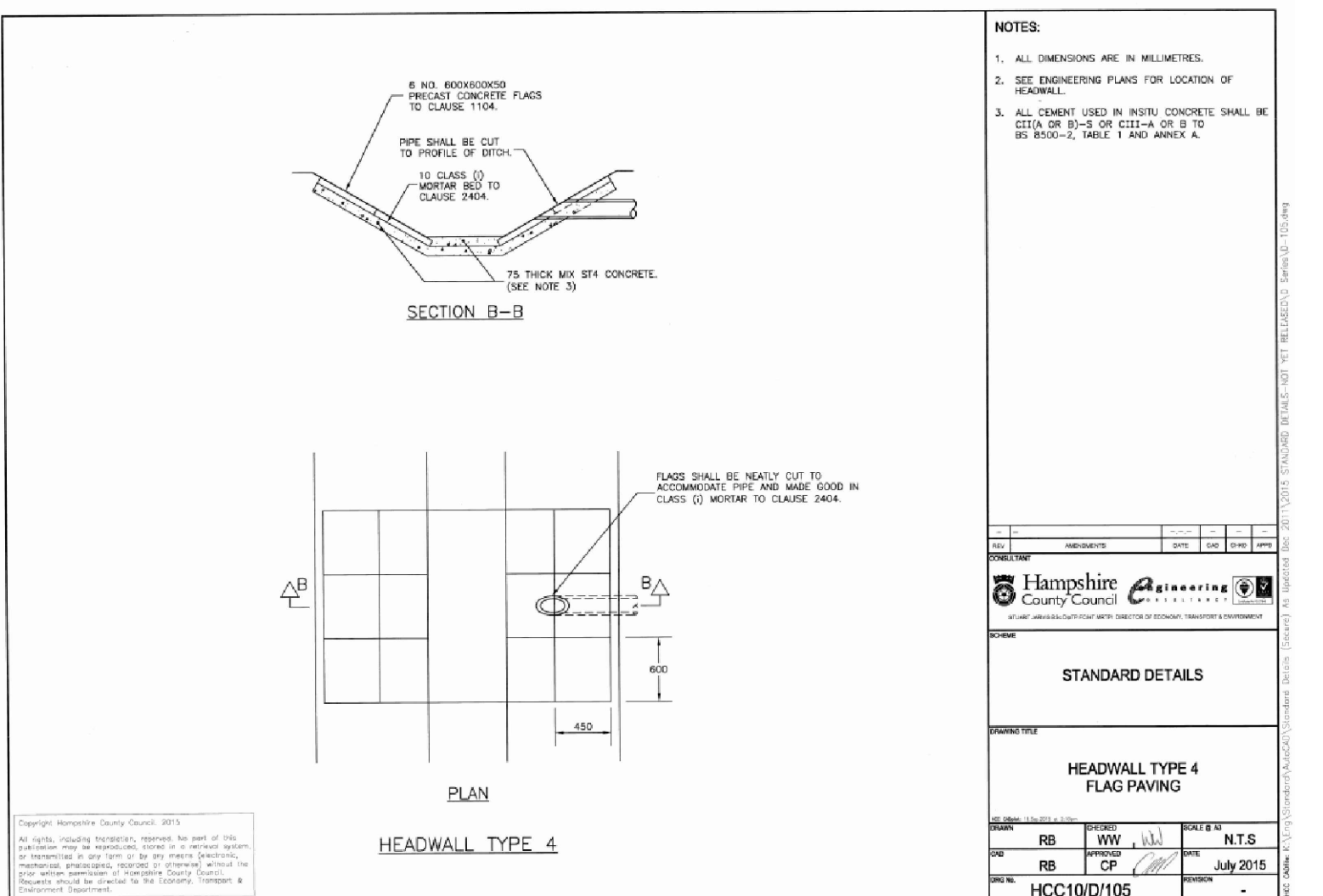
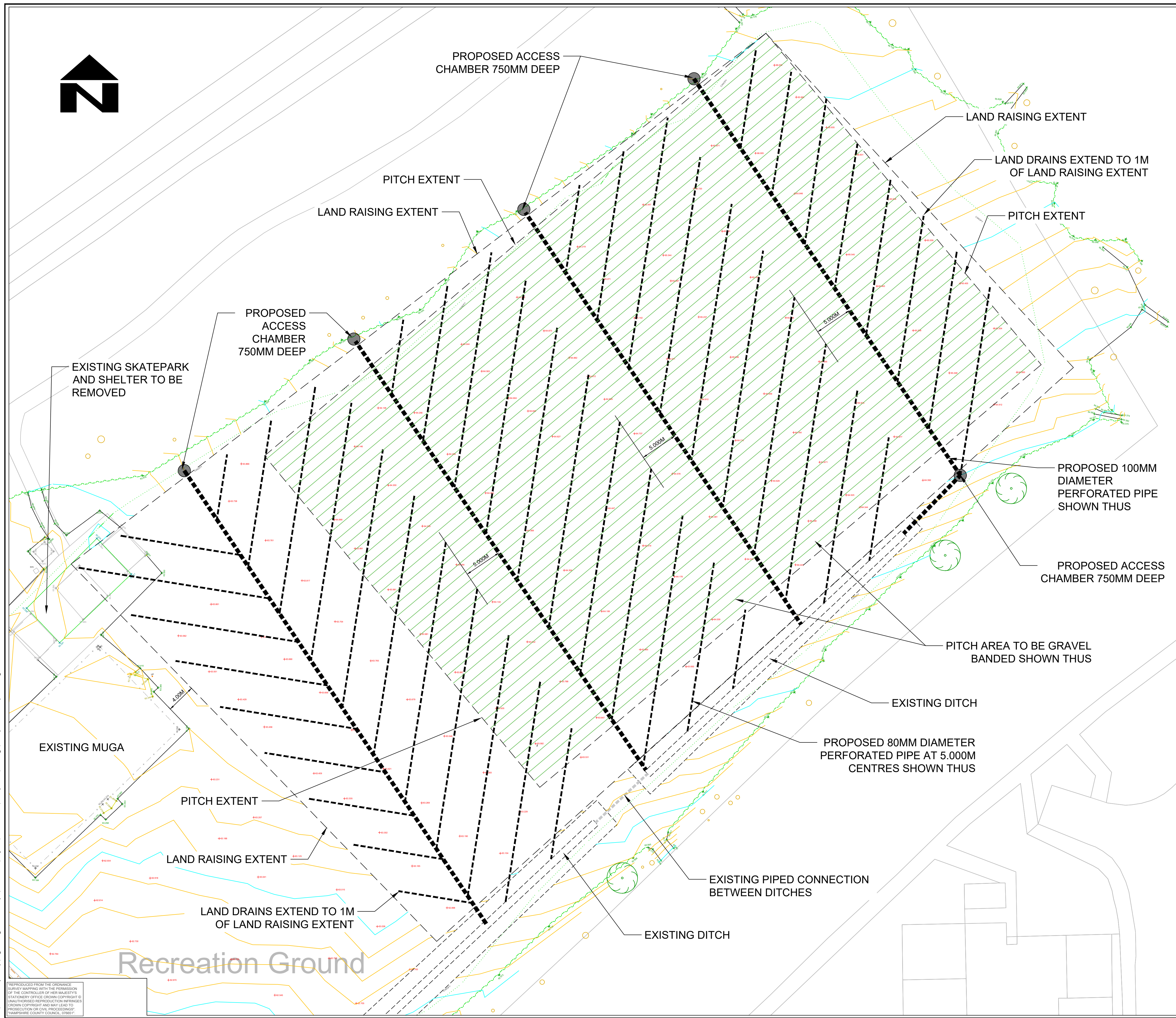
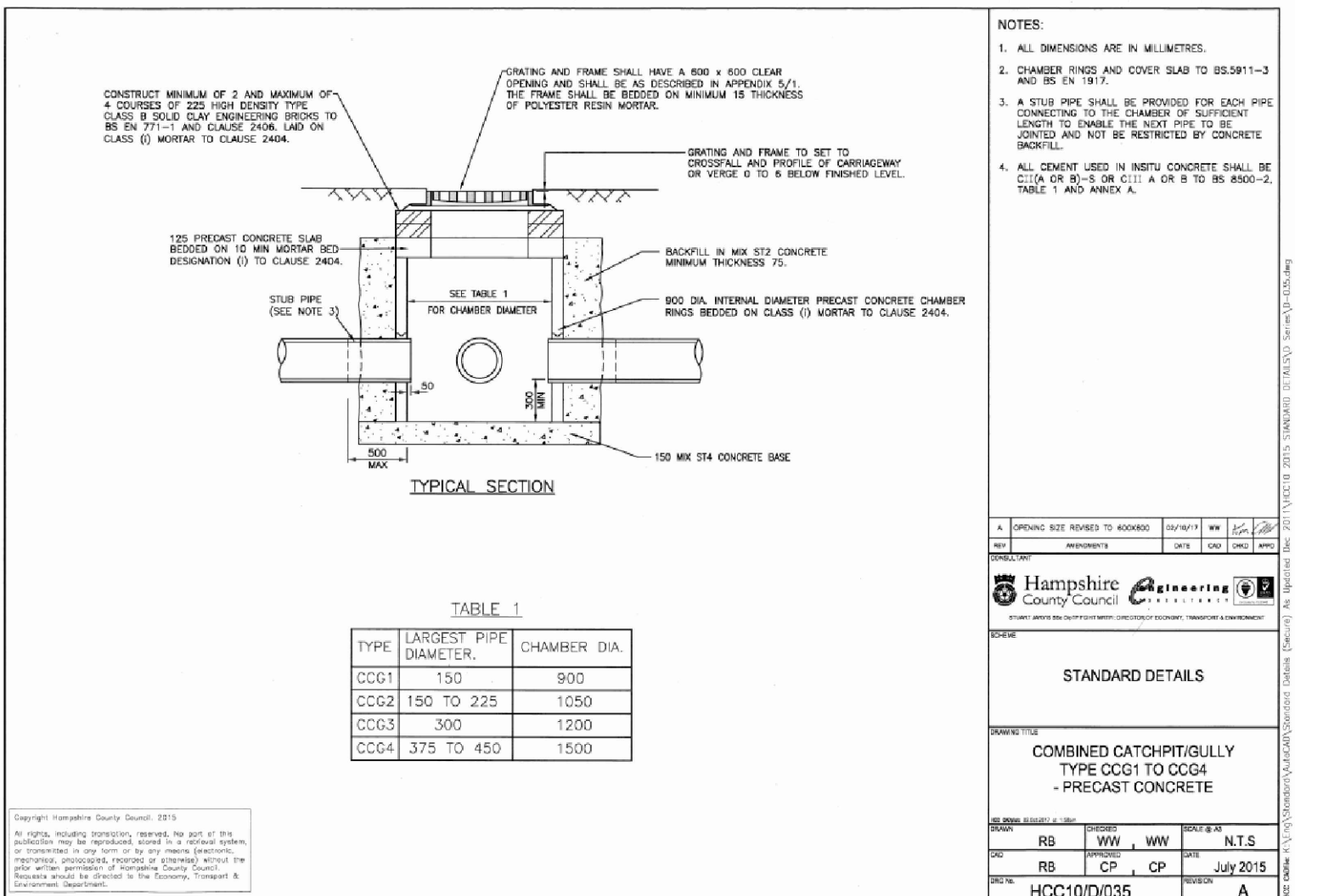




HEADWALL DETAILS FOR CONNECTION OF PIPES INTO DITCH
[NUMBERS OF FLAGS WILL VARY WITH DITCH DEPTH]
FROM STANDARD DRAWING HCC10/D/105



CATCHPIT TYPE CCG1 DETAILS FOR PRECAST CONCRETE
ACCESS CHAMBERS (TYPICAL DEPTH 750MM)
FROM STANDARD DRAWING HCC10/D/035

NOTES

1. DO NOT SCALE FROM THIS DRAWING
2. ALL DIMENSIONS IN MM UNLESS OTHERWISE STATED
3. ALL SPOT HEIGHTS ARE METRES AODN
4. 100MM DIAMETER PIPES AT 28M CENTRES IN 118MM TRENCH
5. 80MM DIAMETER PIPES AT 5M CENTRES IN 97MM TRENCH AND LAID AT 45 DEGREES TO 100MM DIAMETER PIPES
6. PIPE JOINTS TO BE MADE MANUALLY WITH MINIMUM POSSIBLE EXCAVATION AND BACKFILLED WITH 6/14 'HORTAG' OR EQUIVALENT APPROVED AND TOPPED WITH 150MM TOPSOIL
7. ALL PIPES TO BE INSTALLED AFTER LAND RAISING OPERATION IS COMPLETE BUT TO EXTEND INTO ORIGINAL GROUND
8. TRENCH BACKFILL TO BE 6/14 'HORTAG' OR EQUIVALENT APPROVED AND TOPPED WITH 150MM TOPSOIL
9. ALL MANHOLES TO BE FITTED WITH GRADE D400 COVERS
10. PITCH AREA INCLUDES OVERRUN MARGIN
11. GRAVEL BANDING 250MM DEEP WILL BE UNDERTAKEN BY SPECIALIST CONTRACTOR AFTER TOPSOILING AND SEEDING OF THE PITCH: SEE SHELTON 'SPORTSTURF DRAINAGE TECHNIQUES FOR SPORTS PITCHES' DOCUMENT FOR EXAMPLE
12. MAXIMUM SIDE SLOPE TO PITCH TO BE 1:3
13. READ IN CONJUNCTION WITH DRAWING 1650_LA_5300_A

CLIENT				CONSULTANT				DESIGNER		SCHEME		DRAWING TITLE	
Havant BOROUGH COUNCIL Planning Civil Engineering and Landscape				Public Service Plaza Civic Centre Road Havant, Hants. PO9 2AX Telephone: (023) 9247 4174 Email: customer.services@havant.gov.uk Internet: www.havant.gov.uk				SM SM AC DW		HOBBY CLOSE FIELD		PROPOSED LAND FORM LAND DRAINAGE SYSTEM	
Planning				Civil Engineering and Landscape				CHECKED		JOB No.		CAD PLOT: 10/02/2016 10:15:58	
DATE				DATE				SCALE @ A1		DATE		DRAWING NUMBER	
28.05.2020				28.05.2020				1:250		28.05.2020		2018-14-006	
AMENDMENTS				AMENDMENTS				SHEET NUMBER		SHEET NUMBER		REV	
A				A				1 OF 1		1 OF 1		A	



Technical Manual – Section 10

Lytag® products in drainage applications

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Introduction

The unique properties of Lytag® products allow them to be used in a variety of drainage applications. It is a rounded, manufactured aggregate that does not degrade over time. Placing on site is relatively easy as the material “flows” into voids and needs little additional compaction, saving time and money.

General properties

Lytag® products have a typical insitu density of 815kg/m³ based on a moisture content of 15%. This may however vary slightly, and current bulk densities may be obtained from the Lytag Ltd sales office.

Further details on specific properties are given in the appropriate section of the Lytag® Technical manual.

Applications

Land Drainage - Hortag® horticultural media is ideal for smaller land drainage projects. Its rounded shape and regular grading give excellent hydraulic conductivity. It is used to construct golf course greens and is used in slit trenching and gravel banding, including Shelton Systems.

For further information please see Section 19 of the Lytag® Technical Manual.

Geo fill® civil engineering bulk fill may be used for bulk fill purposes, where efficient drainage is important, in contracts using the Specification for Highway Works or is to be used as a granular bedding and sidefill for rigid and flexible pipes. BS EN 1610 – Construction and testing of drains and sewers details the design requirements.

For further information please see section 16 of the Lytag® Technical Manual.

Sports Fields - Hortag® is excellent for both open trenching and for turf slitting. 6/14mm aggregate can also be used for trench fill around bowling greens.

For further information please see section 19 of the Lytag® Technical Manual.



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Applications (cont.)

Green Roof and Architectural Landscaping - When mixed with soil, Hortag® makes an excellent lightweight growing medium. Careful consideration has to be given to the component parts of the system to ensure they provide a suitable medium for sustaining vegetation, provide adequate drainage while still retaining moisture, minimise the weight on the building and should aim to protect the environment but, at the same time minimise the use of finite natural resources and provide reasonable value to those involved in its design, construction and operation. For further information please see section 22 of the Lytag® Technical Manual.

Benefits of specifying Lytag® products in drainage applications

Quality – Effective Quality Management Systems ensure consistent product manufacture.

Stability - They will not degrade, clog or impede drainage. It will aid long life and high performance to any scheme.

Cost Saving - It is half the weight of natural stone or gravel thus savings are made in transportation and laying costs – a 30 tonne tipper truck can collect 36.5m³ of Lytag® products compared with only 18m³ of natural aggregate.

Ease of placing - Being a rounded aggregate, Lytag® products “flow” easily and quickly into position, reducing any need for specialist placing techniques.

Use in Soft Ground - In wet and difficult ground conditions, they can be used when it would be difficult or impossible to transport heavier natural aggregate.

Pellet Shape - Due to the rounded shape of the pellet, no damage is caused to plastic pipes, membranes or bags.

Non-Compactable - Unlike irregular shaped aggregate, which over time often compact and silt up, Lytag® products’ rounded shape maximises the proportions of voids necessary for efficient drainage and aeration. Even after many years of service underground the compaction is minimal so free flowing properties are maintained.

High Absorption - Rapid dispersion of water is improved by both high absorption characteristics and non-compactability (A soak away system using Lytag® products can retain as much as one third its weight in water). Due to its non-compactability it offers a much improved rate of hydraulic conductivity when compared to natural aggregates.

Easy on machinery - Damage to machinery can be reduced due to the rounded shape, weight, and impact reduction and non-abrasive qualities of the pellet.

Manual Handling - Due to the weight of Lytag® products being approximately half that of natural aggregate, handling is less arduous and the risk of physical injury is reduced.



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Environmental considerations

As Lytag® products are manufactured from a waste stream material, the need to extract virgin materials to obtain the aggregate is negated. The original waste ash from the power station does not need to be sent for landfill, hence reducing the requirement for valuable land space.

As Lytag® products are approximately 50% of the weight of 'normal' aggregate, twice the volume can be carried in road vehicles. This significantly reduces vehicle movements on the highway and on and of site.

Where manual handling of the aggregate is required the lighter weight of the aggregate makes it easier to move, hence reducing the physical strain on operatives.



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Technical Manual – Section 19

Hortag®

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Introduction

The unique properties of Hortag horticultural media allow it to be used in a variety of applications. It is a rounded, manufactured aggregate that does not degrade over time. Placing on site is relatively easy as the material “flows” into voids and needs little additional compaction, saving time and money.

General properties

Hortag has a typical insitu density of 815kg/m³ based on a moisture content of 15%. This may however vary slightly, and current bulk densities may be obtained from the Lytag Ltd sales office. Further properties of Hortag are given in table 1.

Applications

Land Drainage - Hortag is an ideal medium for land drainage. Its rounded shape and regular grading give excellent hydraulic conductivity, as detailed in Table 1. It is used to construct golf course greens and is used in slit trenching and gravel banding, including Shelton Systems.

Sports Fields - Hortag is excellent for both open trenching and for turf slitting. 6/14mm aggregate can also be used for trench fill around bowling greens.

Green Roof and Architectural Landscaping - When mixed with soil, Hortag makes an excellent lightweight growing medium. Careful consideration has to be given to the component parts of the system to ensure they provide a suitable medium for sustaining vegetation, provide adequate drainage while still retaining moisture, minimise the weight on the building and should aim to protect the environment but, at the same time minimise the use of finite natural resources and provide reasonable value to those involved in its design, construction and operation.

For further information please see section 22 of the Lytag Technical Manual.



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Benefits of specifying Hortag[®] horticultural media:

Quality – Effective Quality Management Systems ensure consistent product manufacture.

Stability - Hortag will not degrade, clog or impede drainage. It will aid long life and high performance to any scheme.

Cost Saving - Hortag is half the weight of natural stone or gravel thus savings are made in transportation and laying costs – a 30 tonne tipper truck can collect 36.5m³ of Hortag compared with only 18m³ of natural aggregate.

Ease of placing - Being a rounded aggregate, Hortag “flows” easily and quickly into position, reducing any need for specialist placing techniques.

Use in Soft Ground - In wet and difficult ground conditions, Hortag can be used when it would be difficult or impossible to transport heavier natural aggregate.

Pellet Shape - Due to the rounded shape of the pellet, no damage is caused to plastic pipes, membranes or bags.

Non-Compactable - Unlike irregular shaped aggregate, which over time often compact and silt up, Hortag's[®] rounded shape maximises the proportions of voids necessary for efficient drainage and aeration. Even after many years of service underground the compaction is minimal so free flowing properties are maintained.

High Absorption - Rapid dispersion of water is improved by both high absorption characteristics and non-compactability (A soak away system using Hortag can retain as much as one third its weight in water). Due to its non- compactability Hortag offers a much improved rate of hydraulic conductivity when compared to natural aggregates.

Easy on machinery- Damage to machinery can be reduced due to the rounded shape, weight, and impact reduction and non-abrasive qualities of the pellet.

Manual Handling - Due to the weight of Hortag being approximately half that of natural aggregate, handling is less arduous and the risk of physical injury is reduced.



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Compaction

When placing Hortag only minimal compaction is required. For smaller areas the material should be placed in layers of maximum 300mm deep and raked and lightly vibrated to settle into position. Heavy compaction methods should not be used as this may crush the aggregate particles.

As well as reducing pressures exerted on new structures both during construction and in the longer term, savings can also be made on manpower, time and plant.

Environmental considerations

As Hortag is manufactured from a waste stream material, the need to extract virgin materials to obtain the aggregate is negated. The original waste power station fly ash does not need to be sent for landfill, hence reducing the requirement for valuable land space. As Hortag is approximately 50% of the weight of 'normal' aggregate, twice the volume can be carried in road vehicles. This significantly reduces vehicle movements on the highway and on and of site.

Where manual handling of the aggregate is required the lighter weight of the aggregate makes it easier to move, hence reducing the physical strain on operatives.



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Table 1 - Hortag horticultural media Properties

Property / Material	Hortag H1	Hortag H2	Hortag H23
Dry loose bulk density (BS EN 1097-3)	710kg/m ₃	710kg/m ₃	710kg/m ₃
Typical moisture content as delivered (BS EN 1097-5)	15%	15%	15%
Long term maximum moisture content	30%	30%	30%
Permeability m/s (BS EN 1377-5)	1.3 x 10 ⁻¹	1.3 x 10 ⁻¹	1.3 x 10 ⁻¹
pH (BS EN 1377-3)	9.2	9.2	9.2
Effective angle of internal friction Highways Specification CI 636	N/A	42°	39°
Aggregate crushing strength (BS EN 13055)	7N/mm ₂	6.5N/mm ₂	6.5N/mm ₂
pH	9	9	9
Typical grading (BS EN 933-1)			
14mm	100	100	100
10mm	100	87	81
8mm	98	49	29
6.3mm	47	19	8
4mm	5	4	4
3.15mm	4		
2mm	3		
0.063mm	2.3	2.4	2.4



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Shelton



A guide to Sportsturf Drainage Techniques for Sports Pitches



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Sports Pitch Drainage

The advanced Shelton drainage techniques available today can be installed speedily with little disruption to the playing surface, such that 'drain today, play tomorrow' becomes a reality. Cost effectiveness is uppermost in our minds, also. But the timing of the drainage works needs to be selected with care for optimum results – some drainage techniques are best undertaken when soils are relatively dry, others when soil moisture levels are relatively high. Plan long-term to get the backing of the players and create minimum disruption to the course.

The first step is to try and identify the reasons for the excessively wet area. Perhaps it is naturally slow draining clay soil, maybe substantial rainfall over a short period, possibly soil water rising from below, or run-off from adjoining higher ground. It may be caused by excessive thatch or capping of usually well draining soil by heavy pedestrian or mechanical traffic. Is it a broken land drain or a damaged irrigation pipe? Until the reasons for the problem are identified the best and most cost-effective solution cannot be formulated.

Some clubs choose to let their own groundsman rectify the problem; a significant number of them have been trained in basic techniques of land drainage. But can they be spared from other duties for a few days and have they the specialist up to date equipment that will allow them to undertake the work quickly and without substantial disruption of the playing schedule? Do they know the best layout of the primary drainage system and when a secondary drainage scheme may be advantageous and save money?

Before we get into the detail it must be recognised that a ground used for premier division matches is going to require a more intensive drainage system than that required by the local football club. However, basic rules apply to both.

Primary Drainage

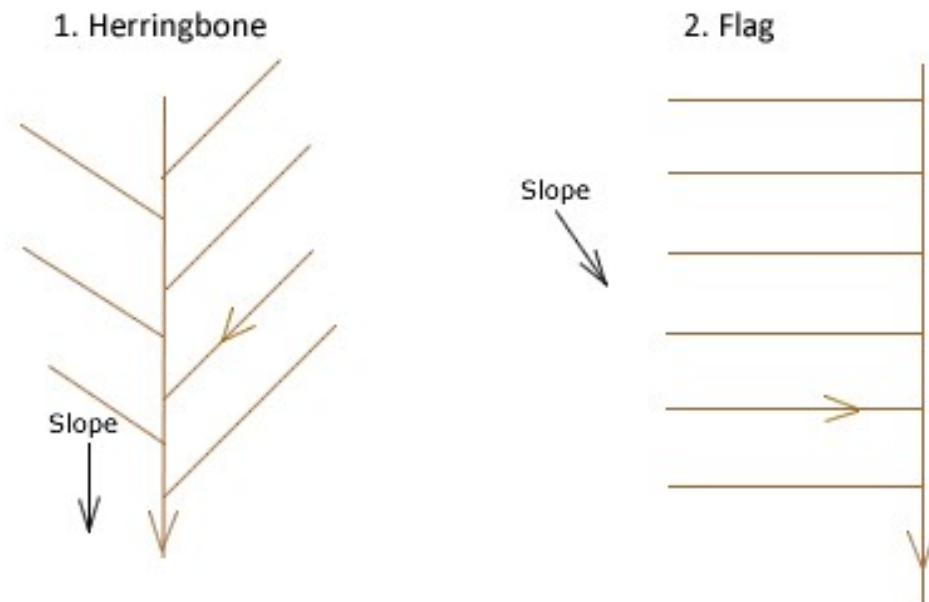
To remove excess soil water from an area is going to require the use of perforated land drainage pipes. It is important not to over-size these pipes: bigger is not necessarily better! The reason for this is that very small soil particles pass through the slots in the drainage pipes and are flushed out by the flow of water. The bigger the pipes the slower the flow of water: if the flow is too slow then the fine particles build up in the pipe and quickly reduce its effectiveness.

Correct pipe sizing is very important; the designer of the system will take a number of variables into account in deciding the appropriate sizes for a particular installation. Substantial sums of money can be saved by getting things right at this stage.

To minimise disruption the layout of the lateral piped system must connect with a main drain or drains off the playing area. The herringbone system is 'out' for the pipe junctions are sited down the centre of the pitch resulting in big scars in the most-used part of the pitch.

With pitches that are crowned run a main drain down each side of the pitch – if space allows some two metres away from the playing area. With other pitches run the main drain down the lower side similarly just off the playing surface.

In the case of crowned pitches, the lateral drains will run across the pitch connecting to both main drains. With other pitches the laterals will be in the flag layout. In both cases the lateral/main drain connections will be off the playing area. Ensure a laser is used to get the correct falls.



Spacing of the lateral drains will be determined, most likely, by the budget. On a premier league pitch 3-5 metre spacing is likely. Whereas 7 or 10 metre spacing is more common where budgets are tight. 10 metre spacing should be considered the maximum. Laser guided equipment would ensure an even fall on these pipes.

But pipe sizes and consequently trench width are major cost considerations also. Big diameter pipes do not necessarily give the best results. The smaller the pipe, the faster the flow, which helps keep them running clear.

Also, the larger the pipe, the wider the trench, and hence larger quantities of aggregate are required to backfill the trenches. Narrower trenches also heal quicker. Main drains would typically be 100mm in 118mm trench, laterals being 60mm in a 78mm trench or 80mm in a 97mm trench.



80mm pipe fits snugly in a 97mm trench

Primary drainage schemes on their own rarely give the speed of drainage required by today's footballers. Hence a secondary drainage scheme needs to be superimposed over them. The choice of secondary systems will be covered later on.

Aggregates

The selection of these aggregates needs to be understood. Spherical materials are the preferred choice as they leave air spaces for water to flow through. Angular gravels tend to run together over time leaving no such spaces. Materials with lots of fines should also be avoided to prevent pipes from becoming blocked.



Lytag has eight times greater hydraulic conductivity than gravel

A crushed 8-10mm gravel may be inexpensive but a product such as Lytag – pulverised fuel ash – could drain up to ten times faster and carries no Government Aggregate Tax. The advantages of using Lytag are many, including faster drainage, the ability to retain water in dry conditions which reduces the striping that can occur when gravel is used. It is half the weight of gravel per volume, which reduces the weight of material being carted across the site. It also shatters on contact with mowers, where gravel will not. The latter could be the more cost-effective material to use; it will depend on your circumstances.

Secondary Drainage Techniques (See also Appendix I)

Before I describe the various secondary systems of drainage available we should consider the role of the secondary system. Piped land drains remove excess soil water off the pitch and whilst it might be desirable to put these close together the cost, in most cases, would be prohibitive. Therefore, it is usual to space them at 3, 5, 7 or 10 metres apart depending on the status of the pitch. (Some of the excess water in the soil therefore has to travel 1½ to 5 metres to the nearest land drain and this takes time.)

To speed up this water movement through the soil a secondary drainage system is superimposed over the primary system, usually at 90° to it.

Sand Slitting

One of the commonest systems has been sand slitting or slit trench drainage. This consists of 50mm wide gravel/sand filled trenches installed using a Supertrencher, spaced one to two metres apart. They are typically 250mm deep, backfilled with 100mm of gravel, and topped off with 150mm of coarse sand. These are best installed in dry conditions.



Sand Slits installed at 2 metre centres at 90 degrees to primary drainage.

Gravel Banding

Shelton Gravel Band Drainage consists of gravel bands, usually 25mm wide and 250mm deep. The soil is opened up by a vibrating stainless steel tine and the gravel fed immediately into the slot. A wheel or roller on the back of the machine partly closes the band to enable use of the pitch immediately afterwards. This system has to be installed when the soil is moist throughout the working depth. This gravel banding is low cost,, yet very effective indeed. Because the bands are close together and half the width of the slit trench drainage technique only rarely do they open up to such an extent that remedial work is required. In such cases an overall surface dressing of a free draining sand suffices.

It is a one-person operation to install and with one tonne and three tonne capacity machines available to suit the circumstances big outputs per day are possible. It is little wonder that gravel banding has become a popular technique on pitches from those in the premier division to those in small towns and villages.



3 Tonne Gravel Band Drainer for large areas



Mounted model useful where space is limited

System 25

System 25™ is a trenching technique where 25mm wide trenches are dug by a high speed wheel. The arisings are conveyed into a trailer running alongside. Coupled to the rear of which is a vibrating hopper immediately back-filling the trench with a permeable aggregate. It is a one-pass operation.

These micro trenches are usually installed at depth of 300mm and are usually spaced between 500mm and 2m apart depending on the speed of drainage required, and the budget available. Shelton System 25™ is best installed when the soil is on the dry side. It entails the use of more equipment and operators than gravel banding hence the cost is somewhat higher. Disruption to the playing surface is minimal and use may be resumed immediately if necessary.



System 25 installing secondary drainage, Gravel Cart keeps hopper topped up

Lightening Drain

There are situations where very speedy drainage is required. To meet this demand we have recently introduced our Lightening-drain™ system; the world's fastest drainage system.

Lightening Drain™ is very similar to System 25™, using the same equipment, except the trenches are dug 35mm wide and a 25mm perforated land drainage pipe is installed prior to backfilling with Lytag. We know of no faster land drainage system when the pipes are spaced at 500mm centres.



25mm perforated drainage pipe

With all secondary drainage systems maintenance is required. A common failing arises because the pitches drain well. As a result they are used by all and sundry both for matches and for training. The grass turns to mud and the effectiveness of the secondary system is thereby reduced.

After the installation of secondary drainage and in years two and three it is advisable to apply 100tonnes of a free draining sand to the pitch in the growing season – preferably in two applications of 50 tonnes so as not to suppress grass growth.

The professional footballer will no longer tolerate playing on a poorly drained, muddy pitch.

The amateur plays football for enjoyment, so why should he? The latest drainage techniques and equipment have revolutionised pitch preparation. Are you part of that revolution?

Options for getting the work done.

Employing a contractor.

Sportsturf drainage calls for specialist skills and specialist machinery. Drainage techniques have advanced considerably in recent years and it is essential to employ only those who have the expertise and specialist equipment to work efficiently and effectively. It is likely to be the most expensive of the options considered here, but should ensure a high quality of workmanship.

Hiring-in specialist equipment, trenchers, backfillers, and possibly tractors.

Consider – has the club got staff skilled in the operation of specialist equipment? Can it spare skilled staff for a few days from their routine duties? Have we got detailed plans for the drainage works? If the answers are yes this option is worthy of an in-depth study.

Hiring-in specialist equipment with trained operator(s)

This approach can show significant savings over using contractors. It is a form of partnership working. However the club must remember it is making the decisions, formulating the plans and directing the team of workers. It usually means there must be a senior member of the staff on site throughout the working day assisted by two or three skilled workers.



Specialist equipment ensures high work rates

Purchasing new or rebuilt equipment.

If the club has a substantial amount of work to do, then purchasing new maybe an option. The equipment will also have a resale value at the end of the project. Pre-owned equipment may also be an option, this initially may be cheap but reliability may be compromised and it can be more expensive in the long run. Refurbished equipment is also worthy of consideration.

Some clubs have taken the middle route – having the primary drainage system installed by a contractor, and installing the secondary drainage system in-house. Each club will have their own preferred route to carrying out the works, which can depend upon many factors, including budget, existing labour and machinery resources.

Appendix I.

A comparison of secondary drainage systems:			
Shelton Gravel Band Drainage	Shelton System 25™	Slit trench drainage sand slitting	Shelton Lightning-drain™
One pass operation	One pass operation	Two or three pass operation	One pass operation
Trench width 25mm	Trench width 25mm	Trench width 50mm	Trench width 35mm
Trench depth 300mm	Trench depth 350mm	Trench depth 250mm	Trench depth 450mm
Spacings usually 400mm to 1,000mm	Spacings usually 400mm to 1,000mm	Spacings usually 1,000mm to 2,000mm	Spacings usually 500mm to 1,000mm
Aggregate brought close to surface	Aggregate brought close to surface	Aggregate brought up to 2" of surface, topped off with free draining sand	Aggregate brought close to surface
Cost per linear unit = x	Cost per linear unit = 2x	Cost per linear unit = 3x	Cost per linear unit = 4-5x
Negligible chance of trench opening-up in dry weather	Little chance of trench opening-up in dry weather	Moderate risk of trench opening-up in dry weather	Little chance of trench opening-up in dry weather
Safety: Excellent	Safety: Good	Safety: Some risks	Safety: Good
Must be undertaken when soils are moist to very moist	Best undertaken when soils are on the dry side	Best undertaken in dry conditions	Best undertaken when soils are on the dry side
Minimum labour requirement: one person	Minimum labour requirement: two persons, preferably three	Minimum labour requirement: two persons, preferably three	Minimum labour requirement: three persons
Output per day: circa 6000 metres	Output per day: circa 3000 metres	Output per day: circa 3000 metres	Output per day: circa 1500-2000 metres

Important Points to Consider

- Remember to take precautions in the vicinity of trees and growing shrubs to prevent roots growing into land drainage pipes.
- One inch of rain on one acre is 22,610 gallons; can it be re-circulated.
- Rats and other vermin can block pipes; ensure vermin guards are fitted
- To avoid damage to irrigation pipes and control wires mark all underground services in the vicinity of the drainage works with a white line.
- Check tyre pressures on tractors and trailers before commencing work to ensure they comply with manufacturer's recommendations.
- Remember the risk assessment.

About Sheltons

Shelton specialises only in the drainage of fine turf. We have over 100 years of experience in the sportsturf drainage industry. Our equipment and techniques have been used to drain many prestigious sporting venues around the world.

We design, manufacture and sell the Shelton range of land-drainage machinery worldwide; new, used and refurbished. We have a contracting department operating throughout the U.K. We have equipment for hire – including tractors and operators.

Shelton can guide you as to which may be the best way to go to rectify your land drainage problems and indicate likely costs.

For more information please call us, or see our website: www.sheltonsdrainage.com



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