GHR Developments

VIRGINIA PARK, CAERPHILLY

Summary Earthworks Specification

11637/TD/19/SES

Intégral
Géotechnique

CLIENT: **Virginia Park Golf Club**

PROJECT: **Virginia Park, Caerphilly**

TITLE: **Summary Earthworks Specification**

JOB NO: **11637**

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Geotechnical Engineers:

Intégral Géotechnique (Wales) Limited
Integral House
7 Beddau Way
Castlegate Business Park
Caerphilly
CF83 2AX

Tel: 029 2080 7991
Fax: 029 2086 2176

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EXECUTIVE SUMMARY

1. Site Clearance

a) Handpicking and removal of any asbestos fragments, encountered in demolition type materials, prior to and during the main works;

b) Identify locations of Japanese Knotweed and/or other invasive plant species; and treat appropriately;

c) Identification of buried services/sewers, protection/easement to live services or diversion as necessary;

d) Felling of saplings/trees and site strip of topsoil;

e) Planing out of tarmac hardstandings, to be set aside for re-use at a later date.

2. Engineering Earthworks

a) Stop of redundant services at site boundaries;

b) Excavate the areas previously occupied by buildings and/or covered with imported fill/made ground materials, up to a depth of 4m below the existing ground levels, as directed by the Engineer, including emptying any below ground tanks and containers left behind. The finished plateau level must be free from obstructions to at least 2m beneath the proposed finished levels and to invert level plus 1.0m for proposed drains and services;

c) Extra-over for breaking up any residual slabs, concrete sub-structures/foundations;

d) Crush concrete/obstructions and process to Class 6F5 grade;

e) Remediate contaminated soils as necessary. Remove off site structurally unsuitable materials (hazardous, hazardous non-reactive and/or inert waste) and replace with imported suitable fill material; or if feasible, treat and re-use

f) Prior to filling proof roll reduced formation any soft spots to be replaced with suitable structural fill;

g) Backfill and raise the reclaimed ground as necessary with site arising suitable structural fill, processed materials and imported materials and re-grade the site to the existing levels;

h) The prepared engineered ground must be capable of supporting an applied maximum structural load of 50kN/m^2,

i) Construction of gas cut off trench; see Figure 3

j) Surface water management during and after the works and their discharge;

k) Collection and treatment of any contaminated groundwater;

l) Validation sampling/testing of the remediated plateau;

m) Field geotechnical testing of the remediated plateau;

n) Liaisons with Regulatory Authorities.

1.0 SITE DESCRIPTION AND RECENT HISTORY

1.1 The site is located at Virginia Park Golf Club in Caerphilly, north of the town centre, at a National Grid Reference of 316010, 187680, see Figure 1.

The site is irregular in shape and occupies an area of approximately 18 hectares. The boundaries of the site are defined by extensive residential development to the north, south, east and west. Caerphilly Leisure Centre, Virginia Park Recreation Ground and rugby ground are also present to the southwest. A site plan is presented in Figure 2.

The site is situated across approximately seventeen hectares where the ground levels vary from an approximate elevation of 74m AOD to 78m AOD.

The site was used as a nine hole golf course and includes a club house, driving range and car parking facilities in the western part of the site. The rest of the site is laid out as a golf course and includes a number of mature trees and some areas of dense vegetation.

Japanese Knotweed has been observed at a number of locations around the site, particularly around the perimeter.

1.2 Ordnance Survey maps have been obtained for the site. The earliest editions of the historical maps dated 1875-1885 showed the site to be undeveloped fields covered with rough pasture and heath. Tree lined field boundaries were also evident and passed through the site. The surrounding areas were also largely undeveloped at this time, although a Gas Works and Rhos Llantwit Colliery were evident to the southeast of the site. Porset Brook was also evident flowing between the Gas Works and the colliery. At this time Caerphilly itself was also developing to the southwest.

The 1901 edition of the map showed the site itself to have remained unchanged and there were no significant changes to the surrounding areas. However, Rhos Llantwit Colliery was now disused.

The 1922 edition of the map showed no significant changes to the site but additional residential development had taken place along Pontygwindy Road to the west and Bedwas Road to the southeast. Virginia Park (Athletic Ground) and allotment gardens were now evident adjacent to the west of the site.

1.0 SITE DESCRIPTION AND RECENT HISTORY (CONTINUED)

The 1947-1951 map editions showed the site to have remained undeveloped. Virginia Park Stadium had been constructed to the west along with some factory units to the north of the stadium. During the 1950's these were known to be a Glove Factory.

By the early 1960's evidence of refuse tipping was obvious to the west of the site between the factory buildings to the west and the site itself. The materials encroached across the western boundary of the site. By 1969/1970 this area had widened across to the eastern edge of the site and covered the majority of the northern area. The south eastern area was now shown to be marshy and more factory units had been constructed to the southeast of the site boundary. The factories to the west were for clothing, car accessories and protective headgear with tracks evident from the factory units across to the site.

By 1976 the tipped materials were no longer evident and the site was now shown to be covered by scrub vegetation with a drain shown which passed through the south western corner of the site. Extensive residential development had taken place to the east by this time, and additional warehouses had been constructed to the south.

The site then remained undeveloped until the 1993 edition of the map where Virginia Park Golf Course and Driving Range was evident and occupied the entire site, as it is today.

2.0 GENERAL REQUIREMENTS

2.1 At present, the site is unused. Live buried services including culverts could be present. Easements will have to be allowed for live services identified entering and crossing the site and/or diversions.

2.2 The site is to be developed for residential use. Development will comprise conventional domestic units with gardens and associated infrastructure.

2.3 Reclamation works will be carried out as part of a site remediation operation to render the site suitable for such residential development.

2.4 An acceptable site is to be achieved by site clearance, demolition/removal of sub-structures/obstructions, treatment and/or removal of obviously contaminated soils, treatment and/or removal of groundwater contamination, and the placing of suitable reprocessed materials in a controlled engineering manner (well compacted layers) to form a site suitable for development.

2.5 The existing levels will be reduced in accordance with depth of existing made ground, peat and clay to sub-formation level. Locally, excavations may be extended as deemed necessary, either to deal with made ground, contamination, soft spots or the requirements of infra-structure to be constructed at depths greater than 4m below existing level. Any grossly contaminated underlying made ground and/or original ground will be removed and treated/processed to provide suitable material for re-use as filling.

2.6 Following site clearance, any cut/fill earthworks and importation of suitable structural fill the site will need to be finished to development levels with hard cover of roads and buildings or in garden areas/soft landscape area with acceptable landscape sub-soil and topsoil materials.

2.7 Based on the contamination test data available at the time of writing elevated concentrations of heavy metals, hydrocarbons (PAH and TPH) and SVOC/VOC compounds have been identified in the made ground deposits. Asbestos containing materials are also present.

2.0 GENERAL REQUIREMENTS (CONTINUED)

Appropriate risk assessment and subsequent mitigation measures are required. These materials will require capping with hard cover of roads and buildings or if any of the impacted soil is to be retained at the ground surface in any private gardens or areas of soft landscaping, a cover system comprising a visual alert membrane beneath a minimum 600mm thick cap of clean/inert subsoil/topsoil would be adequate to prevent site end users coming into contact with the contaminated made ground deposits.

Any visually identifiable asbestos containing materials (ACM's) should be reported and picked from the soil matrix by a licenced asbestos contractor. All such picked ACM should be disposed of at a suitably licenced landfill site.

3.0 BACKGROUND INFORMATION

3.1 The following reports have been made available:

Scoping Site Investigation Report, titled Virginia Park Golf Course, Caerphilly, ref 11637/RB/16/SI/Rev B by Intégral Géotechnique (Wales) Limited for Virginia Park Golf Club dated September 2017

3.2 The following drawings have been made available and are attached:

N/A

3.3 Reference shall be made to the above documents for more detail and when preparing Method Statements for various sections of the works.

4.0 SPECIFIC REQUIREMENTS

4.1 GENERAL

4.1.1 The purpose of the Works is to enable the proposed re-development and prepare the site for housing with gardens end-usage. This will involve the excavation, processing and re-laying of existing fill/made ground material; demolition of any buildings, surface and buried structures and recycling of materials arising for re-use; dealing with any contamination issues; importation of structural fill materials and grading the site to the agreed finished ground levels.

4.1.2 The specification for the required earthworks shall be in accordance with the DTp Specification for Highway Works.

4.1.3 Remediation of contamination shall comply with the current guidelines set out in DEFRA/EA, agreed Soil Screening Values (SSVs) or risk assessments and site specific target levels (SSTL's) for those contaminants of concern (COC). The Category 4 Screening Levels (C4SLs) published by DEFRA for arsenic, cadmium, chromium (VI), lead, benzo(a)pyrene and benzene have been adopted as critical concentrations against which soil contaminant concentrations can be compared. In the absence of additional published C4SLs, the Suitable 4 Use Levels (S4ULs) derived by LQM, Soil Guideline Values (SGVs) and Soil Screening Values (SSVs) derived by Atkins ATRISKsoil for a residential with the consumption of home grown produce end use have been adopted, where considered appropriate.

4.1.4 Imported structural fill must be clean naturally occurring, devoid of anthropogenic contamination and comply with Appendix 6/1: Contamination Testing of Imported Materials

4.1.5 The operational and performance requirements for the Works are set out below.

4.2 SITE CLEARANCE

4.2.1 Any scrap/fly tipping should be removed from site.

4.2 SITE CLEARANCE (CONTINUED)

4.2.2 A full survey of the site should be carried out to determine if invasive plant species such as Japanese Knotweed are present. Any identified areas will then need to be treated in line with accepted industry practices based upon Environment Agency guidelines. The treatment shall be in the form of an appropriate and effective herbicide spray over the required period for at least 95% eradication coupled with bulk removal of rhizome materials.

4.2.3 Prior to remediation/reclamation works commencing on site, all existing services should be located and either diverted, protected or terminated, as appropriate, at site boundaries.

4.2.4 Site strip of surface vegetation/topsoil, felling and chipping of saplings/trees, all to be set aside for landscaping (subject to risk assessment).

4.3 EXCAVATION AND FILLING

4.3.1 The existing made ground shall be excavated down to a depth of up to 4.0m below the existing levels, or until competent original undisturbed ground is encountered if this is less than 2.0m, over the development area. The material shall also be processed to ensure the removal of any unsuitable materials e.g. asbestos, timber, metal, plastics etc. and any large particles greater than 125mm. Locally excavations will be deepened where necessary.

4.3.2 The Works shall be phased to suit the Employer's Development programme and the Contractor's Method of Working.

4.3.3 Prior to filling, the reduced formation shall be proof rolled and all soft and unsuitable materials exposed at the reduced formation level must be removed and replaced with suitable compacted material.

4.3.4 The reprocessed materials shall, subject to Clause 4.4 - Contamination, be used as fill to construct the development plateau. They shall be laid and compacted generally in accordance with the DTp Specification for Highway Works. The moisture content of the fill shall be controlled so that it does not exceed the Proctor Compaction Test (as defined in BS 1377 (1990) Part 4.CL.2.4) Optimum Moisture Content + 1.5%. This should ensure that the compacted fill has an air voids ratio of less than 5% as well as satisfying the performance requirements for bearing pressure and settlement characteristics detailed below:

4.3 EXCAVATION AND FILLING (CONTINUED)

4.3.5 Unsuitable Material shall be classified as follows:

- peat, materials from swamps, marshes and bogs
- logs, stumps, sawdust and perishable materials
- materials in a frozen condition
- materials susceptible to spontaneous combustion except unburnt colliery spoil
- clay of liquid limit exceeding 90% and/or plasticity index exceeding 65%,
- domestic refuse
- concentrated mineral oils
- tyres
- plastic
- liquid wastes
- biodegradable or putrescible wastes
- other similar materials as directed by the Engineer
- asbestos
- expansive materials

4.3.6 Suitable Material

General Earthworks Materials Class 1 and 2

(i) Cohesive materials include clays and marls with up to 20 per cent of gravel or rock and having a moisture content not less than the value of the plastic limit (determined in accordance with clause 5 of BS 1377:1990 Part 2) minus 4. Maximum particle size 125mm.

(ii) 'Well-graded granular and dry cohesive soils' includes clays, shales and marls containing more than 20 per cent of gravel and/or having a moisture content less than the value of the plastic limit (determined in accordance with clause 5 of BS 1377:1990 Part 2) minus 4; well graded sands and gravels with a uniformity coefficient exceeding 10. Maximum particle size 125mm.

(iii) 'Uniformly-graded material' includes sand and gravels with a uniformity coefficient of 10 or less, and all silts and pulverised fuel ashes. Any soil containing 80 per cent or more of material in the particle size range 0.06 and 0.002mm will be regarded as silt for this purpose.

4.3 EXCAVATION AND FILLING (CONTINUED)

4.3.7 Marginal material generated on site can be treated by aeration depending on weather conditions such as wind, humidity and sun. Alternatively, the material can be modified by the addition of lime to make the material acceptable. The Contractor shall provide the Engineer with all necessary method statements and health and safety assessments for these activities (Note that during winter months or during inclement weather periods of conditioning by weather alone are likely to be slow or negative leading to programme extensions).

Where material >125mm is encountered, including concrete slab; foundations and demolition brick/concrete materials, the oversize material shall be removed by an approved method and removed off-site or if appropriate may be processed (i.e. crushed and screened) to a DTp Class 6F5 specification and stockpiled for later re-use at a location agreed with the Client.

4.3.8 The Contractor shall, with reference to any available site investigation information and any desk study archives, plus any further testing he deems necessary, above and beyond that required by Intégral Géotechnique (Wales) Limited classify any site arising materials or materials imported from off-site in accordance with Appendix 6/1 to demonstrate the suitability both physically and chemically. Any further testing the Contractor considers necessary in order to assist him in the classification of materials shall be agreed with Intégral Géotechnique (Wales) Limited.

The Contractor shall allow in his programme and method of working for the site classification of materials and the time taken for testing, sampling and interpretation of results. The Contractors attention is drawn to the need in his programme to allow time for sampling, carrying out the required laboratory testing, reporting and assessment of the results

Any unsuitable materials from the works which cannot be treated are to be relocated off site to a suitable licensed tip. Any bulk asbestos contaminated materials identified on site will be made safe, prior to depositing in a suitably licensed tip by a licensed Contractor.

4.3.9. Hardcore and granular fill, either imported or site processed as above, shall be good clean hard brick, concrete, hardstone, coarse gravel, sound slab or other approved material free from dust and foreign matter, complying with DTp Class 6F5 specification. Screenings will be required to fill surface voids. (Reference should be made to BRE Digest 276).

4.3 EXCAVATION AND FILLING (CONTINUED)

4.3.10 Landscaping sub-soil and topsoil materials shall have acceptable soil forming properties, be free of pathogens, potentially toxic elements, have appropriate growth properties, have no weeds or invasive plant matter, have no stones of sharps or extraneous materials.

5.0 WORKMANSHIP

5.1 The Contractor shall arrange for the rapid disposal of any water shed on to all earthworks during construction or which enters the earthworks from any source.

5.2 Prior to placing fill material the existing ground shall be proof rolled to the satisfaction of the Engineer. Soft or unsound spots in the formation or under areas to be filled shall be excavated as instructed by the Engineer. The resultant excavation shall be backfilled with approved material deposited and compacted as specified for the forming of filled areas. For backfilling of excavations below standing water the Contractor shall use only free draining material. Such material may be deposited below water without the associated use of compaction plant.

5.3 All filling materials other than rock shall be deposited in layers not exceeding 250mm loose depth or such depth to ensure compatibility with the material type and compaction plant unless as a result of compaction trials the Engineer approves a greater depth.

Areas to be filled shall be clear of rubbish, scrap material, topsoil and standing water when fill material is placed.

5.4 Where filling is to be placed on sloping ground (steeper than 1 vertical to 30 horizontal) the surface of the ground shall be benched in steps to enable blending of the fill with the existing slope, and may include, as necessary, under-draining for dealing with water.

Fill material in areas of benching shall be carefully placed and compacted to ensure that no voids occur at the vertical steps of the benching.

Placing and compacting of fill material on a lower bench shall continue to a level one compacted layer thickness above an adjacent higher bench before material is placed upon the latter bench.

Four additional passes of the approved compaction plant shall be made over a width of 2m each side of each vertical face immediately following the compaction of the first layer of material on each bench.

5.5 All filling material used in earthworks shall be compacted in accordance with Table 6/4 and the Contractor shall submit to the Engineer for approval his proposals for the compaction of each main type of material to be used in the filled areas, the types of plant to be used, the number of passes and the loose depth of layer. Compaction shall be considered satisfactory when the compacted material has a dry density equal to or greater than 95% of its maximum dry density and not greater than 5% air voids.

5.0 WORKMANSHIP (CONTINUED)

5.6 Fill shall be placed in layers which shall extend over the full width of the works and each layer shall be thoroughly compacted with a roller of approved capacity to a thickness not greater than that agreed before the next layer is placed.

5.7 Where for any reason the moisture content of acceptable material changes to a value unacceptable for compaction, the Contractor shall raise or lower the moisture content until satisfactory compaction can be achieved.

5.8 Control testing shall be carried out on each layer of fill material. Testing scope and frequency shall comprise:

Material characteristics -

chemical characteristics (prior to import)	three per source
chemical characteristics	1 per 500m^3
grading	1 per 500m^3
dry density relationship	1 per 500m^3
plasticity	1 per 500m^3
moisture content	1 per 100m^3

In situ placement performance

In-situ CBR (highways)	1 per 500m^2
In-situ density/air voids determination (optional)	3 per 1000m^3
In-situ plate test/dynamic probing	1 per 500m^2

5.9 In-situ plate load testing/dynamic probing should be undertaking during the works at approximately 1m intervals and following completion of the filling works. A minimum of 3No. tests per area, or testing on alternate plots is recommended dependent on proposed site layout.

5.10 A suitably qualified Engineer from Intégral Géotechnique (Wales) Limited will regularly attend on site from the commencement of work on site up to the completion of the site filling works.

Intégral Géotechnique (Wales) Limited will submit to the Contractor, a programme of chemical testing of soils during the site filling that will be undertaken based on the requirements of this Appendix.

5.0 WORKMANSHIP (CONTINUED)

The purpose of the chemical testing shall be to confirm the suitability of the materials and enable appropriate certification to be made.

Intégral Géotechnique (Wales) Limited will arrange for all chemical testing to be undertaken at an approved laboratory. The laboratory shall hold UKAS/MCERTS accreditation for the specified determinants. The minimum frequency of testing for the purpose of classifying material is given in above.

Intégral Géotechnique (Wales) Limited will arrange for the provision of all the necessary equipment, sample containers and transport of samples to a laboratory. The Contractor will be informed within 24 hours of receipt of test results. The Contractor shall be immediately informed of any results exceeding the values specified.

All laboratory contaminant test results are to be reported within ten working days from the time of sampling.

It may be necessary to specify additional testing after the results of the original tests are available.

Testing and reporting shall be carried out in accordance with BS 7755 unless otherwise specified.

Samples shall be examined for characteristics such as colour, odour, and any non-soil materials, and the findings recorded.

The percentage volume of the following categories of matter in the sample shall be estimated and each category described:

i. 'Inert' material, less than 2mm (e.g. clay, sand)
ii. 'Inert' material, greater than 2mm, (e.g. stones, glass, pottery etc)
iii. Organic material - non-putrescible
iv. Organic material - putrescible

Test results for the contamination ground investigation shall be accompanied by an unambiguous description of sample preparation, extraction and analysis method used

6.0 CONTAMINATION

6.1 The site shall be investigated and remediated in accordance with the current national guidelines and to the satisfaction of Caerphilly County Borough Council (CCBC), Natural Resources Wales (NRW) and the NHBC.

6.2 Air quality shall be monitored, to include both nuisance dust and respiratory dust, to the satisfaction of the Local Environmental Health Officer and the NRW.

6.3 Materials within at least 1m of the surface of the reclaimed plateau shall be uncontaminated to the extent that the risk posed to end users, which will include residents with private gardens, is acceptably low. Materials deeper than 1m below the surface of the reclaimed land shall be uncontaminated to the extent that the risk posed to construction/maintenance workers and end-users or infrastructure works is acceptably low.

6.4 Materials deeper than 1m below the surface of the reclaimed plateau shall be uncontaminated to the extent that the risk posed to the aquatic environment is sufficiently low to be acceptable to Natural Resources Wales.

6.5 On completion of the reclaimed plateau a series of trial pits on 50m x 50m grid with sampling and testing shall be undertaken. For the materials to be included in the permanent works, the tests undertaken shall satisfy the DEFRA/EA SGV's or agreed SSV's/SSTL's with respect to the recommended contaminant concentrations for the proposed end-use.

6.6 If the tested materials do not satisfy these criteria then depending on the measured concentrations of various contaminants and their volume, they should either be removed off site or, if possible, treated by techniques such as bio-remediation. After such treatment and provided that a) the required clean-up standards have been achieved and b) the materials are acceptable geotechnically, then these could be re-used in the works.

6.7 The reprocessed acceptable materials shall be sampled and tested for chemical elements/compounds and the results shall satisfy the appropriate SGV's/SSV's or SSTL's for the intended end-use which will include dwellings with domestic gardens. The materials for re-use shall be non-shrinkable, non-expansive and non-frost susceptible. The frequency of sampling and testing shall be 4 N^{o} tests per 1000m^{3} of reprocessed materials.

6.0 CONTAMINATION (CONTINUED)

6.8 Samples of reprocessed materials shall also be tested for leachability characteristics to ensure that any leachate from site does not adversely affect the aquatic environment.

6.9 Any imported materials shall be free of contamination. The imported materials shall be free of any asbestos, hydrocarbons and oil based contaminants. In addition, they should satisfy SGVs/SSV's for the proposed end-use including housing type development.

6.10 Sufficient sampling and testing of the imported fill materials shall be carried out to ensure that the above contamination requirements are achieved. The frequency of sampling and testing, as a minimum, shall be 4 N^{o} tests per 1000m^{3} of imported fill, and at least 1 N^{o} test from each source if the quantity of fill from that source is less than 250m^{3}.

6.11 The sampling and testing shall also be in accordance with the requirements of Natural Resource Wales and the Local Authority's Environmental Health Officers.

6.12 The reprocessed and imported fill shall be such that it does not generate gases such as methane, carbon dioxide or radon.

6.13 The imported materials shall be such that any future excavations will not require any precautionary measures with respect to ground contamination other than normal good health and safety/hygiene practices.

6.14 Areas of proposed soft finished/gardens will require a capping layer, of a minimum thickness of 600mm, of clean sub-soil and topsoil laid over a visual alert membrane (by others).

7.0 FOUNDATIONS AND GROUND FLOOR SLABS

7.1 The prepared ground must be capable of supporting applied structural loads of 50kN/m^2 for strip foundations.

7.2 The prepared ground shall be suitable as a working platform for the proposed foundation construction works.

8.0 ACCESS ROADS, CAR PARKING AREAS AND SERVICE RUNS

8.1 The earthworks including the compaction works, will be carried out such that the whole of the reclaimed plateau meets with the following criteria:

8.2 California Bearing Ratio (CBR) value of at least 3% within 750mm of the ground surface of the reclaimed plateau. Once the controlled earthworks have commenced, in-situ CBR tests will be undertaken to confirm the CBR values are achieved.

8.3 The preparation of the reclaimed plateau shall be such that twelve years after completion of the reclaimed plateau and housing, the total settlement at any point on the reclaimed plateau (other than beneath the houses) shall not exceed 30mm as a result of change in volume of the fill materials or consolidation of underlying in-situ materials. During this period, the differential movement between the structures and the adjacent finished ground levels shall not be more than 20mm. Along the new access roads, car parking areas and service runs, the differential settlements shall not exceed 1 in 500 as a result of change in volume of the fill materials or consolidation of the underlying in-situ materials.

8.4 There are likely to be loose materials within the backfilled trenches of the existing, either live or disused services. Any loose materials, if not removed during the earthworks operation, will be removed and recompacted to achieve the above settlement criteria.

8.5 Disused services shall either be removed and replaced with well compacted materials or grouted up with an appropriate cementitious grout mix.

9.0 FINISHED PLATEAU LEVELS

9.1 Reclaimed plateau levels will depend on the original state of compaction of the fill, the extent of obstructions to be removed, the amount of unsuitable material within the fill and final slab levels (allowing for disposal of site arising construction materials). However, preliminary levels will be agreed with the Employer, and any change in levels or profile will be subject to confirmation between the Employer, Contractor and IGW.

9.2 The surface of the reclaimed plateau shall be a minimum of 750mm below the intended finished level of the gardens i.e. approximately 900mm below the proposed floor slab levels, subject to 9.1.

9.3 The surface of the reclaimed plateau will be graded to temporary ditches including settlement ponds to prevent run-off.

10.0 CERTIFICATION

10.1 All investigation works and remediation works, physical and chemical, must be designed, supervised and certified by Intégral Géotechnique with the reports and certification assignable to the Client. All these works shall be to the agreement and approval of the relevant regulators, including the Local Authority's Environmental Health Department the NHBC and NRW.

10.2 Since the reclamation works are to be undertaken in phases, testing and certification of each phase of works will be required prior to works being commenced on following phases. This is to ensure that the development areas comply with the Specification prior to phased handover to the Client.

APPENDIX A

TABLE 6/1A ACCEPTABILITY CRITERIA: PHYSICAL PROPERTIES

APPENDIX 6/1 :

ACCEPTABLE CRITERIA FOR FILL MATERIALS (CLASS 1 & 2)

TABLE 6/1A PHYSICAL PROPERTIES (BS 1377)	
PARAMETER	**LIMITS**
MOISTURE CONTENT	OPTIMUM MOISTURE CONTENT + 1.5% - 2.0%
ATTERBERG LIMITS	1.2 X P.L.
COMPACTION TEST	OPTIMUM MOISTURE CONTENT/MAXIMUM DRY DENSITY BY 2.5KG METHOD
GRADING	TABLE 6/2 CLASS 1 & 2, (EXCLUDING CLASS 1C, 2D & 2E)
IN SITU DENSITY TEST	95% OF MAXIMUM DRY DENSITY

APPENDIX B

CONTAMINATION TESTING FOR IMPORTED SOIL

Appendix 6/1: Contamination Testing of Imported Materials

All imported materials (excluding garden sub-soil and topsoil) to be placed on site shall be tested as given below in Table 6/1B and shall be:-

- free from asbestos, hydrocarbons, mineral oils, volatile/semi-volatile organic compounds, timber, metal, plastic etc; and;
- not exceed the Threshold Concentration (see Table below) and
- have acceptable physical properties.

Group	Determinand	Residential
		SGV **(mg/kg)**
Metals	Antimony	113
	Beryllium	60.3
	Boron	290
	Cadmium	26
	Chromium (III)	910
	Chromium (VI)	6
	Copper	2400
	Lead	200
	Mercury	-
	Mercury (Elemental)	1
	Mercury (Inorganic)	170
	Mercury (Methyl)	11
	Nickel	130
	Vanadium	410
	Zinc	3700
Semi-Metals & Non-Metals	Arsenic	37
	Cyanide	34
	Free Cyanide	-
	Selenium	350

PAH	Acenaphthene	210
	Acenaphthylene	170
	Anthracene	2400
	Benzo(a)anthracene	7.2
	Benzo(a)pyrene	2.2
	Benzo(b)fluoranthene	2.6
	Benzo(ghi)perylene	320
	Benzo(k)fluoranthene	77
	Chrysene	15
	Dibenzo(ah)anthracene	0.24
	Fluoranthene	280
	Fluorene	170
	Indeno(123cd)pyrene	27
	Naphthalene	2.3
	Phenanthrene	95
	Pyrene	620
VPH/EPH (TPH)	Aliphatic C5-C6	42
	Aliphatic C6-C8	100
	Aliphatic C8-C10	27
	Aliphatic C10-C12 EPH	130 (48)^{vap}
	Aliphatic C12-C16 EPH	1,100 (24)^{vap}
	Aliphatic C16-C35 EPH	65,000 (8.48)^{sol}
	Aliphatic C35-C44 EPH	65,000 (8.48)^{sol}
	Aromatic C5-C7	70
	Aromatic C7-C8	130
	Aromatic C8-C10	34
	Aromatic C10-C12 EPH	74
	Aromatic C12-C16 EPH	140
	Aromatic C16-C21 EPH	260
	Aromatic C21-C35 EPH	1,100
	Aromatic C35-C40 EPH	1,100
BTEX	Benzene	0.33
	Toluene	610
	Ethylbenzene	350
	O-Xylene	250
	M-Xylene	240
	P-Xylene	230
Others	Phenol	420
	Asbestos	**ND**

APPENDIX C

TABLE 6/4 COMPACTION REQUIREMENTS

TABLE 6/4: Method Compaction for Earthworks Materials: Plant and Method (Method 1 to Method 6). (This Table is to be read in conjunction with sub-Clause 612.10)

Type of Compaction Plant	**Ref No.**	**Category**	**Method 1**		**Method 2**		**Method 3**		**Method 4**		**Method 5**		**Method 6**		
			D	N#	D	N#	D	N#	D	N	D	N	N for D = 110mm	N for D = 150mm	N for D = 250mm
Smooth wheeled roller (or vibratory roller operating without vibration)		Mass per metre width of roll													
	1	over 2100 kg up to 2700 kg	125	8	125	10	125	10*	175	4	unsuitable		unsuitable	unsuitable	unsuitable
	2	over 2700 up to 5400 kg	125	6	125	8	125	8*	200	4	unsuitable		16	unsuitable	unsuitable
	3	over 5400 kg	150	4	125	8	unsuitable		300	4	unsuitable		8	16	unsuitable
Grid roller		Mass per metre width of roll:													
	1	over 2700 kg up to 5400 kg	150	10	unsuitable		150	10	250	4	unsuitable		unsuitable	unsuitable	unsuitable
	2	over 5400 kg up to 8000 kg	150	8	125	12	unsuitable		325	4	unsuitable		20	unsuitable	unsuitable
	3	over 8000 kg	150	4	150	12	unsuitable		400	4	unsuitable		12	20	unsuitable
Tamping roller		Mass per metre width of roll:													
	1	over 4000 kg	225	4	150	12	250	4	350	4	unsuitable		12	20	unsuitable
Pneumatic-tyred roller		Mass per wheel:													
	1	over 1000 kg up to 1500 kg	125	6	unsuitable		150	10*	240	4	unsuitable		unsuitable	unsuitable	unsuitable
	2	over 1500 kg up to 2000 kg	150	5	unsuitable		unsuitable		300	4	unsuitable		unsuitable	unsuitable	unsuitable
	3	over 2000 kg up to 2500 kg	175	4	125	12	unsuitable		350	4	unsuitable		unsuitable	unsuitable	unsuitable
	4	over 2500 kg up to 4000 kg	225	4	125	10	unsuitable		400	4	unsuitable		unsuitable	unsuitable	unsuitable
	5	over 4000 kg up to 6000 kg	300	4	125	10	unsuitable		unsuitable		unsuitable		12	unsuitable	unsuitable
	6	over 6000 kg up to 8000 kg	350	4	150	8	unsuitable		unsuitable		unsuitable		12	unsuitable	unsuitable
	7	over 8000 kg up to 12000 kg	400	4	150	8	unsuitable		unsuitable		unsuitable		10	16	unsuitable
	8	over 12000 kg	450	4	175	6	unsuitable		unsuitable		unsuitable		8	12	unsuitable

Table 6/4: Method Compaction for Earthworks Materials: Plant and Methods (Method 1 to Method 6) (continued)
(This Table is to be read in conjunction with sub-Clause 612.10)

Vibratory roller		Mass per metre width of a vibratory roll:										
	1	over 270 kg up to 1500 kg	unsuitable		75	16	150	16	unsuitable	unsuitable	unsuitable	unsuitable	unsuitable
	2	over 450 kg up to 700 kg	unsuitable		75	12	150	12	unsuitable	unsuitable	unsuitable	unsuitable	unsuitable
	3	over 700 kg up to 1300 kg	100	12	125	10	150	6	125	10	unsuitable	16	unsuitable	unsuitable
	4	over 1300 kg up to 1800 kg	125	8	150	8	200	10*	175	4	unsuitable	6	16	unsuitable
	5	over 1800 kg up to 2300 kg	150	4	150	4	225	12*	unsuitable		unsuitable	4	6	12
	6	over 2300 kg up to 2900 kg	175	4	175	4	250	10*	unsuitable		400	5	3	5	11
	7	over 2900 kg up to 3600 kg	200	4	200	4	275	8*	unsuitable		500	5	3	5	10
	8	over 3600 kg up to 4300 kg	225	4	225	4	300	8*	unsuitable		600	5	2	4	8
	9	over 4300 kg up to 5000 kg	250	4	250	4	300	6*	unsuitable		700	5	2	4	7
	10	over 5000 kg	275	4	275	4	300	4	unsuitable		800	5	2	3	6
Vibrating plate compactor		Mass per m² of base plate:													
	1	over 800kg up to 1100 kg	unsuitable		unsuitable		75	6	unsuitable		unsuitable	unsuitable	unsuitable	unsuitable
	2	over 1100 kg up to 1200 kg	unsuitable		75	10	100	6	75	10	unsuitable	unsuitable	unsuitable	unsuitable
	3	over 1200 kg up to 1400 kg	unsuitable		75	6	150	4	150	8	unsuitable	unsuitable	unsuitable	unsuitable
	4	over 1400 kg up to 1800 kg	100	6	125	6	150	4	unsuitable		unsuitable	8	unsuitable	unsuitable
	5	over 1800 kg up to 2100 kg	150	6	150	5	200	4	unsuitable		unsuitable	5	8	unsuitable
	6	over 2100 kg	200	6	200	5	250	4	unsuitable		unsuitable	3	6	12

Table 6/4: Method Compaction for Earthworks Materials: Plant and Methods (Method 1 to Method 6) (continued)
(This Table is to be read in conjunction with sub-Clause 612.10)

Vibro-tamper		Mass:											
	1	over 50 kg up to 60 kg	100	3	100	3	150	3	125	3	unsuitable	4	8	unsuitable
	2	over 65 kg up to 75 kg	125	3	125	3	200	3	150	3	unsuitable	3	6	12
	3	over 75 kg up to 100 kg	150	3	150	3	225	3	175	3	unsuitable	2	4	10
	4	over 100 kg	225	3	200	3	225	3	250	3	unsuitable	2	4	10
Power rammer		Mass:												
	1	100 kg up to 500 kg	150	4	150	6	unsuitable		200	4	unsuitable	5	8	unsuitable
	2	over 500 kg	275	8	275	12	unsuitable		400	4	unsuitable	5	8	14
Dropping-weight compactor		Mass of rammer over 500 kg height drop:												
	1	over 1m up to 2m	600	4	600	8	450	8	unsuitable		unsuitable	unsuitable	unsuitable	unsuitable
	2	over 2m	600	2	600	8	unsuitable		unsuitable		unsuitable	unsuitable	unsuitable	unsuitable

FIGURES

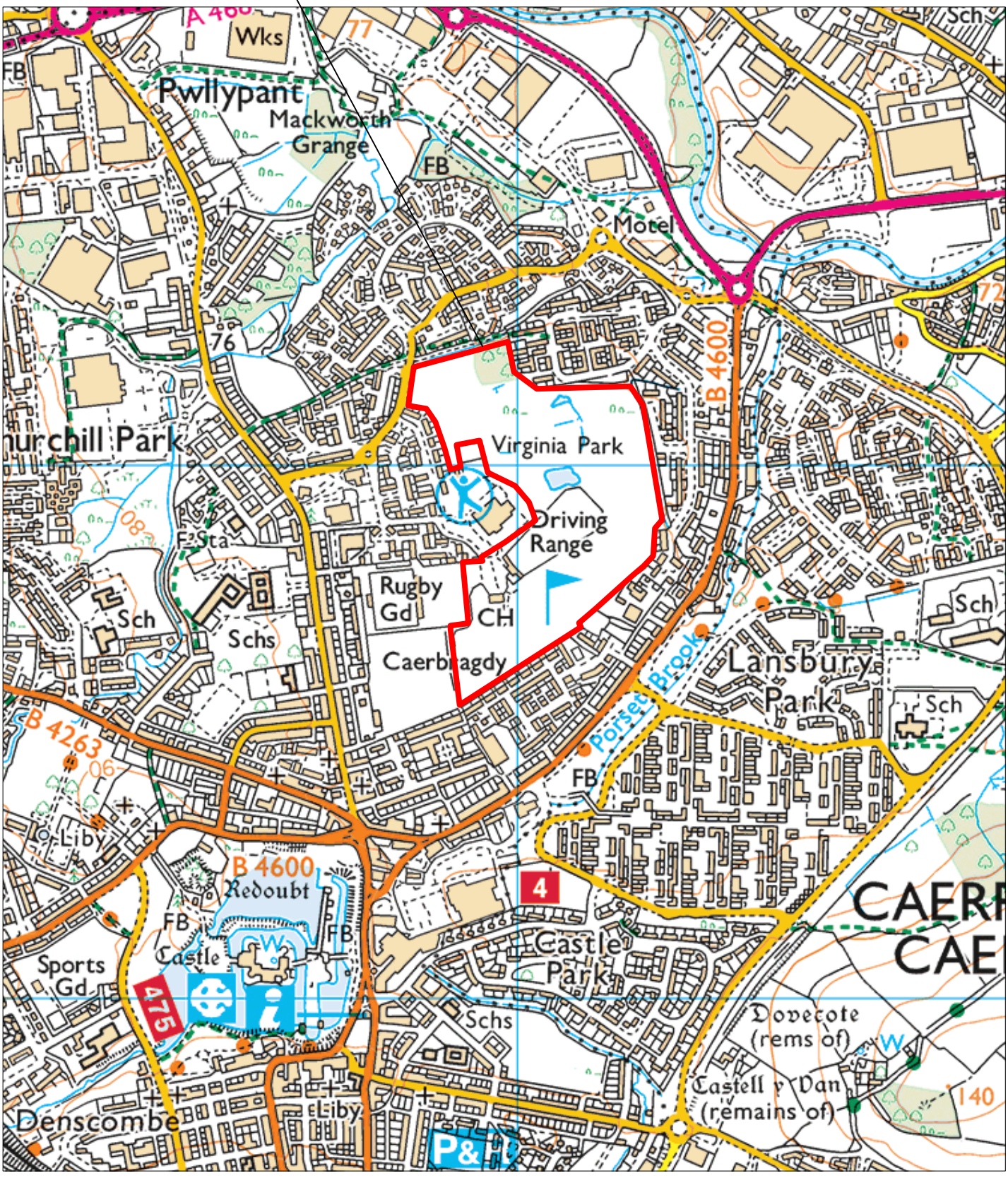

Figure 1: Site Location

Project: Virginia Park Golf Course, Caerphilly	Job no.: 11637	Intégral Géotechnique	Integral House, 7 Beddau Way, Castlegate Business Park, Caerphilly, CF83 2AX. Tel: 029 2080 7991
Client: Virginia Park Golf Club	Scale: 1:10,000 at A4		

Figure 2: Trial Pit Location Plan

Project: Virginia Park Golf Course, Caerphilly	Job No.: 11637	Intégral Géotechnique	Integral House, 7 Beddau Way, Castlegate Business Park, Caerphilly, CF83 2AX. Tel: 029 2080 7991
Client: Virginia Park Golf Club	Scale: 1:2,000 at A3		

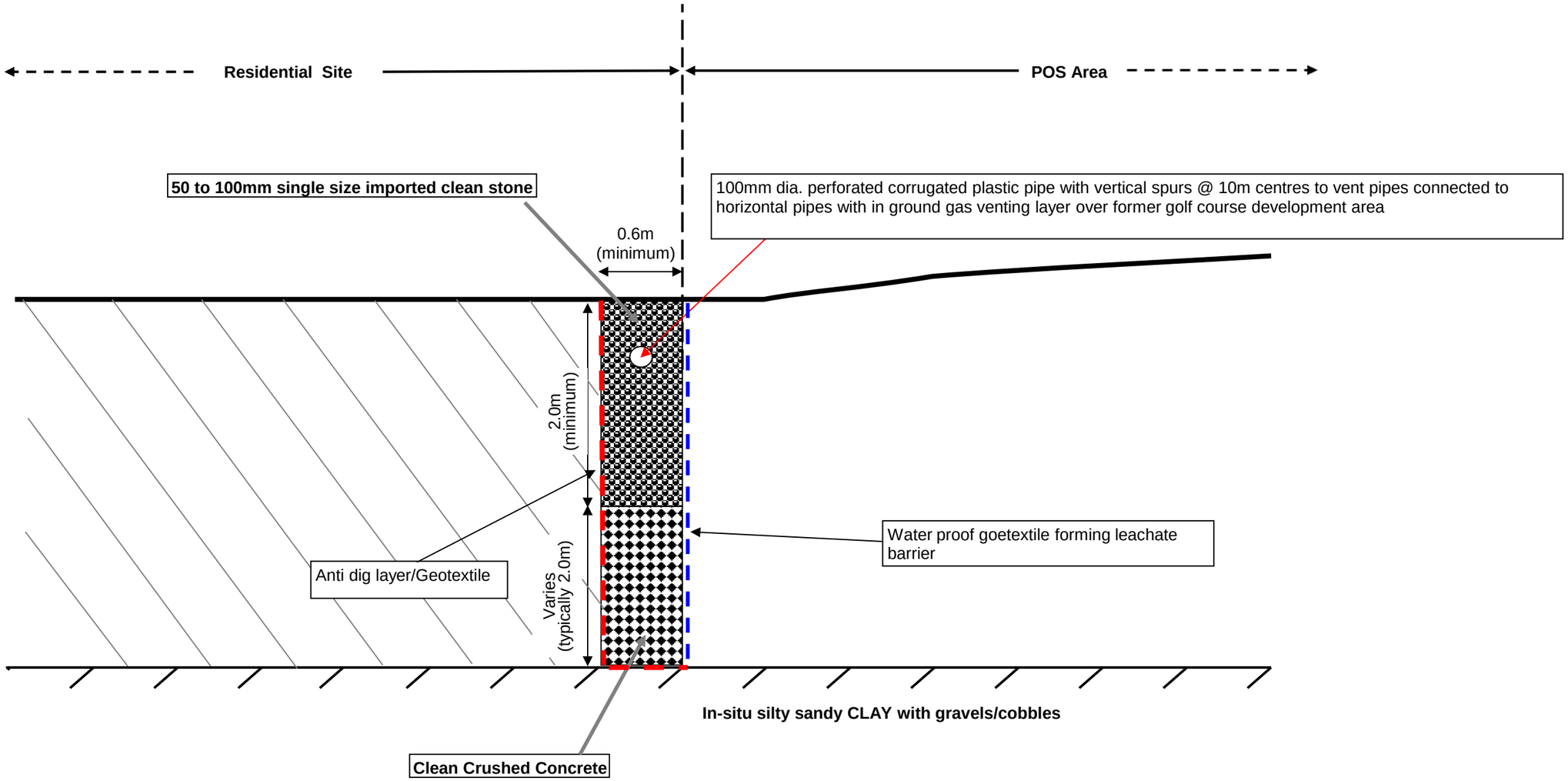

FIGURE 3: TYPICAL GAS CUT-OFF TRENCH DETAIL

Virginia Park, Caerphilly

Integral Géotechnique
Integral House
7 Beddau Way
Castlegate Business Park
Caerphilly
CF83 2AX
Tel: 029 2080 7991
Fax: 029 2086 2176