °C	14,1	15,0	17,2	20,8	24,4	26,6	29,2	29,2	26,9	23,5	19,7	15,8
Precipitation in mm	17	15	16	4	0	0	2	0	0	1	2	10
Precipitation in days	2	2	2	0	0	0	0	0	0	0	1	1
% humidity	61	57	52	45	42	47	47	46	52	54	57	61

GENERAL CONSTRUCTION RECOMMENDATIONS

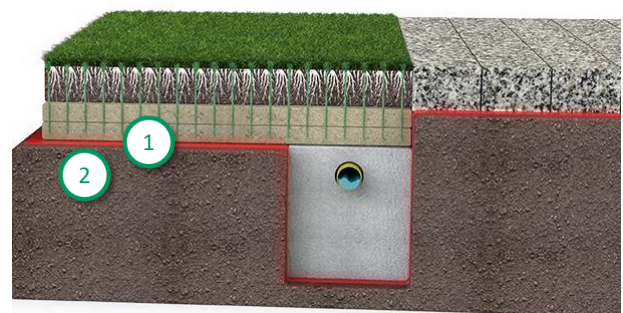
Hydrorock is a true sustainable drainage solution used for buffering storm water, harvesting rainwater, infiltrating runoff, draining groundwater and irrigation:

- Soaking up water like a sponge – rapidly absorbing 94% of its cubic volume
- Holding water like a reservoir – suspends water within the capillaries between fibres – supports weight of the water – prevents soil compaction
- Releasing water like a watering can – water readily infiltrates the soil through both the bottom and sides of the Hydrorock blocks/ panels

Based upon these characteristics the following construction for this object is suggested:

CLOSED CONSTRUCTION

The Hydrorock elements allow to make space for water to prevent onsite flooding and drought. Water is retained within the capillaries of the Hydrorock elements or moved in and out through them by water pressure differential between inside the block and the surrounding soil. When the water pressure is equal between the Hydrorock and the soil, water is retained within the block. As the moisture level of the soil drops as it dries, so does the water pressure and water is released from Hydrorock into the soil.



- 1 The implementation of an non-permeable layer makes it possible to collect and reuse excess water in an efficient way, for example for washing machines, showers, irrigation, etc.
- 2 Underneath the non-permeable fleece there is a capillary breaking layer of 8 cm with compacted crushed stones (e.g. 5-10 mm)

ADVANTAGES

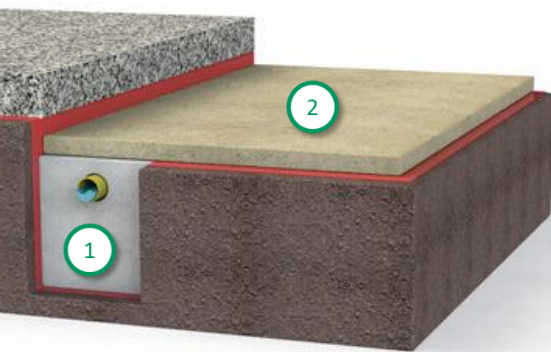
- With this construction no water (rain water, irrigation, etc.) will get lost into the (existing) soil as the Hydrorock elements will soak up water like a sponge and hold it
- Water can be pumped from a dwell or an existing water reservoir directly into the Hydrorock elements, providing water to the roots from below
- In this way water is exactly where it should be for the roots providing water, oxygen and air at all times without causing any water stress for the grass roots

HYDROROCK BLOCKS AND PANELS

Hydrorock provides the unique ability to support the weight of the water within them. This means that there is much lower hydrostatic pressure on the soil beneath, preventing compaction and enabling infiltration across the whole surface area.

To prevent any difficulty in draining heavy rainfall quickly, or to keep natural grass surfaces hydrated during the dry summer months, so that for example a football field remains usable, the field is divided in sectors. Therefore, Hydrorock BD elements (blocks with a drainpipe) are installed in the axis of the field, both in width and length as well as at the perimeter of each sector. This will warrant out- and inflow of water in an efficient way.

STRUCTURE AROUND THE FIELD



1 Hydrorock BD element (L 1200 x H 360 x W 330 mm) as perimeter drainage system

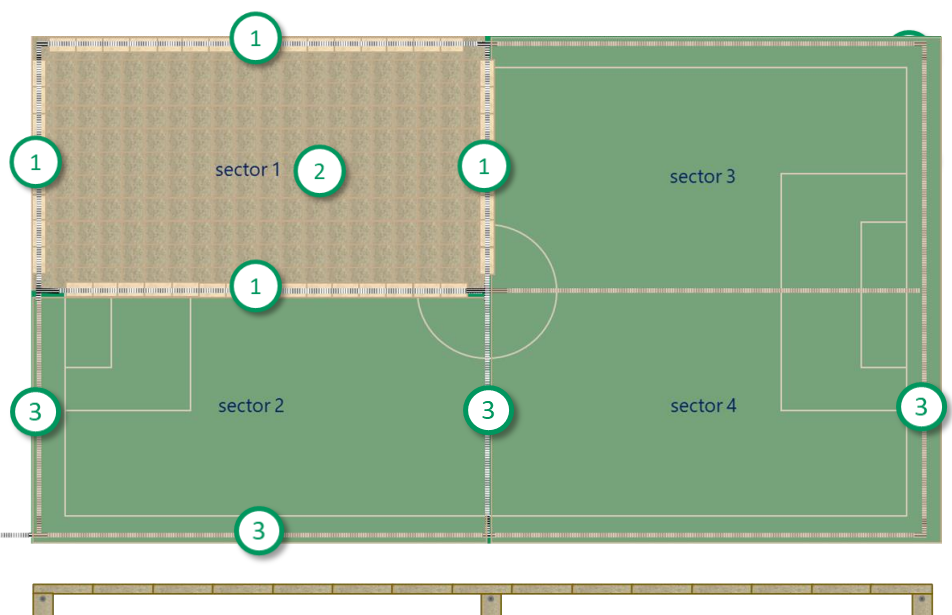
2 Hydrorock panel with (L) 1000mm x (W) 1000 mm x (H) 50 mm

STRUCTURE IN THE FIELD

1 Hydrorock BD element (L 1200 x H 360 x W 330 mm) as perimeter drainage system

2 Hydrorock panel with (L) 1000mm x (W) 1000 mm x (H) 50 mm

3 Through the drainage pipes an efficient out- and inflow of water is provided



WATER MANAGEMENT

Hydrorock is a true sustainable drainage solution used for buffering water, harvesting water, infiltrating runoff, draining rain and irrigation water. As a 100% natural material Hydrorock manages and saves water in a highly efficient way. Hydrorock and Hydrofields have ongoing scientific studies with the "International Center of Biosaline Agriculture (ICBA) in Dubai and "Wageningen University & Research (WUR)" in The Netherlands as well as practical studies with "STRI" in Australia.

EXISTING WATER CONSUMPTION

Area in m2	daily (in liters)		weekly (in liters)		monthly (in liters)		year
	summer	winter	summer	winter	summer	winter	total
8.400	126.000	92.400	882.000	646.800	3.780.000	2.772.000	39.312.000
6.500	97.500	71.500	628.500	500.500	2.925.000	2.145.000	30.420.000
9.000	135.000	99.000	945.000	693.000	4.050.000	2.970.000	42.120.000
8.400	126.000	92.400	882.000	646.800	3.780.000	2.772.000	39.312.000

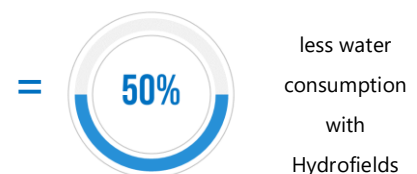
HYDROROCK WATER MANAGEMENT DATA

Basic data of Hydrorock:

- Size panel (L) 1000mm x (W) 1000 mm x (H) 50 mm
- Water capacity 45 liter/m²
- Consumption 45 liter/m2 is enough for 1 week

Water availability and water consumption based on the data above are as follows:

Area in m2	water storage (in liters)		consumption	year
	/m2	total	monthly	total
8.400	45	378.000	1.606.500	19.278.000
6.500	45	292.500	1.243.125	14.917.000
9.000	45	405.000	1.712.250	20.655.000
8.400	45	378.000	1.606.500	19.278.000



EXISTING WATER SUPPLY

The existing fields are watered using fresh water which is stored in tanks and pumped to the fields. Eventually, the existing fields will be supplied with water via an irrigation system. Excess water flows to the drainage channels, but it is not collected for re-use.

HYDROROCK WATER MANAGEMENT SOLUTION

Hydrorock outperforms every other type of water management as a result of the blocks' unique characteristics. Especially in warmer areas with limited water availability and where every drop of water counts, the system allows for a highly efficient way of managing water:

1. INFLOW OF WATER

A traditional irrigation system has some practical disadvantages:

- Not consistent
- Weather depended (especially wind)
- Only 60-70% of water on pitch because of wind and evaporation
- A traditional construction of a natural grass pitch will not hold the water – a lot will “disappear” into the ground. Consequently, the 60-70% of irrigation water that will fall effectively on the pitch will not completely be available for the grass roots.

Each Hydrofields system allows for pumping the available water (ground water from a dwell, water from a reservoir, water from a basin; etc.) through the drain pipes of the BD element into the Hydrorock elements all over the field. This allows for:

- a) The system to function as a subsoil irrigation system;
- b) Water to be there where it should be: at the level of the grass roots; and
- c) No loss of water as it is transferred from panel to panel without any external negative influence, and
- d) Effectively each m² of the field to store up to 45 liters of water – uniformly all over the field

The inflow of water can be controlled automatically by means of sensors that measure the moisture content of the Hydrorock elements. AgriOT soil sensors allow for smart monitoring and control through a mobile apps and/ or a web portal in real-time anywhere, anytime.

The inflow of water also allows for applying soluble fertilizers for precision feeding of grass roots. The nutritional input is a small percentage of the total cost of natural grass maintenance , but it has a major effect. Fertilisers will help to promote healthy growth, giving the sports field with natural grass the essential nutrients they need. With Hydrorock as a subsoil irrigation system, the dosage of fertilizers can be optimized in view of quantity and using the right nutrients

2. OUTFLOW OF WATER

The major difference between a traditional drainage system and Hydrorock is that Hydrorock holds/ stores water up to 45 liters/m². Practically every drop of water coming from above or below is absorbed and stored by the Hydrorock elements. Only once the elements are saturated, the outflow of the water will start, whereas the water is actually pushing itself outwards. Fibers are cross-linked providing a slope causing the water to run off to the sides of the pitch “automatically”.

Consequently, water is not wasted and can be managed in a highly efficient way. The excess water can be collected and stored in different ways – water tank(s), water basin, pond, etc.. It can be used for a variety of purposes, such as

The main reason for collecting excess water is to pump the water back into the Hydrorock elements (see “inflow of water”) in order to benefit from the efficiency of the Hydrorock system and to lower the quantity of water/ costs of water as much as possible.

3. FILTRATION OF WATER

Filtration benefits of Hydrorock elements:

- **Filters rainwater**

Mineral wool material naturally captures pollutants, greatly reducing amount entering the soil and water courses

- **Dissolves chemical contaminants**

Polycyclic Aromatic Hydrocarbons (PAHs)

- **Filters metals and solid particulate matter**

Metals such as zinc, copper, etc.

- **Natural material**

Particles of silt and sand over 40 microns in size are prevented from entering the Hydrorock elements

NEXT STEPS

Client to provide:

- More detailed input of the location and the surrounding elements
- More detailed input about where water supply is located and where it is (and can) be stored
- Drawings of the venue/ field(s)

Online meeting

- Q&A session
- Explain the different Hydrofields systems
- Discuss construction steps
- Planning

Visit site in Dubai

Detailed offer

APPENDIX 1

GENERAL INFORMATION HYDROFIELDS SYSTEM BASED ON HYDROROCK TECHNOLOGY

- Hydrofields is a patented hybrid system consisting 3 main elements: a layer of sand/ substrate; reinforcement through artificial grass fibers; and a growing layer.
- The growing layer is a substantial element of the Hydrofields system and is based on the Hydrorock technology.
- Besides the characteristics and functionality as described in the general information above, the Hydrorock panels serve as a growing layer for the natural grass:
 - It maintains optimal water balance at all times and enables oxygen to readily reach the root zone, ensuring that natural grass is not exposed to water stress, and
 - The ready availability of water and oxygen encourages the roots to grow deep and remain safely below ground, allowing the natural grass to become strong and fully established - natural grass roots also grow in and around the stone wool, becoming even stronger and more resilient
- Synthetic turf fibers are stitched into the construction layers, or installed as an artificial turf carpet, providing increased stability by reinforcing the sand/ substrate structure.
- The sand / substrate used as infill must fulfil certain specifications (be at least 15cm high and consist of a stone-free sand/organic mix) in order to provide best playing conditions and allow for proper water and oxygen permeability.
- Required natural grass seed mixtures and coverage quantity will vary according to local climatic conditions.
- Hydrofields, as a “hybrid natural surface”, is classified as “natural grass” by the sport governing bodies, such as FIFA and UEFA.
- The quality and the sustainability of each Hydrofields project depends on local climatic conditions and the level of utilization.
- For each Hydrofields project a proper and technically correct individual maintenance program must be specified related to the usage of fertilizers, pesticides, fungicides, etc., regular mowing as well as aeration and irrigation.
- Hydrofields’ “Maintenance Manual” as such contains general maintenance recommendations, whereas monitoring maintenance and recommendation of appropriate measures should always be defined for each project individually, preferably with a natural grass consultant and/or agronomist.

APPENDIX 2

GENERAL INFORMATION HYDROROCK TECHNOLOGY

- Hydrorock panels are made of stone wool - a natural 100% recyclable material made from basalt rock and produced in a sustainable way.
- Hydrorock technology is based on infiltration. Once placed into the soil, Hydrorock panels buffer rainfall quickly and effectively, enabling subsequent infiltration into the soil, or discharge it for example to a water tank or the sewer system.
- Hydrorock panels are able to absorb 94% water of their cubic capacity. This means practically the entire volume of the panels is available for the collection of water.
- The basic material is stone wool, which retains the characteristics and properties of the original basalt rock. Hydrorock panels - being a substantial part of the total (subbase) construction - can bear any sport application on top of the system without the Hydrorock panels becoming deformed or losing any functionality (provided installation and subsequent usage is undertaken properly, in accordance with specification).
- Hydrorock panels have a direct load bearing capacity of at least 6.000 kg / m², depending on the density. The strength of the Hydrorock panels decreases minimally when wet. Any light damage to Hydrorock panels during installation will not have any material influence on the panels' operational stability and functionality.
- Hydrorock panels have been tested under varying climatic conditions and temperatures and are frost resistance. The strength of the Hydrorock panels may decrease minimally only when the panels become completely saturated after long periods of sustained very low temperatures. In all other cases, low temperatures have no material influence on the Hydrorock panels.
- The structure of Hydrorock panels ensures that the system never becomes clogged. Larger particles ($\geq 45 \mu\text{m}$) cannot enter the Hydrorock panels and particles that are small enough to enter ($\leq 45 \mu\text{m}$) will also flow out again.
- The Hydrorock panels are easy to adapt, without loss of functionality during and after installation (without harming quality and performance).
- The Hydrorock panels are easy to replace and are fully recyclable.

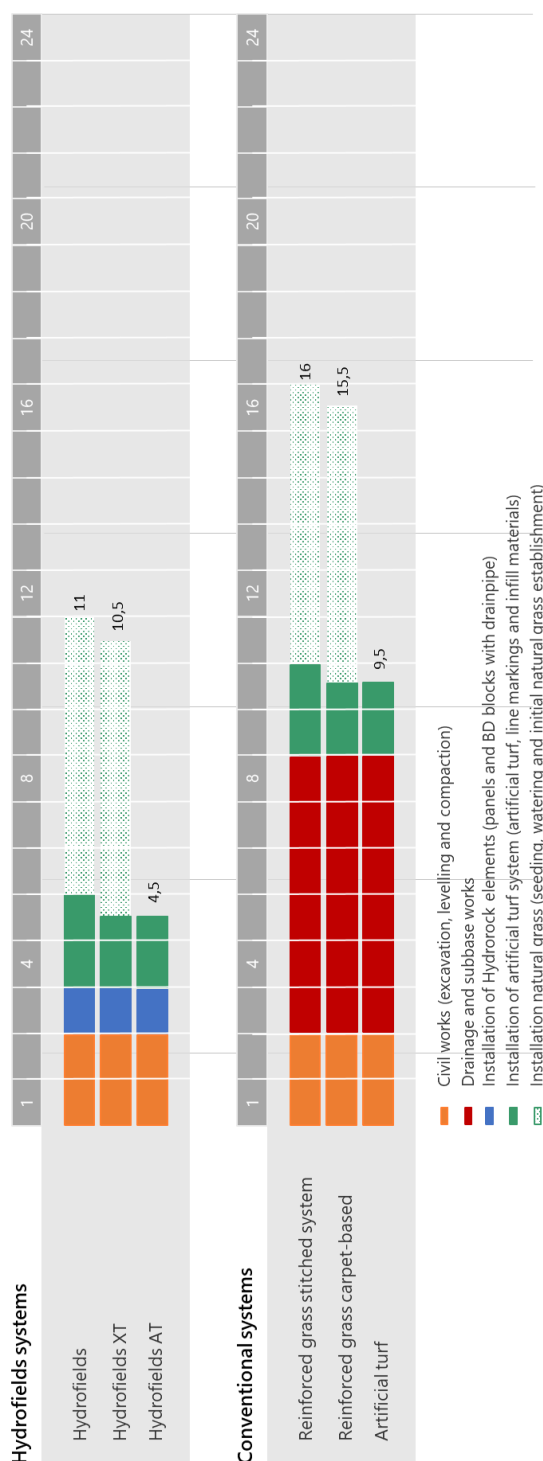
APPENDIX 3

ADVANTAGES THAT GO BEYOND EXISTING HYBRID SYSTEMS

PLAYABILITY	SYSTEM	OPERATIONAL	FINANCIAL	ENVIRONMENT
Consistent high playing quality all year round	3-in-1 hybrid turf system with integrated water management function	Easy to install and within a very short time ready to play	Cost efficient system from installation to end of life cycle	100% Recyclable
Consistency – Hydrofields provides a high-quality playing surface – traction, energy restitution and ball bounce are consistent all year	Durability – the Hydrofields construction has a load capacity of up to 8,000 kg per m2	Speed – Hydrofields is easy to install as a system with an estimated construction time from sub-base works until seeding of max. 4 weeks only	Initial Cost – Hydrofields is much more cost effective to install and maintain, e.g. no drainage system is necessary due to Hydrorock™	Natural material - Hydrorock™ technology is based on stone wool, a 100% natural material, which is a horticultural growing media
Reduced Risk – The risk of injury caused by an uneven surface and divots are minimized – Hydrofields as a system ensures the pitch stays divot free throughout the year	Water management - Full surface water management system with a large net volume for optimal drainage, infiltration and storage capacity of water	Speed – If quick installation is needed, Hydrofields can be installed as a pre-grown system	On-going costs – Maintenance costs with Hydrofields are strongly reduced (less water, stronger grass, less fertilizers, etc.) and are not more than a grass pitch to maintain	End of life – Once the area of a football field is replaced, Hydrorock™ being a natural material made of basalt rock and chalk, can be reused
Training – Players can train on the pitch they play matches on	Water management - 90 liters/m² of water are stored without any change to the system and playing characteristics	Speed – parts of the field can be changed within a short time	Equipment costs – no specialist maintenance equipment is required	
Weather – Even under wet conditions, Hydrofields retains its stability at all times.	Water management - Cooling down effect as water is stored permanently	Timing – Hydrofields can be produced 24/7 and can be installed at the time that is most convenient	End of Life Costs – Hydrofields is 100% recyclable, no significant end of life financial liability	
	Water management - The fibers of the Hydrorock™ are cross-linked providing a slope causing the water to run off to the sides of the pitch into the drain channel/ drainpipes	Maintenance – Hydrofields uses Hydrorock™ which retains nutrients and water which results in a less intensive maintenance and fertilization regime.	Training center costs – As Hydrofields allows much higher pitch usage it may be possible to reduce the size/number of pitches at the training facilities, thereby reducing on-going maintenance costs	
	Growing layer - Hydrorock™ provides a buffering reservoir of water in the root zone while maintaining an adequate volume of air (oxygen) in contact with the roots, which promotes vigorous root growth.		Revenue Generation – The resilience of Hydrofields allows the pitch to be used for some additional events on non match days	

APPENDIX 4

CONSTRUCTION TIME (INDICATIVE)



HYDROFIELDS_PROJECT DUBAI_QUO23-RVE9000