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BLOFIELD PRIMARY SCHOOL NATURAL TURF SPORTS PITCH DEVELOPMENT

Agrostis Sports Surface Consulting

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Agrostis Sports Surface Consulting aims to assist clients in matters concerning sports surfaces. All recommendations are offered free of bias. *Agrostis* has no commercial connections or obligations to any manufacturer, supplier or contractor.

22 March 2024 **TAL**

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BLOFIELD PRIMARY SCHOOL NATURAL TURF SPORTS PITCH DEVELOPMENT

CONTENTS

1 HEALTH AND SAFETY

The Contractor shall carry out all operations associated with the specified works in accordance with current legislation and the Code of Practice for Contractors, including the Construction (Design and Management) Regulations 2015 (CDM) where applicable.

The Contractor is required to provide a Health and Safety Policy with a statement demonstrating that due regard has been given to all aspects of health and safety relevant to the site and specified works.

The Contractor should ensure that his rates are adequate to meet the cost of making all necessary arrangements for the health, safety and welfare of all persons affected by the construction work.

Under the Construction (Design and Management) Regulations 2015 (CDM 2015) a Construction Phase Plan is required for every construction project.

As Contractor on this project, you will be responsible for:

- Preparing a Construction Phase Plan before the work starts
- Organising the work;
- Working together with others to ensure health and safety

The project is NOT considered to be notifiable under the Construction (Design and Management) Regulations 2015 (CDM)[1]. However, the Contractor should submit a Health and Safety Plan prior to commencing work.

[1] If the job will last longer than 500 person days or 30 working days (with more than 20 people working at the same time) it will need to be notified to HSE.

2 PROJECT INFORMATION

2.1 Contact

The employer is NPS, where the instructing officer is Amy Duckworth, Project Manager

Address for correspondence:

NPS Property Consultants
5 Anson Road
Norwich
NR6 6ED

Mob: 07594 647366
Tel: 01603 706706
Email: amy.duckworth@nps.co.uk
Web: www.nps.co.uk

The Designer is Agrostis Turf Consultancy Ltd represented by Dr Tim Lodge.

Address for correspondence:

21 Grove Park
Walsham le Willows
Bury St Edmunds
IP31 3AE

Email: info@agrostis.org.uk
Tel: 01359 259361
Mob: 07725 629492

2.2 Site location

The site is at the location:

Nat. Grid: TG336099
OS X (Eastings) 633672, OS Y (Northings) 309957
Lat: N52:38:13 (52.6370)
Long: E1:27:07 (1.4520)
Nearest Postcode: NR13 4FG

Maps showing this location are provided in Figure 2-1.

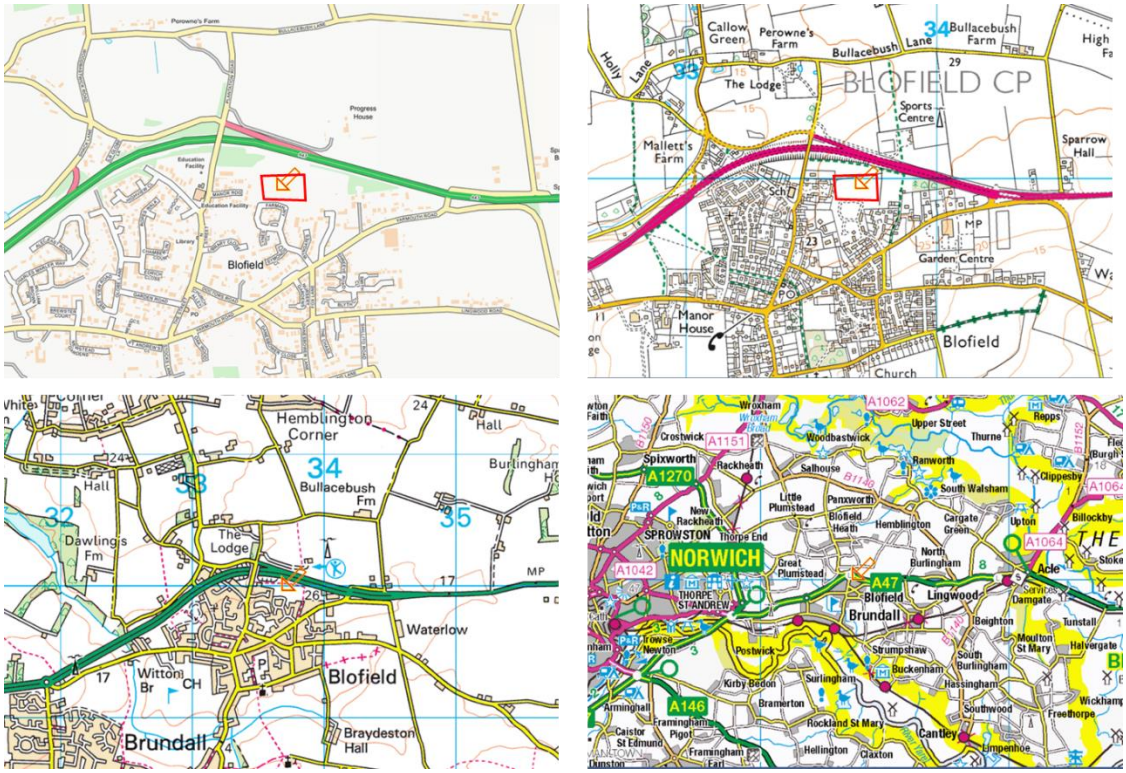


Figure 2-1 Location of the site

The outline of the site, in Google Earth, is shown in Figure 2-2.

Figure 2-2 Outline of the site in Google Earth

2.3 Access

Access to the working area may be obtained from Farman Way to the south. Pedestrian gates give access to the site through a timber fence.

Between the site and Farman Way the area is referred to as the Community Space. Disturbance of the Community Space is to be minimised throughout the works. The access route across the Community Space will require protection during the works using ground protection decking. The temporary removal of fencing will also need to take place. These features are shown in Figure 2-3.

Figure 2-3 Possible access from Farman Way

3 SITE INFORMATION

3.1 Geology and soil type

The geology and soil type of the location are summarised in APPENDIX 1 – SITE DATA .

3.2 Surroundings

The sports pitch development forms part of a school construction the buildings for which are to be located to the north. This is on an area of what is currently scrubland. The school development lies beyond a broken hedge line with three mature trees (T6, 9 and 10) that are to be retained.

Figure 3-1 South westward view over the site

To the east, beyond a broken hedgerow, is a field, in use for pasture at the time of the site investigation.

To the west are houses and gardens. The Community Area and Farman Way are to the south.

Figure 3-2 Western boundary of the site

3.3 Site history

Google Earth imagery from 2011 indicated that the land was in use for arable agriculture as it most probably will have been for many decades if not centuries.

In 2017, however, much of the land was in use as a construction compound and contained various earth mounds and areas from which topsoil had clearly been stripped. This was apparent in 2016 also when the housing development associated with Farman Way was probably built.

The land appeared to have returned to arable agriculture in 2019 but further earthwork activity had subsequently taken place and by 2021 the existing ground formation seems to have come into being. This included the formation of three shallow ponds in what has subsequently become the Community Space.

Figure 3-3 Appearance of dry 'ponds' in Community Space

3.4 Ground cover

Vegetation across the site, including over the Community Space, consisted entirely of ruderal species that may have established by natural processes since the last phase of earthworks had been undertaken.

Much of the ground cover was provided by moss with a very thin covering of fescues and spear thistle. This suggests a generally low level of soil fertility that has possibly come about through blending of topsoil and subsoil, or de-structuring of the soil generally.

Figure 3-4 Vegetation across the working area

The various mounds across the site supported a more vigorous ground cover containing grasses and taller vegetation such as mugwort, dock, field thistle and mullein.

Figure 3-5 Areas of fuller ground cover

3.5 Topography

A topographic survey was provided and the data, presented with contours at 0.1 metre intervals, is shown in Figure 3-6.

Figure 3-6 Existing topography with key feature annotations

The drawing is annotated with various features that are shown in Figure 3-7.

Figure 3-7 Significant topographical features of the working area

A prominent embankment runs along the western edge of the working area and formed by the formation of a soil mound along this line. The two root protection zones, applicable to trees T6, T9 and T10, are present as depressions, each around 300 mm below the surrounding soil level.

3.6 Soil profile

Excavation in the central section of the working area revealed the profile shown in Figure 3-8.

Figure 3-8 Soil profile in the central section of the working area

The topsoil extended to around 300 mm depth and consisted of a moist, easily worked, clay loam. This contained relatively few stones that were typically small flints.

The subsoil was of pale clay with chalk flecks and more frequent flints.

An excavation of the mounds to the north of the site indicated that these were formed mainly of topsoil. Excavation within the low ground of the RPZ for T9 and 10, thought to represent the original condition of the site, revealed the profile shown in Figure 3-9. Here, a clay loam topsoil extended to around 200 mm where it blended with a clay subsoil that became a fairly dense clay, with chalk flecks, at around 500 mm.

Figure 3-9 Excavation of northern embankment (left) and of RPZ T9/10

4 SUMMARY OF PROPOSED WORKS

The intended sports pitch layout is shown in Figure 4-1[2]. The site is to be used predominantly for junior football on natural turf with a 100 metre running straight. However, the site will have the capability to provide a natural turf surface for other sports played during both winter and summer. Areas around the specific sporting surface are to be prepared as general amenity grassland.

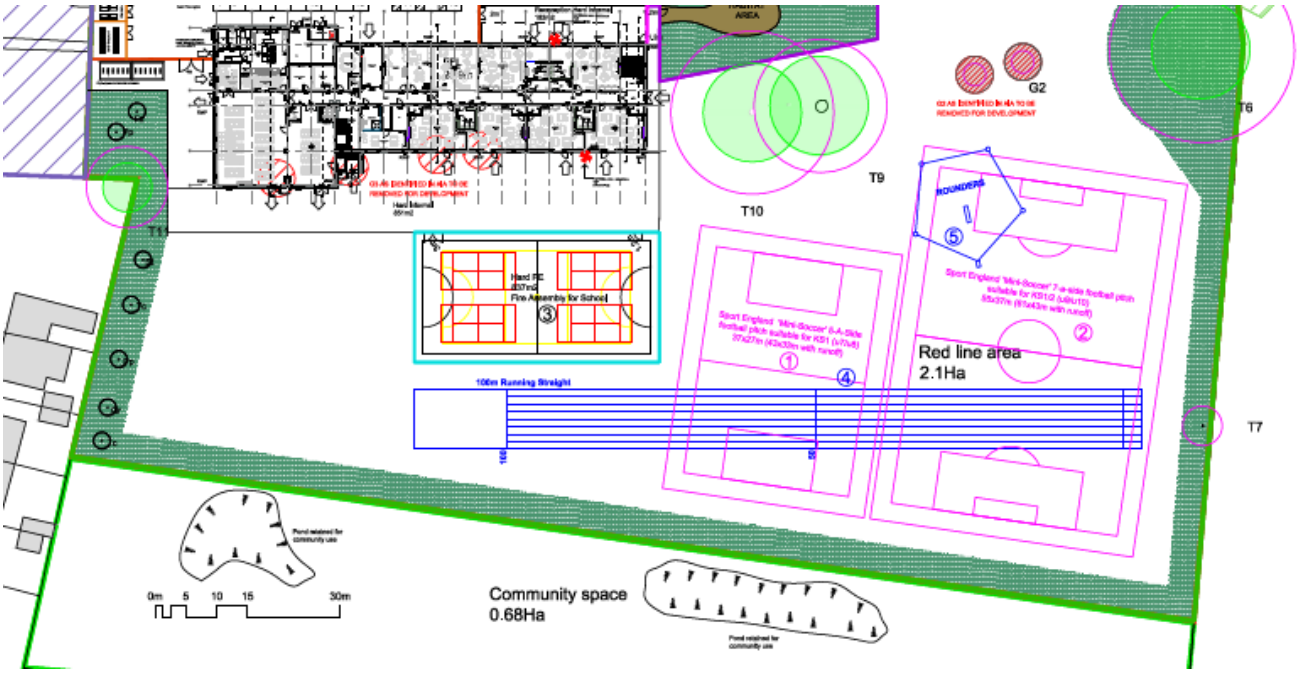


Figure 4-1 Intended sports provision on the site

A summary of the proposed works to be carried out over the area is as follows:

- Cut down and remove above ground vegetation
- Spray off and remove remaining vegetation
- Grade to a single platform within topsoil
- Prepare stone-free and suitably firm tilth
- Incorporate sand carpet to specified area
- Incorporate rabbit fencing
- Sow specified seed
- Maintain grass surface through establishment period

[2] Proposed Pitch Markings. NPS-ZZ-00-D-A-019. NPS Group. 20 October 2022

4.1 Drawings

The various stages of the project are available as layers in the accompanying CAD file 'Blofield Natural Turf.dwg'. The layers are referred to as follows:

- Existing topography
- Vegetation removal
- Grade
- Sand carpet
- Seed

Drainage details are provided in the separate pdf drawing 'Blofield Drainage'.

Extracts from the model and from 'Blofield Drainage' are included here for explanatory purposes.

4.2 Storage compound and welfare facilities

The contractor will need to provide their own storage compound and welfare facilities on site at a suitable location to be agreed with the Engineer. It may be possible to utilise facilities already on site by agreement with the main contractor.

4.3 Spoil deposition

Any spoil is to be deposited on site at a location to be determined.

4.4 Method statement

A statement shall be provided describing the proposed general and detailed arrangements and methods for carrying out the works, and of the time when, and the order in which it is proposed that these shall be executed.

4.5 As done drawings

Drawings showing the actual locations of all features and surfaces shall be provided on completion of the project.

4.6 Designer's note

The history of the site has involved a good deal of earth moving. On the assumption that the root protection zones to the north represent the original land surface, it is not unlikely that the levels across the site have been elevated by the import of what will have been a substantial volume of material, probably consisting of both topsoil and subsoil. This may have originated from the footprint of the houses constructed to the south. The resulting landscape has subsequently been manipulated at various stages to produce the topography that now exists. The upshot is that the form and condition of the soil profile at any one point cannot accurately be predicted.

Although the sandy texture of the topsoil as determined by laboratory analysis is quite favourable in terms of its suitability for the provision of sports turf surfaces, many features of the site indicate that the structure of the topsoil is very far from satisfactory. Furthermore, measurement of infiltration, using double ring infiltrometers, indicated rate of water infiltration of near zero.

Figure 4-2 Infiltration rate measurement on the site

It is not appropriate to replace the topsoil on the site for the purposes. So, in order to restore some of the soil structure that has been lost it is essential that all soil handling and cultivation in the works described here is carried out when the soil itself, and the weather generally, is dry. Furthermore, the works include the incorporation of a sand carpet over the areas likely to be subject to the greatest degree of wear. This is intended to restore some of the free draining characteristics that the topsoil would most probably have had in its original condition.

Similarly, the original condition of the subsoil may well have been sufficiently porous to allow the incorporation of suitably performing sports pitches without the incorporation of a pipe drainage system. However, to reduce the risk of excessive water retention within the profile as a whole developing as a result of the lost structure in the deeper layers, a limited degree of pipe drainage has been included here.

5 EARTHWORKS

5.1 Spray off and vegetation removal

Cut down and remove off site (or otherwise dispose of in an appropriate and approved manner) all vegetation from the area shown in Figure 5-1.

Figure 5-1 Area of vegetation removal. Contours at 0.25 m intervals

The vegetation height should be reduced to no more than 30 mm prior to the application of herbicide.

Kill off all vegetation within this area by spraying with a total non-residual herbicide based on glyphosate. The herbicide should be applied carefully during still weather conditions strictly according to manufacturer's recommendations and all current legislation and health and safety regulations. On absolutely no account must the herbicide be allowed to drift or otherwise affect any areas beyond the designated working boundaries.

Allow a period of 7-10 days for the herbicide to have full effect before proceeding with further works.

5.2 Cultivation

Use a disc harrow or similar, making as many passes as are required to break up the topsoil before cultivating.

Cultivate intensively the area of vegetation removal to a depth of no less than 150 mm.

Any significant variations in the nature and consistency of the topsoil that may come to light during this process must be brought to the attention of the Engineer.

5.3 Platform formation

Grade within the topsoil to produce the platform shown in Figure 5-2. The platform slope is 1 in 150 in the direction shown.

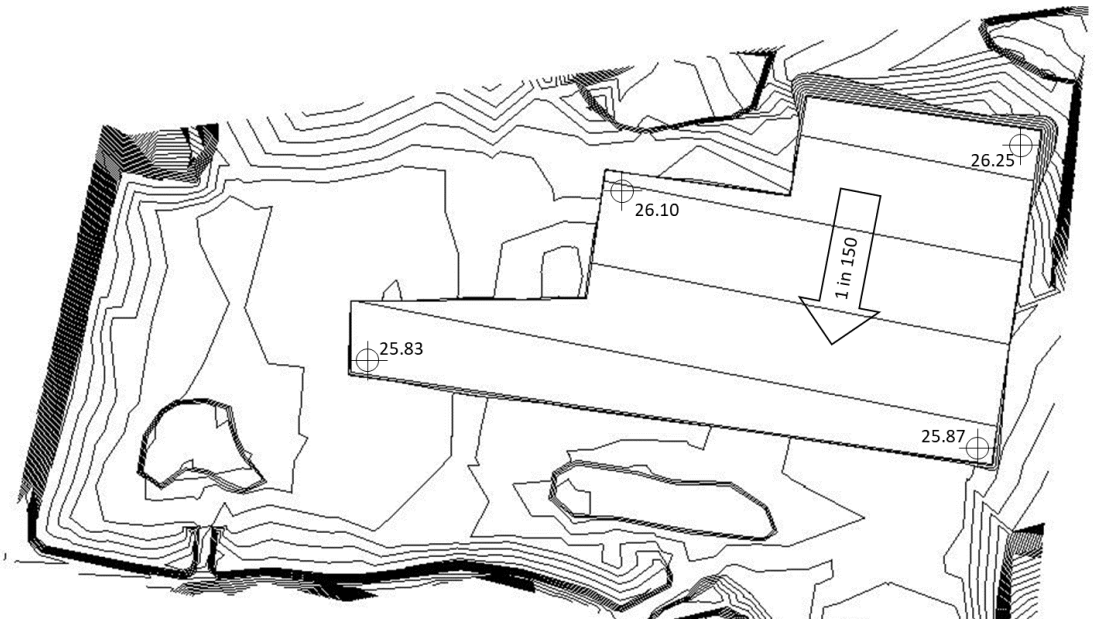


Figure 5-2 Grade within the topsoil. Contours at 0.1 m

Areas of cut and fill are shown in 'Cut and fill', an extract of which is shown in Figure 5-3.

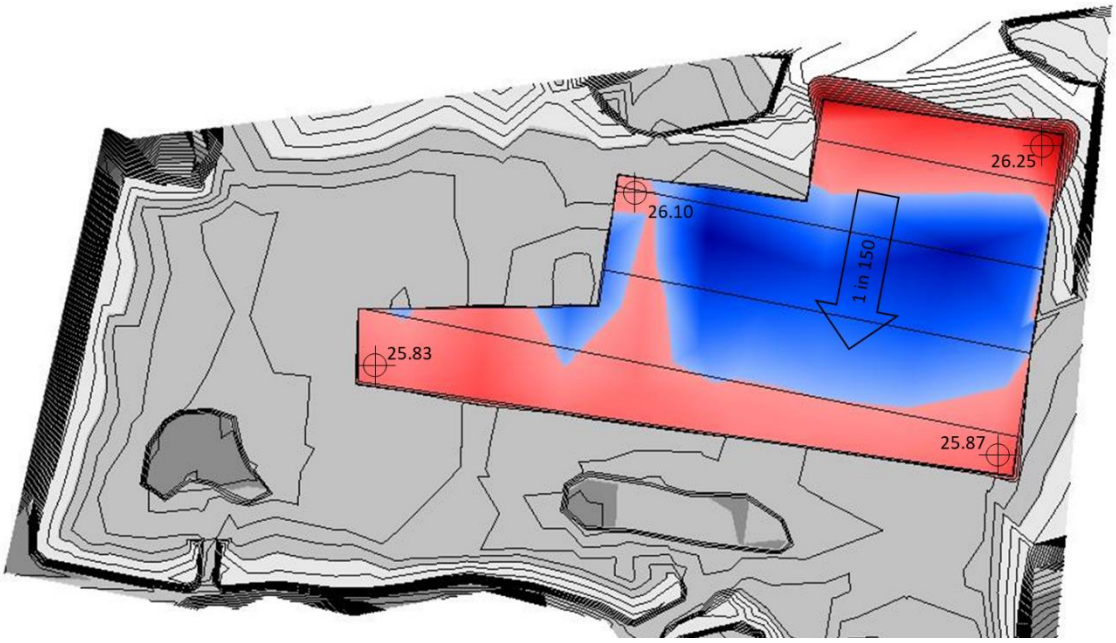


Figure 5-3 Areas of cut (red) and fill (blue)

The operation is balanced so no material need be transported on or off site.

The average depth of both cut and fill should be around 90 mm. Areas requiring a cut of greater than 100 mm should be pointed out to the Engineer to determine the necessity or otherwise for localised stripping of topsoil and grading within the subsoil.

Both 'cut' and 'fill' embankments should be no steeper than 1 in 5 and where possible should be made less steep.

Use appropriate laser guided equipment. This may be box graders, 360 excavators with earth moving lorries or dozers or a combination of these techniques.

On completion, no point shall vary by more than 50 mm from the design levels.

On no account must any of the surrounding hedgerow or woodland be damaged or disturbed by the cut and fill operation, above and below ground. Fill embankments must not be allowed to extend beneath the canopy of trees outside of the working area.

The surface must be approved by the Engineer at this point before proceeding to the next stage. The Engineer may apply the tests of smoothness as described in 10.4 Smoothness tolerance.

6 DRAINAGE

6.1 General

Layout

The pipe drainage system to be installed is shown in 'Blofield Drainage', the overview from which is shown in Figure 6-1. Any significant deviations from this arrangement must first be approved by the Engineer.

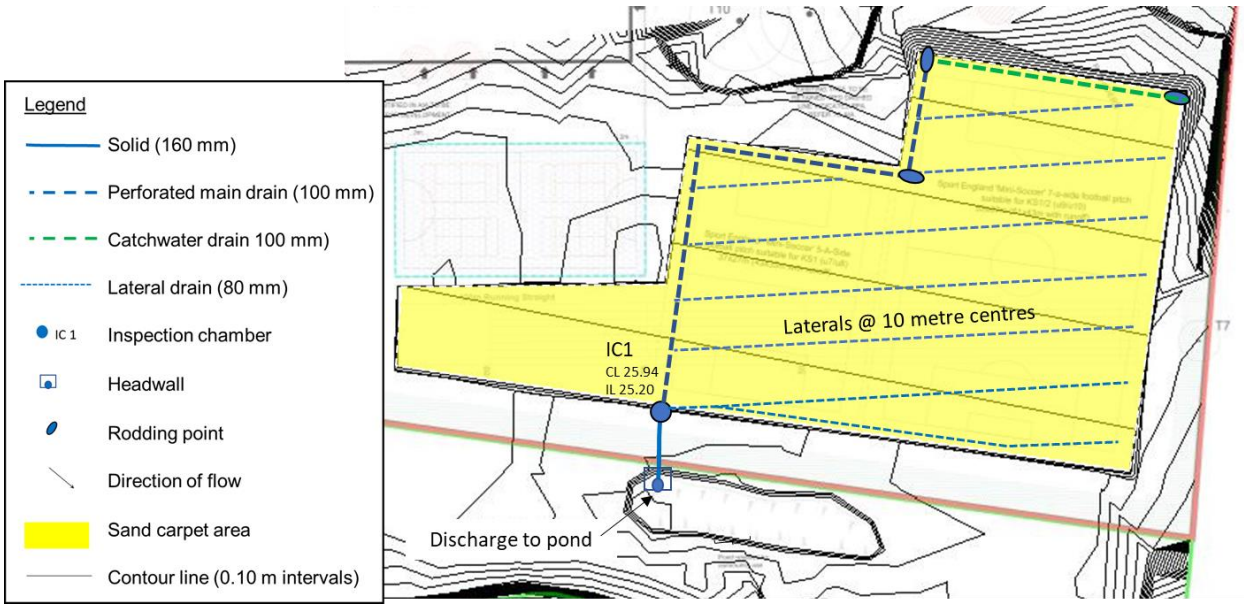


Figure 6-1 Drainage overview. Detail from 'Blofield Drainage'

The land drainage system is to comprise lateral drains incorporated at 10 metre centres that intersect a main drain running along the western side of what will eventually be 2 football pitches. A catchwater drain forms the northern section of this main drain. The main drain is to discharge into the central of the 3 ponds in the Community Space.

Spoil

Drainage spoil is to be disposed of in an appropriate manner on or off site, to be confirmed.

6.2 Inspection chambers

The generalised form of the inspection chambers is shown in Figure 6-2.

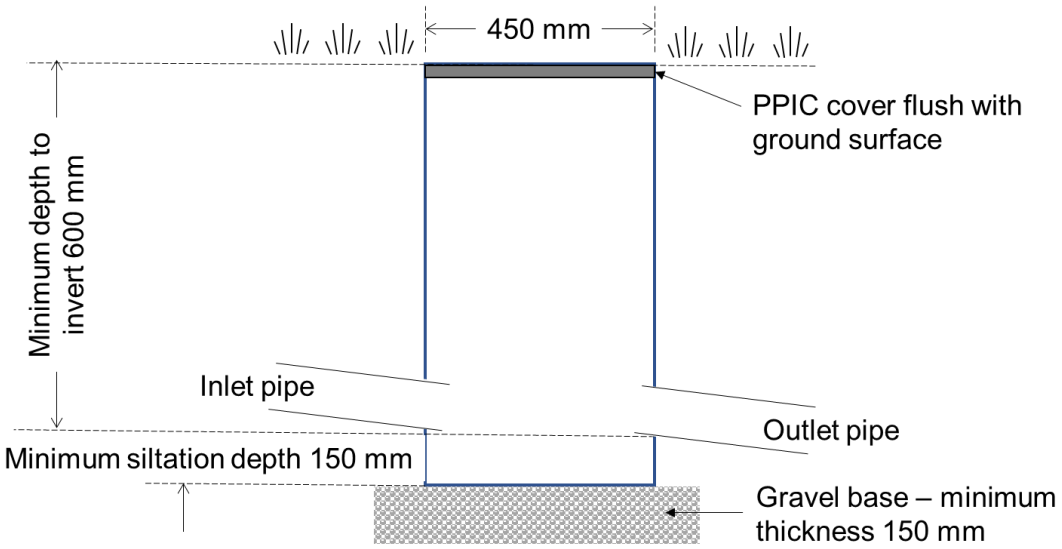


Figure 6-2 Generalised form of inspection chamber

Excavate for and construct inspection chambers with minimum internal dimensions 900 mm by 600 mm and invert depth of 300 mm below the outlet pipe at the locations shown. Surplus spoil shall be disposed of on-site as for drainage arisings.

Variations on these dimensions and on the form of the inspection/access chambers are permitted provided the alternatives are approved by the Engineer beforehand.

The chambers shall be set on 150 mm thickness of gravel.

The chambers shall be fitted with a mini access chamber, appropriate cover and polypropylene frame, with the cover set flush with the finished ground level.

Incorporate inlet and outlet pipes and point and seal around all units and pipes to ensure efficient waterproofing. Backfill and reinstate around chambers.

6.3 Connections to discharge

The sports field drainage system is to discharge to the central of the 3 ponds in the Community Space.

The connection between IC1 and discharge shall be through 160 mm diameter twinwall solid pipe. This shall be located within a trench 200 mm wide and minimum 600 mm deep.

A minimum fall of 1 in 150 must be achieved between IC1 and the pond.

A schematic cross section of the discharge drain is shown in Figure 6-3.

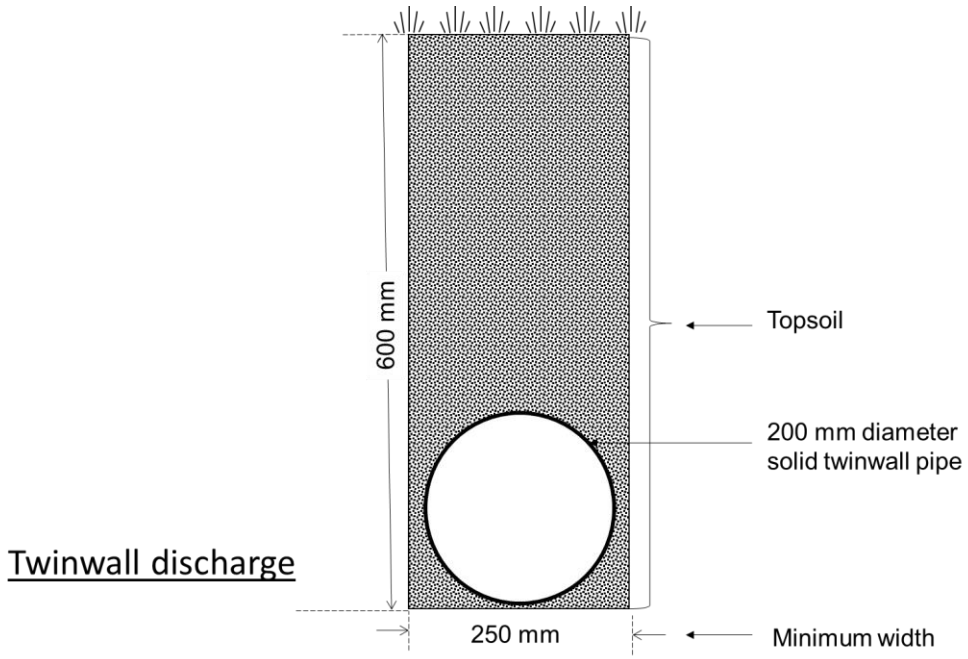


Figure 6-3 Schematic cross section through Twinwall discharge drain

The trench is to be backfilled with topsoil and the surface re-seeded with the remainder of the site.

The outfall shall be provided with a prefabricated discharge unit or headwall (Figure 6-4) of the appropriate orifice size and fitted securely into place in the feature embankment.

Figure 6-4 General purpose headwall unit

Note that it may be necessary to excavate the pond approximately 300 mm deeper in the vicinity of the headwall in order to ensure the appropriate fall is achieved.

6.4 Catchwater drains

A schematic cross section through a completed catchwater drain, 100 mm diameter, is shown in Figure 6-5.

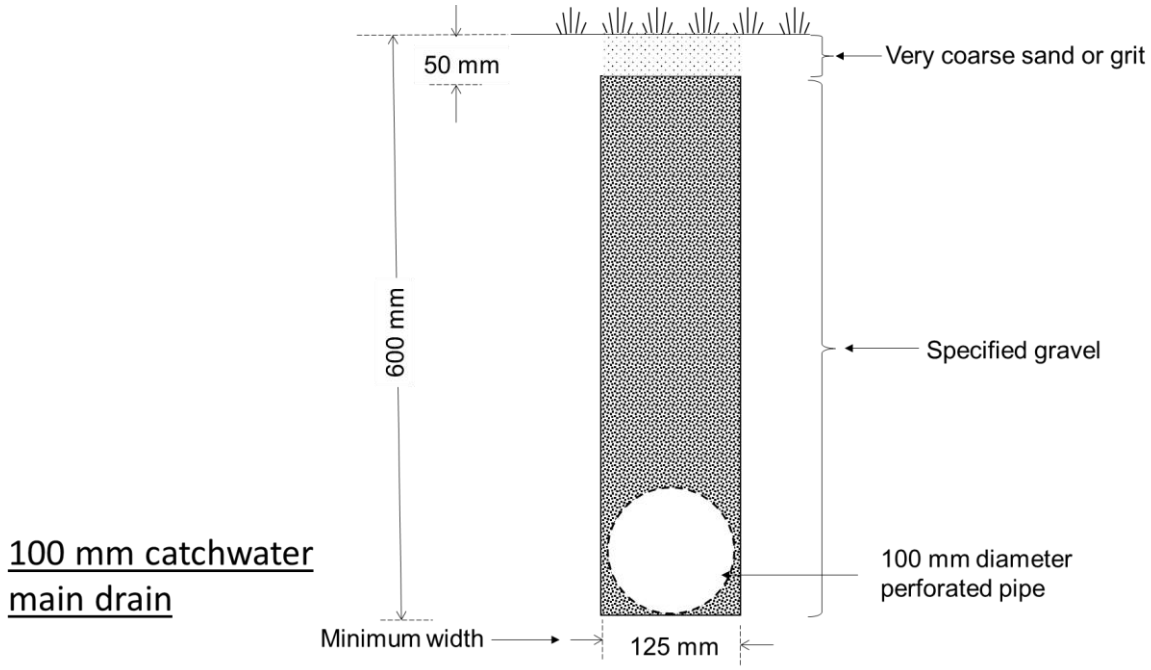


Figure 6-5 Schematic cross section through catchwater drain

The catchwater trenches, accommodating 100 mm perforated pipe, shall be of minimum width of 110 mm and a minimum depth of 600 mm below finished surface level.

The trenches should have a minimum fall of 1 in 200 towards their outfalls.

6.5 Main drains

A schematic cross section through a completed perforated main drain, 100 mm diameter, is shown in Figure 6-7.

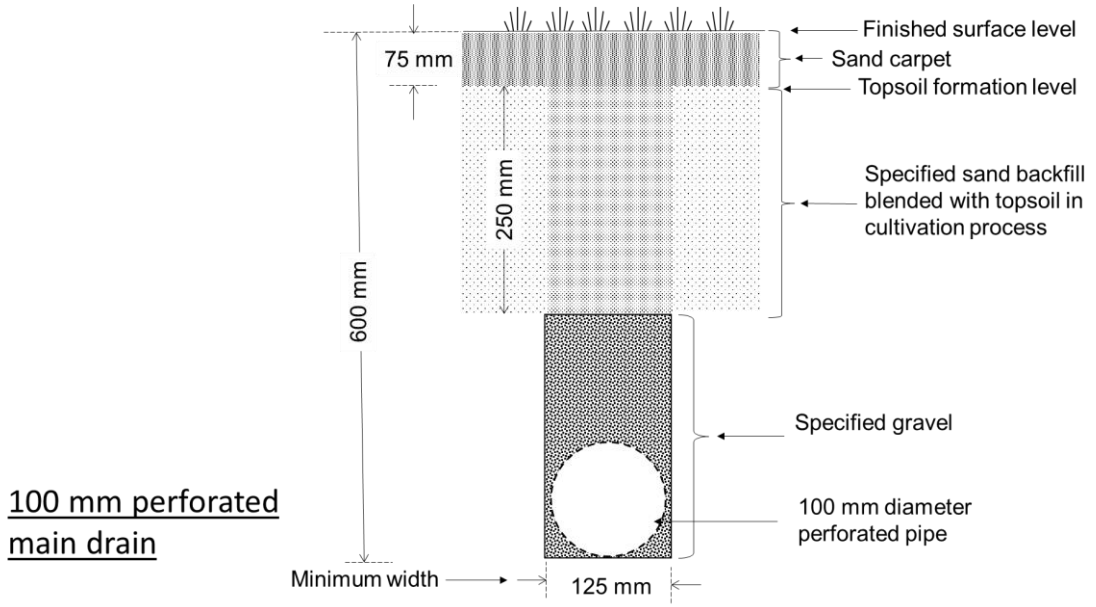


Figure 6-6 Schematic cross section through perforated main drain

The main drain trenches, accommodating 100 mm perforated pipe, shall be of minimum width of 110 mm and a minimum depth of 600 mm below finished surface level.

The trenches should have a minimum fall of 1 in 200 towards their outfalls.

6.6 Lateral drains

A schematic cross section through a completed lateral drain is shown in Figure 6-7.

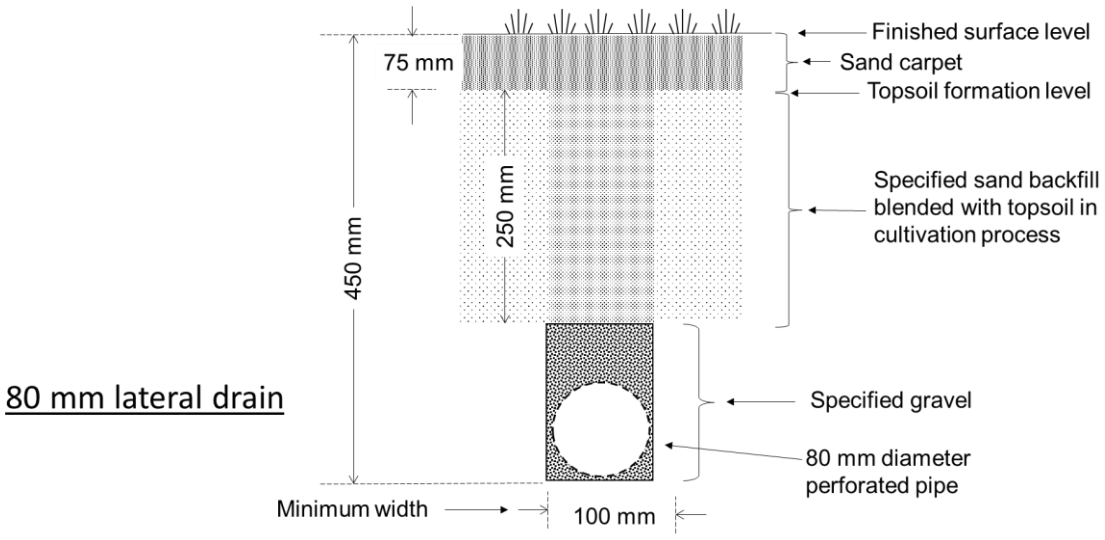


Figure 6-7 Schematic cross section through lateral drain

Lateral drain trenches, accommodating 80 mm perforated pipe, shall be of minimum width of 100 mm and a minimum depth of 450 mm below finished surface level.

All trenches shall have a minimum fall of 1 : 200 along their lengths achieved using laser levelling equipment.

Allowance shall be made over the final few metres for the relevant lateral drain trench depths to be adjusted to reach the main drain or catchwater drain invert level.

Lateral drain lines should be parallel to one another, at 10.0 metre centres.

Their orientation should be as shown in 'Blofield drainage'.

6.7 Pipework and fittings

All laterals shall be perforated plastic pipe and of 80 mm diameter.

Main and catchwater drains shall be of 100 mm perforated.

All pipe shall conform to BS 4660:1989 with the kite mark clearly shown.

All joints in the drains and connections between laterals and main drains shall be made using appropriate connectors of the right size. All drain runs shall be tested for line and gradient before backfilling and approved by the Engineer.

Any existing drains which are cut through or damaged shall be pointed out to the Engineer or his representative and shall, if possible, be connected to the new drainage system to the satisfaction of the Engineer.

6.8 Backfill

Approval
All the proposed backfill materials shall be approved by the Engineer no less than three weeks prior to the commencement of the works. The Engineer should be provided with samples and particle size data referring to the proposed materials.

Drainage gravel selection
Selection of gravel is based on the particle size distribution of the proposed sand material. Strict adherence to these criteria is imperative as failure to follow these guidelines could result in the failure of the drainage system.

Gravel selection criteria are based on engineering principles that rely on the largest 15 % of the sand particles 'bridging' with the smallest 15 % of the gravel particles. Smaller voids are

produced, and they prevent migration of sand particles into the gravel yet maintain adequate permeability.

The D85 (sand) is defined as the particle diameter below which 85 % of the particles (by weight) are smaller. The D15 (gravel) is defined as the particle diameter below which 15% of the gravel particles (by weight) are smaller.

- For bridging to occur, the D15 (gravel) must be less than or equal to eight times the D85 (sand)
- To maintain adequate permeability across the sand/gravel interface, the D15 (gravel) shall be greater than or equal to five times the D15 (sand)
- The gravel shall have a uniformity coefficient (Gravel D90/Gravel D15) of less than or equal to 3.0

Furthermore, any gravel selected shall have 100 % passing a 12 mm sieve and not more than 10 % passing a 2 mm sieve, including not more than 5 % passing a 1 mm sieve.

Typically, gravels categorised as ‘6 to 10 mm’ tend to conform to these criteria.

Final backfill for lateral and main drains
Final backfill material shall be 100 % sand material that conforms to the grading curve presented in 10.1 Drainage sand backfill grading curve and to the criterial described above in relation to the gravel component of the drainage system.

Catchwater backfill materials
The gravel selected for incorporation into the lateral and main drains will also be suitable for the catchwater drains. Furthermore, if this gravel is used, there will be no need to incorporate the final layer of coarse sand or grit as indicated in Figure 6-5. If a coarser gravel or stone is used for backfilling, however, the final very coarse sand or grit should be incorporated.

Gravel incorporation
After incorporation of the pipework, backfill the trenches to no more than 250 mm from the surface using the approved gravel. Adequately and evenly firm to prevent settlement.

Final backfill
Backfill the remainder of each trench to ground level with the approved coarse sand final backfill material.

Adequately and evenly firm to prevent settlement.

Obtain the approval of the* Engineer *at this stage.

7 SURFACE PREPARATION

7.1 Tilth formation

Operate a stone burier at minimum forward speed and maximum speed of rotation over the platform area.

Grade using a blade grader.

Consolidate using a Cambridge roller.

Alternate and repeat stone burying, grading and Cambridge rolling operations as necessary to produce a surface that conforms to the standards of stoniness and evenness described in 10.3 Stone tolerance and 10.4 Smoothness tolerance.

7.2 Sand carpet

The sports platform area is to be provided with a sand carpet. This area is indicated in Figure 7-1. The drawing also shows the finished levels of the platform area.

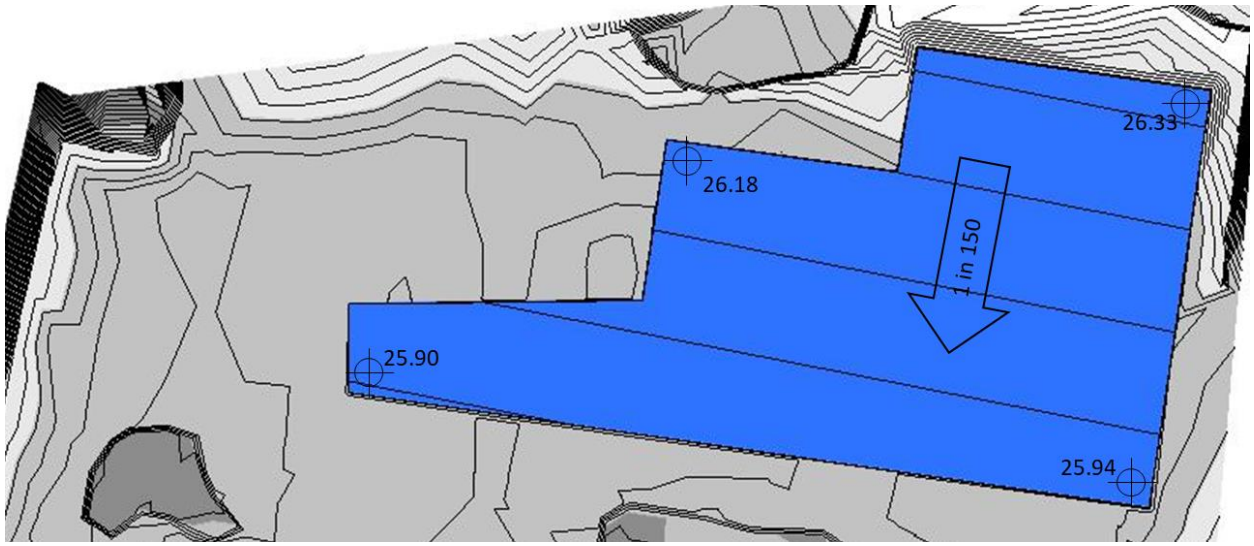


Figure 7-1 Area of sand carpet. (Contours at 0.1 metre intervals0

Sand
Obtain a medium coarse lime free sand sufficient to cover the area shown to a uniform depth of 75 mm.

The sand shall be of medium coarse particle size distribution and shall fall within the tolerance limits as indicated in 10.2 Sand carpet sand grading curve.

Spreading and integrating sand
Spread the sand over the specified areas and stone bury to a depth of 75 to 100 mm in a single pass to achieve the appropriate blend of sand and soil.

This is to be closely supervised by the Engineer before commencing in order that the correct blend of topsoil and sand is achieved.

7.3 Seed selection

Two seed mixtures shall be used for the re-establishment of a suitable grass sward across the working area of the site. These are referred to as the 'Sports mix', which is to be applied to the area of sand carpet only (see Figure 7-1), and the remainder, referred to as 'Amenity mix'.

The areas to receive each of the seed mixes are shown in Figure 7-2.

Figure 7-2 Grass seed mix areas

The seed mixtures shall consist of species composition (by weight) as close as possible to those indicated in Table 7-1.

			Fescues				
	Smooth stalked meadow grass	Perennial ryegrass	Slender	Chewings	Strong	Hard	Sheeps
Sports mix	50	10	10	10	10	10	0
Amenity mix		30	10	10	10	30	10

Table 7-1 Seed species and percentage (by weight) of each within the mixes

Variation of the contribution of each species to the mixes shall not be greater than 5 % of the percentages indicated in the table without the prior approval of the Engineer. Note that these mixes are unavailable as proprietary products and will need to be blended specifically for the purpose by an appropriate seed merchant.

The seed mixture shall comply with the minimum standards set out in the Seed Regulations at the time of sowing and shall be approved by the Engineer no less than three weeks prior to commencing the work.

The seed shall be obtained in sufficient quantities to deliver a rate of 50 g/m^2 (500 kg/ha) to the relevant areas.

7.4 Sowing

Pre-seeding fertiliser
Supply and evenly apply to the spray off area 35 g/m^2 (350 kg/ha) of granular fertiliser with analysis of 10:15:10 or similar, to be approved by the Engineer.

Quantities
The grass seed shall be obtained in sufficient quantities to deliver a rate of 50 g/m^2 (500 kg/ha) to the area.

Sowing
Sowing shall be carried out during suitable conditions using an approved seeder suitable for the incorporation of seed in the loose and very sandy surface created here. The total quantity of seed shall be divided into thirds, each third being sown evenly in varying directions.

Seeding should extend across the embankments.

Rolling
At the conclusion of the sowing, roll under suitable (dry) conditions using a flat roller.

7.5 Rabbit-proof fencing

General

A rabbit-proof fence is to be installed around all of the prepared surface. The fence must be in place at or shortly after the sowing of grass seed. Disturbance of the newly seeded surface must be avoided during the fence installation.

Depending on the extent to which the wider project is to have fencing incorporated, exactly when that fencing is to be put in place and the form of that fencing, the design set down here may be subject to variations. The design set down here assumes no fencing at all is to be put in place in relation to the wider development.

Extents and gates

The fence shall have three gates 3.6 metres wide and a 1.2 metre-wide timber field gate. These are to be situated at the approximate locations shown in Figure 7-3.

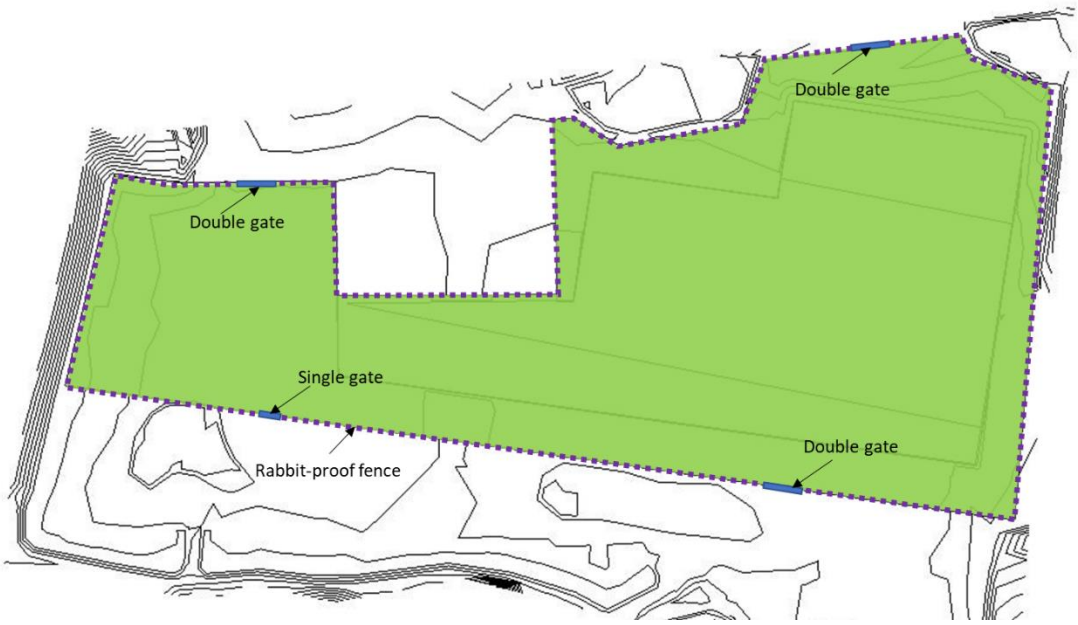


Figure 7-3 Location of rabbit fence and approximate locations of gates

Straining posts

These are to be 2.13 metres in length and 120 to 150 minimum top diameter.

Gate posts

The pedestrian field gate shall be mounted on 125 mm square timber posts with galvanised fittings.

The double gates shall be mounted on 175 mm square posts with galvanised fittings.

Struts
These are to be 2.13 metres in length and 75 to 100 mm top diameter.

Intermediate
These are to be 1.7 metres in length and 50 to 75 mm top diameter.

Line wires
Two straining wires shall be used. These shall be of mild steel and 4 mm diameter.

Netting
Netting is to be 18 gauge, 31 mm hexagonal mesh (BS 1772) of 1050 mm width.

Staples shall be 30 mm long.

7.5.1 Installation

The finished fence shall be of minimum height 750 to 800 mm to top of netting from ground level

The strainer posts to be driven or dug into the ground to a depth of 900 mm.

Posts to be positioned at every change in direction and at a maximum gap of 50 metres in a straight run.

Strainer struts to be notched and nailed to the strainer 600 mm above the ground. The bottom of the strut is to be dug into the ground and fixed with a post or large stone (not an intermediate post).

The intermediates to be driven into the ground at a maximum spacing of 4 metres.

The lines wires to be fixed to the side of the posts outside the playing area and joined using appropriate connectors. Wires are to be placed at ground level and on the top of the wire netting. These to be clipped to the netting using galvanised fencing rings at a maximum interval of 1000 mm.

The netting to have 150 mm lapped on the surface towards the outside of the playing area placed on the lapped netting at maximum 1000 mm intervals.

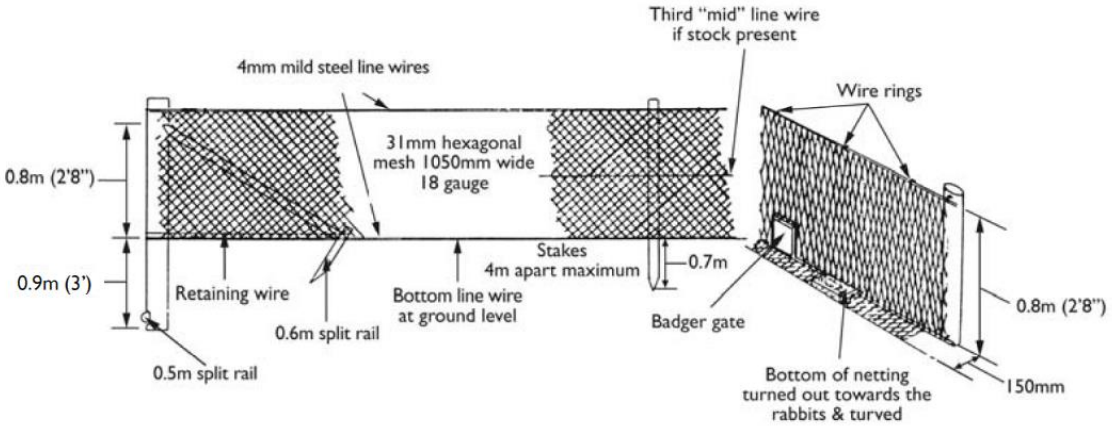


Figure 7-4 Diagram of rabbit fencing

This point shall be considered practical completion of the contract.

8 EARLY MAINTENANCE

8.1 Sward cleaning

Stone pick
When the grass is an average of 35 mm in height, lift from the prepared areas and remove all surface stones having one dimension larger than 25 mm.

Roll
Carefully roll the platform area under suitable conditions using a flat roller.

Weed control (Provisional)
By means of spraying, apply a selective non-residual herbicide to the working area. The herbicide should be applied carefully during still weather conditions strictly according to manufacturer's recommendations and all current legislation and health and safety regulations. On absolutely no account must the herbicide be allowed to drift or otherwise affect any areas beyond the designated working boundaries. Allow a period of 7-10 days for the herbicide to have full effect before proceeding with further works.

8.2 Mowing

Operation
When the grass is no more than an average of 40 mm long, mowing shall be carried out using sharp front-mounted rotary mowers. No more than 25 mm of the foliage shall be removed.

The spoil mound should not be included in the mowing operations.

The ground cover at this stage shall conform to the tolerance limits as indicated in APPENDIX 2 – TOLERANCES*,* Ground cover tolerance at the time of first cut*. Shortfalls to be made good by appropriate means.*

Repeats
Repeat mowing on four further occasions with the blades set to cut at 30 mm allowing the grass to grow no taller than 40 mm with each topping.

Cylinder mowing
Mowing shall hereafter become the responsibility of the Client on general approval of:

- the condition of the surface at this time
- the machinery it is proposed should be used for mowing
- the procedures by which mowing is to be undertaken

A standard mowing height of 25 mm is to be adopted. Mowing operations should take place whenever the sward height exceeds 40 mm.

8.3 Post-establishment fertiliser

First application
At an appropriate stage during the rotary mowing period, supply and evenly apply to the platform a granular fertiliser with an analysis of 12:6:6 or similar. The fertiliser shall be applied at a rate of 350 kg per hectare during a period when rainfall can be expected in the following 24 hour period.

Repeats
Repeat this fertiliser on one further occasion prior to the opening of the sports pitches.

9 APPENDIX 1 – SITE DATA

9.1 Geology

The British Geological Survey classifies the solid (bedrock) geology of the site as *'Grag Group - Sands, gravels, silts and clays. The sands are characteristically dark green from glauconite but weather bright orange with haematite 'iron pans'. The gravels in the lower part of the group are almost entirely composed of flint. Those higher in the group include up to 10% of quartzite from the Midlands, igneous rocks from Wales, and chert from the Upper Greensand of south-eastern England.'*

The drift (superficial) deposits are recorded *as 'The Lowestoft Formation - an extensive sheet of chalky till, together with outwash sands and gravels, silts and clays. The till is characterised by its chalk and flint content. The carbonate content of the till matrix is about 30%, and tills within the underlying Happisburgh Formation have less than 20%.'*

9.2 Soil Survey of England and Wales

The Soil Survey of England and Wales has classified the soil type of the location as being of the 'Wick 2 Association'. These are formed over glaciofluvial and aeolian drift and till and are described as '*Deep well drained coarse loamy soils, often stoneless. Some similar soils with slowly permeable subsoils and slight seasonal waterlogging. Slight risk of water erosion*.'

A typical profile is shown in Figure 9-1.

Figure 9-1 Soil Survey of England and Wales profile description of Wick Association **(Cranfield University 2016. The Soils Guide. Available: www.landis.org.uk. Cranfield University, UK. Last accessed 20/12/22)**

The Soil Survey goes on to state of the Wick 2 Association soils…

9.2.1 Detailed Description

This association of deep coarse loamy soils covers 454 km² in Norfolk forming much of the land between Sheringham, Norwich and Great Yarmouth, with smaller areas to the west in the upper Glaven valley and near Melton Constable and Heydon. The land is gently undulating, ranging from a little above sea level in the Broads and on the coast, to about 90 m O.D. on the Cromer Ridge behind Sheringham. The soils are formed mostly in thin aeolian drift, but their lower layers are often in the underlying till (Norwich Brickearth) or glaciofluvial sands. The main soils belong to the very slightly stony Wick series, typical brown earths, … with lower subsoils that are usually sandy, and the stoneless Wickmere series, stagnogleyic argillic brown earths, with a brown, loamy lower subsoil. These soils make up more than two-thirds of the association. ….

9.2.2 Soil Water Regime

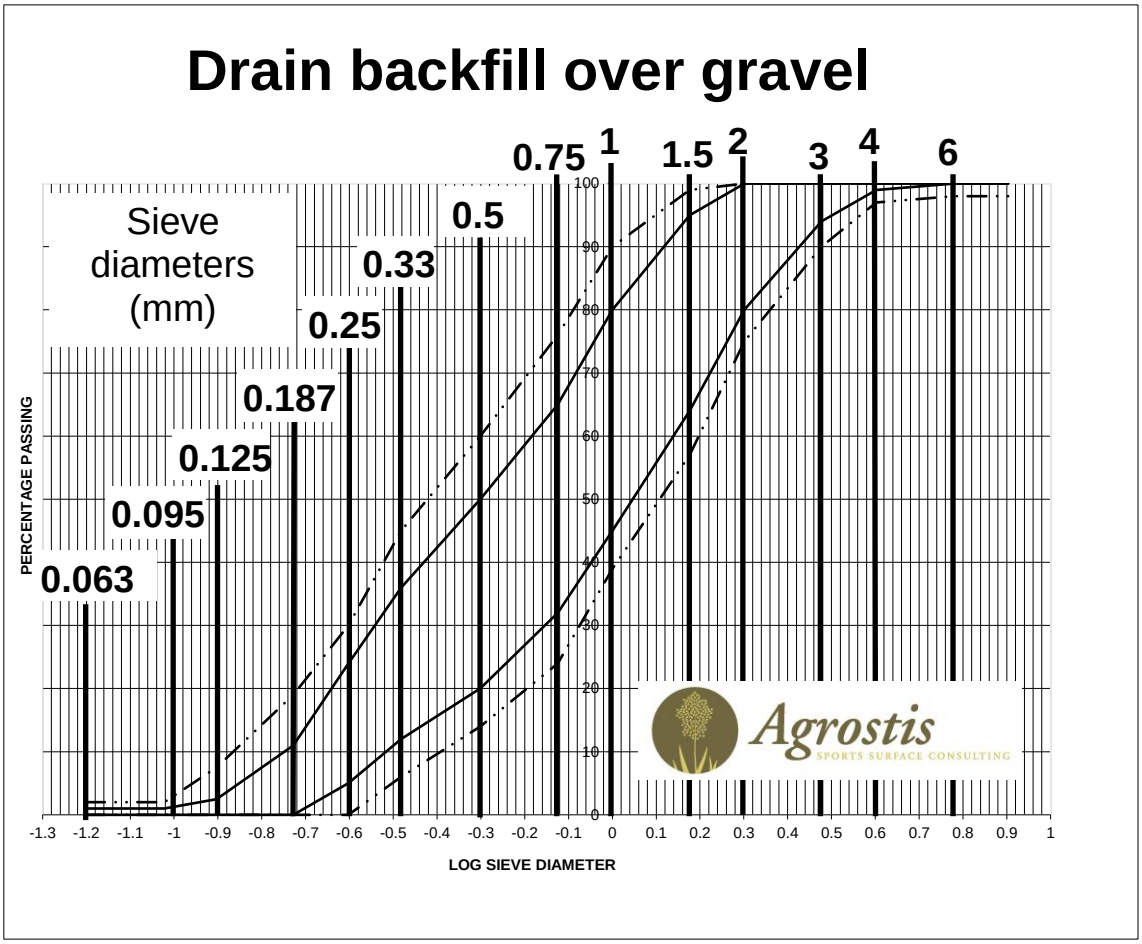
Wick and Sheringham soils have permeable surface and subsurface layers unaffected by groundwater and are well-drained (Wetness Class I). Wickmere soils have mottled moderately permeable subsoils but with drainage measures are largely well-drained. The permeable subsoils of the Aylsham series are naturally waterlogged in winter (Wetness Class II and III), but where the water-table has been lowered these soils are now well-drained. All the soils are water-retentive and non-droughty for the deeper-rooting crops such as sugar beet and slightly droughty for other crops, except grass, in normal years. Crops grown on the Wick series with sandy lower subsoils are the most likely to be affected by drought in dry years ….

9.2.3 Cropping and Land Use

The soils are easily worked and there is ample time in both autumn and spring in normal years during which cultivations can be made without damage to soil structure. There is some restriction on Wickmere and Burlingham soils in very wet springs. Having large silt and small organic matter contents, the topsoils of all component soils slake and cap after heavy rain and seedling emergence can be adversely affected. The association provides some of the most valuable land in Norfolk as the soils are flexible to manage and consistently give high yields. Cereals are mainly autumn sown and large areas of sugar beet and maincrop potatoes are grown as well as field vegetables. Horticultural crops and soft fruit are grown locally.…

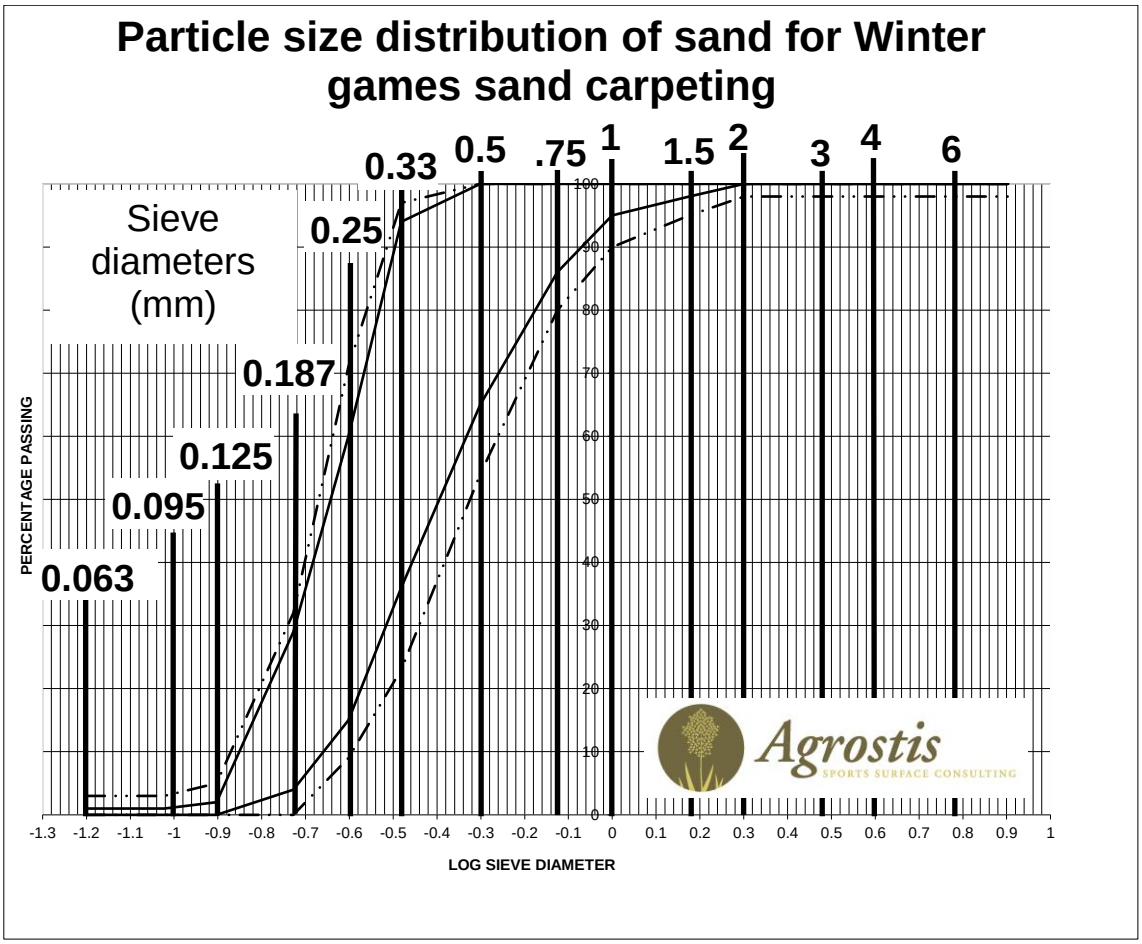
10 APPENDIX 2 – TOLERANCES

10.1 Drainage sand backfill grading curve



Particle size distribution analysis should fall between the solid lines.

10.2 Sand carpet sand grading curve



Particle size distribution analysis should fall between the solid lines.

10.3 Stone tolerance

The maximum tolerance of surface stone density is expressed here by the average distance between stones of the same size that may be encountered. These data are expressed numerically in Table 10-1.

Diameter mm	Separation m
30	2
40	4
50	7
60	12
70	16
80	20
90	30
100	40
110	60
120	100
130	200

Table 10-1 Surface stone tolerance for the site

As an example, maximum tolerable density for surface stones greater than 100 mm would be one every 40 metres, for stones of 40 mm diameter would be one every 4 metres and for 30 mm stones one every 2 metres.

All collected stones shall be removed from site.

10.4 Smoothness tolerance

In the event of doubt, the surface shall be assessed using the following methods.

10.4.1 Undulation – Entire Area

Using appropriate equipment, spot heights (in mm) shall be recorded at 32 equidistant intervals along a 'transect' running from each corner to its diagonal opposite. The variability due to the overall slope along this line shall be removed by performing linear regression on the data. The mean square of the residuals shall thus represent the extent of deviation above and below the general slope and an average value of this shall be obtained from the square root of this.

10.4.2 Undulation – Within

The same approach shall be adopted on a series of spot heights taken every 62 mm along 16 transects of 2 metres length. Transects shall be oriented in two directions at right angles to one another. The average root residual mean squares (RRMS) in each of the two directions shall be derived, along with the average of the two.

10.4.3 Smoothness tolerances

The maximum tolerable average vertical deviation of the surface along 32 equidistant intervals across the two diagonals of the surface shall be 15 mm.

The maximum tolerable average vertical deviation of the surface at thirty two 62 mm intervals along 16 randomly located transects oriented along and across the direction of play on the surface shall be 5 mm.

10.5 Ground cover tolerance at the time of first cut

The nature and extent of ground cover shall be assessed at or around the time of the first cut. At that time, a shoot density of no less than 50 shoots per square decimetre shall have established over the entire seeded area. Shortfalls shall be met by proportionate overseeding by appropriate means.