

Sandra Edwards

From: Amanda Scholes on behalf of Planning.Responses
Sent: 20 July 2018 09:17
To: Planning Scanning
Subject: FW: A/82/18/DOC - Quiet Water, Angmering - Condition 7 - SUDs
Attachments: Groundwater Dynamic Installation Specification (002) Oct17.pdf

From: Michael Eastham
Sent: 19 July 2018 12:25
To: Planning.Responses
Subject: FW: A/82/18/DOC - Quiet Water, Angmering - Condition 7 - SUDs



Thanks,

Michael

From: Chris Frost 
Sent: 19 July 2018 12:17
To: Laura Gibbons
Cc: 'Joe O'Meara'; 'Alan Morris'; Michael Eastham; 'Mateusz Debczak'; 'Garry Hutchinson'; 'James Richardson'; 'Philip Todd'
Subject: RE: A/82/18/DOC - Quiet Water, Angmering - Condition 7 - SUDs

Hi Laura

I attach Groundwater Dynamic's Installation Specification for the EGRP system, which gives more information about it.

If you have any specific queries about its installation and operation we would be happy to answer them.

Best regards

Chris Frost, MRTPI
Director

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2 Wardrobe Place, London EC4V 5AH


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Future Planning and Development Limited
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From: Laura Gibbons [REDACTED]
Sent: 19 July 2018 11:50
To: 'Chris Frost' <chris.frost@futurepd.co.uk>
Subject: RE: A/82/18/DOC - Quiet Water, Angmering - Condition 7 - SUDs

Chris,
Do you have any literature on the proposed EGRP that you could send through?
Thanks,

Laura Gibbons, MEng, GMICE
Engineer (Drainage & Coastal)

Laura Gibbons | Engineer (Drainage & Coastal), Engineering Services, Arun District Council | Location: First Floor, Arun Civic Centre,
Maltravers Road, Littlehampton, BN17 5LF

[REDACTED]
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Save the environment - think before you print.

From: Chris Frost [REDACTED]
Sent: 17 July 2018 16:07
To: Laura Gibbons
Cc: Michael Eastham; 'Philip Todd'; 'Mateusz Debczak'; 'James Richardson'; 'Garry Hutchinson'; 'Joe O'Meara'; 'Alan Morris'
Subject: FW: A/82/18/DOC - Quiet Water, Angmering - Condition 7 - SUDs

Hi Laura

Further to our email of 13 July, I attach the following drawings and information:

1. Drawings J5762/EX01 rev. B and /EX01 rev. B, which propose a foul water connection to the public sewer
2. Drawing FSC4082-D1 & D100 (AQUAFLOW PERMEABLE PAVING LAYOUT FOR PARKING AREA AND ACCESS ROAD AND CONSTRUCTION DETAILS)
3. Proposed Infiltration Drainage by EGRP Design Statement(rev D) including micro-drainage calculations
4. Borehole Details drawing
5. Site Investigation Report

For completeness, we have set out below the measures we have taken to address the points raised in your email from 20 June 2018:

- *No winter groundwater monitoring results have been provided with the application, the acceptability of the proposed design cannot therefore be assessed. We have provided comparable result from the neighbouring sites which you have agreed.*
- *The use of boreholes 6.3m deep to dispose of surface water and effluent from a foul package treatment plant are of concern. The Environment Agency should therefore be consulted regarding this. The proposed revisions mean that the foul package treatment plant is no longer connected to the boreholes, which have been reduced to 3.3m. I understand that the EA have been consulted.*
- *Why can more traditional means of infiltration not be used? The poor quality ground on the site makes trenches difficult to construct and has on-site safety issues. The EGRP borehole method is significantly more efficient.*

- *Why can foul water not be disposed of by connection to the main sewer system? We have now proposed a connection to the foul sewer*
- *The Infiltration test results are insufficient. Please provide the ground investigation report that was completed by GD. Copy of ground investigation report prepared by Hemsley Consulting is attached.*
- *Full details of the proposed boreholes will need to be provided before the condition is discharged. Borehole details drawing attached.*
- *We would encourage that the proposed porous pavement is left un-tanked to allow for some infiltration. The SUDS system is designed to be tanked. An untanked system would be liable to silt up resulting in longer term maintenance issues for the site.*
- *Insufficient detail regarding calculations has been provided. Please provide Micro drainage printouts. Micro-drainage calculations are included within the Drainage Design Statement (rev D).*
- *The drainage layout plan provided shows a different proposed arrangement of the site to other plans submitted. Please confirm which layout is correct. The plans have been updated to the current scheme, with the exception of the playspace layout, which does not affect the drainage design.*

We trust that the details submitted fully address your concerns and you are now able to recommend approval of the details submitted for Condition 7.

Best regards

Chris Frost, MRTPI
Director

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From: Garry Hutchinson [REDACTED]
Sent: 13 July 2018 11:30
To: 'laura.gibbons@arun.gov.uk'
Cc: Chris Frost; 'James Richardson'; 'Mateusz Debczak'; 'jomeara@groundwaterdynamics.co.uk'
Subject: A/82/18/DOC - Queit Qater, Angmering - Condition 7 - SUDs

Dear Laura

In response to your comments dated 20 June 2018 (attached) and the subsequent conversations with our drainage engineer, we have amended the foul water from the initial proposed bio-disk to a new connection to the public sewer.

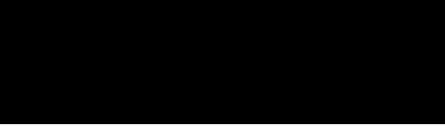
I understand that you are now satisfied with the ground water monitoring having assessed the comparable site to the north. We have revised surface water drainage details and will provide the updated report and micro-drainage calculations this afternoon.

I would be most grateful if you can confirm that the revised scheme and additional information submitted overcomes your initial concerns and you can recommend approval of condition.

Many thanks

Garry Hutchinson, MRTPI
Associate Planner

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DX 57406 Littlehampton

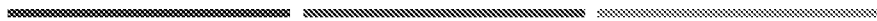
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GROUNDWATER DYNAMICS

INSTALLATION SPECIFICATION



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Energy-Passive Groundwater Recharge Pump (EGRP)

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EGRP SUPPORTED INFILTRATION TRENCH GUIDE

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5.0 Defects Liability Statement

EGRP Installation

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7.0 Follow-Ups

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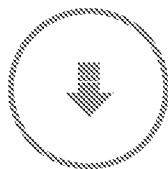
ENERGY-PASSIVE GROUNDWATER RECHARGE PUMP (EGRP).

1.0 Energy-Passive Groundwater Recharge Pump (EGRP)

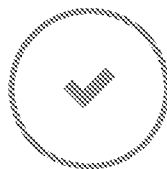
Increased property development has resulted in a larger proportion of land with non-permeable surfaces which, when combined with prolonged periods of rainfall, can give rise to nuisance groundwater and flooding. Whilst traditional piped drainage systems require an outflow to storm drains, the Energy-Passive Groundwater Recharge Pump (EGRP) system empowers you to deal with rainfall at source, cost effectively, environmentally and with minimal disruption.

EGRP, a worldwide patented technology, enhances and accelerates the soils ability to absorb water and the system is used for natural turf drainage as well as for SUDS solutions in urban drainage schemes. Also, the devices themselves have no moving parts, require no external energy source and are self-cleaning requiring no ongoing maintenance.

1.1 The Features of Energy-Passive Groundwater Recharge Pump (EGRP)



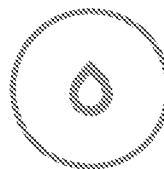
*Promotes
Infiltration*



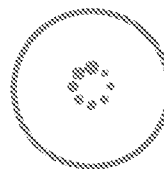
*Promotes
Drainage*



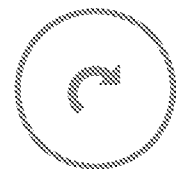
*Facilitates the
lateral
movement of
water*



*Manages
surface water
runoff*



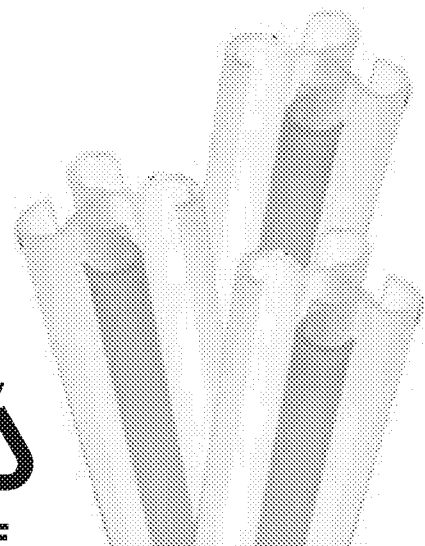
*Equalises
moisture content
throughout the
depth of the
device*



*Recharges
groundwater*

1.11 EGRP Material

The EGRP drainage extrusion is made from Standard HDPE (High-density Polyethylene), a thermoplastic made from petroleum. With a high strength-to-density ratio, HDPE material is often used for corrosion-resistant piping and is deemed more eco-friendly than other materials used within the industry as it does not deteriorate in the soil. HDPE is commonly recycled and has the number “2” as its resin identification code.



1.2 Borehole Depths

Vertical Borehole with a diameter of between 63.5mm and 88.9mm are drilled using displacement augers to depths up to 12 metres below ground level. The majority of boreholes however are between 1.5 and 3 metres deep and once drilled the EGRP device is capped and then vertically installed coming to rest 300mm below ground level. The borehole is then dressed with a mixture of native soil and a root zone mix before the original turf core is replaced.

1.3 EGRP Lengths

EGRP's are manufactured and stored in 6 metre lengths. Before each installation begins, these lengths are cut into 1.5 and 3 metre lengths and will be installed into the 63.5mm diameter borehole, according to the specification on the design drawing. For deeper depths of 6 and 12 metres, three EGRP devices are interlinked together creating more vertical channels before being vertically inserted into the larger 88.9mm diameter borehole.

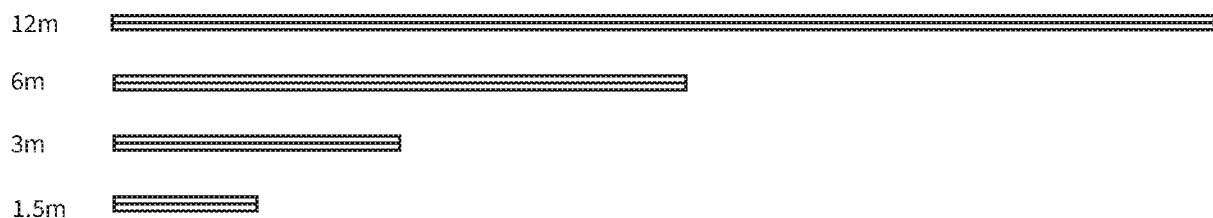


Figure 2, Four most common EGRP lengths used.

1.4 Secondary & Primary EGRP Devices

Every installation will include both shallow borehole drilling i.e, 1.5 & 3 metre devices along with deeper borehole drilling of 6 & 12 metres respectively. Each of these sets has a different purpose within the overall system design.

The shallow devices are the “foot soldiers” and are there to remove saturation and standing water off the surface and account for approximately 85% of the total number of boreholes on any one installation. We sometimes refer to the shallow devices as “secondary devices”.

The deeper drilling is there to penetrate further into sub-soil strata and to provide a greater capacity within the borehole for storage. These deeper devices, once the system is more than 12 weeks old and “acclimation” has taken place, create areas of low pressure and are a key to the activation of the whole system. We sometimes refer to the deeper devices as “primary devices”.

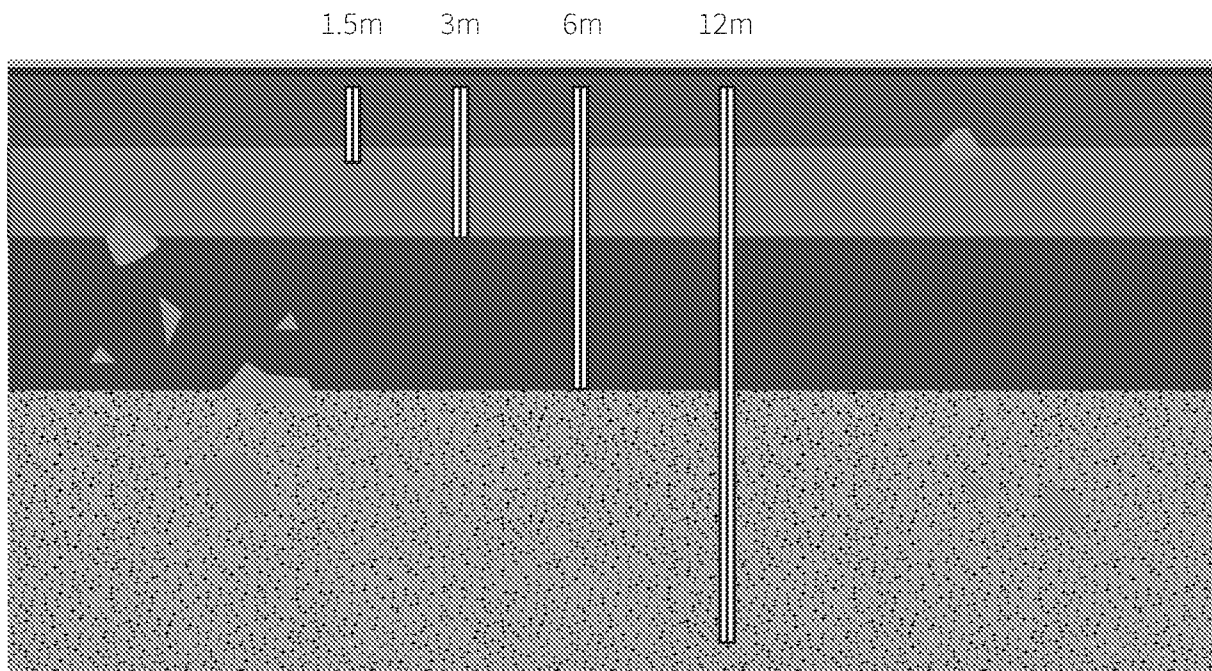


Figure 3, Shows the four EGRP depth

1.5 EGRP Caps

It is important to note that before being installed, each EGRP is capped at one end (the top end once inserted). The cap is required to activate the performance of the EGRP by creating a mild vacuum at the top of the device once acclimation has taken place and a column of water is pulling down against the rim of the cap. This mild-vacuum draws groundwater into the product laterally and not vertically. The cap also serves a second physical barrier, preventing any soil falling into the chambers of the product.

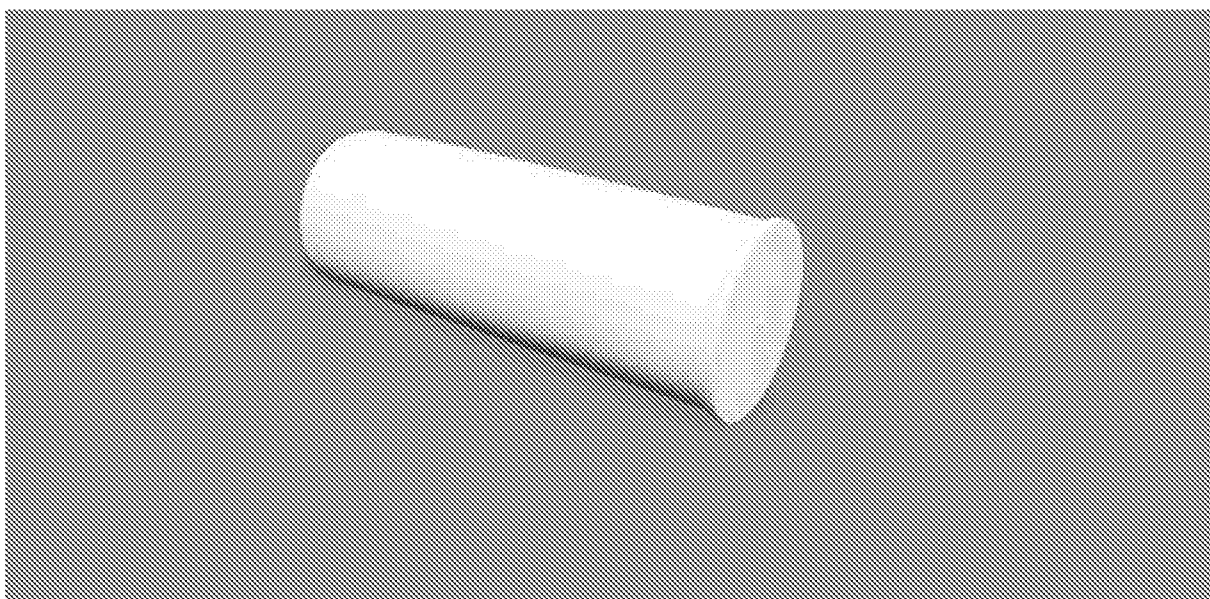


Figure 4 Example of an EGRP Cap

MACHINE DRILLING EQUIPMENT AND TECHNIQUES

2.0 Comacchio GEO205 mini-drill rig

Groundwater Dynamics use the Comacchio GEO205 mini drill-rig. This machinery can carry out a variety of drilling techniques which makes it a formidable, yet compact soil investigation rig.

2.01 GEO 205 Rig Specification

Tracking width:	1.1m
Tracking length:	4.5m
Working width:	2.0m
Working height:	4.5m
Height:	2.1m
Weight:	2.0 tonnes
(modified to GWD specification)	

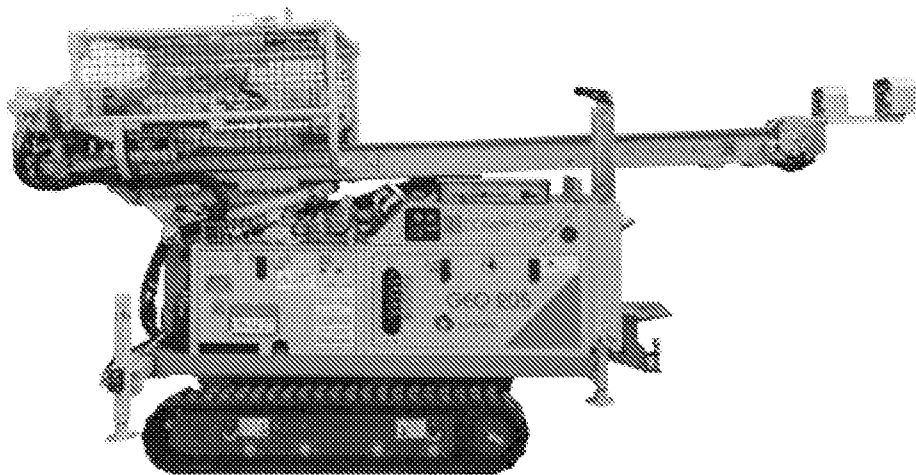


Figure 5, Comacchio GEO 205 mini-drill rig.

2.02 Augers

Augers

Lengths 5' and 3'

Dia. 2.5' and 3.5'

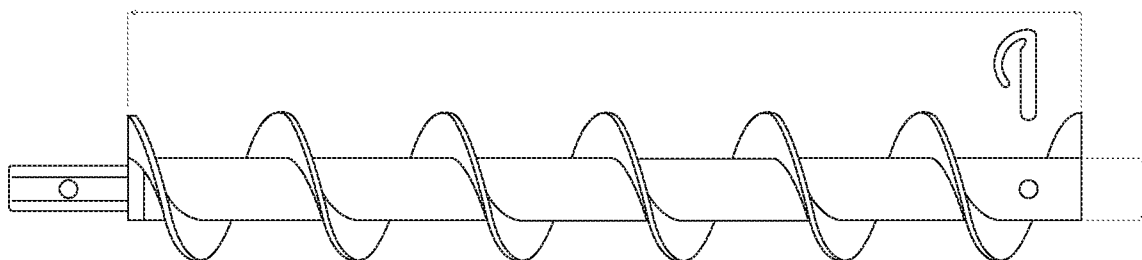


Figure 6, Diagram of Groundwater Dynamics Augers used to create the boreholes

2.1 Depth of Drilling

Generally speaking the standard depth for EGRP's post installation will be at least 300mm below ground level (BGL). Therefore, borehole drilling will be 300mm to 500mm deeper than the length of the EGRP. The depths of drilling and EGRP installation lengths are dependent on antecedent type soil and local topography.

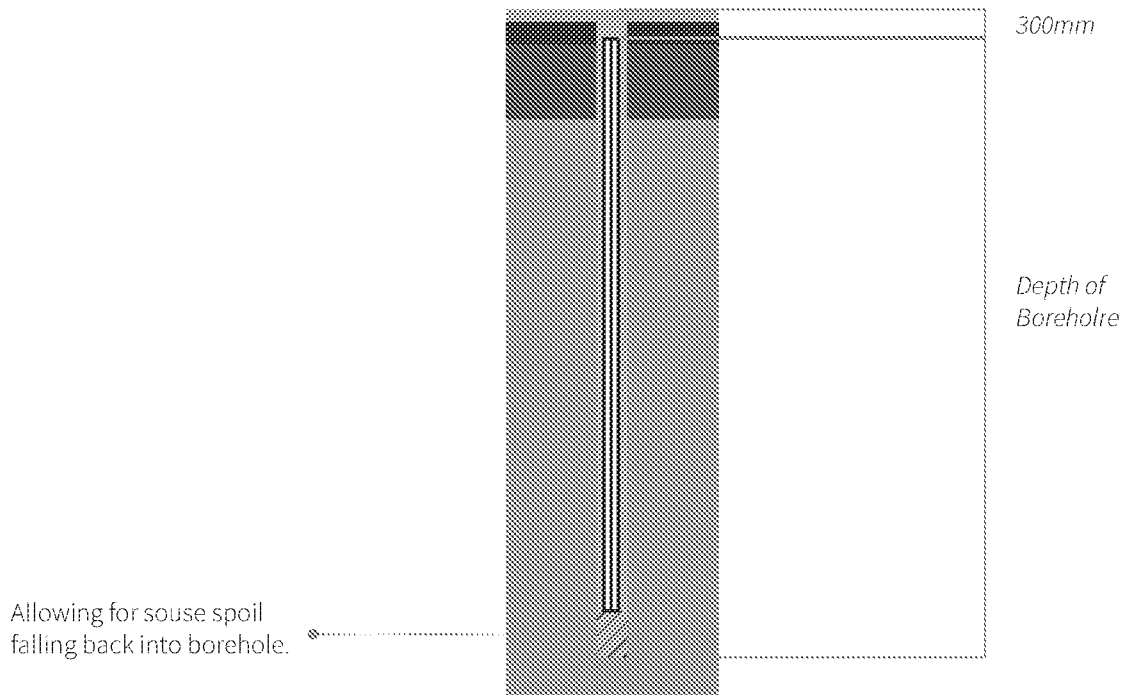


Figure 7, Diagram shows the depth of the borehole and the EGRP within

- For EGRP's of 1.5 and 3 metres the boring diameter shall be minimum 63.5mm.
- For EGRP's of 6 and 12m the boring diameter shall be minimum 88.9mm.
- All borings must be drilled vertically at 90 degrees on flat surfaces.
- Sloped Areas - all borings must be drilled vertically where drilling rig is stabilised and level using hydraulic outriggers. Uneven and undulating ground will increase the time and consequently the cost of installation.

2.2 Navigating the Comacchio GEO 205 Drill Rig

It must be noted that to prevent damage to any surrounding playing surfaces or surface areas, Groundwater Dynamic navigates the 2.0 tonne Comacchio GEO 205 drill rigs using track mats.

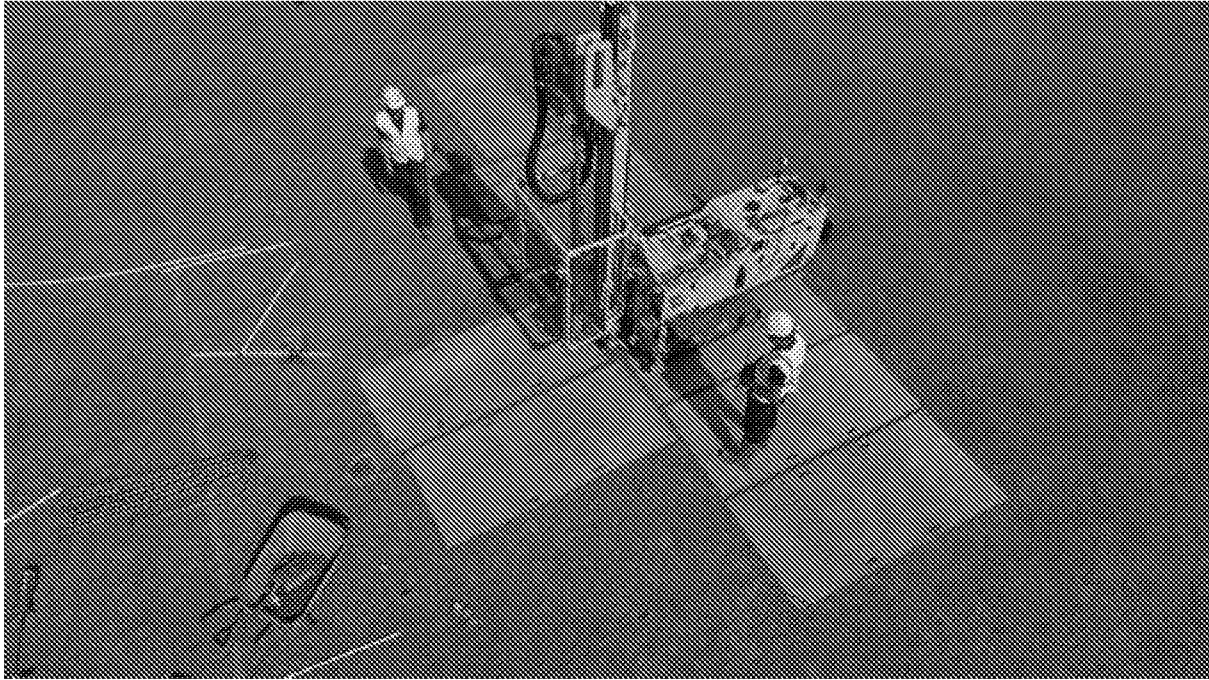


Figure 8 Shows how tracking mats are used while navigating the drill rigs

2.3 Diamond Pattern

- 3 metre EGRP devices are installed along a centre line at between 900mm and 1m centres depending on soil type and local topography.
- 1.5 metre EGRP devices are installed between & perpendicular to each 3 metre device 500mm from the centre line.
- 6 & 12 metre EGRP's are either integrated or offset from the diamond pattern line. These Primary devices are normally installed every 7 metres however, depending on the purpose of the installation, can be widely used for a number of other objectives e.g, run-off water, defensive lines, increased storage, localised ponding, basement dewatering etc.

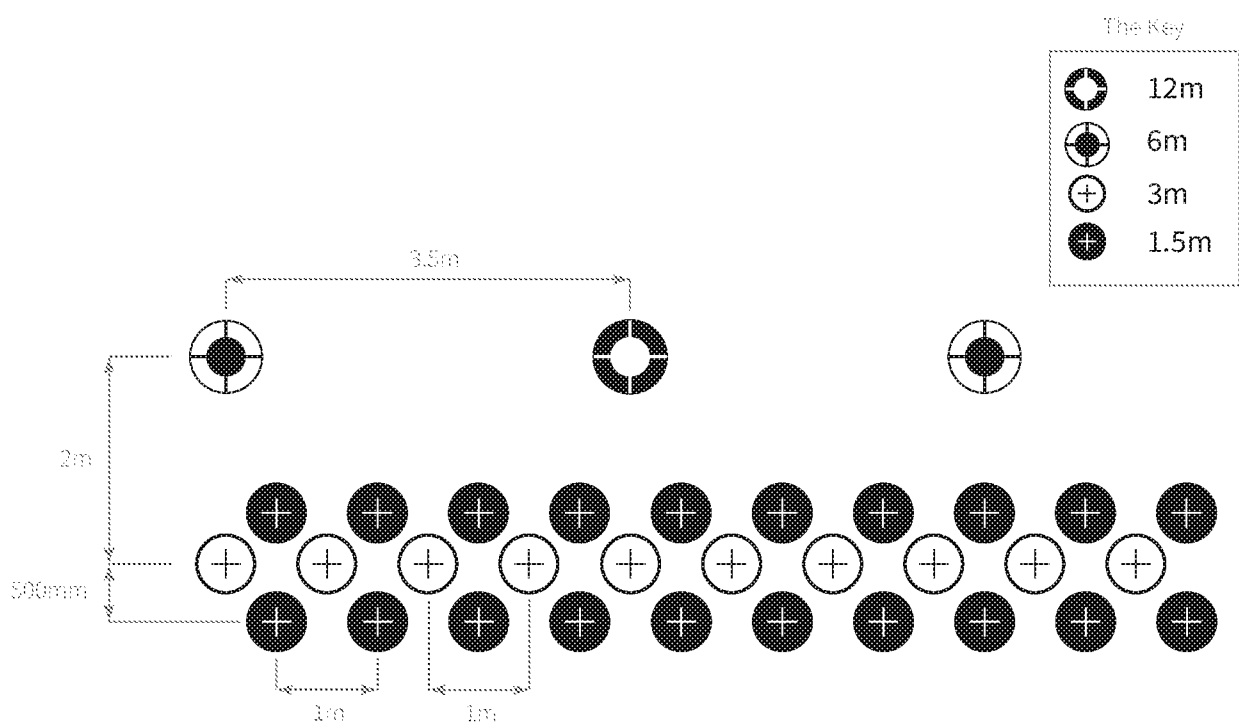


Figure 6, Diagram of Groundwater Dynamics Augers used to create the boreholes

2.4 Waterproofing & Dewatering Pattern

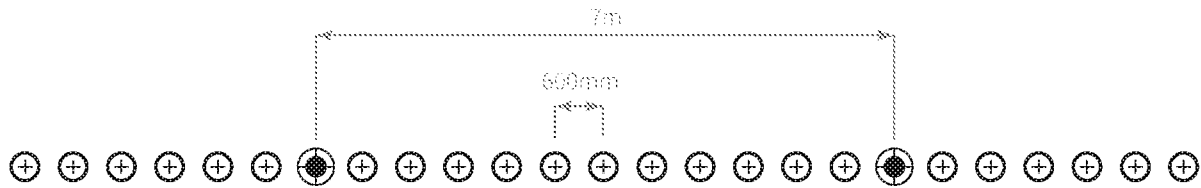


Figure 10 Waterproofing Pattern

- Formation of 4.5m, 6m and 12m EGRP's.
- It may also use a combination of 1.5m and 3m EGRP if necessary.
- EGRP are installed in a straight line 1.5/2 metres back from the building walls at 600mm centres. The key to the success of the installation is the depth of the boreholes as this must be directly related to the construction dimensions of the asset in question with a mixture of 4.5 metre and Primary devices.

Each EGRP is strategically placed according to a site specific design drawing created by the principle designer Groundwater Dynamics Ltd in order to create a system that meets the needs of the customer expectations.

The two patterns most often utilized are the Diamond Pattern and Waterproofing Pattern.

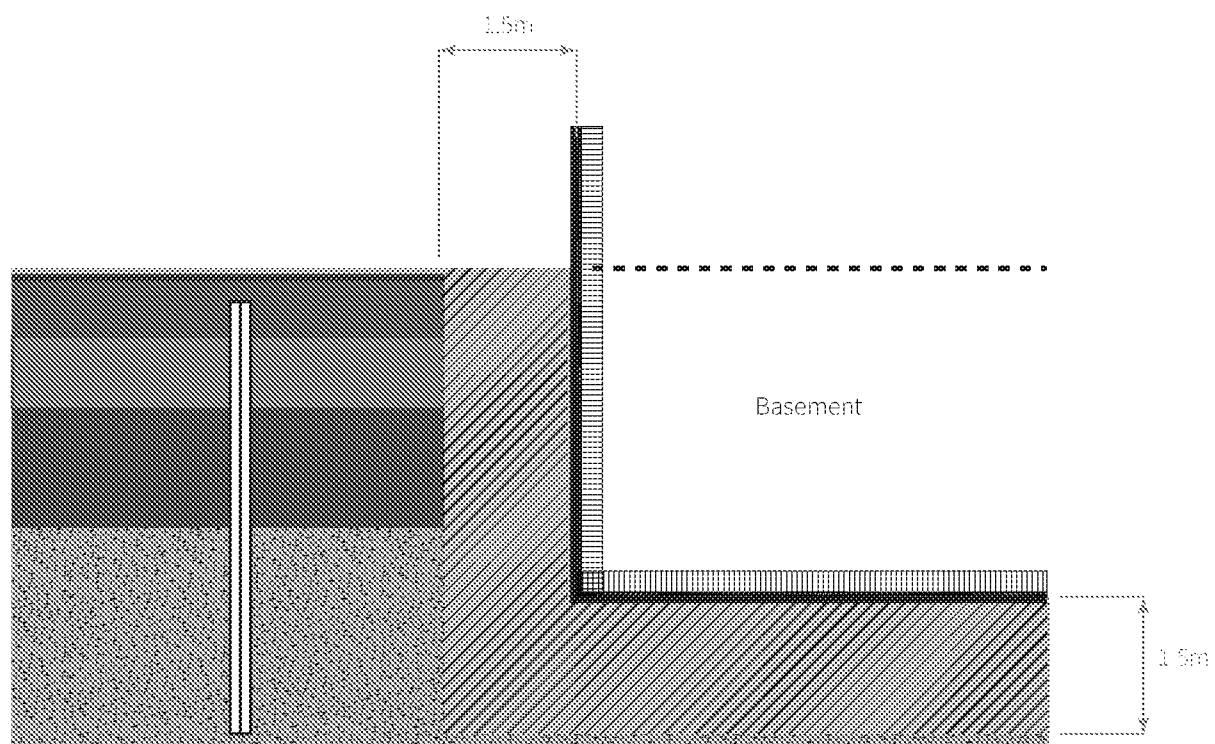


Figure 11, outlining the area on site where a waterproofing pattern

2.5 Variables to consider

Layouts are custom designed solutions indicating the amount, location and depth of each EGRP based on the site investigation material available or on a Curtins Engineering Design Statement following a test drilling day. For sports turf drainage the standard Diamond Pattern is used with the central line 3 metre EGRP spacing at either 900mm or 1 metre.

Variables to consider are: area, vegetation, soil type/condition/saturation, elevations, and impervious surfaces such as roofs, parking, walkways, and driveways, local topography (run-off), compaction, groundwater levels and others.

- Soil Saturation
- Local Topography/ Elevated or sloping site
- Sub-soil Strata & textural changes at depth
- Soil Compaction and sub Soil type.
- Local water courses & localised history of flooding
- Ground maintenance regime
- Existing drainage assets
- Frequency and type of use
- Quality of grass sward
- Permeable surfaces

TESTING AND ANALYSIS

3.0 Testing

Should Groundwater Dynamics be unable to gather sufficient site specific data during the preliminary stages of system design then a Test-drilling Day will be recommended. Test-Drilling days consist of groups of 4 different borehole depths (1.5m, 3m, 6m and 12m) being drilled at selected areas across the site (normally max 4 areas in one day). Once the test boreholes have been drilled they are filled with water and rates of

infiltration are measured over one hour using a sonic alarm device. This data is then sent to Curtins Engineers who in turn produce a Drainage Design Statement using actual infiltration rates alongside local rainfall data in order to specify what volume of EGRP product is required to meet the client objective. Also, the test day helps to identify soil types and textural changes in soil strata at deeper depths.

3.1 Curtins Test Results and Analysis

Test drilling analysis and reporting is carried out by an independent third party engineering company to validate the site specific drainage calculations. The Engineering Drainage Design Statement is based on actual soil infiltration rates, localised rainfall data using M5-60 and R values and the industry standard "Windes Detailed Design Package". The main purpose of the report is to calculate the optimal amount of EGRP product to be installed using the site specific infiltration data and a means of buffering should there be any surplus storm water following peak rainfall.

3.2 Technical Drawing

An as-built drawing to 10mm accuracy is produced following each installation. Before start-on-site, the site is marked up with the location and depth of each borehole. Sometimes these locations have to be altered due to boreholes collapsing or due to impermeable rock strata restricting the drilling depth (or running sand restricting the

integrity of the borehole). Once a borehole has been drilled and the EGRP has been capped and installed, the borehole is top-dressed and the core of soil trimmed and replaced. A Trimble GPS device is used to record the location and depth of each device respectively, information which is later fed into a CAD design drawing.

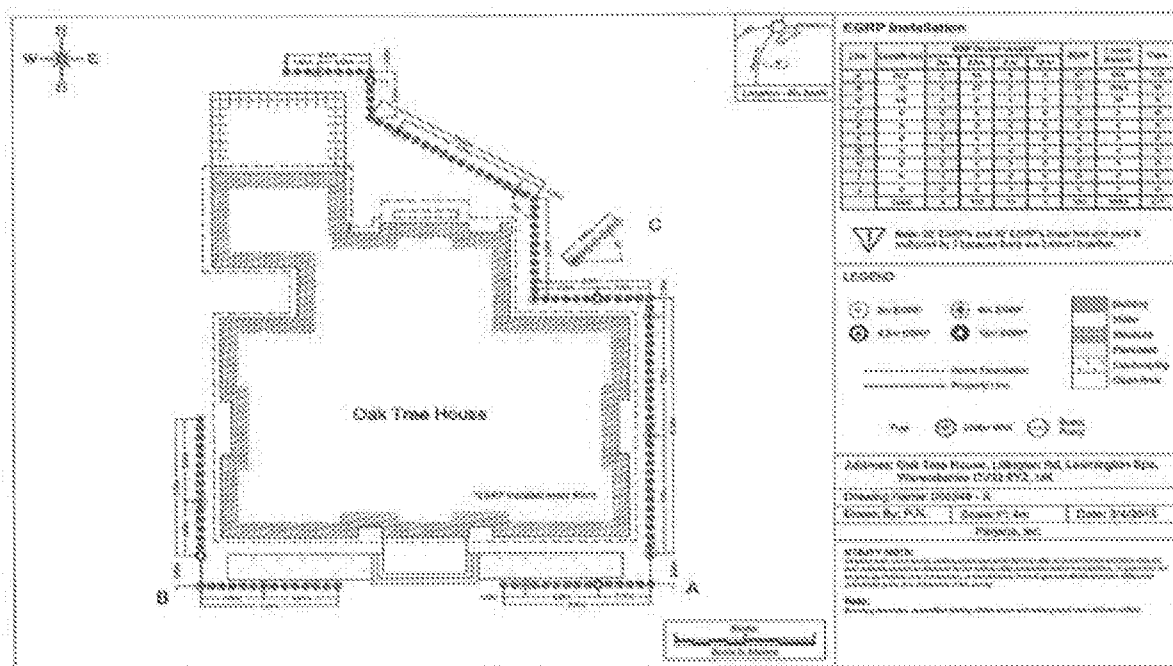


Figure 12, Example of a technical drawing of a design proposal

3.21 Technical Information

Post physical site completion this data is transferred to CAD and sent to our design team. A detailed as-built design drawing is produced showing locations and depth of each EGRP device installed – a useful reference particularly for those client who are installing on an annual program to suit their budget.

3.21a EGRP Installation

The EGRP system is a collection of devices installed at differing depth, designed to exploit better infiltration capabilities at lower depths. There are many different uses of the EGRP system and many different designs.

3.21b Site Information

Our preliminary site investigation program includes researching local borehole data, contacting utility companies, searching the Environment Agency website, taking soil samples from the top 300mm, testing for high organic (carbon) content and test drilling (dry & wet tests).

3.21c Natural Turf Maintenance

In order to promote and improve the natural ability of the grass sward to freely infiltrate groundwater, the EGRP system achieves optimal performance when regular ground maintenance is carried out on the installation area. Basic ground maintenance includes verti draining to break up compaction and assist with aeration, scarifying to remove thatch and promote root growth and some form of fertiliser in order to promote growth of the grass sward and assist with increasing root depth for a durable playing surface. In some instances a sports sand top dressing is highly recommended to ameliorate the soil and increase micro-porosity which assists infiltration rates.

3.3 Prelims

After carrying out a site survey a Pre-Design Questionnaire is completed which includes locating the area(s) to be treated and records a description of the client’s statement of need. GWD then carries out desktop due diligence by investigating local historic borehole records, identifying the topology of the surrounding area via Google Earth, checking for utilities & other services on Linesearch plus other environmental enquiries, in order to create a drainage system design. In order to establish a site specific dcurtiansrainage “design rate” a test drilling exercise, which measures infiltration rates at depth, enables Curtins Consulting Engineers to generate a Drainage Design Statement.

3.4 Curtins Consulting Engineers

Test drilling analysis and reporting is carried out by Curtins Consulting Engineers, an independent third party specialist, to validate the site specific drainage calculations. The Drainage Design Statement is based upon actual soil infiltration rates, localised rainfall data using M5-60 and R values and uses the industry standard “Windes Design Package” with the Maximum Allowable Discharge rate set to zero. The main purpose of the report is to calculate the volume of water to be stored/drained away and then work out the amount of EGRP product required, based on the site specific average rate of infiltration or the drainage “design rate”.

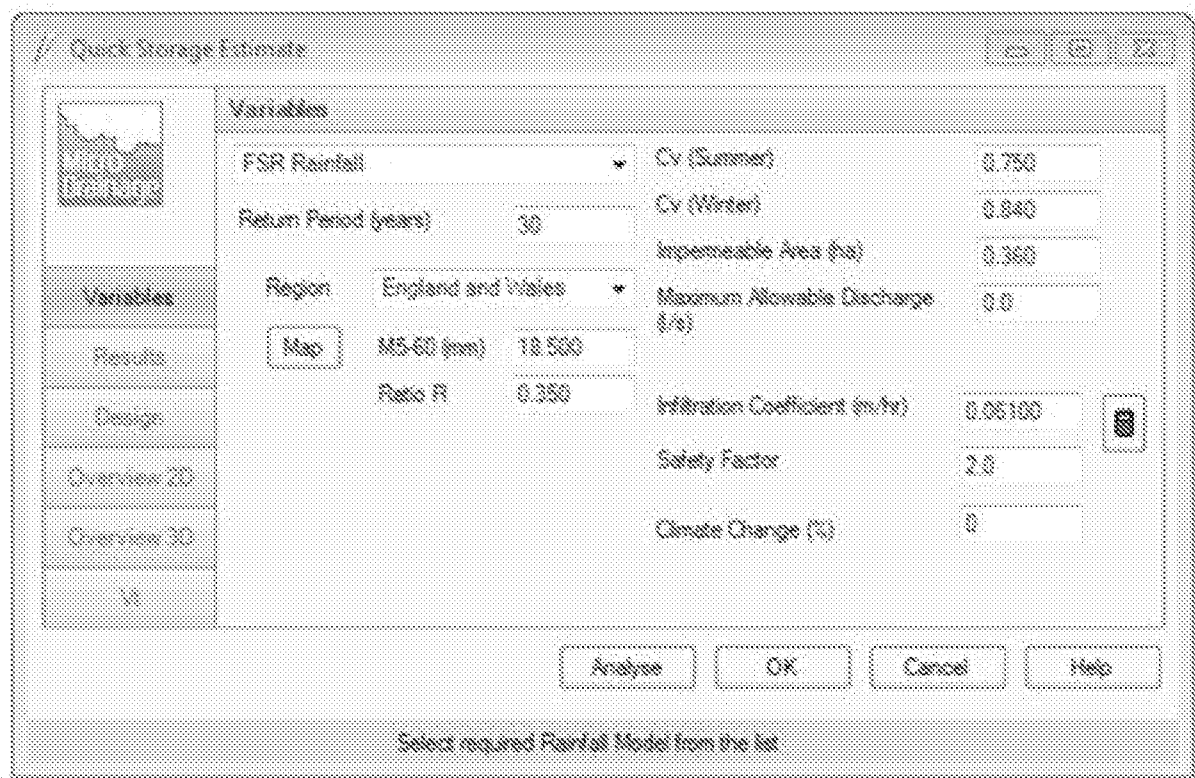


Figure 13, WinDes software with Max Allowable Discharge set to zero (no outflow requirement).

3.5 Site Specific Data

Local rainfall records are used along with dimensions of the geographical area to be treated to work out a quick storage estimate (QSE) which identifies the amount of storm water to be dealt with during a specified storm event e.g. 1:30 year return event.

Along with the data from the test drilling exercise Curtins are able to run a report on the WinDes modelling package which will lead to a full Drainage Design Statement bespoke to the clients statement of need and specific to the site.

Infiltration Test Drilling			Location TB4	
Area 1				
BH Depth	1.5m	3m	6m	12m
minute	63.5	63.6	88.9	89.9
	Infiltration Rates in millimetres			
1	140	140	570	550
2	160	210	810	800
3	180	320	1050	1000
4	200	370	1200	1200
5	220	470	1380	1370
6	220	560	1420	1450
7	240	670	1520	1530
8	250	780	1590	1620
9	260	850	1680	1680
10	270	910	1700	1750
15	280	1250	1800	1920
20	280	1350	2000	2050
25	280	1490	2200	2300
30	280	1540	2200	2500
40	280	1670	2200	2300
50	280	1770	2200	2500
60	360	1890	2300	2606

Figure 14, Typical Set of Infiltration Data

Test Drilling helps to identify soil types and textural changes in soil strata at deeper depths along with borehole drilling productivity data which improves the accuracy of the pricing model. Test-Drilling days consist of drilling a number of groups of boreholes to varying depths (1.5m, 3m, 6m and 12m) at pre-selected areas across the site (normally max 4 areas in one day).

Once the test boreholes have been drilled they are filled with water and rates of infiltration are measured over one hour using a sonic alarm device. This data is then sent to Curtins Engineers who in turn produce a Drainage Design Statement using the WinDes modelling package where actual infiltration rates are averaged in order to generate a drainage "design rate".

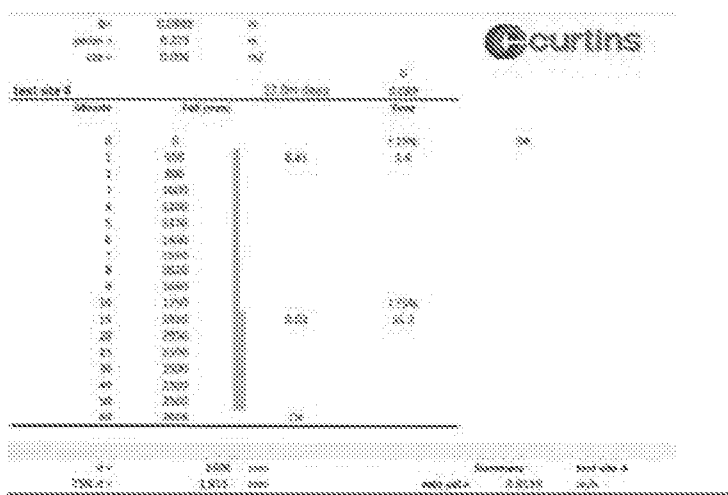


Figure 15, Falling Head Test Results.

Fig.15 shows the falling head data as it is transferred into the WinDes software package.

3.6 Curtins Drainage Design Statement

The data shown in Fig.16 below represents the output from the WinDes software package. With the Maximum Allowable Discharge value set to zero, the drainage design rate is instrumental in calculating the amount of EGRP required in order to satisfy the clients statement of need.

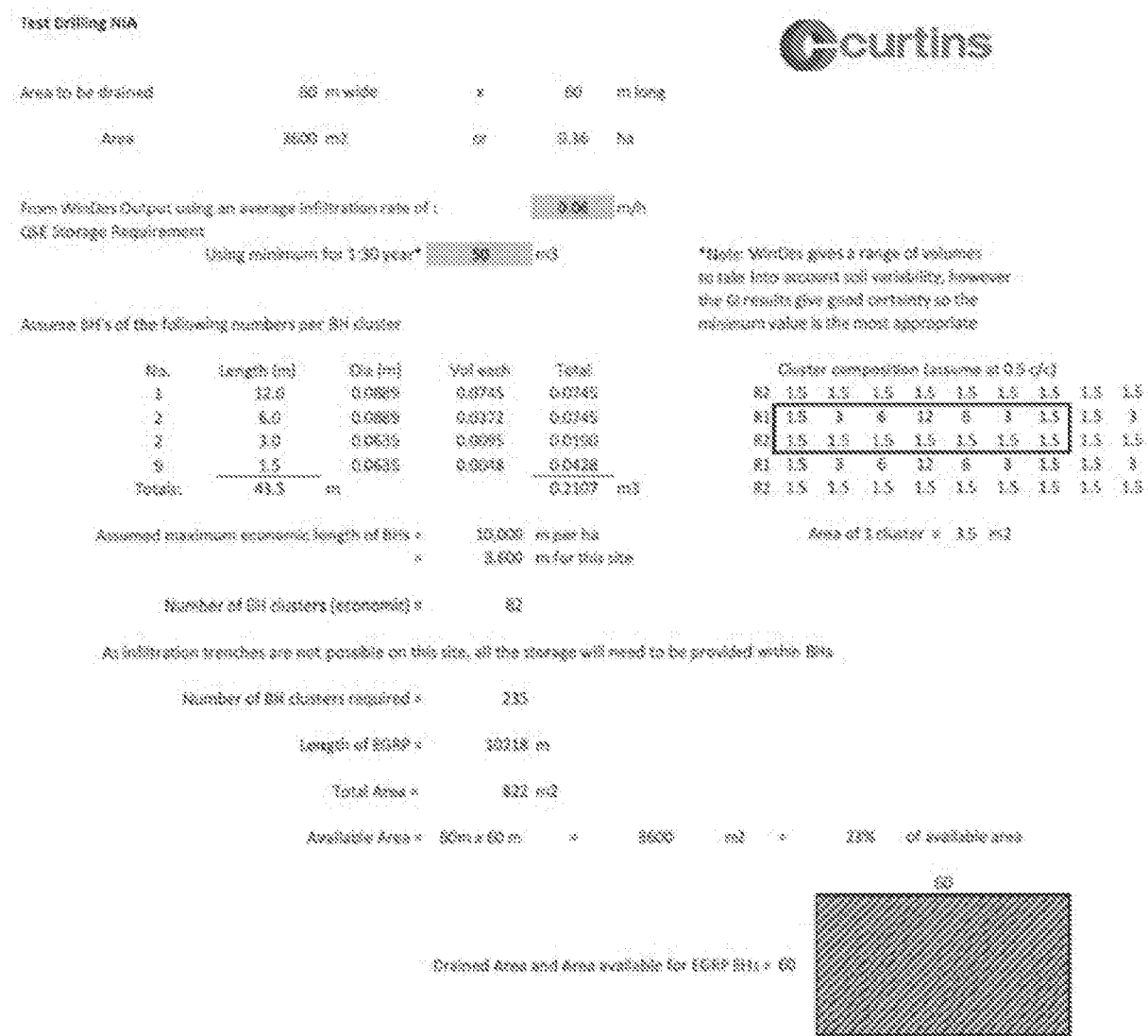


Figure 16, Drainage Design Statement

The primary drainage system which has been designed by Curtins deals with storm water at source and does not require an outflow to public storm water drains or sewers.

3.7 Cost

The packaged cost of a GWD/Curtins test drilling exercise includes the following;

- Initial site walk-over survey & Pre-Design Questionnaire
- Site Specific Health & Safety File (RAMS)
- GWD's test borehole drilling & infiltration testing
- Curtins Consulting Engineering Drainage Design Statement
- GWD Pricing Letter based on Client's Statement of Need

EGRP SUPPORTED INFILTRATION TRENCH GUIDE

4.0 Curtins

Test drilling analysis and reporting is carried out by Curtins Engineering Consultants, an independent third party specialist drainage engineering company to validate the site specific drainage calculations. The Drainage Design Statement is based on actual soil infiltration rates, localised rainfall data using M5-60 and R values and the industry standard "Windes Design Package" where the outflow value is set to zero. The main purpose of the report is to calculate the volume of water to be stored and then workout the amount of EGRP product required based on the site specific average rate of infiltration or "the drainage design rate".

4.1 Testing

Prior to starting on site, Groundwater Dynamics carry out desktop due diligence gathering sufficient site specific data during the preliminary stages of EGRP system design. In circumstances where a Drainage Design Statement is required by the client which requires engineering calculations to deal with specified rainfall events then an Infiltration Test- drilling Day will be required.

Test Drilling helps to identify soil types and textural changes in soil strata at deeper depths along with borehole drilling productivity data which improves the accuracy of the pricing model. Test-Drilling days consist of drilling a number of groups of boreholes to varying depths (1.5m, 3m, 6m and 12m) at pre-selected areas across the site (normally max 4 areas in one day).

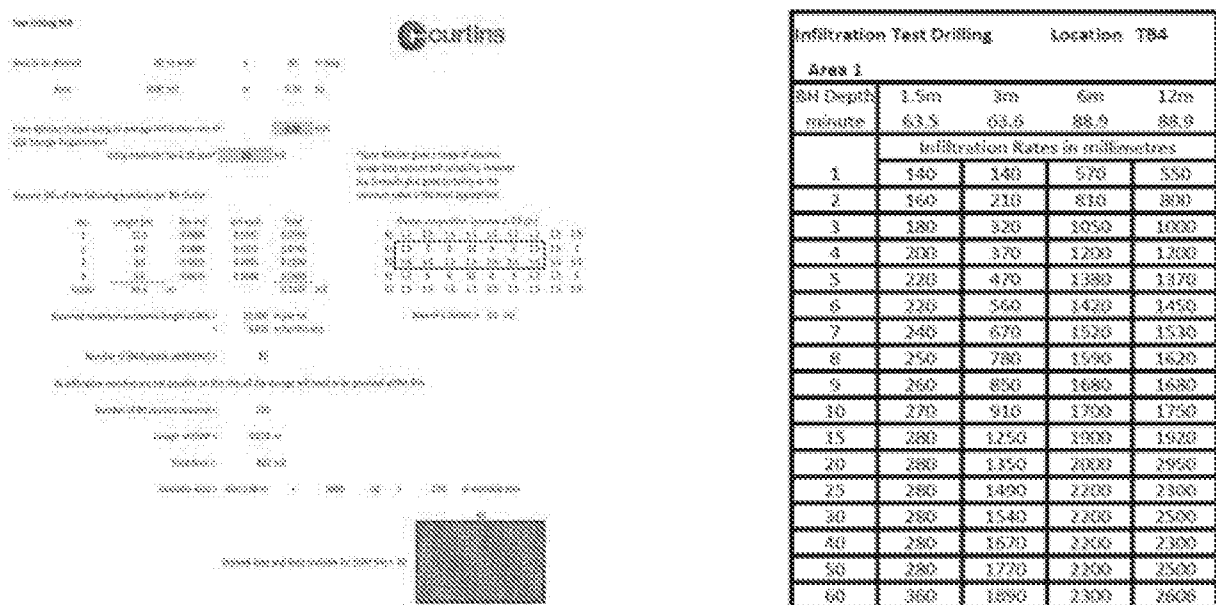


Figure 16, show typical infiltration test drilling results & the extract from the Curtins Drainage Design Statement shows a storage requirement of 50m³ requiring 10,218m of EGRP

Once the test boreholes have been drilled they are filled with water and rates of infiltration are measured over one hour using a sonic alarm device. This data is then sent to Curtins Engineers who in turn produce a Drainage Design Statement using the Windes modelling package where actual infiltration rates are averaged in order to generate a “drainage design rate”.

4.2 GEO205 Comacchio Drill-Rig

The figure below shows a GEO205 drill-rig positioned on track-mats (so as not to cause any damage to the natural turf surface) ready to drill a 12 metres borehole which will subsequently be filled with water and infiltration readings (falling head test) taken over the course of one hour using a sonic measuring device.

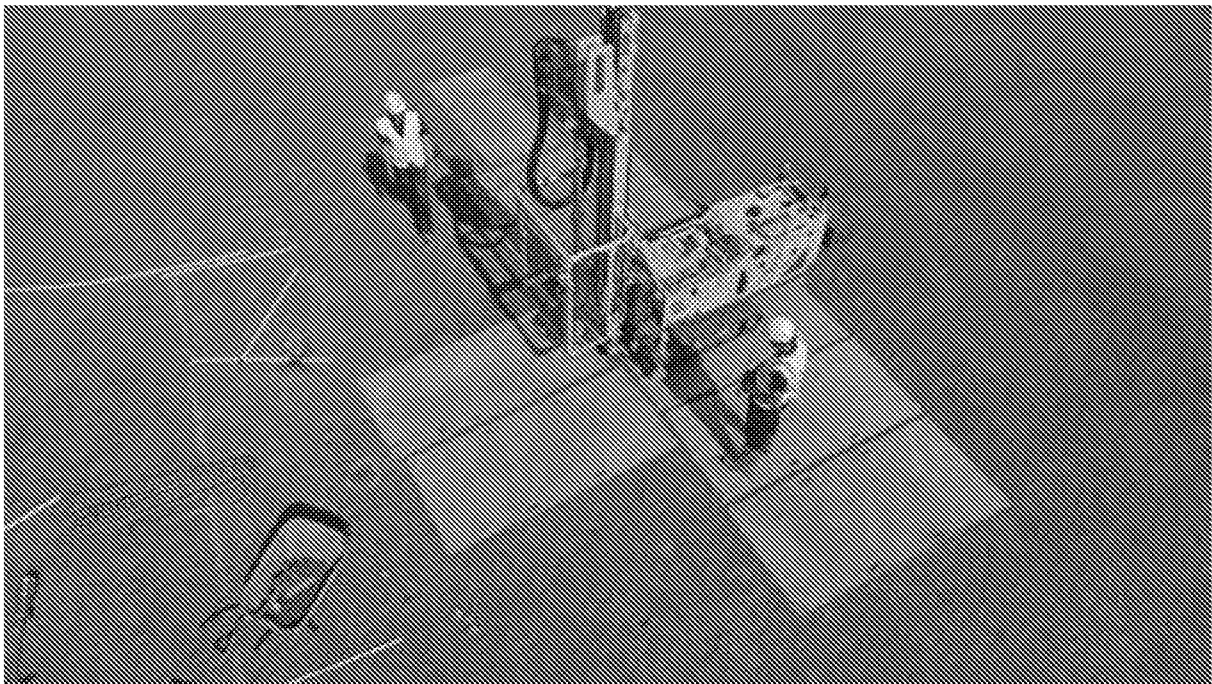
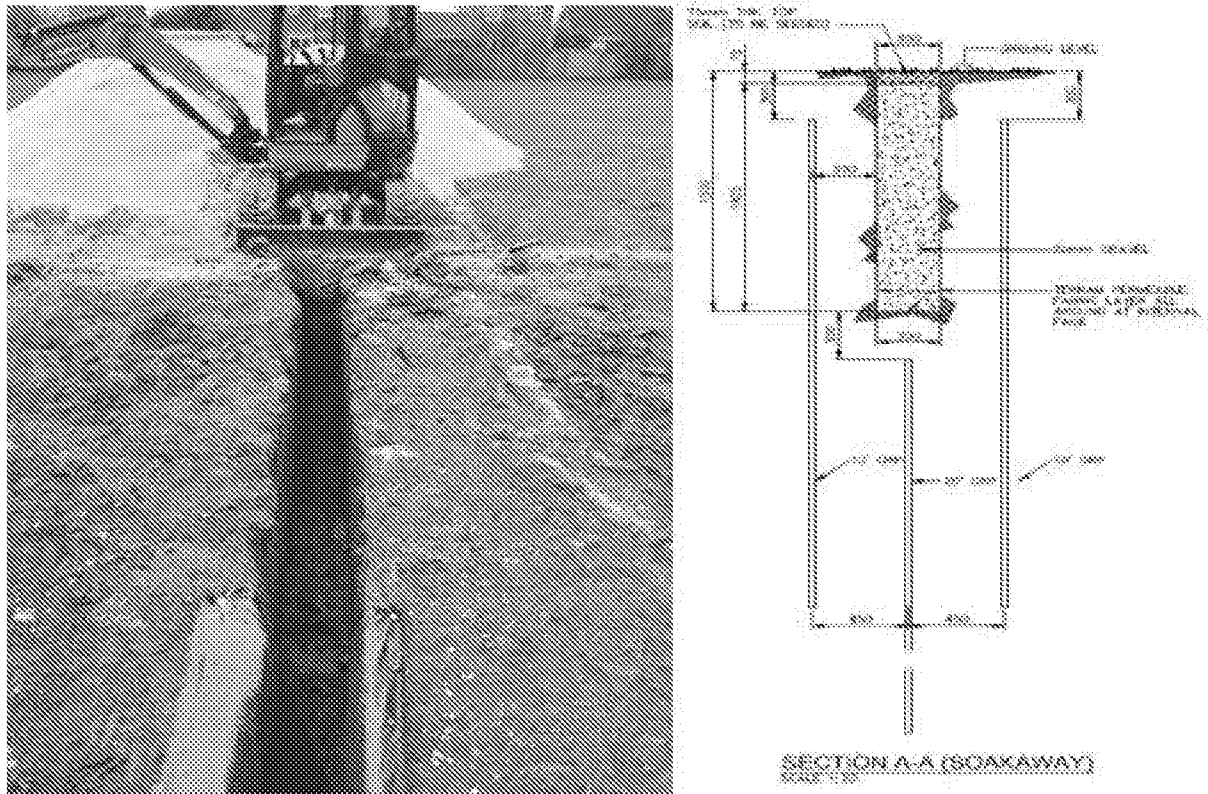


Figure 17, shows a GEO205 drill-rig positioned on track-mats

4.3 Infiltration Trench

Once the test boreholes have been drilled they are filled with water and rates of infiltration are measured over one hour using a sonic alarm device. This data is then sent to Curtins Engineers who in turn produce a Drainage Design Statement using the Windes modelling package where actual infiltration rates are averaged in order to generate a “drainage design rate”.



EGRP Supported Infiltration Trench

The Infiltration Trench shown above forms part of a sports field drainage project. Installed in the base of the trench are 6 metre EGRP devices at 2 metre spacing and the side walls of the trench respectively have 3 metre EGRP devices at 1 metre centres. The above cross sectional sketch shows the positioning of the EGRP devices in relation to the trench and ground level. The top of the trench is dressed with an RT/Free draining root zone in order to ensure high levels of percolation during storm events.

This EGRP supported design creates a drainage asset which creates significant buffer storage before the EGRP devices assist with emptying the trench, which in turn creates capacity for the next rainfall event.

4.4 Curtins Drainage Design Statement

Following an analysis of the infiltration results from the test drilling exercise and identification of the client's statement of need, Curtins Consulting Engineers (Leeds Office) calculate;

- a. The Drainage Design Rate
- b. Quick Storage Estimate (QSE) identifying volume of storm water to be dealt with
- c. The dimensions of the Infiltration Trench
- d. The amount of EGRP in metres

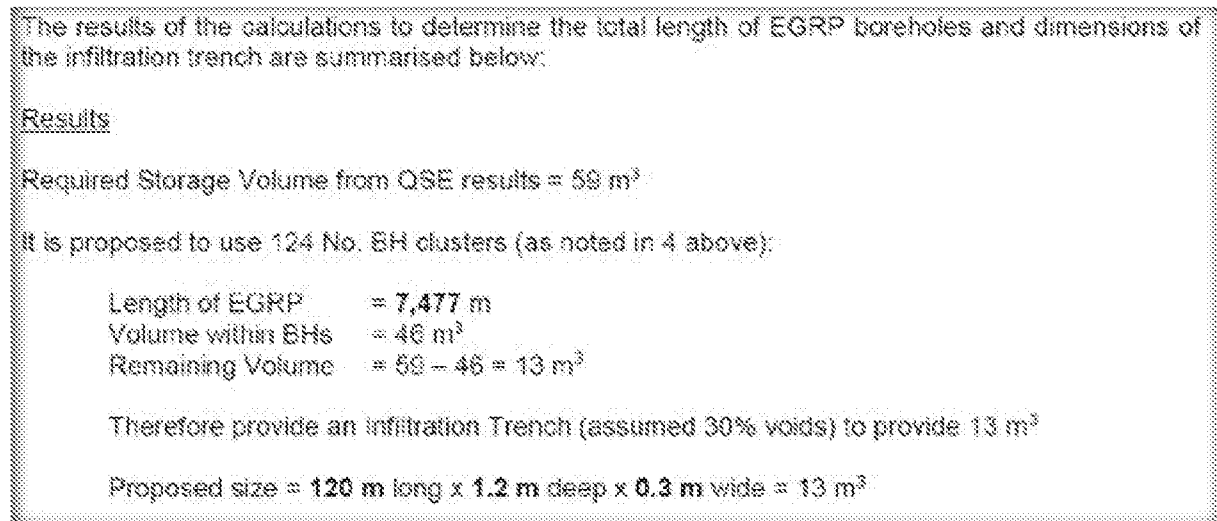


Figure 19, Extract from a Curtins Drainage Design Statement

Curtins Consulting Engineers are now in a position to issue/sign off “Sustainable Drainage Design Compliance Certificates” or similar SUDS compliance documentation in order to verify the authenticity and integrity of the drainage scheme within the SUDS framework.

Typically works for Local Authorities and/or Utility Companies are designed to deal with 1:100 (+30%CC) year return storm events. The higher the specification of storm event, the longer the trench. The Infiltration Trench is 300mm wide and is easily accommodated on most sites.

DEFECTS LIABILITY STATEMENT.

5.0 Defects Liability Statement

Further to the site survey respectively and the identification of the area to be treated with EGRP vertical drainage, Groundwater Dynamics Ltd the Principal Designer will decide upon the quantity and layout for proposed work before issuing a price for the scheme to the client.

Groundwater Dynamics Ltd offer a two year defects liability period where any defects arising within two years of physical completion will be remedied by the installation of additional EGRP devices within the area where the original installation took place, at no cost to the client.

During the installation period Groundwater Dynamics Ltd will advise the client of;

1. A basic level of natural turf maintenance required in order to optimise the performance of the EGRP system.
2. Any factors contributing towards ground saturation and localised flooding of the treated areas.

The defects liability warranty is not an insured warranty and any additional remedial works are provided at Groundwater Dynamics own cost.

EGRP INSTALLATION

6.0 Work Site Installation



Figure 19: Preparing the work area

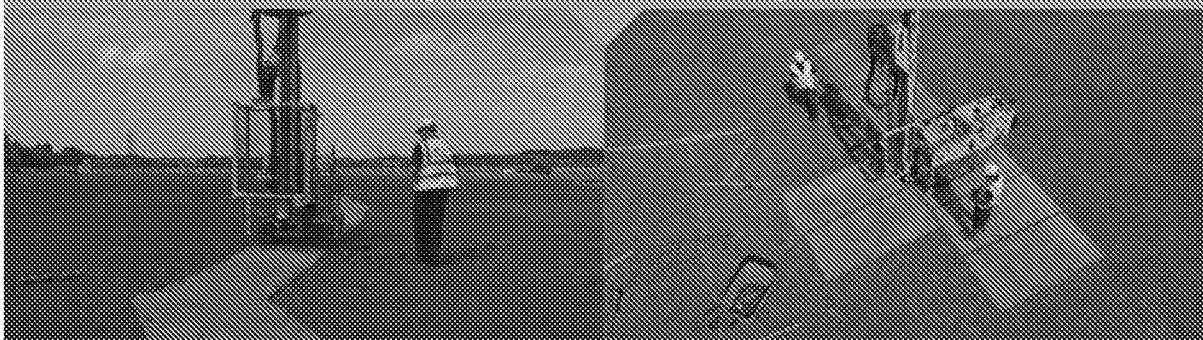


Figure 20: Preparing the work area

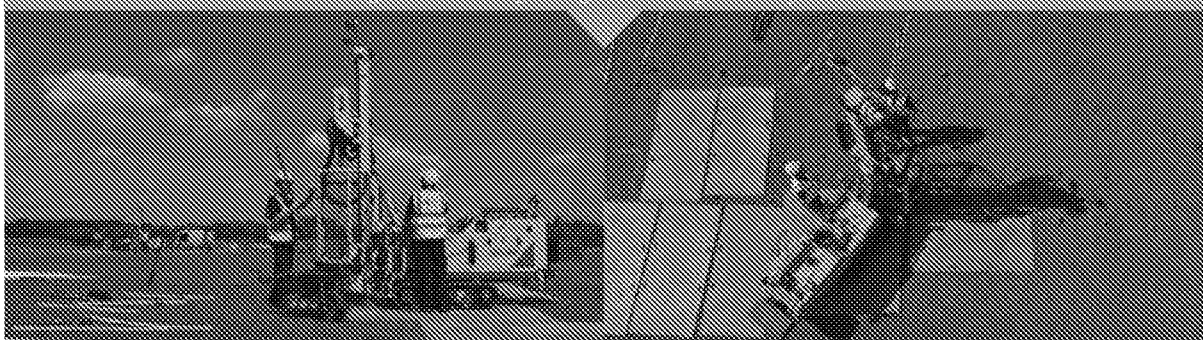


Figure 21: Preparing the work area



Figure 22: Preparing the work area



Figure 23: Preparing the work area

6.1 Acclimation Period

It takes approximately 12 weeks for the soil to close in around the EGRP, a period we term as the “acclimation period” after which the system begins to work. Groundwater finds its way into the system laterally before using the EGRP as an elevator shaft in order to access lower levels of unsaturated soil. Therefore instead of experiencing saturated ground near the surface, the system equalises moisture content throughout the depth of the borehole, whilst the device stops the bore holes from closing in, which in turn creates permanent “Aeration” across the whole installation. In dry and hot weather the EGRP system enables moisture to travel back to the surface which stabilises moisture content in the ground and rehydrates the root zone.

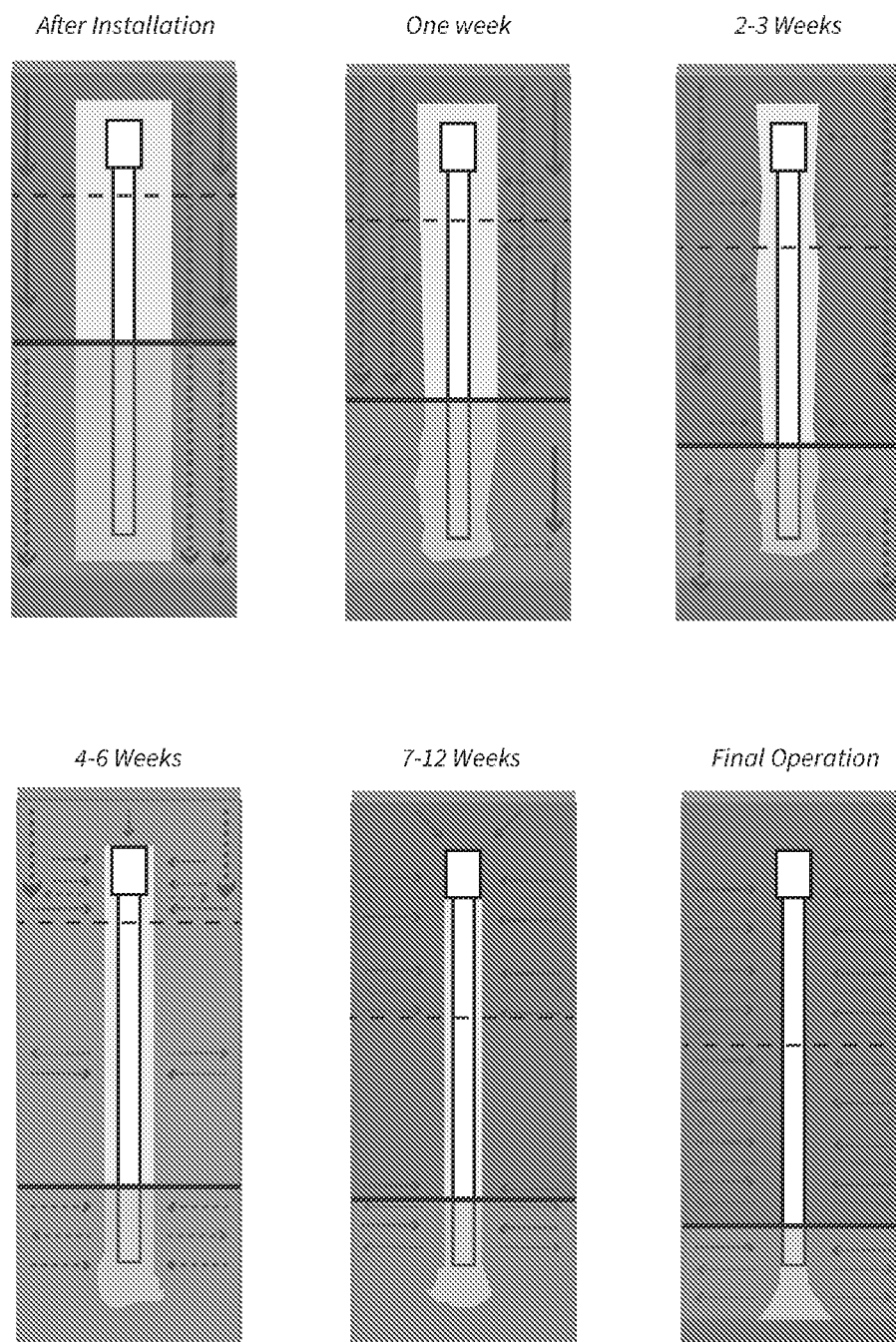


Figure 25, highlights the Acclimation Period

FOLLOW-UPS

7.0 Follow-Ups

Groundwater Dynamics contact the client again after the system has been installed for 12 weeks in order to establish how the system is performing in the early stages.

7.1 Borehole Collapse

In some cases a borehole which has been refilled and top-dressed will collapse and a hole or indentation may appear at the installation site. This hole will stop the acclimation process until it is corrected. It is Groundwater Dynamics responsibility to check the installation site 10 days after the completed install to ensure no holes/indentations have appeared. The property owner should also be made aware to look for these holes and contact the installer should they appear.

7.2 Twelve Week Follow-up – System Acclimation

Groundwater Dynamics contacts the client again 12 weeks after the installation to determine how the system is performing in the early stages and to see if there are any outstanding issues following the installation.



GROUNDWATER DYNAMICS

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