16-007R_001 Rev A

Engineering Specifications

ON

Furniss Way
Hayling Island

FOR

Quartz Project Services

Second Issue 25.01.16

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REPORT AMENDMENT REGISTER

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1. GROUND SLAB PERFORMANCE SPECIFICATION

1. The slab is to be designed as ground bearing in line with the recommendation of the site investigation report. Subject to full dead and imposed loading the ground floor will be designed to limit total settlement of the slab to 25mm and differential settlement to 10mm over a 6m length. The slab is to be mesh reinforced concrete with minimum concrete grade of RC40.

2. Workmanship and materials shall comply with the NBS Specifications.

3. The Contractor is responsible for the design, construction and compatibility of all floor elements. Design calculations to be provided for review by the Engineer prior to slab pour and to submit for Building Control

4. The ground floor slab to the warehouse areas shall have minimum design thickness of 175mm and have a power floated finish. The slab will be designed in accordance with the recommendations of the Concrete Society Technical Report 34 (Latest 4th Edition), for a maximum uniformly distributed loading of 40kN/m^2 or a rack leg load of 70kN placed back to back (with centre line base plates placed a minimum distance 300mm away from floor joints) anywhere on the floor.

5. Where joints are provided in the construction of the floor, they should be generally detailed in accordance with TR34 and designed so that no vertical movement occurs across the joint. Where possible the number of joints should be kept to a minimum. Joint location should be co-ordinated with a notional racking layout, unless a fixed layout is available, and agreed with the Engineer. Day joints in the warehouse area should be tied or reinforced with 10mm minimum thickness arris protection e.g. Permaban Alpha Joint or equal approved. Along the perimeter with the loading/unloading docks a steel angle assembly or approved proprietary joint is to be cast into the edge of the slab to protect arris's in trafficked areas.

6. The concrete is to be in accordance with BS EN 206 and have a minimum compressive strength of 40 N/mm^2 at 28 days. The concrete will have a minimum cement content of 325kg/m3 of a maximum cement content of 450kg/m3 with a maximum water cement ratio of 0.50. The concrete will be designed to have a maximum slump of 75 mm due to water, the use of super-plasticisers will be permitted to obtain the workability required by the subcontractor for placing the concrete.

7. Prior to construction of the slab, the proposed concrete mix is to be tested to show that its coefficient of drying shrinkage is less than 0.045%. Tests are to be in accordance with BS EN 1367-4.

8. A high standard of floor finish is required using power trowelling techniques. Floors are to be cast using the "laser screed" or equivalent approved system. No ripping or power float scores will be accepted. The ground floor warehouse slab will be constructed so that the surface tolerances complies with FM3 as defined in TR34 (Latest 4th Edition)

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9. After the final power floating operation, the floor slab is to be sprayed with an acrylic based, curing sealing and hardening membrane, with a curing efficiency of 90%, Sikafloor Proseal, or similar approved. The floor will not be trafficked by any vehicles for a minimum of four days following the sealing operation. Fully laden vehicles will not be allowed on the floor until the concrete has reached its design strength.

10. The ground slab is to be constructed on a minimum 1200 gauge PIFA polythene damp proof membrane laid on a layer of granular sub-base with a minimum thickness as stipulated on the Structural Engineers drawings. Insulation requirement as Architects details.

11. The sub-base of minimum 250mm of DOT Type 2 blinded fill is to be provided (depending on the subgrade reaction achieved by filling process) and is to be compacted in accordance with the Structural Engineer's requirements. Where necessary, the sub-base layer can be blinded with a fine material to close the surface, sand must not be used. The surface tolerance of the hardcore will be +0 mm and –10 mm. The sub base must be capable of supporting a fully laden concrete truck without rutting. To verify the assumptions made in the slab design, plate bearing tests must be carried out at underside of sub base level using a 750mm diameter plate to determine the modulus of subgrade reaction (k value) in accordance with the Highways Agency Specification HD25/94. At least one plate bearing test shall be carried out for every 1500sq m of slab area. The test results shall be issued to the Employers Project manager prior to commencement of slab construction.

12. Prior to concreting the slab, all roof and wall sheeting and loading doors must be fixed to provide protection from wind and rain. If due to programme restraints this cannot be achieved, then temporary sheeting must be used to seal all openings.

13. All joints are to be sealed prior to practical completion (apart from the day joints that will be sealed during the rectification period) with sealing compounds having a minimum shore hardness of 40. The sealant must be suitable for application at operating temperature of 2 degrees and a temperature of 0 degrees for 2 months of the year. Lower part of all joints must be filled/sealed using a closed cell polyethylene foam backer or siliconised debonding tape. These joints are to be inspected at three monthly intervals during the defects liability period and checked for arris damage. Any significant arris damage must be repaired with an epoxy mortar placed in accordance with the manufacturer's recommendations. At the end of the defects liability period, the trafficked joints in the aisles or free movement areas of the floor slab are to be resealed. The sealant will be a minimum shore hardness of 70 for sawn joints and of a suitable shore hardness for the design width of movement joints.

14. A Flatness survey for the concrete floor shall be carried out by an independent company experienced in the measurement of concrete floors in accordance with TR34 to demonstrate compliance with the flatness specification. Results shall be provided on completion of each survey. The contractor shall carry out any remedial works necessary in the event of non-compliance with the flatness specification (Remedial works to be agreed with the Employers Project Manager prior to commencement).

15. A Consultant Specialising in industrial concrete floor construction should be considered to monitor the quality of materials and workmanship during construction of the floor slab.

16. The rate of sampling for concrete cube testing shall be at least one sample per 200m³ and not less than one sample per day. Each sample shall comprise 4No cubes, 2No for 7 and 28 day testing and 2No spare.

17. Care shall be taken to avoid staining by diesel spillages and the like. Any such spillages shall be steam cleaned prior to handover. The finished slab shall be suitably protected from mechanical damage during construction.

18. The floor slab is to be capable of receiving floor bolts (minimum 100mm depth) to support racking and other installations at any point (subject to compliance with the minimum edge distances).

19. The Contractor must provide the Employers Project Manager with a specification of ongoing repair and maintenance and any restrictions on the use of the floor during the first year must be clearly set out (e.g. restrictions on equipment/loading/temperature/use/etc, work which will need to be carried out to joints, to prevent damage the slab including joints.)

20. All efforts should be made in the construction and detailing of the floor to reduce the possibility of random cracking. If cracks do occur, they are to be pressure grouted with a low viscosity epoxy mortar if they are wider than 0.8mm.

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2. STEELWORK PERFORMANCE SPECIFICATION

1. Work to be carried out in accordance with the Contract preliminaries and all relevant Architect's drawings which accompany this specification and the following schedules.

2. Workmanship and materials shall comply with the NBS Specifications.

3. The Contractor is responsible for the design, construction and compatibility of all steelwork elements. Steelwork is to be designed, supplied, and fabricated in accordance with current codes of practice and to meet Building Regulations. The steelwork design calculations are to be submitted for comment to the Structural Engineer, prior to fabrication.

4. Design of the structural steelwork is to be in accordance with BS 5950-1 "Structural Use of Steelwork in Building. Code of Practice For design. Rolled and Welded Sections" and/or BS EN 1993-1 "Eurocode 3 - Design of Steel Structures", and all other current related British Standards, European Standards and Codes of Practice.

5. The building is to be braced by portal action or means of bracing - horizontal and vertical diagonal steelwork. Bracings are to be in positions so as not to affect the fenestration of the building or the internal net lettable area. If for these reasons diagonal bracing is not possible then rigid frames should be introduced. Any bracing forming part of the existing structure along with interface with the new extension shall be removed and replaced elsewhere without affecting the stability of the structure as a whole.

6. Movements of the frame due to dead loads, wind loads and thermal effects are to be taken into account and the structural frame shall be designed so that the completed building does not suffer in any way from deflection movements.

7. To ensure robustness and minimise disproportionate collapse the building frame is to be designed to incorporate: fully tied horizontal and vertical joints, the proposed bracing arrangement is to be equally distributed around the building, and the load paths to be continuous from roof level down to the foundations.

8. Steelwork, cladding and their components adjacent to site boundaries must be designed in accordance with the Constrado recommendations on 'Single-storey Steel Framed Buildings in Fire Boundary Conditions" guidance SC1-P-087.

9. All columns will be designed with pinned bases, except where required for Fire Collapse by Building Regulations, where the bolts and baseplates will be partially fixed in accordance with the "Single-storey Steel Framed Buildings in Fire Boundary Conditions" guidance SC1-P-087. Columns to be built off the concrete foundation prepared by others at 450mm below structural slab level unless noted otherwise on the Structural Engineers drawings.

10. Include for supplying of holding down bolts for building in by others. Final holding down bolt design and details to consider the depths of the proposed foundations, as detailed on the Structural Engineers drawings, and to assume there is no reinforcement in the top of the foundation. Shear keys to underside of baseplates are not permitted.

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11. All purlins and rails will be fixed in accordance with manufacturer's recommendations and will have a minimum thickness of 1.45 mm to assist a positive cladding fixing. All sheeting rails within 2.0m of FFL to be installed 'toes down' to prevent build-up of debris.

12. All dimensions in the first instance relating to height, length and width to be taken from the architects drawings provided. The clear height from ground finish floor level to the underside upper floors and the intersection of the stanchion and the haunch is as noted on the drawings. Grid layout for the buildings as shown on the Architect's drawings.

13. Clear height to underside of roof haunch to the Architect Details

14. The roof pitch and the heights of the overall building including extent of hipped roofs and parapets are noted on the Architect's drawing.

15. Setting out and fabrication of the steelwork is to be carried out taking account of proposed building finishes and services installations, and provide all necessary framing, sub framing and support to the following:

    a) Roof and wall cladding including insulation sheeting.
    b) Roof lights and windows.
    c) Rainwater disposal including gutters and down pipes.
    d) Entrance structure, canopies, entrance doors, exit doors and service doors.
    e) Perimeter walls.
    f) Suspended services and plant.
    g) Division walls.
    h) Access ladders, hatches and handrails
    j) Doors, including tracks and mechanical equipment.
    k) Trimming and support steel for building mounted signage.

16. All necessary beams, posts, trimmers, cold rolled sections etc, are to be provided to form the profiles and elevations shown on the Architects drawings and to restrain them from movement.

17. Members of similar profile but different design, e.g. beams with different support conditions, shall be designed and detailed so that walls, cladding and other finishes are true to line and level when the building is in normal use. Where it is thereby necessary to introduce camber in supporting beams, or varying initial support levels, the Engineer's approval in writing must be obtained.

18. Provide all necessary beam restraints to internal and perimeter walls and partitions, at head and mid-height positions.

19. All steelwork will shot blasted to BS 7079 and BS EN ISO 8501-1 before painting with one coat of 2 pack high build epoxy zinc phosphate with a satin finish to a nominal dry film thickness of 75 microns to give 15 years life to first maintenance, finished colour to be light grey. Cold formed sections will be manufactured from hot dipped galvanised coil to BS EN 10147 and BS EN 10143. Where steelwork is to be encased in masonry, it will receive two coats of bituminous paint. Where remedial works are required to webs, flanges, beams, columns or other steelwork that is visible in the completed building the whole area of the affected steelwork will be coated to provide a uniform appearance.

20. Where necessary fire protection requirements will be to the Architects details and may comprise internally of 100mm thick concrete block work, fire roof sheeting or similar cladding or intumescent paint treatment all in accord with the Building Regulations and the satisfaction of the Building Inspector.

21. Deflection limits to be in accordance with the Steel Construction Institute Steelwork Design Guide to BS5950 Volume 4 "Essential Data for Designers" Section 8 "Deflection Limits for Pitched Roof Portal Frames".

The maximum permitted horizontal deflections under any combination of loading is to be limited to the following:

Horizontal deflection at eaves (cladding, full height)	: height/150
Horizontal deflection at eaves (masonry up to 3m)	: height/250
Horizontal deflection at eaves (masonry full height)	: height/360
Horizontal deflection at eaves (Full height glazing) – to suit manufacturers	: height/500

The maximum permitted vertical deflections under any combination of loading is to be limited to the following:

Vertical deflection at ridge	:span/200
Cantilever roof canopies	:span/180
Suspended and Mezzanine Floor level beams	:span/360
Floor and roof level beams supporting or restraining specialist curtain walling or large doors to be confirmed by Specialist Curtain Walling or Door Contractor	:span/500

22. The steel frame is to be designed for the following loads:

a. All dead loadings for roof, floor and ceiling finishes assessed from the descriptions contained within the Architect's drawings and specification. Allowance to be made to supporting suspended ceilings from roof framework above offices.

b. Wind loading in accordance with BS 6399-2 or BS EN 1991

c. Roof superimposed generally 0.6kN/m² but increase this to allow for build-up of snow in the valleys, at change of height locations, and at eaves behind parapets. Refer to BS 6399-3 or BS EN 1991.

d. Roof service loading to main frame and purlins to 0.25kN/m². Note, minimum purlin gauge to be 1.3mm, great care is to be taken with the coordination of services hung from the purlins.

e. Refer to Architect's drawings for further details.

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3. STATEMENT ON GROUND CONDITION

a. Refer to Land Contamination assessment by Wilson Bailey dated June 2015. Boreholes 8 and 9 are relevant for the industrial development.

b. Ground conditions on the site appear to be reasonable consistent with topsoil overlying silty clay over gravel and sand. Groundwater may be sub-artesian and at shallow depth.

c. No ground gases were identified and no ground contamination.

d. Pad foundations and ground bearing slabs are the likely foundation solution for this site. However the clay is soft in areas, at shallow depth and may be influenced by tree root action. The gravel is a good bearing strata but the sub-artesian groundwater conditions may make construction difficult.

e. The client is looking for the contractor to take all risks in the ground.

f. It is considered that further intrusive investigations in terms of a series of trial pits across the site would be required to enable the final foundation solution to be identified.

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4. STATEMENT ON FLODDING AND DRAINAGE

a. The foul water flows from the development are to discharge into a 150mm spur that will be provided at the site boundary. This pipe feeds into the foul water system for the residential development which in turn connects into the adopted sewers.

b. Refer to Opus drainage assessment report attached dated August 2015 included within the appendices.

c. Southern Water have confirmed that there is capacity in their system to take the flows from the development following some off-site reinforcement works. These will be undertaken by others. The contractor will need to make a S106 application for a new non-direct connection.

d. The surface water flows from the development are to discharge into a swale positioned along the northern site boundary. This swale is to be constructed by the contractor and is to feed into the swale on the adjoining residential land.

e. Refer to Opus drainage assessment report attached dated August 2015 and FRA by Opus dated 2015 included within the appendices.

f. The site is within Flood Zone 1.

g. Surfacewater flows from the site are to be controlled as defined in the FRA and the planning conditions. An attenuation feature is to be provided off site by the residential developer. Current understanding is that the industrial site can discharge freely.

h. Suds features are required as defined in the FRA and the planning conditions.

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D - GROUNDWORK

D20 EXCAVATING AND FILLING

To be read with Preliminaries/General conditions.

GENERALLY/THE SITE

112 SITE INVESTIGATION REPORT
- Refer to all relevant SI Reports

145 VARIATIONS IN GROUND WATER LEVEL
- Give notice: If levels encountered are significantly different from levels in the site investigation report or previously measured.

150 EXISTING SERVICES, FEATURES AND STRUCTURES
- Services: Contractor to obtain all available information to satisfy themselves that no existing underground services will conflict with any aspect of the proposed works.
- Site features to be retained: Refer to drawings.
- Structures to be retained: Refer to drawings.

CLEARANCE/EXCAVATING

220 STRIPPING TOPSOIL
- General: Clear area of rubbish and debris. Before beginning general excavation or filling, remove vegetation and strip topsoil from areas where there will be regarding, buildings, pavings / roads and other areas shown on drawings. Grub up and dispose of large roots without undue disturbance of soil.
- Site storage: Keep separate from excavated sub-soil.

225 HANDLING TOPSOIL
- Standard: To BS 3882.
- Aggressive weeds:
  - Species: Included in the Weeds Act, section 2 or the Wildlife and Countryside Act, Schedule 9, part II.
  - Give notice: Obtain instructions before moving topsoil.
- Wet condition: Handle topsoil in driest condition possible. Not following heavy rainfall or wetter than plastic limit as defined in BS3882 Annex N2.
- Contamination: Do not mix topsoil with:
  - Subsoil, stone, hardcore, rubbish or material from demolition work.
  - Other soil or material containing aggressive weeds, sharps, plastics and non-soil forming materials and notifiable animal or plant diseases.
  - Oil, fuel, cement or other substances harmful to plant growth.
  - Other classifications of topsoil.
- Multiple handling: Keep to a minimum. Use topsoil immediately after stripping.

244 EXCAVATIONS ADJACENT TO EXISTING FOUNDATIONS (including those of pavements)
- Prior to commencing excavation:
  Excavate trial pits adjacent to existing foundations to determine extent, construction and formation levels.
- Critical level:
  - Distance between near faces of foundation and lower excavation less than 1m on plan: 150mm above foundation formation level.
  - Otherwise: 150mm above a 45° line drawn from the formation level of an existing foundation where it intersects with the near face of lower excavation.
- Give notice: if excavations are required below critical levels.

310 UNSTABLE GROUND

- Generally: Ensure that the excavation remains stable at all times.
- Give notice: Without delay if any newly excavated faces are too unstable to allow earthwork support to be inserted.
- Take action: If instability is likely to affect adjacent structures or roadways, take appropriate emergency action.

320 RECORDED FEATURES

- Recorded foundations, beds, drains, manholes, etc: Break out and seal drain ends.
- Contaminated earth: Refer to ground remediation strategy / report.

330 UNRECORDED FEATURES

- Give notice: If unrecorded foundations, beds, voids, basements, filling, tanks, pipes, cables, drains, manholes, watercourses, ditches, etc. not shown on the drawings are encountered.

DISPOSAL OF MATERIALS

415 EXCAVATED TOPSOIL REMOVAL

- General: Reuse to form bunds around site as detailed on Landscape Architects drawings. Remove surplus unusable material from site.

441 SURPLUS SUBSOIL

- Excavated material: Stockpile in temporary storage heaps.
- Retained material: Spread and level surplus subsoil on site.
- Locations: Refer to proposed levels for areas that require fill.
- Protected areas: Do not raise soil level within root spread of trees that are to be retained.
- Remaining material: Remove from site.

450 WATER

- Generally: Keep all excavations free from water until:
  - Formations are covered.
  - Below ground constructions are completed.
  - Basement structures and retaining walls are able to resist leakage, water pressure and flotation.
- Drainage: Form surfaces of excavations and fill to provide adequate falls.
- Removal of water: Provide temporary drains, sumps and pumping as necessary. Do not pollute watercourses with silt laden water.

454 GROUND WATER LEVEL, SPRING OR RUNNING WATER

- Give notice: If it is considered that the excavations are below the water table.
- Springs/ Running water: Give notice immediately if encountered.

457 PUMPING

- General: Do not disturb excavated faces or stability of adjacent ground or structures.
- Pumped water: Discharge without flooding the site or adjoining property.
- Sumps: Construct clear of excavations. Fill on completion.
- Locations: Contractor's choice.

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FILLING

510 HAZARDOUS, AGGRESSIVE OR UNSTABLE MATERIALS

- Standard: Highways Agency 'Specification for Highway Works' clause 601, 602 & Table 6/1.
- General: Do not use fill materials which would, either in themselves or in combination with other materials or ground water, give rise to a health hazard, damage to building structures or instability in the filling, including material that is:
  - Frozen or containing ice.
  - Organic.
  - Noxious.
  - Susceptible to spontaneous combustion.
  - Likely to erode or decay and cause voids.
  - With excessive moisture content, slurry, mud or from marshes or bogs.
  - Clay of liquid limit exceeding 80 and/or plasticity index exceeding 55.
  - Unacceptable, class U2 as defined in the Highways Agency 'Specification for highway works'.

530 PLACING FILL

- Standard: Highways Agency 'Specification for Highway Works' clause 608 & 610.
- Surfaces of excavations and areas to be filled: Free from loose soil, topsoil, organic material, rubbish and standing water.
- Freezing conditions: Do not place fill on frozen surfaces. Remove material affected by frost. Replace and recompact if not damaged after thawing.
- Adjacent structures, membranes and buried services:
  - Do not overload, destabilise or damage.
  - Submit proposals for temporary support necessary to ensure stability during filling.
  - Allow 14 days (minimum) before backfilling against in situ concrete structures.
- Layers: Place so that only one type of material occurs in each layer.
- Earthmoving equipment: Vary route to avoid rutting.

535 COMPACTION GENERALLY

- Standard: Highways Agency 'Specification for Highway Works' clause 612 & Table 6/4.
- General: Compact fill not specified to be left loose as soon as possible after placing.
- After compaction: Surface of each layer must be well closed, showing no movement under compaction plant, and without cracks, holes, ridges, loose material and the like.
- Defective areas: Remove and recompact to full thickness of layer using suitable material.

540 BENCHING IN FILL

- Adjacent areas: If, during filling the difference in level between adjacent areas of filling exceeds 600 mm, cut into edge of higher filling to form benches 600 mm minimum width and height equivalent to depth of a layer of compacted filling.
- New filling: Spread and compact to ensure maximum continuity with previous filling.

650 PROTECTION OF COMPACTED FILLING

- Temporary protective filling: Before allowing construction traffic, raise level of compacted cohesive soil filling at least 150 mm above formation level using properly compacted temporary filling.
- Removal: Remove temporary protective filling from site.

EARTHWORKS TESTING SCHEDULE

1.0 Earthworks Performance Requirements

All formations or bearing surfaces, in natural soil or in engineered fill shall be shown by in-situ testing to have achieved a CBR value of at least 5%, which is equivalent to a modulus of sub-grade reaction of at least 40 MPa/m.

Fill material is to be placed in horizontal layers (200mm maximum thickness) and compacted in accordance with Series 600 of the Highways Specification. During the laying and compacting exercise of the fill the insitu testing detailed below is to be undertaken to confirm the fill material is being compacted to achieve the required performance.

Compacted Type 1 and Type 2 sub-base material, laid and compacted in accordance with Series 800 of the Specification for Highway Works, will be shown to have a minimum CBR value of 30%. The use of sub-base replacement is subject to agreement with the Engineer.

For engineered site won material, the degree of compaction shall ensure a maximum of 5% air voids and be at least 98% (below the building footprints) and 95% (below external areas) of the average maximum dry density achieved on tests undertaken on site samples in the laboratory. No test result in respect of the fill dry density shall fall below the value determined by the laboratory testing. Where such occurs, an area of 20 by 20 metres with the test location at its centre shall be considered to have failed and remedial action taken.

2.0 Imported Granular Fill Material:

2.1 Suitability/Classification Tests (all to be carried out prior to starting earthworks):

2.1.1 Provide full details of source/supplier and sample of material for on-site inspection.

2.1.2 Carry out following tests on at least 6 nr samples of source material:

- Particle size distribution analysis (PSD) in accordance with BS1377 (Part 2)
- Natural Moisture Content (NMC) in accordance with BS1377 (Part 2)
- 10% fines value (not required for sand fill) in accordance with BS812 (Part 3)
- Maximum and Minimum Dry Density in accordance with BS1377 (Part 4)

2.1.3 Before placing, all fill material to be screened to remove all deleterious material not suitable for fill purposes.

2.2 Tests during filling works:

2.2.1 Carry out following tests at frequency of at least one per day:

- Particle size distribution analysis (PSD) in accordance with BS1377 (Part 2)
- Natural Moisture Content (NMC) in accordance with BS1377 (Part 2)

2.2.2 Carry out following tests at locations agreed with the Engineer:

- At a frequency of one per 500m^2 per layer of fill, Nuclear Density Tests in accordance with BS1377 (Part 9). (Nuclear density tests to be calibrated by sand replacement test or other approved calibration method at frequency of 2 per day in accordance with BS1377 (Part 9)).
- At a frequency of one per 500m^2 per 2 layers of fill (per 400mm depth), 300 mm diameter plate CBR bearing tests in accordance with BS1377, Part 9.

3.0 Site Won Fill Material

3.1 Suitability/Classification Tests (all to be carried out prior to starting earthworks):

3.1.1 Carry out following tests at frequency of at least two per day:

- Particle size distribution analysis (PSD) – for granular material in accordance with BS1377 (Part 2)
- Maximum and minimum dry density – for granular material in accordance with BS1377 (Part 4)
- Plasticity Classification Test – for cohesive material in accordance with BS1377 (Part 2)
- Natural Moisture Content (NMC) – for all materials in accordance with BS1377 (Part 2)
- Point MCV – for cohesive material in accordance with BS1377 (Part 2)
- 4.5kg Compaction Test (CT) – for cohesive material in accordance with BS1377 (Part 4)

3.2.2 Before placing, all fill material to be screened to remove all deleterious material not suitable for fill purposes.

3.2 Tests during filling works:

3.2.1 Carry out following tests at locations agreed with the Engineer:

- At a frequency of one per 500m^2 per layer of fill, Nuclear Density Tests in accordance with BS1377 (Part 9). (Nuclear density tests to be calibrated by sand replacement test or other approved calibration method at frequency of 2 per day in accordance with BS1377 (Part 9)).
- At a frequency of one per 500m^2 per 2 layers of fill (per 400mm depth), 300 mm diameter plate CBR bearing tests in accordance with BS1377, Part 9.

4.0 CBR Tests on Formation / Bearing Surfaces

4.1 Carry out the following CBR plate test on the approved formation surface (on natural soil in cut areas and on top of fill material in fill areas), at a frequency of one per 500m2, at locations agreed with the Engineer and after inspection and rolling:

- 600 mm diameter plate bearing tests in accordance with BS1377 (Part 9).

Note:

- Allow for minimum of 5No CBR tests to be taken below per building footprint.
- Allow for minimum of 10No CBR tests to be taken to the external areas; 4No along new access road, 3No in each concrete service yard and 3No to the car park areas. (Note for testing along new access road, liaise with Highways Engineer on any Local Authority specifics for undertaking CBR testing to meet adoptable standards)

5.0 Plate Bearing Tests Below Building Area

5.1 If not provided by Specialist Groundworks Contractor or determined through the plate test taken on the final formation or bearing fill surface noted above, minimum 5No plate bearing tests per building to be carried out at level to underside of sub-base (on top of fill material in fill areas), using 750mm diameter plate bearing tests in accordance with BS1377 (Part 9) to determine CBR or equivalent plate bearing test to determine equivalent K value in accordance with Highways Agency specification HD 25/94.

5.2 Minimum 12No plate bearing tests per building to be carried out at level of top of capping/sub-base (underside of slab) using 600mm diameter plate to determine CBR and equivalent K value.

6.0 Plate Bearing Tests to Confirm Ground Bearing Pressure for Foundations

6.1 If not provided by Specialist Groundworks Contractor, provided minimum 4No plate bearing tests per building to be carried out at foundation formation level using 750mm diameter plate bearing tests in accordance with BS1377 (Part 9) to determine bearing capacity of the ground (GBP) and equivalent K value, to Building Control Approval.

7.0 Unsatisfactory Test Results

Where in-situ testing (i.e. compliance) has identified areas where the specification has not been met the Contractor will be expected to rectify the areas deemed unsatisfactory and demonstrate by further testing that the Specification has been met. The Contractor will propose how he intends to rectify such areas of unsatisfactory compaction. Methods such as recompaction and remove and replace will generally prove acceptable. In certain circumstances modification of the ground may be necessary.

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E - INSITU CONCRETE/LARGE PRECAST CONCRETE

E05 IN SITU CONCRETE CONSTRUCTION GENERALLY

To be read with Preliminaries/General conditions.

210 CONTRACTOR DESIGN OF STRUCTURAL CONCRETE
For concrete works shown on the drawings.
- Extent: Refer to drawings.
- Standards: Design To:
  - BS 8007;
  - BS 8110-1 and -2; and
  - BS EN 1992-1.1.
  - Drawings: To BS EN ISO 4157-1 and BS EN ISO 4157-2.
  - Reinforcement schedules: To BS 8666.
- Design working life: 50 years.
- Fire resistance: 60 minutes.
- Loadings: BS 6399 and as noted on the drawings.
- Other requirements: None.

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223 STRUCTURAL DRAWINGS AND SCHEDULES
- Standards:
  - Drawings: To BS EN ISO 3766 and 'Standard method of detailing structural concrete' published by the Institution of Structural Engineers.
  - Reinforcement schedules: To BS 8666.

225 TEMPERATURE RECORDS
- Requirement: Throughout period of concrete construction record:
  - Daily: Maximum and minimum atmospheric shade temperatures.
  - Under adverse temperature conditions: Temperature at commencement and end of placing.
- Equipment: Contractor's choice .
  - Location: In the shade, close to the structure.

235 OPENINGS, INSERTS AND FIXINGS
- Requirement: Collate all information.
- Submit: Details where openings, inserts and fixings can only be accommodated by adjustments to reinforcement.
- Locate reinforcement: To ensure specified minimum cover at openings and inserts and to be clear of fixing positions.

250 STRUCTURAL TESTING
- Requirement: Cube Testing.
- Method/ standard: Submit proposals.
  - Timing: every 20m3 of concrete poured.
- Report: 7, 14 and 28 days testing.
  Submission: as required.

290 ACCURACY OF CONSTRUCTION
- Setting out: To BS 5964-1.
- Geometrical tolerances: To BS 5606.
  - Conflicts: Notwithstanding tolerances specified elsewhere, do not exceed requirements for compliance with the designated code of practice.
  - Substitution of alternative requirements: None.

310 SURFACE REGULARITY OF CONCRETE FLOORS TO BS 8204 - GENERAL

- Standard: To BS 8204-1 or -2.
- Measurement: From underside of a 2 m straightedge (between points of contact) placed anywhere on surface and using a slip gauge.

315 SURFACE REGULARITY OF CONCRETE FLOORS TO BS 8204 - TOLERANCE CLASS

- Location: New ground floor slab as stated in the employers structural requirements.
- Abrupt changes: Not permitted.

318 SURFACE REGULARITY OF WAREHOUSE CONCRETE FLOORS TO TR 34 - GENERAL AND TOLERANCE

- Measurement of surface regularity: To Concrete Society Technical Report 34 (TR 34) Latest Edition
- Surface deviations: Comply with permissible limits for floor classifications/ locations: FM2 generally.

410 IN SITU CONCRETE CONSTRUCTION - SUPERVISION/ CHECKING

- Standard: To BS EN 13670, Execution Class 1.

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E10 MIXING/CASTING/CURING IN SITU CONCRETE

To be read with Preliminaries/General conditions.

CONCRETE

101 SPECIFICATION

- Concrete generally: To BS 8500-2.
- Exchange of information: Provide concrete producer with information required by BS 8500-1, clauses 4 and 5.

105 DESIGNATED CONCRETE

- Designation: Refer to drawings.
- Fibres: Not required.
- Aggregates:
  - Size (maximum): 20 mm.
  - Coarse recycled aggregates: Not permitted.
  - Additional aggregate requirements: None.
- Special requirements for cement/ combinations: None.
- Consistence class: Contractor's choice.
- Chloride class: Normal.
- Admixtures: Concrete producer's choice.
- Additional mix requirements: None.

110 BASIC DESIGNATED CONCRETE

- Designation: As shown on drawings.
- Coarse recycled aggregates: Not permitted.
- Consistence class: Contractor's choice.
- Additional requirements: Submit proposals.

125 SUBSTITUTION OF STANDARDIZED PRESCRIBED CONCRETE FOR DESIGNATED CONCRETE

- General: Conform to BS 8500-2, clause 9.
- Substitution: In accordance with BS 8500-1, table A. 13.
  - Proposals: Submit for each substitution, stating reasons.
- Site mixing: Not permitted.

MATERIALS, BATCHING AND MIXING

215 READY-MIXED CONCRETE

- Production plant: Currently certified by a body accredited by UKAS to BS EN 45011 for product conformity certification of ready-mixed concrete .
- Source of ready-mixed concrete: Obtain from one source if possible. Otherwise, submit proposals.
  - Name and address of depot: Submit before any concrete is delivered.
  - Delivery notes: Retain for inspection.
- Declarations of nonconformity from concrete producer: Notify immediately.

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218 SITE MIXED CONCRETE

- Batching by mass:
  - Restrictions: Maximum pour size 0.5m³.
  - Accuracy of measuring devices: To BS EN 206-1, clause 9.6.2.
    Tolerances for quantity of constituent material: To BS EN 206-1, table 21.
- Batching by volume:
  - Restrictions: Maximum pour size 0.5 m³.
- Mixing: To BS 8000-2.1, subsections 2, 3 and 4.

221 INFORMATION ABOUT PROPOSED CONCRETES

- Submit when requested:
  - Details listed in BS 8500-1, clause 5.2.
    Additional information: Data concerning the anticipated rate of strength gain.

225 CHANGES TO SPECIFICATION

- Changes to specification of fresh concrete (outside concrete producer's responsibility): Prohibited.

230 INTERRUPTION OF SUPPLY DURING CONCRETING

- Elements without joints: Where elements are detailed to be cast in a single pour without joints, make prior arrangements for a back-up supply of concrete.
- Elsewhere:
  - Preparation: Manage pour to have a full face, and have materials available to form an emergency construction joint while concrete can still be worked.
  - Before pour is completed: Submit location and details of joint, make proposals for joint preparation.

315 AGGREGATES FOR EXPOSED VISUAL CONCRETE

- Limitations on contaminants: Free from absorbent particles which may cause 'popouts', and other particles such as coal and iron sulfide which may be unsightly or cause unacceptable staining.
- Colour: Consistent.
- Supply: From a single source and maintained throughout the contract.
- Samples: Submit on request.

325 MATERIALS FOR EXPOSED VISUAL CONCRETE

- Alterations to sources, types and proportions: Submit proposals.

415 ADMIXTURES

- Calcium chloride and admixtures containing calcium chloride: Do not use.

490 PROPERTIES OF FRESH CONCRETE

- Adjustments to suit construction process: Determine with concrete producer. Maintain conformity to the specification.

PROJECT TESTING/ CERTIFICATION

505 PROJECT TESTING OF CONCRETE - GENERAL

- Testing: To BS 8500-1, Annex B.
  - Nonconformity: Obtain instructions immediately.
- Recording: Maintain complete correlated records including:
  - Concrete designation.
  - Sampling, site tests, and identification numbers of specimens tested in the laboratory.
  - Location of the parts of the structure represented by each sample.
    Location in the structure of the batch from which each sample is taken.

520 TESTING LABORATORY

- Laboratory: Accredited by UKAS or other national equivalent.
  - Name and UKAS reference number: Submit well in advance of making trial mixes or concrete for use in the works.

530 TESTS RESULTS

- Submission of reports: Within one day of completion of each test.
  - Number of copies: 1.
- Reports on site: A complete set, available for inspection.

550 BROKEN CUBES FROM FAILED STRENGTH TESTS

- Nonconformity: Keep separately the pieces of each cube which fail to meet the conformity requirements for individual results.
- Period for keeping cubes: Obtain instructions.

PLACING/ COMPACTING/ CURING AND PROTECTING

610 CONSTRUCTION/ SEQUENCE/ TIMING REQUIREMENTS

- to contractor .

620 TEMPERATURE OF CONCRETE

- Application: across site.
- Objective: Limit maximum temperature of concrete to minimize cracking during placing, compaction and curing. Take account of:
  - High temperatures and steep temperature gradients: Prevent build-up during first 24 hours after casting. Prevent coincidence of maximum heat gain from cement hydration with high air temperature and/ or solar gain.
  - Rapid changes in temperature: Prevent during the first seven days after casting.
- Proposals for meeting objective: Submit.

630 PREMATURE WATER LOSS

- Requirement: Prevent water loss from concrete laid on absorbent substrates.
  - Underlay: Select from:
    Polyethylene sheet: 250 micrometres thick.
    Building paper: To BS 1521, grade B1F.
  - Installation: Lap edges 150 mm.

640 CONSTRUCTION JOINTS

- Location of joints: Submit proposals when not shown on drawings.
- Preparation of joint surfaces: As section E40.

648 ADVERSE TEMPERATURE CONDITIONS

- Requirement: Submit proposals for protecting concrete when predicted ambient temperatures indicate risk of concrete freezing or overheating.

650 SURFACES TO RECEIVE CONCRETE

- Cleanliness of surfaces immediately before placing concrete: Clean with no debris, tying wire clippings, fastenings or free water .

660 INSPECTION OF SURFACES

- Notice: Give notice to allow inspections of reinforcement and surfaces before each pour of concrete.
  - Period of notice: Obtain instructions.
- Timing of inspections: To be agreed.

670 TRANSPORTING

- General: Avoid contamination, segregation, loss of ingredients, excessive evaporation and loss of workability . Protect from heavy rain.
- Entrained air: Anticipate effects of transport and placing methods in order to achieve specified air content .

680 PLACING

- Records: Maintain for time, date and location of all pours.
- Timing: Place as soon as practicable after mixing and while sufficiently plastic for full compaction.
- Temperature limitations for concrete: 30°C (maximum) and 5°C (minimum), unless otherwise specified. Do not place against frozen or frost covered surfaces.
- Continuity of pours: Place in final position in one continuous operation up to construction joints. Avoid formation of cold joints.
- Discharging concrete: Prevent uneven dispersal, segregation or loss of ingredients or any adverse effect on the formwork or formed finishes.
- Thickness of layers: To suit methods of compaction and achieve efficient amalgamation during compaction.
- Poker vibrators: Do not use to make concrete flow horizontally into position, except where necessary to achieve full compaction under void formers and cast-in accessories and at vertical joints.

690 COMPACTING

- General: Fully compact concrete to full depth to remove entrapped air. Continue until air bubbles cease to appear on the top surface.
  - Areas for particular attention: Around reinforcement, under void formers, cast-in accessories, into corners of formwork and at joints.
- Consecutive batches of concrete: Amalgamate without damaging adjacent partly hardened concrete.
- Methods of compaction: To suit consistence class and use of concrete.

720 VIBRATORS

- General: Maintain sufficient numbers and types of vibrator to suit pouring rate, consistency and location of concrete .
- External vibrators: Obtain approval for use.

730 PLASTIC SETTLEMENT

- Settlement cracking: Inspect fresh concrete closely and continuously wherever cracking is likely to occur, including the top of deep sections and at significant changes in the depth of concrete sections .
  - Timing: During the first few hours after placing and whilst concrete is still capable of being fluidized by the vibrator .
- Removal of cracks: Revibrate concrete.

810 CURING GENERALLY

- Requirement: Keep surface layers of concrete moist throughout curing period, including perimeters and abutments, by either restricting evaporation or continuously wetting surfaces of concrete.
  - Surfaces covered by formwork: Retain formwork in position and, where necessary to satisfy curing period, cover surfaces immediately after striking.
  - Top surfaces: Cover immediately after placing and compacting. If covering is removed for finishing operations, replace it immediately afterwards.
- Surface temperature: Maintain above 5°C throughout the specified curing period or four days, whichever is longer.
- Records: Maintain details of location and timing of casting of individual batches, removal of

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formwork and removal of coverings. Keep records on site, available for inspection.

811 COVERINGS FOR CURING

- Sheet coverings: Suitable impervious material.
- Curing compounds: Selection criteria:
  - Curing efficiency: Not less than 75% or for surfaces exposed to abrasion 90%.
  - Colouring: Fugitive dye.
  - Application to concrete exposed in the finished work: Readily removable without disfiguring the surface.
  - Application to concrete to receive bonded construction/ finish: No impediment to subsequent bonding.
- Interim covering to top surfaces of concrete: Until surfaces are in a suitable state to receive coverings in direct contact, cover with impervious sheeting held clear of the surface and sealed against draughts at perimeters and junctions

812 PREVENTING EARLY AGE THERMAL CRACKING

- Deep lifts or large volume pours: Submit proposals for curing to prevent early age thermal cracking, taking account of:
  - Temperature differentials across sections.
  - Coefficient of thermal expansion of the concrete.
  - Strain capacity of the concrete mix (aggregate dependent).
  - Restraint.

815 ADDITIONAL CURING REQUIREMENT - WATER CURING

- Commencement of water curing: As soon as practicable after placing and compacting concrete.
  - Surfaces covered by formwork: Expose to water curing as soon as practicable.
  - Top surfaces: Cover immediately with impermeable sheeting to prevent evaporation before commencement of water curing.
- Water curing: Wet surfaces continuously throughout curing period.
  - Select methods from:
    Mist spray.
    Wet hessian covered with impermeable sheeting.

817 CURING CLASS

- Standard: To BS EN 13670 Curing class 1.

818 CURING PERIODS GENERALLY

- Minimum periods: When not otherwise indicated, to BS EN 13670, Annex F.8.5.

840 PROTECTION

- Prevent damage to concrete, including:
  - Surfaces generally: From rain, indentation and other physical damage.
  - Surfaces to exposed visual concrete: From dirt, staining, rust marks and other disfiguration.
  - Immature concrete: From thermal shock, physical shock, overloading, movement and vibration.
    In cold weather: From entrapment and freezing expansion of water in pockets, etc.

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E20 FORMWORK FOR IN SITU CONCRETE

To be read with Preliminaries/ General Conditions.

GENERALLY/ PREPARATION

110 LOADINGS

- Requirement: Design and construct formwork to withstand the worst combination of the following:
  - Total weight of formwork, reinforcement and concrete.
  - Construction loads including dynamic effects of placing, compacting and construction traffic.
    Wind and snow loads.

132 PROPPING

- General: Prevent deflection and damage to the structure. Carry down props to bearings strong enough to provide adequate support throughout concreting operations.
- Method statement: Submit proposals for prop bearings and sequence of propping/ repropping and backpropping.
  - Timing of submission: To be agreed between the permanent works designer and the temporary works coordinator .

145 PERMANENT FORMWORK

- Location and materials: Submit proposals.

160 CAMBERS

- Application of specified upward cambers: To the concrete immediately before formwork is struck.
  - Formwork: Allow for deflection under weight of fresh concrete.
  - Top surfaces of concrete: Camber to maintain the required structural depths and profiles.
- Checks after striking of formwork and removal of props: Levels to determine extent of any residual camber. Submit results.
- Upward cambers: Construct forms to achieve the following:
- - See drawings .

170 WORK BELOW GROUND

- - FOUNDATIONS;
- - LIFT PITS;
- - SLAB EDGES
- Casting vertical faces against faces of excavation: Not permitted.
  Requirements: not permitted

176 TEMPORARY SUPPORTS TO PROFILED STEEL SHEETS

- Nature: Continuous across full width of slab.
  - Number in each span: As drawings.
  - Location: At centre of each span and at third points of each span.
- Width of bearing (minimum): 75 mm.
- Deflection of bearer (maximum): 5 mm.
- Removal of temporary supports: Obtain instructions.

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178 FORMATION OF OPENINGS IN COMPOSITE ACTION SLABS

- Generally: Except as otherwise agreed, box out for openings in concrete.
- Forming holes in profiled steel sheet:
  - Timing: Obtain instructions.
  - Method: Contractor's choice.

225 PERMANENT FORMWORK FOR SUSPENDED FLOORS

- Type: Lightweight and compatible with permanent insulation formwork (PIF) system for walls.
- Manufacturer: As permanent insulation formwork (PIF) system.
  Product reference: Agrément certified, contractor's choice.

CONSTRUCTION

310 ACCURACY

- General requirement for formwork: Accurately and robustly constructed to produce finished concrete in the required positions and to the required dimensions.
- Formed surfaces: Free from twist and bow (other than any required cambers).
- Intersections, lines and angles: Square, plumb and true.

315 SUBSTRUCTURE FORMWORK AND UNDERSLAB INSULATION

- Cutting: Neat and accurate to edges, and around penetrations and downstands.
- Laying: Tightly butted and fully supported on firm, even substrate.
- Vertical faces: Stiffen as necessary to act as shutter.
- Formwork/ insulation surfaces: Protect from indentation by spacers and other items.
- Joints in formwork/ insulation and with edge structure and penetrations: Seal to prevent penetration of concrete.
- Concrete placement: Restrain formwork/ insulation against movement.

320 JOINTS IN FORMS

- Requirements including joints in form linings and between forms and completed work:
  - Prevent loss of grout, using seals where necessary.
  - Prevent formation of steps. Secure formwork tight against adjacent concrete.

330 INSERTS, HOLES AND CHASES

- Positions and details:
  - Dimensioned on drawings provided on behalf of the Employer: Do not change without consent.
  - Undimensioned or from other sources: Submit proposals.
- Positioning relative to reinforcement: Give notice of any conflicts well in advance of placing concrete.
- Method of forming: Fix inserts or box out as required. Do not cut hardened concrete without approval.

470 RELEASE AGENTS

- Use: All formwork.
- General: Achieve a clean release of forms without disfiguring the concrete surface.
- Product types: Compatible with formwork materials, specified formed finishes and subsequent applied finishes. Use the same product throughout the entire area of any one finish.
- Protection: Prevent contact with reinforcement, hardened concrete, other materials not part of the form face, and permanent forms.

480 SURFACE RETARDERS
- Use: Obtain approval.
- Reinforcement: Prevent contact with retarder.

STRIKING

510 STRIKING FORMWORK
- Timing: Prevent any disturbance, damage or overloading of the permanent structure.

521 MINIMUM PERIOD FOR RETAINING FORMWORK/ TEMPORARY SUPPORTS IN POSITION
- Concrete strength at time of formwork removal (minimum): 75% of 28 day strength.
- Assumptions: Maturity of adjacent elements of structure is at least equal to element under consideration.
  - Before removing formwork: Submit proposals if assumptions will not be realised.
- Method to be used in assessing early age strength of concrete: Submit proposals.

FORMED FINISHES

615 FINISH TO RECEIVE ASPHALT TANKING
- Finish: Even and suitable to receive asphalt.
- Permissible deviation of surfaces:
  - Sudden irregularities (maximum): 3 mm.
  - Gradual irregularities (maximum): 3 mm, when measured from underside of a 1 m straightedge, placed anywhere on surface.
- Surface blemishes:
  - Permitted: Blowholes less than 10 mm in diameter.
  - Not permitted: Voids, honeycombing, segregation and other large defects.
- Projecting fins: Remove.
- Formwork tie holes: Filled with mortar.

635 STANDARD FINISH
- Location: Architect to advise.
- Standard: BS 8110-1, clause 6.2.7.3.
- Quality: Architect to advise.
- Face as formed: As the regional Reference Panel.

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E30 REINFORCEMENT FOR IN SITU CONCRETE

To be read with Preliminaries/ General Conditions.

REINFORCEMENT

110 QUALITY ASSURANCE OF REINFORCEMENT
- Standards:
  - Reinforcement: To BS 4449, BS 4482, BS 4483 or BS 6744.
  - Cutting and bending: To BS 8666.
- Source of reinforcement: Companies holding valid certificates of approval for product conformity issued by the UK Certification Authority for Reinforcing Steels (CARES).

140 PLAIN BAR REINFORCEMENT
- Standard: To BS 4482.
  Strength grade: 250.

150 RIBBED BAR REINFORCEMENT
- Standard: To BS 4449.
  - Strength grade: Generally B500B, but B500C where detailed.

160 GALVANIZED STEEL REINFORCEMENT
- Galvanizing: To BS EN ISO 1461 after cutting but before bending.

210 STANDARD FABRIC REINFORCEMENT
- Standard: To BS 4483.
- Strength grade: B500B.

240 PROPRIETARY PREFABRICATED REINFORCEMENTFOR SHEAR HEADS
- Manufacturer: Submit proposals.
  - Product reference: Submit proposals.

250 PROPRIETARY PREFABRICATED CONTINUITY REINFORCEMENT STRIPS
- Manufacturer: Submit proposals.
  - Product reference: Submit proposals.

255 PREFABRICATED CONTINUITY REINFORCEMENT STRIPS
- Source: Obtain from a manufacturer holding a valid Technical Product Approval certificate issued by the UK Certification Authority for Reinforcing Steels (CARES) or equivalent.

WORKMANSHIP

310 CUTTING AND BENDING REINFORCEMENT
- General: To schedules and to BS 8666.
- Bending on site, including minor adjustments: Obtain instructions and Continuity reinforcement - use prefabricated strips.

320 PROTECTION OF REINFORCEMENT
- Dropping from height, mechanical damage and shock loading: Prevent.
- Cleanliness of reinforcement at time of pouring concrete: Free from corrosive pitting, loose mill scale, loose rust and contaminants which may adversely affect the reinforcement, concrete, or bond between the two.

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410 LAPS OR SPLICES

- Details not shown on drawings: Obtain instructions.

425 LAPS NOT DETAILED ON DRAWINGS

- Laps in bar reinforcement (minimum): 40 x bar diameter.
- Laps in fabric reinforcement (minimum): 400mm.
  - Laps at corners: Avoid four layer build-up.

427 LAPS IN FABRIC REINFORCEMENT

- Terms: As defined in BCA publication 97.321.
- Lap type:
  - Long edge of fabric: Butt end bars in adjacent fabric sheets and provide loose bars of the same diameter and type as the fabric bars, tied to and with a full lap with the bars in each sheet.
  - Short edge of fabric: Butt end bars in adjacent fabric sheets and provide loose bars of the same diameter and type as the fabric bars, tied to and with a full lap with the bars in each sheet.
- Other requirements: Stagger laps in fabric to each face.

430 WELDING REINFORCEMENT

- Standard: no permitted.
- Joint type/ dimensions: no permitted.
  - Location: no permitted.
- Site welding: Not permitted.

451 FIXING REINFORCEMENT

- Standard: To BS 7973-1 and -2.
- Installation: In addition to any spacers and chairs shown on drawings or schedules, provide adequate support, tie securely and maintain the specified cover.
- Tying:
  - Wire type: 16 gauge black annealed. Use stainless steel wire for stainless steel reinforcement.
  - Ends of tying wire: Prevent intrusion into the concrete cover. Remove loose ends.
- Compatibility of metals: Prevent contact between ordinary carbon steel and stainless or galvanized reinforcement.

470 TOLERANCES ON COVER

- Tolerance (maximum): +-10mm.
- Checking specified cover dimensions: Before concreting check that cover dimensions will be achieved.

480 NOMINAL COVER TO REINFORCEMENT

- As noted on drawings

510 RUST STAINING

- Staining of surfaces of concrete which will be exposed to view in the finished work: Prevent.

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520 COVER METER SURVEY

- Purpose of survey: To check positions of reinforcement and that the specified cover has been achieved.
- Type of cover meter: A magnetic induction digital display type selected to suit arrangement and type of reinforcement.
  - Use: In accordance with recommendations of BS 1881-204 and manufacturer as appropriate to yield accurate results.
  - Surveyor: Experienced with cover meter surveys.
  - Calibration: At the outset and thereafter regularly at 45 minute (maximum) intervals.
- Locations for checking: Include columns, beams, cantilevers, slab soffits and all faces exposed to the weather in the finished structure.
- Timing: As soon as practicable after casting.
  - Notification: Give adequate notice.
- Results: Submit. Notify immediately where specified cover has not been achieved.

521 COVER METER FOR USE BY OTHERS

- Type of cover meter: Provide a magnetic induction digital display type selected to suit arrangement and type of reinforcement.
- Availability: Calibrate and maintain ready for use by others as instructed.
  Periods/ time: Within 24 hours of striking formwork.

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E40 DESIGNED JOINTS FOR INSITU CONCRETE

To be read with Preliminaries/General conditions.

120 CONSTRUCTION/MOVEMENT JOINTS GENERALLY

- Accuracy: Position and form joints accurately, straight, well-aligned and truly vertical or horizontal or parallel with setting out lines of the building.
- Modifications: If necessary to any joint design or location, agree before proceeding.
- Placing concrete:
  - Prevent concrete entering joints or penetrating compressible joint fillers and making movement joints ineffective.
  - Do not place concrete simultaneously on both sides of movement joints.

210 FORMED JOINTS:

- Construction: Rigid, grout-tight side forms or stop ends designed to accommodate projecting bars or fabric without temporary bending or displacement.

230 CONSTRUCTION JOINT FACES

- Roughening: While concrete is still green, remove laitance without loosening the aggregate to leave a thoroughly roughened, exposed aggregate finish.

410 TIE BARS:

- Standard: To BS 4449, Grade 250, clean and free from loose millscale, loose rust, ice, oil and other deleterious substances.
- Position: Fix centred on the joints.

420 MESH TIE STRIPS

- Standard: To BS 4483, clean and free from loose millscale, loose rust, ice, oil and other deleterious substances.
- Position: Fix with the width of the mesh strip centred on the joint.

430 DOWEL BARS

- Standard: To BS 4449, Grade 250, perfectly straight, with sawn (not sheared) ends.
- Debonding: Coat half of each bar with a suitable proprietary debonding compound or fit with a suitable plastic sleeve.
- Position: Fix bars at right angles to and centred on the joint.
- Expansion joints: Fit an approved type of cap incorporating not less than 20 mm of compressible material to debonded ends of all bars

440 LOAD TRANSFER SYSTEMS:
Manufacturer: Permaban, or similar approved
- Product reference: Alpha Joint 4010

450 JOINT SEALANT
All joints in the slab will be filled with a proprietary two-part polysulphide mastic sealant, Fosroc Thioflex 600, or similar approved, prior to occupation.

E41 WORKED FINISHES TO INSITU CONCRETE

To be read with Preliminaries/General conditions.

150 FINISHING GENERALLY

- Timing: Carry out finishing operations at optimum times in relation to the setting and hardening of the concrete.
- Prohibited treatments to concrete surfaces: Wetting to assist working and sprinkling cement.

210 TAMPED FINISH

- Method: Tamp surface with edge of a board or beam to give an even texture of parallel ribs.

230 BRUSHED FINISH

- Finish: Lightly textured surface produced while concrete is still green.

310 SMOOTH FLOATED FINISH

- Finish: Even surface with no ridges or steps.

320 TROWELLED FINISH

- Floating: Float to an even surface with no ridges or steps, then immediately commence curing as section E10.
- Trowelling: When suitably stiff, trowel to a uniform, smooth but not polished surface, free from trowel marks and other blemishes, and suitable to receive specified flooring material. Resume curing without delay.

330 TROWELLED FINISH FOR WEARING SURFACES

- Floating: Float to an even surface with no ridges or steps, then immediately commence curing as section E10.
- Trowelling: Successively trowel at intervals, applying sufficient pressure to close surface, to give a uniform smooth finish free from trowel marks and other blemishes. Resume curing without delay.

335 DRY SHAKE TROWELLED FINISH FOR WEARING SURFACES

- Dry shake manufacturer: Sikafloor, or similar approved
  - Product reference: Fibreshield
  - Colour: Grey
- Floating: Float to an even surface with no ridges or steps, then immediately commence curing as section E10.
- Application of dry shake: At appropriate stages during floating and before trowelling, sprinkle evenly at rate of 5 kg/m².
  - Protection: Prevent marking of existing surfaces.
- Trowelling: Successively trowel at intervals, applying sufficient pressure to close surface, to give a uniform smooth finish free from trowel marks and other blemishes. Resume curing without delay.
- Sealer: Armorex Proseal, or similar approved

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520 SURFACE SEALER

- Manufacturer: Sikafloor, or similar approved
  - Product reference: Proseal, or similar approved
- Preparation: Clean cured concrete to remove dirt, grease, oil and other surface contaminants.
- Moisture content of slab: As recommended by sealer manufacturer. Test relative humidity to BS 8203, Annex A if required to verify suitability to receive sealer.
- Application: Evenly to dry surfaces using sufficient coats to form an effective seal but without a glossy finish.

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E42 ACCESSORIES CAST INTO IN SITU CONCRETE

To be read with Preliminaries/ General conditions.

GENERAL

310 HOLDING DOWN SYSTEMS

- Bolts: To contractor's design.
  - Material: Carbon steel.
  - Standard: To BS 7419.
  - Type: To contractor's design.
  - Designation: 8.8.
  - Diameter: To contractor's design.
  - Coating: As connected steelwork.
- Nuts:
  - Material: Carbon steel.
  - Standard: To BS 4190.
  - Grade: To suit NSSS clause 2.2, Table 2.5.
  - Coating: To contractor's design.
- Washers:
  - Material: To contractor's design.
  - Coating: To contractor's design.
- Bolt box: To contractor's design.
- Anchorage: To contractor's design.
- Other requirements: None.

330 ANCHOR BOLTS

- Material: Stainless steel.
  - Designation: 8.8.
  - Coating or treatment: Galvanized.
- Manufacturer: Contractor's choice.
  - Product reference: Contractor's choice.

335 SHEAR LOAD CONNECTORS

- Material: To contractor's design.
  - Designation: S355.
- Manufacturer: Contractor's choice.
  - Product reference: Contractor's choice.
- Anchors: Welded to back of section.
  - Type/ centres: Contractor's choice.
- Temporary fixings to shutter/ temporary supports: Contractor's choice.

345 ANCHOR PLATES/ COLUMN SHOES

- Location: As contractor's drawings.
- Material: To contractor's design.
  - Designation: S275JR.
- Manufacturer: Contractor's choice.
  - Product reference: Contractor's choice.
- Anchors: Welded to face in contact with concrete.
  - Type/ centres: Contractor's choice.
- Temporary fixings to shutter: Contractor's choice.

380 DUCTS THROUGH SLABS

- Material: Contractor's choice.
- Shape: Generally circular, but rectangular in detailed locations.
  - Size: As detailed.
- Location: As Architect's/M&E drawings.
- Other requirements: None.

390 GALVANIZED COATINGS

- Standard: To BS 7371-6.
- Galvanizing: Applied and passivated by component manufacturer. Threaded items tapped after galvanizing.

395 SHERARDIZED COATINGS ON METAL FASTENERS

- Standard: To BS 7371-8.

EXECUTION

610 HOLLOW ACCESSORIES

- Filling/ sealing: Temporally fill or seal accessory to prevent ingress of grout during concreting. Leave filling/ seals in position until accessory is used.

620 TEMPORARY SUPPORTS

- Location: Provide to hold accessories for casting into unshuttered surface of concrete, set at a level that will not adversely affect finish of concrete surface remote from accessory.
- Position: Hold securely to prevent lateral movement or rotation of accessory during concreting.

63 PROTECTIVE COATINGS

- Inspect: Immediately prior to casting concrete.
- Damage to coatings:
  - Minor: Submit proposals for coating repair.
  - Significant: Replace accessory.

640 INSTALLATION

- Cleanliness: At time of casting, surfaces in contact with concrete to be free from contaminants which may adversely affect accessory, reinforcement, concrete, or bond between accessory and concrete.
- Position: Hold accessory firmly in position, preventing displacement during concreting.
- Other requirements: None.

E60 PRECAST/ COMPOSITE CONCRETE FLOORS/ ROOF DECKS

To be read with Preliminaries/ General conditions.

PROPRIETARY FLOORS/ ROOF DECKS

180 PRECAST STAIRS

- Manufacturer: Contractor's choice.
  - Product reference: Submit proposals.
- Parameters: n/a.
- Finish:
  - Exposed faces: Manufacturer's standard.
  - Treads and risers: To Architect.
- Other requirements: none.

PERFORMANCE SPECIFIED FLOORS/ ROOF DECKS

GENERAL/ PERFORMANCE

240 DETAILING OF PROPRIETARY SYSTEM

- Installation details: Submit location and assembly drawings showing every aspect of the construction, incorporated components and features, trimming for voids, holes for services, and related work by others.
  - Purpose: To allow checking of compatibility with surrounding structure and coordination services.
- Method statement and risk assessment for installation: Submit.
- Programme: Submit well in advance of construction.

250 CONTRACTOR'S STRUCTURAL DESIGN

- Design: Complete in accordance with the designated code of practice to satisfy specified performance criteria.
  - Composite construction: Fully continuous over supports.
  - Fully precast construction: Provide diaphragm and tie action where required.

350 LEVELS OF STRUCTURAL CONCRETE FLOORS

- Tolerances: Standard: To BS 8204-1 or -2.

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G – STEELWORK

G10 STRUCTURAL STEEL FRAMING

To be read with the Steelwork Performance Specification

GENERAL REQUIREMENTS/INFORMATION

115A DESIGN CONSTRAINTS

- Minimum Clear height from FFL to underside portal haunches or valley beams (allowing for deflection): To the Architects details.
- Roof pitch: To the Architects details.
- Position members forming bracing systems or girders of lattice construction so that their lines of action intersect at a point.
- Bolts to be grade 8.8 and not less than 16 mm diameter (12mm for cold formed steelwork).
- Not less than two bolts to be used in any connection.
- Welds to be minimum 6mm fillet welds.
- Top of foundation levels as shown on Engineer's Drawings.

120A DRAWINGS AND CALCULATIONS:

- At date to be advised by the Engineer, submit:
  Column base reactions and setting out information to enable design of foundations to be carried out.
- Before fabrication, submit to Engineer for comment:
  Statement of structural design philosophy and design loads adopted.
  General arrangement drawings with individual steel members clearly identified.
  Where requested by Engineer, calculations for main structural members.
- At date to be advised by Architect submit full set of steelwork calculations for Building Regulations submission.
- All drawings shall be submitted in CAD format agreed with the Engineer.

125 SPECIFICATION STANDARD

- Standard: Comply with latest edition of National Structural Steelwork Specification (NSSS).
  - Document availability: Make available during the course of the Works at fabrication shop and on site.

FABRICATION

180 NOTIFICATION OF COMMENCEMENT

- Give notice: Before fabrication is due to start.
  - Period of notice (minimum): five working days.

190 MARKING:

- Identifying and recording materials and components: Submit details of proposed methods.
- Location of marks:
  - Generally: Visible for checking after erection.
  - Weathering steel: On surfaces not exposed to open view in the completed work.
- Steel to be blast cleaned, pickled, metal sprayed or galvanized: Marked so that subsequent treatment cannot obliterate the marking.

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195 HARD STAMPING

- Usage: Not permitted except as indicated on drawings.

200 FAYING SURFACES FOR HIGH-STRENGTH FRICTION GRIP (HSFG) JOINTS

- Steel 25 mm thick or over: Check faying surfaces for deformities that may reduce slip factor to below design limit.
- Remedial measures: Submit proposals.

210 END CONNECTIONS

- Angle cleats: Project beyond ends of simply supported members.

215 HOLLOW SECTIONS

- Insides of sections: Debris and moisture removed before sealing ends and openings.

220 ACCESS/ VENTILATION HOLES IN BASE PLATES

- Base plates larger than 1 m²: Make 25 mm diameter holes as necessary for pressure grouting, escape of entrapped air or direct compaction of filling/ bedding material.

225STEELWORK TO BE GALVANIZED

- Cutting, drilling and shop welding: Completed before galvanizing.
- Vent and drain holes: Provided as necessary.
  - Locations: Submit proposals.
  - Sealing: Not required.

WELDING

255 SITE WELDING

- Usage: Permitted only where indicated on drawings.
- Working conditions: Suitable and safe. Do not weld when surfaces are wet or when ambient temperature is below 0°C.

270 ADDITIONAL WELDS

- Welds (including tack welds) not indicated on drawings: Not permitted without approval.

290 FINISHED WELDS

- Finished welds: Carefully dressed to remove slag without deforming surface of weld.

ERECTION

410 PRE-ERECTION CHECKS

- Scope: At least 7 days before proposed erection start date, check the following:
  - Foundations and other structures to which steelwork will be attached: Accuracy of setting out.
  - Holding down bolts: Position, protruding length, slackness and condition.
- Inaccuracies and defects: Report without delay.
- Permission to commence erection: Obtain.

420A SETTING OUT

- Permissible deviations: In addition to the requirements of the NSSS, comply with the following:
  Provide appropriate cladding supports to achieve the alignment tolerances required for the cladding panels. Alignment of cladding rails to be within the permissible deviations specified by the cladding supplier and agreed with the cladding contractor.

425 MODIFICATIONS

- Steelwork: Do not modify without approval.

440 COLUMN BASES

- Levels: Adjust using steel shims or folding wedges no larger than necessary.
- Location of shims/wedges: Position symmetrically around perimeter of base plate. Do not use a single central pack.
- Give notice: If space beneath any column base is less than, or over 25 mm greater than, the specified dimension.
- Accuracy of erection: Check, and correct errors before filling and bedding beneath bases and carrying out other adjacent work.

441 MORTAR FILLING/ BEDDING OF COLUMN BASES

- Bolt pockets: Completely filled with neat cement slurry.
- Spaces beneath base plates: Completely filled as follows:
  - Spaces 25-50 mm deep: 1:1 cement:sand mortar, just fluid enough to pour. Tamped well as filling proceeds. Provide temporary shuttering as necessary.
  - Spaces 50-80 mm deep: 1:2 cement:sand mortar, just damp, tamped well against properly fixed supports as filling proceeds.
- Cement: Portland cement BS EN 197-1 - CEM I 42.5 or 52.5.
- Sand: To BS 882, Grading limit M or equivalent to BS EN 12620.

443 PROPRIETARY FILLING/ BEDDING OF COLUMN BASES

- Preparation: Concrete surfaces scarified to provide a good mechanical key.
- Bolt pockets and spaces beneath base plates: Completely filled with approved proprietary grout/bedding material.

444 FINE CONCRETE FILLING/ BEDDING OF COLUMN BASES

- Bolt pockets: Completely filled with neat cement slurry.
- Spaces beneath base plates: Completely filled with a 1:1.25:2 cement:sand:fine aggregate mix, tamped well against properly fixed supports as filling proceeds.
- Cement: Portland cement BS EN 197-1 - CEM I 42.5 or 52.5.
- Sand: To BS 882, Grading limit M or equivalent to BS EN 12620.
- Aggregate size (maximum): 10 mm.

445 MOVEMENT JOINTS

- Sliding surfaces: Coated with molybdenum disulfide grease before connecting.
- Appearance and fit: Bolts centred in slotted holes. Joints free to move.

450 FIXING PROFILED SHEET FOR FLOOR SLABS

- Standard: To BS 5950-4.
- Fixing method: in accordance with supplier's recommendations.

PROTECTIVE COATINGS

523A COMPATIBILITY OF SHOP PRIMER WITH SITE APPLIED INTUMESCENT COATING

- Where the primer coat is to be overcoated with intumescent fire protection, the proprietary brand of primer selected must be compatible with the selected proprietary brand of intumescent, both generally and under fire conditions.
- Obtain relevant recommendations and evidence from the intumescent manufacturer, including fire test data to BS 476-20 and -21, or BS EN 1363-1 and BS EN 1365-2, -3, and/or -4 as appropriate and submit to engineer before proceeding with priming.

PROTECTIVE COATING SYSTEMS

620 GALVANIZING TO BLAST CLEANED STEEL

- Use/ location: Externally exposed steelwork.
- Preparation: Blast cleaning to BS EN ISO 8501-1, preparation grade S.A 2.5 using chilled angular iron grit grade G24 to give a coarse surface profile, followed by chemical cleaning.
- Galvanizing: To BS EN ISO 1461.
  - Minimum mean coating thickness: 140 micrometres.

640A SHOP PAINTING WITH PRIMER FINISH

- Use/ location: Internal steelwork.
- Paint manufacturer: Leigh's Paints, or similar approved.
- Shop preparation: Blast cleaning to BS EN ISO 8501-1, preparation grade SA 2.5.
- Shop primer: High Build Two pack zinc phosphate primer,
  - Epigrip M455, or similar approved.
  - Dry film thickness: Minimum 75 micrometres.
  - Colour: To the Architects details
  - Final paint system to be compatible with intumescent fire protecting paint to the Architects details

  After erection all areas of damaged coating shall be touched up by the steelwork contractor with an approved coating to the satisfaction of the engineer. All touch up areas shall match the original coating, both in colour and surface finish. Any steelwork member that has been touched up on site and does not meet the satisfaction of the engineer shall be fully repainted on site so as to achieve aesthetic uniformity.

670 STEELWORK WITHIN EXTERNAL CAVITY WALLS:

Steelwork to be enclosed within external cavity walls shall be further protected by two coats of high build bitumen paint, applied by the main contractor.

PREPARATION FOR PAINTING

710 OFFSITE PREPARATION AND PAINTING

- Working area: Covered and properly lit, heated and ventilated.
- Sequence of working: Select from the following and submit proposals:
  - Fabricate, blast clean, prime.
  - Blast clean, fabricate, remove flash rust with a light overall sweep blast, prime.
  - Blast clean, apply weldable prefabrication primer, fabricate, prime.
- Prefabrication primer (option 3): Type recommended by manufacturer of post fabrication primer.
  - Thickness of post fabrication primer coat: May be reduced if and as recommended by manufacturer.
- Surfaces inaccessible after assembly: Apply full treatment and coating system including, if necessary, local application of site coatings.

725 MANUAL CLEANING OF NEW STEELWORK

- Preparation: Remove fins, burrs, sharp edges, weld spatter, loose rust and loose scale.
- Surface finish: Clean but unpolished to BS EN ISO 8501-1, grade St 2.
- Finishing: Thoroughly degrease and clean down. Remove any consequent rusting back to grade St 2. Prime without delay.

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730 PREPARATION FOR SITE WELDING OF SHOP PAINTED STEELWORK

- Method: Select from the following:
  - Mask weld areas immediately after blast cleaning and before coating steelwork. If paint system comprises more than one coat, step each coat 30 mm back from edge of preceding coat and away from masked areas. Remove masking immediately before welding.
  - Prepare and paint steelwork including weld areas. Grind off to bare steel around each weld area immediately before welding.

735 TREATMENT OF SITE WELDED JOINTS IN PAINTED STEELWORK

- Preparation: After welding, and without delay, remove scale and weld spatter from weld areas. Remove traces of rust. Wash with clean water and allow to dry. Prime without delay.
- Protective/Decorative coatings: Apply to weld areas to match surrounding painted areas.

736 TREATMENT OF SITE WELDED JOINTS IN GALVANIZED STEELWORK

- Preparation: After welding, and without delay, remove scale and weld spatter from weld areas. Remove traces of rust. Wash with clean water and allow to dry.
- Coating: Reinstate using one of the methods given in BS EN ISO 1461, clause 6.3.

740 BOLTED JOINTS (OTHER THAN FRICTION GRIP JOINTS)

- Steelwork to be shop painted: Apply full shop specification to joint faces.
- Steelwork to be erected with mill finish then site painted: Before erection, prepare and prime joint faces and allow to dry.
- Bolted joints in externally exposed steelwork:
  - Immediately before assembling, apply a further coat of primer and bring surfaces together while still wet.
  - After assembling and before applying site coatings, seal crevices to bolts and joint perimeters with a compatible sealant.

745 FAYING SURFACES OF FRICTION GRIP JOINTS

- Protection: Immediately after blast cleaning and before coating surrounding areas, mask faying surfaces to protect from contamination and deterioration.
  - Paint systems comprising more than one coat: Step each coat 30 mm back from edge of preceding coat and away from masked areas.
- Removal of protection: Immediately before bolting, remove masking. Check faying surfaces are free from adhesive. Clean with solvent if necessary.

750 FRICTION GRIP JOINTS IN SHOP PAINTED STEELWORK

- Post assembly treatment of bolts and surrounding areas: After final tightening of bolts and inspection of joints:
  - Thoroughly degrease and clean uncoated areas including bolts.
  - Prime without delay.
  - Apply full shop coating specification.
- Direct tension indicators: Seal measuring gap to prevent ingress of moisture.

755 UNCOATED FASTENERS

- Treatment: After steelwork erection and before applying site coatings, thoroughly degrease and clean. Without delay, coat to match adjacent shop painted areas.

760 GALVANIZED FASTENERS

- Treatment: After steelwork erection and before applying site coatings, thoroughly degrease and clean. Etch prime.

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765 SITE PREPARATION OF SHOP PAINTED STEELWORK

- Preparation: Before coating, abrade or wash down or both, as recommended by paint manufacturer.

770 SITE PREPARATION OF GALVANIZED SURFACES FOR PAINTING

- Preparation: Thoroughly degrease. Remove white corrosion products. Wash off and allow to dry before applying etching wash or primer.

PAINTING

810 ENVIRONMENTAL CONDITIONS

- General requirements prior to starting coating work:
  - Surfaces: Unaffected by moisture or frost.
  - Steel temperature: At least 3°C above dew point, with conditions stable or improving, and not high enough to cause blistering or wrinkling of the coating.
  - Relative humidity: Below 85%.

815 COATINGS

- Surfaces to be coated: Clean, dust free and suitably dry. Previous coats to be adequately cured.
- Multiple coats of same material: Use different tints to assist checking of complete coverage.
- Penultimate coat: Colour recommended by paint manufacturer to suit top coat colour.
- Finish required: Smooth and even, of uniform thickness and colour, free from defects.

820 FILM THICKNESS

- Wet film thickness: During application, check thickness of each coat with a wheel or comb gauge used in accordance with BS EN ISO 2808.
- Accumulated dry film thickness: After each coat has dried, check total accumulated film thickness.
  - Method: Magnetic or electromagnetic meter.
  - Number and position of measurements: As directed.
  - Validation: Measurements to be independently witnessed.
  - Meter calibration: Check against standard shims and recalibrate regularly against a smooth steel reference plate.
- Average dry film thickness:
  - At least specified thickness over any square metre.
  - No reading to be less than 75% of specified thickness.
- Top coat dry film thickness: Sufficient to give an even, solid, opaque appearance.

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Q – PAVING

Q10 KERBS AND EDGINGS

To be read with Preliminaries/General conditions.

TYPES OF KERBS/EDGINGS AND CHANNELS

112 PRECAST CONCRETE KERBS

- Standard: To BS EN 1340.
- Recycled content: 20% (minimum) to BS EN ISO 14021.
- Designations:
  - CS1 Channel, square;
  - EF Edging, flat top;
  - BN Kerb, bullnosed;
  - HB2 Kerb, half battered; and
  - To match existing.
- Size (width x height x length): Standard.
  Special shapes:
  - Dropper kerbs DL1 and DR1 to footway crossings;
  - Internal angle BNIA;
  - Internal angle HBIA;
  - External angle BNXA; and
  - External angle HBXA.
- Finish: As cast.
- Colour: Grey.
- Bending strength: Class 2.
- Weathering resistance: Class 3.
- Abrasion resistance: Class 4.
- Slip/ skid resistance: No requirement.
- Bedding: Cement mortar.
- Joints generally: Dry, 2-3 mm gap.
- Sealant movement joints: Not required.
- Accessories: None.

395 ROAD MARKING (THERMOPLASTIC)

- Standard: Road Safety Markings Association standard specification document for road marking and road studs (StanSpec).
- Manufacturer: Contractor's choice.
  - Product reference: Contractor's choice.
- Colour: White.
- Retroreflectivity to BS EN 1436: Not required (Class R0).

LAYING

510 LAYING KERBS, EDGINGS AND CHANNELS

- Cutting: Neat, accurate and without spalling. Form neat junctions.
  - Long units (450 mm and over) minimum length after cutting: 300 mm.
  - Short units minimum length after cutting: The lower of one third of their original length or 50mm.
- Bedding of units: Positioned true to line and levelled along top and front faces, in a mortar bed on accurately cast foundations or on a race of fresh concrete.
- Securing of units: After bedding has set, secured with a continuous haunching of concrete or on a race of fresh concrete with backing concrete cast monolithically.

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520 ADVERSE WEATHER

- Conditions: Do not construct if the temperature is below 3°C on a falling thermometer or 1°C on a rising thermometer. Adequately protect foundations, bedding and haunching against frost and rapid drying by sun and wind.

530 CONCRETE FOR FOUNDATIONS, RACES AND HAUNCHING

- Standard: To BS 8500-2.
- Designated mix: Not less than GEN0 or Standard mix ST1.
- Workability: Very low.

540 CEMENT MORTAR BEDDING

- Mix (Portland cement:sand): 1:3.
  - Portland cement: Class CEM I 42.5 to BS EN 197-1.
  - Sand: to BS EN 12620, grade 0/4 or 0/2 (MP).
- Bed thickness: 12-40 mm.

547 BEDDING/BACKING OF UNITS ON FRESH CONCRETE RACES

- Standard: To BS 7533-6.

610 ANGLE KERBS

- Usage: Internal and external 90° changes of direction.
- Cutting of mitres: Not permitted.

620 ACCURACY

- Deviations (maximum):
  - Level: ± 6 mm.
    Horizontal and vertical alignment: 3 mm in 3 m.

625 REGULARITY OF PAVED SURFACES

- Maximum undulation of (non-tactile) paving surface: 3 mm.
  - Method of measurement: Under a 1 m straight edge placed anywhere on the surface (where appropriate in relation to the geometry of the surface).
- Difference in level between adjacent units (maximum):
  - Joints flush with the surface: Twice the joint width (with 5 mm max difference in level).
  - Recessed, filled joints: 2 mm.
    Recess depth (maximum): 5 mm.
  - Unfilled joints: 2 mm.
- Sudden irregularities: Not permit

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Q20 GRANULAR SUBBASES

To be read with Preliminaries/General conditions.

110 THICKNESSES OF SUB-BASE/ SUBGRADE IMPROVEMENT LAYERS

- Thicknesses: Refer to drawings.

120 CHECKING OF SUBGRADES

- Anticipated subgrade conditions:
  - Soil type: Refer to Investigation Report.
  - Plasticity index: Refer to Investigation Report.
  - CBR (minimum): To be tested for new car park and new road and reported to engineer.
  - Depth below formation level to groundwater table: Not encountered.
- Subgrade variation: If material appears to vary from anticipated conditions, or if there are extensive soft spots, report condition and await instruction before proceeding.

140 EXCAVATION OF SUBGRADES

- Standard: Highways Agency 'Specification for Highway Works' clause 603 & 604.
- Final excavation to formation or subformation level: Carry out immediately before compaction of subgrade.
- Soft spots and voids: Give notice.
- Old drainage and service trenches: Excavate to remove soft or damaged material, then backfill using suitable material. Refer to D20/510, 530, 535.
- Wet conditions: Do not excavate or compact when the subgrade may be damaged or destabilized.

145 PREPARATION AND COMPACTION OF SUBGRADES

- Standard: Highways Agency 'Specification for Highway Works' clause 601, 602, 612, 616 & 617. Also Tables 6/1 to 6/4.
- Timing: Immediately before placing sub-base.
- Soft or damaged areas: Excavate to remove soft or damaged material, then backfill using suitable material. Refer to D20/510, 530, 535.
- Compaction: Thoroughly, by roller or other suitable means, adequate to resist subsidence or deformation of the subgrade during construction and of the completed roads/ pavings when in use. Take particular care to compact fully at intrusions, perimeters and where local excavation and backfilling has taken place.

170 GEOTEXTILE FILTER/ SEPARATOR MEMBRANE At Formation

- Standard: Highways Agency 'Specification for Highway Works' clause 609.
- Manufacturer: Terram.
  - Product reference: 1000.
- Jointing: 300 mm overlap.
- Protect from:
  - Exposure to light, except during laying (maximum five hours).
  - Contaminants.
  - Materials listed as potentially deleterious by geotextile manufacturer.
  - Damage, until fully covered by fill.
  - Wind uplift, by laying not more than 15 m before covering with fill.
- Preparation: Remove humps and sharp projections and fill hollows before laying.

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200 SUBGRADE IMPROVEMENT LAYER (CAPPING)

- Material: To Highways Agency 'Specification for highway works', Class 6F2 as per table 6/1 and Series 600 (particularly 601, 602, 608, 610, 612, 613, 616, 617 & 631).
  - Recycled aggregate: Permitted.
- Compaction: Placed and compacted to Highways Agency 'Specification for highway works', table 6/4.

210 HIGHWAYS AGENCY TYPE 1 UNBOUND MIXTURE FOR SUB-BASE

- Material: To Highways Agency 'Specification for highway works', Type 1 as per clause 801, 802 & 803.
  - Recycled aggregate: Permitted.
- Compaction: Placed and compacted to Highways Agency 'Specification for highway works', table 8/4.

220 FROST SUSCEPTIBLE GRANULAR MATERIAL

- Definition (non frost susceptible material): To Highways Agency 'Specification for highway works' clause 801.8.
- Depth of frost susceptible material below final surface of paving (minimum): 450 mm.
- Testing: Test materials used if required and supply certificates.

225 PLACING OF MATERIAL WITH HIGH SULFATE CONTENT

- Standard: To Highways Agency 'Specification for highway works', clauses 801.2 and 801.3.
  Separation distance (minimum): 500 mm.

230 PLACING GRANULAR MATERIAL GENERALLY

- Preparation: Loose soil, rubbish and standing water removed.
- Structures, membranes and buried services: Ensure stability and avoid damage.

240 LAYING GRANULAR SUB-BASES FOR VEHICULAR AREAS

- General: Spread and levelled in layers. As soon as possible thereafter compact each layer.
- Standard: To Highways Agency 'Specification for highway works' clause 802.
- At drainage fittings, inspection covers, perimeters and where local excavation and backfilling has taken place: Take particular care to compact fully.

250 LAYING GRANULAR SUB-BASESFOR PEDESTRIAN AREAS

- General: Spread and levelled.
- Compaction:
  - Timing: As soon as possible after laying.
  - Method: By roller or other suitable means, adequate to resist subsidence or deformation of the sub-base during construction and of the completed paving when in use. Take particular care to compact fully at intrusions, perimeters and where local excavation and backfilling has taken place.

310 ACCURACY

- Permissible deviation from required levels, falls and cambers (maximum):
  - Subgrades:
  Roads and parking areas: +20 -30 mm.
  Footways and recreation areas: ± 20 mm.
  - Sub-bases:
  Roads and parking areas: +10 -30 mm.
  Footways and recreation areas: +10 -30 mm.

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330 COLD WEATHER WORKING

- Frozen materials: Do not use.
- Freezing conditions: Do not place fill on frozen surfaces. Remove material affected by frost. Replace and recompact if not damaged after thawing.

340 PROTECTION

- Sub-bases: As soon as practicable, cover with subsequent layers, specified elsewhere.
- Subgrades and sub-bases: Prevent degradation by construction traffic, construction operations and inclement weather.

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Q21 INSITU CONCRETE ROADS

To be read with Preliminaries/General conditions.

TYPES OF PAVING

115 PAVING WITH EMBEDDED METAL (DESIGNATED CONCRETE) Rigid Paving.

- Subgrade improvement layer: Highways Agency 6F2 unbound mixture, as section Q20.
  - Compacted thickness: Refer to drawings.
- Geotextile filter: As section Q20.
- Granular sub-base: Highways Agency Type 1 unbound mixture, as section Q20.
  - Compacted thickness: Refer to drawings.
- Separation membrane: Polyethylene sheet 125 micrometres thick, edges lapped 300 mm.
- Embedded metal: Fabric reinforcement A393.
- Concrete: To BS 8500-2.
  - Designation: PAV2.
  - Fibres: Not required.
  - Aggregate:

    Size (maximum): 20 mm.

    Coarse recycled concrete aggregate: Not permitted.

    Additional aggregate requirements: None.
  - Consistence class: S2.
  - Additional mix requirements: None.
- Slab thickness (minimum): Refer to drawings.
- Finish: Brush-textured as Highway Agency 'Specification for Highway Works' clause 1026.

GENERAL/ PREPARATION

140 READY-MIXED CONCRETE

- Production plant: Currently certified by a body accredited by UKAS to BS EN 45011 for product conformity certification of ready-mixed concrete.
- Source of ready-mixed concrete: Obtain from one source if possible.
  - Delivery notes: Retain for inspection.
- Declarations of nonconformity from concrete producer: Notify immediately.

240 SUB-BASE PREPARATION

- Surface: Sound, free of debris, mud and soft spots, and suitably close textured.
- Levels and falls: Within specified tolerances:
  - Vehicular areas: ±20 mm.
  - Pedestrian areas: ±12 mm.
  - Drainage outlets: +0 to -10 mm of required finished level.
- Kerbs and edgings: Complete, adequately bedded and haunched, and to required levels.

250 LAYING FABRIC REINFORCEMENT

- Flatness: Lay in flat sheets, straight and out of winding.
- Main reinforcement: Parallel to long axis of slab.
- Temporary support: Securely fix and support fabric during construction of slab.
- Lapping at joints (minimum):
  - Longitudinal bars: 450 mm.
  - Transverse bars: 450 mm.
- Extent of fabric: Fully within slab.
  - Stopping short of slab edges by: 60 ±20 mm.
  - Stopping short of centre line of transverse joints by: 60 ±20 mm.
  - Stopping short of centre line of longitudinal joints: 60 ±20 mm.
- Alternative placing method: Fabric may be placed on top of first compacted layer of concrete, followed by top layer of concrete, placed within two hours of the first layer.

LAYING CONCRETE

310 TRANSPORTING CONCRETE

- General: Avoid contamination, segregation, loss of ingredients, excessive evaporation and loss of workability. Protect from heavy rain.
- Entrained air: Anticipate effects of transport and placing methods in order to achieve specified air content.
- Placing: Use suitable walkways and barrow runs for traffic over reinforcement and freshly placed concrete.

320 LAYING CONCRETE GENERALLY

- Timing: Place as soon as practicable after mixing and while sufficiently plastic for full compaction. After discharge from the mixer do not add water or retemper.
- Temperature of concrete at point of delivery:
  - In hot weather (maximum): 30°C.
  - In cold weather (minimum): 5°C.
- Cold weather:
  - Do not use frozen materials.
  - Do not place concrete against frozen or frost covered surfaces.
  - Do not place concrete when air temperature is below 3°C on a falling thermometer. Do not resume placing until rising air temperature has reached 3°C.
- Surfaces on which concrete is to be placed: Free from debris and standing water.
- Placing in final position: Place in one continuous operation up to construction joints.
  - Do not place concrete simultaneously on both sides of movement joints.
- Spreading: Spread and strike off with surcharge sufficient to obtain required compacted thickness.
- Adjacent work: Form neat junctions and prevent damage. Keep clean all channels, kerbs, inspection covers, etc.

330 COMPACTING

- General: Fully compact concrete to full depth (until air bubbles cease to appear on the surface) especially around reinforcement, cast-in accessories, into corners and at joints.
- Poker vibrators: Do not use to make concrete flow into position. Do not allow to come into contact with fabric reinforcement.
- Wet formed joint grooves: Rectify any irregularities by means of a vibrating float.
- Finish: A dense, even textured surface free from laitance or excessive water.
  Excess concrete: Remove from top of groove formers.

340 MANHOLE COVER AND GULLY GRATING FRAMES

- General: Set frames in independent concrete slabs placed over, but slightly larger than, exterior of manhole shaft or gully pot and any concrete surround.
- Positioning of joints in main slab: Set out so that manhole/ gully slabs are adjacent to a main transverse joint, wherever possible.
- Joints: Separate the independent slabs from main slabs with 25 mm thick joint filler board. Set board 20 mm below top of slab to form a sealing groove.

350 LEVELS

- Lines and levels of finished surface: Smooth and even, with regular falls to prevent ponding.
- Finished surfaces: Within ±6 mm of required levels (+6 or -0 mm adjacent to gullies and manholes).

360 SURFACE REGULARITY

- General: Where appropriate in relation to the geometry of the surface, the variation in gap under a 3 m straight edge (with feet) placed anywhere on the surface to be not more than 5 mm.
- Sudden irregularities: Not permitted.

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JOINTS

410 JOINTS GENERALLY

- Layout: All joints to be accurately located, straight and well aligned.
- Construction joints made at end of working day: Form as contraction joints.
- Modifications to joint design or location: Submit proposals.
- Temporary support: Prior to concreting, set formwork, dowel bars, tie bars, joint filler boards, sealing groove fillets and the like rigidly in position and support to prevent displacement. Maintain support until concrete has set.
- Keep clean:
  - Do not allow concrete to enter gaps or voids in formwork or to render movement joints ineffective
  - Do not allow concrete to impregnate or penetrate materials used as compressible joint fillers.

420 TIE BARS

- Standard: To BS 4449.
  - Product form/ designation: Ribbed.
  - Strength grade: B500B.
- Bar dimensions: 12 mm diameter x 1000 mm long.
- Protection: Coat 150 mm long central section of bars as Highway Agency 'Specification for Highway Works' clause 1012(2).
- Cleanliness: Free from corrosive pitting, loose mill scale, loose rust and contaminants which may adversely affect the tie bars, reinforcement, concrete, or bond between the two.
- Location: Place tie bars centred on and perpendicular to line of joint, within middle third of slab depth.
  - Centres: 400 mm.

  Cover below top crack inducer/ joint groove (minimum): 30 mm.

430 DOWEL BARS

- Standard: To BS EN 13877-3.
  - Material/ Designation: Carbon steel.
  - Strength: B500B.
  - Profile: Plain, round.
  - Condition: Free from oil, dirt, loose rust and scale.
- Bar dimensions: 25 mm diameter x 600 mm long.
- Location: Place dowel bars in movement joints at mid depth of the slab ±20 mm, centred on joint and at 300 mm centres. Bars to be parallel to longitudinal axis and top surface of the slab.
  - Misalignment tolerance per 300 mm length of dowel bar: ±3mm.
- Debonding of bars: Flexible polymeric coating as Highway Agency 'Specification for Highway Works' clause 1011(7).
- Bars in expansion joints: Provide 100 mm long plastics caps for free bar movement. Before placing concrete, ensure there is a space between the end of the cap and the end of the dowel bar 10 mm greater than the thickness of the joint filler board.

440 LONGITUDINAL CONSTRUCTION JOINTS

- Definition: Longitudinal joints are those parallel to the main axis of the paving.
- Standard: To Concrete Society Technical Report 28.
- Formed groove:
  - Size (minimum width x depth): 15 x 13 mm.
  - Preparation: Repair damaged edges of initially cast slab prior to forming groove.
  - Method: Fix preformed fillet against top edge of the initially cast slab before placing the adjacent slab. Remove when concrete is fully cured.
- Completion: Round upper edges of slabs at joints to 5 mm radius. Do not overwork concrete.

450 CONTRACTION JOINTS WITH SAWN GROOVE

- Standard: To Concrete Society Technical Report 28.
- Temperature: Do not start sawing if temperature is falling.
- Sawn groove:
  - Timing: Cut as early as possible after the slab has been placed but without causing edges of groove to spall.
    - Width (minimum): 3 mm.
    - Depth: 3 mm per 10 mm depth of slab or 50 mm, whichever is the greater.
- Upper portion of joint: Enlarge by sawing a groove:
  - Width (minimum): 13 mm.
  - Depth: 25 mm.

470 EXPANSION JOINTS

- Joint filler board:
  - Type: Bitumen impregnated fibre board.
  - Standard: To Highway Agency 'Specification for Highway Works', clause 1015.
  - Thickness: 25 mm.
  - Depth: Joint filler board must extend from underside of sealing groove fillet to full depth of slab to provide complete separation of adjacent slabs.
  - Holes for dowel bars: Accurately bored or punched holes to form a sliding fit for dowel bars.
- Completion: Round upper edges of slabs at joints to 5 mm radius. Do not overwork concrete.

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Q22 ASPHALT ROADS

To be read with Preliminaries/General conditions.

TYPES OF PAVING

110 ASPHALT CONCRETE PAVING TO CAR PARK
- Standard: To BS EN 13108
- Subgrade improvement layer: Highways Agency 6F2 unbound mixture, as section Q20.
  - Compacted thickness: Refer to drawings.
- Granular sub-base: Highways Agency Type 1 unbound mixture, as section Q20.
  - Compacted thickness: Refer to drawings.
- Binder course: AC 20 dense bin.
  - Paving grade: 100/150.
  - Compacted thickness: Refer to drawings.
- Surface course: AC 6 dense surf.
  - Paving grade: 100/150.
  - Compacted thickness: Refer to drawings.
- Reclaimed content:
  - Standard: To BS EN 13108-8.
  - Value (maximum): Surface course 10%, other courses 50%.
- Surface treatment: Not required.
- Other requirements: N/A.

111 ASPHALT CONCRETE PAVING TO ACCESS ROAD
- Standard: To BS EN 13108
- Subgrade improvement layer: Highways Agency 6F2 unbound mixture, as section Q20.
  - Compacted thickness: Refer to drawings.
- Granular sub-base: Highways Agency Type 1 unbound mixture, as section Q20.
  - Compacted thickness: Refer to drawings.
- Base: AC 32 dense base.
  - Paving grade: 40/60
  - Compacted thickness: Refer to drawings.
- Binder course: AC 20 dense bin.
  - Paving grade: 40/60
  - Compacted thickness: Refer to drawings.
- Surface course: HRA 55/10 F Surf 40/60, 10mm aggregate
  - Paving grade: 40/60.
  - Compacted thickness: Refer to drawings.
- Reclaimed content:
  - Standard: To BS EN 13108-8.
  - Value (maximum): Surface course 10%, other courses 50%.
- Surface treatment: Not required.
- Other requirements: N/A.

PREPARATORY WORK/ REQUIREMENTS

240 ACCEPTANCE OF SURFACES
- Surface: Sound, clean and suitably close textured.
- Level tolerances: To Highways Agency 'Specification for highway works', clause 701 & 702.
- Kerbs and edgings: Complete, adequately bedded and haunched and to the required levels.

250 ABUTMENTS

- Vertical edges of manholes, gullies, kerbs and other abutments: Clean and paint with a thin uniform coating of hot applied 70/100 paving grade bitumen.
- Finishing: Tamp surface around projections.
  Level: Flush or not more than 3 mm above projections.

LAYING

310 LAYING GENERALLY

- Preparation: Remove all loose material, rubbish and standing water.
- Adjacent work: Form neat junctions. Do not damage.
- Channels, kerbs, inspection covers etc: Keep clean.
- New paving:
  - Keep traffic free until it has cooled to prevailing atmospheric temperature.
  - Do not allow rollers to stand at any time.
  - Prevent damage.
  - Lines and levels: With regular falls to prevent ponding.
  - Overall texture: Smooth, even and free from dragging, tearing or segregation.
  - State on completion: Clean.

320 ADVERSE WEATHER

- Frozen materials: Do not use.
- Suspend laying:
  - During freezing conditions
  - If the air temperature reaches 0°C, or in calm dry conditions -3°C, on a falling thermometer.
  - Hot rolled asphalt: During periods of continuous or heavy rain or if there is standing water on the base.

340 FLATNESS/ SURFACE REGULARITY

- Deviation of surface: Where appropriate in relation to the geometry of the surface, the variation in gap under a 3 m straight edge placed anywhere on the surface to be not more than:
  - Base: Hand laid, 25 mm and Machine laid, 25 mm.
  - Binder course: Hand laid, 13 mm and Machine laid, 13 mm.
  - Surface course: Hand laid, 10 mm and Machine laid, 7 mm.
  - Where a straightedge cannot be used the surface must be of a comparable standard of accuracy when judged by eye.

351 CONTRACTOR'S USE OF PAVEMENTS

- Preparation for final surfacing:
  - Timing: Defer laying until as late as practicable.
  - Immediately before laying final surfacing: Clean and make good the base/ binder course. Allow to dry.
  - Adhesion: Bond coat.
    Application rate: As manufacturer's recommendation.
    Accuracy: Uniform, without puddles.
    Finishing: Allow emulsion to break completely before applying surface.

360 UNCOATED CHIPPINGS FOR SURFACE TREATMENT

- Chippings: Clean aggregate to BS EN 13043 and PD 6682-2, size 2.8/6.3, grading category Gc85/15.
  - Type/ Source: Contractor's choice.
  - Colour: Contractor's choice.

- Binder:
  - Cutback bitumen to BS EN 12591 or bitumen emulsion to BS 434-1.
  - Do not use cut-back bitumen at temperatures below 15°C.
  - Do not use modified binders without prior approval.
- Application:
  - Binder application rate: In accordance with TRL Road Note 39. Adjust rate for modified binders in accordance with manufacturer's instructions.
  - Coverage: 100–105% shoulder to shoulder to BS 598-108.
  - Compaction: Roll. Do not crush chippings.
- Completion:
  - Before trafficking, remove excess chippings.
  - Carry out further removal of loose chippings disturbed by traffic as necessary.

370 COATED CHIPPINGS

- Chippings and application: To BS EN 13108-4.
  - Type/ Source: Contractor's choice.
  - Size: 14/20mm.
  - Colour: Contractor's choice.

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Q24 INTERLOCKING BRICK/BLOCK ROADS/PAVINGS

To be read with Preliminaries/General conditions.

TYPE(S) OF PAVING

112 CONCRETE BLOCK PAVING TO FOOTPATH AREAS
- Drawing reference(s): Refer to the External Works Layout drawing and the Architects details.
- Granular sub-base: As section Q20 clause 211, thickness 150mm.
- Bedding: Sand
  Nominal thickness after compaction: 30 mm.
- Blocks: To BS 6717-1.
  Manufacturer and reference: To the Architects details
  Size(s): To the Architects details
  Special blocks: To the Architects details
  Colour/finish: To the Architects details
- Setting out:
  Bond: To the Architects details
  Features: To the Architects details

113 CONCRETE BLOCK PAVING TO CAR PARK AREAS
- Drawing reference(s): Refer to the External Works Layout drawing and the Architects details.
- Granular sub-base: As section Q20 clause 211, thickness 200mm.
- Bedding: Sand
  Nominal thickness after compaction: 40 mm.
- Blocks: To BS 6717-1.
  Manufacturer and reference: To the Architects details
  Size(s): To the Architects details
  Special blocks: To the Architects details
  Colour/finish: To the Architects details
- Setting out:
  Bond: To the Architects details
  Features: To the Architects details

LAYING

210 LAYING GENERALLY:
- Ensure that sub-bases are suitably accurate and to specified gradients before laying paving.
- Cut blocks/pavers neatly and accurately without spalling to give neat junctions at edge restraints and changes in bond.
- Select blocks/pavers vertically from at least 3 separate packs in rotation, or as recommended by manufacturer, to avoid colour banding.

213 LAYING SAND BEDDED AND JOINTED PAVING: Lay blocks/pavers on a well graded sand bed and vibrate to produce a thoroughly interlocked paving of even overall appearance with regular sand filled joints and accurate to line, level and profile.

220 SAMPLES: Before placing orders submit for approval representative sample(s) of the proposed block paving system for approval. Ensure that delivered materials match sample(s).

240 ADVERSE WEATHER:
- Do not use frozen materials or lay bedding on frozen or frost covered sub-bases.

242 ADVERSE WEATHER (SAND BEDDED AND JOINTED PAVING):

- Protect stockpiled bedding material to ensure it does not become saturated.
- Protect exposed areas of sand bedding and uncompacted areas of paving from heavy rainfall.
- Remove and replace any sand bedding which becomes saturated before laying paving, or allow to dry before proceeding.
- When conditions are damp, brush in as much jointing sand as possible and minimize site traffic over the paving. As soon as paving is dry, top up joints and complete the compaction.

250 ACCEPTANCE OF NEW SUB-BASES: Before starting work ensure that:

- The sub-base surface is sound, clean, and close-textured enough to prevent loss of sand bedding into it during compaction and use.
- The levels and falls of the sub-base are as detailed, and within the specified tolerance.
- Drainage outlets are within +0 to -10 mm of the required finished level.
- Edge restraints, manhole covers, drainage outlets and the like are complete, to the required levels, and adequately bedded and haunched in mortar that has reached sufficient strength.
- Haunching to gullies, manhole covers and the inside face of edge restraints is vertical so that pavings do not 'ride up' when compacted.

280 SAND FOR BEDDING - GENERAL USE:

- Naturally occurring clean sharp sand from the quaternary geological series or sea dredged, graded to BS 7533-3, Annex D, Category II.
- Free from deleterious salts, contaminants and cement.
- Obtain from only one source and ensure that all sand supplied has consistent grading.
- Maintain at an even moisture content which will give maximum compaction. Sand squeezed in the hand should show no free water and bind together when pressure is released.

281 SAND FOR BEDDING - LIGHT USE:

- Naturally-occurring clean sharp sand or crushed rock fines, graded to BS 7533-3, Annex D, Category IV.
- Free from deleterious salts, contaminants and cement.
- Obtain from only one source and ensure that all sand supplied has consistent grading.
- Maintain at an even moisture content which will give maximum compaction. Sand squeezed in the hand should show no free water and bind together when pressure is released.

290 SAND FOR JOINTING:

- Clean free flowing dried silica sand graded to BS 7533-3, table D3.
- Do not use sand that will stain paving blocks.
- Free from deleterious salts, contaminants and cement.

300 LAYING BEDDING GENERALLY:

- Determine by trial on site the depth of loose bedding material needed to ensure the specified thickness after final compaction of paving.
- Maintain a prepared area of bedding not less than 1 m and not more than 3 m in advance of the laying face at all times, and not more than 1 m at the conclusion of any working period.
- Do not leave areas of bedding exposed; proceed with laying blocks/pavers immediately.
- Do not deliver bedding materials to working area over uncompacted paving. Prevent disturbance to the bedding course by pedestrian or wheeled traffic.
- Fill, rescreed and recompact any parts of the bedding layer disturbed by removal of screed rails or trafficking.

310 LAYING BLOCKS/PAVERS:

- Commence from an edge restraint. Unless specified otherwise, lay blocks/pavers hand tight with a joint width of 2-5 mm. Maintain an open working face and do not use mechanical force to obtain tight joints. Place blocks/pavers squarely with minimum disturbance to bedding.
- Supply blocks/pavers to laying face over newly laid paving but stack at least 1 m back from laying face. Do not allow plant to traverse areas of uncompacted paving.
- Continually check alignment of pavers with string lines as work proceeds to ensure maintenance of accurate bond.
- Infill at edge restraints as work proceeds. Wherever the type of bond and angle of edging permit, avoid very small infill pieces at edges by breaking bond on the next course in from the edge, using cut blocks/pavers not less than 1/3 full size.
- In situ mortar infill, 1:3 cement:sand as section Z21, colour to match paviors, may be used in areas up to 40 x 40 mm.

315 OBSTRUCTIONS:

- After laying full paving units, trim blocks/pavers neatly around drainage fittings and other obstructions, with joints not exceeding 5 mm and without reducing the thickness of the blocks/pavers.
- Where this is not possible, form a rectangular in situ surround of grade C35 air entrained concrete, maximum aggregate size 10 mm, to BS 5328, with a minimum thickness of the combined depth of blocks/pavers and sand bedding, and a minimum width of 100 mm all round the obstruction, colour matched to approval.

320 CUT BLOCKS/PAVERS with a masonry saw only.

340 COMPACTING AND JOINTING:

- Thoroughly compact blocks/pavers with vibrating plate compactor as laying proceeds but after infilling at edges. Apply the same compacting effort over the whole surface.
- Do not compact within 1 m of the working face.
- Do not leave uncompacted areas of paving at the end of working periods, except within 1 m of unrestrained edges.
- Check paving after compacting first few metres, then at frequent intervals to ensure that surface levels are as specified; if they are not, lift blocks/pavers and relay.
- Except for permeable pavings, brush sand into joints, revibrate surface and repeat as required to completely fill joints.
- Avoid damaging kerbs and adjacent work during vibration. Do not begin vibration until kerb haunchings have matured.

342 BEDDING LAYER TOLERANCES, after final compaction:

- 50 mm nominal thickness: +15/-20 mm.
- 30 mm nominal thickness: +12/-0 mm.

345 LEVELS OF PAVING: Permissible deviation from specified levels to be ± 6 mm generally. Set paving 6-10 mm above gullies and 3-6 mm above surface drainage channels.

349 REGULARITY:

- Sudden irregularities not permitted.
- Where appropriate in relation to the geometry of the surface, the variation in gap under a 3 m straight edge placed anywhere on the surface to be not more than 10 mm.
- The difference in level between adjacent blocks/pavers to be not more than 2 mm.

370 AFTER COMPLETION OF PAVING WITH SAND FILLED JOINTS:

- Do not use vacuum cleaning machines.
- Leave a thin (1-2 mm) layer of jointing sand over the paving.

380 REMEDIAL WORK: During the Contract and Defects Liability Period:

- Any areas of paving which settle must be relaid as specified.
- Where early trafficking leads to settlement of the jointing sand, refill the joints as specified.

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R – DISPOSAL SYSTEMS

R12 BELOW GROUND DRAINAGE SYSTEMS

To be read with Preliminaries/General conditions.

PRODUCTS

312 ADAPTORS TO PLASTICS DRAINAGE

- Material and standard: Plastics to BS 4660 and Kitemark certified or to BS EN 1401-1 and Kitemark certified.
- Type: To suit waste pipe / discharge stack / rainwater pipe connection to underground plastic pipe.
- Manufacturer: Contractor's choice.
- Reference: Contractor's choice.

313/4 GULLIES

- Standards: To BS EN 1253-1, -2, -3, -4 and -5; or
  - Clay: To BS EN 295-1 and Kitemark certified, or Agrément certified.
  - Concrete: To BS 5911-6 and Kitemark certified, or Agrément certified.
  - Plastics: To BS 4660 and Kitemark certified, or Agrément certified.
  - Polypropylene: To BS EN 1852-1.

Road Gullies -
Milton Precast (or similar approved) – Load Class D400
Precast concrete flexible jointed trapped gully with a 150mm outlet. Internal size: 450mm diameter, 900mm deep (Gully capacity 95 litres).
Yard Gullies -
Hepworth (or similar approved) – Load Class E600
Clay square gully with a 100mm outlet. Internal size: 160mm square, 280mm deep.

344 PIPES, BENDS AND JUNCTIONS - PLASTICS - STRUCTURED WALL

- Standard: Type B, to BS EN 13476-1 and -3, Kitemark or Agrément certified.
- Supplementary requirements: Puncture resistance, jetting resistance and longitudinal bending to requirements of WIS 4-35-01, issue 2.
- Material: PVC-U.

357 CONNECTORS - SADDLE

- Standards: Plastics: To BS 4660 and Kitemark certified, or Agrément certified.
- Jointing: Connections to larger pipes should be made so invert of smaller pipe does not adjoin below mid height of larger pipe.

359 FLEXIBLE COUPLINGS

- Standard: To BS EN 295-4 or WIS 04-41-01 and Kitemark certified, or Agrément certified.

371 RODDING POINTS

- Standards: Plastics: To BS 4660 and Kitemark certified, or Agrément certified.
- Sizes: DN 150.

407 CONCRETE MANHOLES

- Standards: To BS 5911-3 and BS EN 1917 and Kitemark certified; or BS 5911-4 and BS EN 1917.
- Cement type and content: To BS 5911-1 and BS EN 1916.

412 INSPECTION CHAMBERS

- Standard: To BS EN 13598-2, BS 4660 and Kitemark certified, BS EN 13589-1, or Agrément certified.

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421 OIL AND PETROL SEPARATOR UNITS

Type: To suit application, by-pass separator or full retention as shown on Engineer's drawings

- Class: To suit application, class 1 or 2, as shown on Engineer's drawings
- Standard: To Environment Agency PPG 3 and BS EN 858, with oil level alarm.
- Manufacturer: SPEL Products,or similar approved.
- - Product reference: as shown on Engineer's drawings
- Nominal size: as shown on Engineer's drawings
- Inlet pipe: as shown on Engineer's drawings
- Outlet pipe: as shown on Engineer's drawings
- Vent pipes: as shown on Engineer's drawings
- Access covers and seating: Ductile iron, seated on Class B engineering bricks or precast concrete cover frame seating rings.

422 OUTFALLS TO WATERCOURSE

- Type: Precast Concrete Headwall
- Pipe outflow invert (minimum): Seasonal peak level or 150 mm above normal water level, whichever is the higher.
- Pipe surround and backfill to the last 2 m run of drain: Excavated subsoil, rammed home.
- Splash plate: Plain insitu concrete, mix as specified under 'Generally' .
- Vermin grating: Mild steel frame to extend 75 mm beyond pipe opening on all sides, with 25 mm maximum opening steel mesh grille. Top hinged on built-in fish-tail straps and with bottom pin lock.
- - Finish: Galvanized to BS EN ISO 1461 after fabrication.

439 MANHOLE STEPS

- Standard: To BS EN 13101.
- Type: D.
- Material: Plastics coated steel.

444-8 SEALING FOR CONCRETE MANHOLES

- Mortar: Contractors choice.
- Bituminous strips: Submit proposals.
- Sealant: Submit proposals.

464 MODULAR STORMWATER ATTENUATION UNITS - Refer to drawings.

471 ACCESS COVERS AND FRAMES

- Standard: To BS EN 124.
- Loading grades to BS EN 124:
  - A15, for pedestrian use;
  - B125, for light traffic use;
  - C250, for slow moving traffic use; and
  - D400, for heavy use.

475 ACCESS LADDERS Depth to soffit 3m to 6m

- Standard: To BS 4211.

483 CONCRETE (GENERAL)

- Standard: To BS 8500-2.
- Concrete: Designated, GEN1.
  - Foul manholes and sewers: Pre-cast units and in-situ concrete for benchings to foul manholes to be formed using Class 4 sulphate resisting concrete (min. cement content of 360kg/m³, max. free water ratio of 0.45 and 20mm n.s. aggregate).

485 CONCRETE (STRUCTURAL)

- Standard: To BS 8500-2.
- Concrete: Designated, GEN3.

496 GRANULAR MATERIAL – NATURAL

- Standard: To BS EN 12620.

510A DRAINAGE CHANNEL (CAR PARK AREAS WITHOUT SUDS)

ACO Water Management (or similar approved) – Load Class C250
Grated channel, sized to suit discharge as noted on the drainage drawings and discharging via trapped rodable sump. Rodding access to provided at head of run, at change of directions or at minimum 15m centres.

510B DRAINAGE CHANNEL (CAR PARK AREAS WITH SUDS)

Permavoid Permachannel (or similar approved) – Load Class C250
Grated channel, sized to suit discharge as noted on the drainage drawings and discharging via trapped rodable sump. Rodding access to provided at head of run, at change of directions or at minimum 15m centres.

510C HEAVY DUTY DRAINAGE CHANNEL (HGV AREAS)

Gatic Castslot (or similar approved) – Load Class D400
Ultra slot channel, sized to suit discharge as noted on the drainage drawings and discharging via trapped rodable sump. Rodding access to provided at head of run, at change of directions or at minimum 15m centres.

EXECUTION

611 EXISTING DRAINS

- Setting out: Before starting work, check invert levels and positions of existing drains, sewers, inspection chambers and manholes to be reused against drawings. Report discrepancies.
- Protection: Protect existing drains to be retained and maintain normal operation if in use.
- Covers: Reset to proposed levels.

616 SELECTED FILL FOR BACKFILLING

- Selected fill: As-dug material, free from vegetable matter, rubbish, frozen soil and material retained on a 40 mm sieve.
  - Compaction: By hand in 100 mm layers.

623 LOWER PART OF TRENCH – GENERAL

- Trench up to 300 mm above crown of pipe: Vertical sides, width as small as practicable.
  Width (minimum): External diameter of pipe plus 300 mm.

625 LOWER PART OF TRENCH - TRANSITION DEPTH

- Trench widths up to 300 mm above crown of pipe (maximum):
  - DN 100 pipelines more than 6.0 m deep: 600 mm.
  - DN 150 pipelines more than 5.4 m deep: 700 mm.
  - DN 225 pipelines more than 4.0 m deep: 800 mm.
  - DN 300 pipelines more than 2.9 m deep: 900 mm.

631 TYPE OF SUBSOIL

- General: Where type of subsoil at level of crown of pipe differs from that stated for the type of bedding, surround or support, give notice.

635 FORMATION FOR BEDDINGS

- Timing: Excavate to formation immediately before laying beddings or pipes.
- Mud, rock projections, boulders and hard spots: Remove. Replace with consolidated bedding material.
- Local soft spots: Harden by tamping in bedding material.
- Inspection of excavated formations: Not required.

641 PIPES AT DIFFERENT LEVELS IN COMMON TRENCH

- Subtrench: Permissible provided soil of step is stable and unlikely to break away.
  - Subtrench not permissible: Trench depth as required for lower pipe. Increase thickness of bedding to upper pipe as necessary.
- Lower pipe: Backfill with compacted granular material to at least half way up higher pipe.
- Clear horizontal distance between pipes (minimum):
  - Pipes up to DN 700: 350 mm.
  - Pipes exceeding DN 700: 500 mm.

651-78 BEDDING AND SUPPORT

- Type of subsoil: Refer to ground investigation report.
- Granular material: Natural.
- Bedding: Granular, compacted over full width of trench.
- Blinding for concrete surrounds:
  - Material: Concrete (general).
  - Thickness (minimum): 25 mm.
  - Width: Full width of trench.
  - Allow to set before proceeding.
- Pipes: Dig slightly into bedding, rest uniformly on barrels and adjust to line and gradient.
- Surround:
  - Material: Granular or selected fill free from stones larger than 40mm.
  - Depth: To slightly above crown of pipe.
  - Compaction: By hand.
- Surround below slabs, cast integrally with slab:
  - Material: Concrete of same mix as slab.
- Backfilling:
  - Material and depth: Protective cushion of selected fill to 300 mm above crown of pipe; or additional granular material, to 100 mm above crown of pipe.
  - Compaction: By hand in 100 mm layers.
- Vertical construction joints in concrete encased pipes:
  - Location: At face of flexible pipe joints.
  - Material: 18 mm thick compressible board precut to profile of pipe.
  - Socketed pipes: Fill gaps between spigots and sockets with resilient material to prevent entry of concrete.

680 CONCRETE SURROUND FOR PIPE RUNS NEAR FOUNDATIONS

- Class Z surround: Provide in locations where bottom of trench is lower than bottom of foundation and as follows (horizontal clear distance between nearest edges of foundations and pipe trenches):
  - Trenches less than 1m from foundations: Top of concrete surround not lower than bottom of foundation.
  - Trenches more than 1m from foundations: Top of concrete surround not lower than Dmm below bottom of foundation, where Dmm is horizontal distance of trench from foundation, less 150mm.

683 LAYING PIPELINES

- Laying pipes: To true line and regular gradient on even bed for full length of barrel with sockets (if any) facing up the gradient.
- Ingress of debris: Seal exposed ends during construction.
- Timing: Minimize time between laying and testing.

685 JOINTING PIPELINES

- Connections: Durable, effective and free from leakage.
- Junctions, including to differing pipework systems: With adaptors intended for the purpose.
- Cut ends of pipes: Clean and square. Remove burrs and swarf. Chamfer pipe ends before inserting into ring seal sockets.
- Jointing or mating surfaces: Clean and, where necessary, lubricate immediately before assembly.
- Allowance for movement: Provide and maintain appropriate clearance at ends of spigots as fixing and jointing proceeds.
- Jointing material: Do not allow to project into bore of pipes and fittings.

687 CONCRETE SURROUND FOR CROSSOVERS

- Class Z surround: Provide where two pipelines (other than plastics pipes) cross with less than 300 mm separation.
  - Extent, on both pipes: 1m centred on the crossing point, and beyond as necessary to come within 150 mm of nearest flexible joints.

689 PIPELINES PASSING THROUGH STRUCTURES

- Pipelines that must be cast in or fixed to structures (including manholes, catchpits and inspection chambers): Provide 600 mm long rocker pipes adjacent to the external face of the structure (or both faces where appropriate, e.g. walls to footings), with flexible joints at both ends.
  - Distance to rocker pipe from structure (maximum):150 mm.
- Provision for movement for pipelines that need not be cast in or fixed to structures (e.g. walls to footings):
  - Rocker pipes as specified above; or
  - Openings in the structures to give 50 mm minimum clearance around the pipeline.

  Closely fit a rigid sheet to each side of opening to prevent ingress of fill or vermin.

691 BENDS AT BASE OF SOIL STACKS

- Type: Nominal 90° rest bends up to 3 storeys (Use long radius when serving above 3 storeys).
  - Radius to centreline of pipe (minimum): 200 mm (800mm for long radius).
- Height of invert of horizontal drain at base of stack below centreline of lowest branch pipe (minimum): 450 mm (750mm when serving above 3 storeys).
- Bedding: Do not impair flexibility of pipe couplings.

  Material: Concrete (general).

693 DIRECT CONNECTION OF GROUND FLOOR WCS TO DRAINS

- Drop from crown of WC trap to invert of drain (maximum): 1.3 m.
- Horizontal distance from the drop to a ventilated drain (maximum): 6 m.

697 INSTALLING FLEXIBLE COUPLINGS

- Ends of pipes to be joined: Cut cleanly and square.
- Outer surfaces of pipes to be joined: Clean and smooth. Where necessary, e.g. on concrete or iron pipes, smooth out mould lines and/ or apply a cement grout over the sealing area.
- Clamping bands: Tighten carefully to make gastight and watertight seals.

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699 CONNECTIONS TO PUBLIC SEWERS

- Standard: 'Sewers for Adoption 6th Edition.
- General: Connect new pipework to existing adopted sewers to the requirements of the adopting authority and following receipt of S106 connection consent.
- Timing: Form connections prior to commencing any upstream drainage.
- Give notice: If connection point differs from information design drawings are based on.

705 INITIAL TESTING OF PIPELINES

- Before testing:
  - Cement mortar jointing: Leave 24 h.
  - Solvent welded pipelines: Leave 1 h.
- Method: Block open ends of pipelines to be tested and pressurise. Air test short lengths to BS EN 1610.

711 TRENCH SUPPORTS

- Removal of trench supports and other obstacles: Sufficient to permit compacted filling of all spaces.

713 INSTALLING ROOT BARRIERS

- Root barrier installation: Full depth of excavation. Fit closely to trench wall nearest the tree.

715 BACKFILLING TO PIPELINES

- Backfilling above top of surround or protective cushion: Material excavated from trench, compacted in layers 300 mm (maximum) thick.
- Heavy compactors: Do not use before there is 600 mm (total) of material over pipes.

718 BACKFILLING OVER CONCRETE

- Minimum times from placing concrete:
  - Backfilling generally: 24 h.
  - Heavy compactors and traffic loads: 72 h.

720 BACKFILLING UNDER ROADS AND PAVINGS

- Backfilling from top of surround or protective cushion up to formation level: Granular sub-base material, laid and compacted in 150 mm layers.

722 PUBLIC ROADS AND PAVINGS

- Excavating and backfilling of trenches: To Department for Transport 'Specification for the reinstatement of openings in highways'.

734 INSTALLING ACCESS POINTS AND GULLIES

- Connections:
  - 100Ø: Lay at min. 1:40 unless noted otherwise on drawings.
  - 150Ø: Lay at min. 1:80 unless noted otherwise on drawings.
- Bedding:
  - Material: Concrete.
  - Thickness (minimum): 150 mm.
- Surround:
  - Material: Concrete (general).
  - Thickness (minimum): 150 mm.
  - Height: Full height.

- Backfilling:
  - Material: Granular material - natural, size 4/10, to 100 mm above crown of pipes, then selected fill.
  - Compaction: By hand in 100 mm layers.
- Setting out relative to adjacent construction features: Square and tightly jointed.
- Permissible deviation in level of external covers and gratings: +0 to -6 mm.
- Raising pieces (clay and concrete units): Joint with 1:3 cement: sand mortar.
- Exposed openings: Fit purpose made temporary caps. Protect from traffic.

741 INSTALLING PLASTIC INSPECTION CHAMBERS

- Bedding:
  - Material: Granular material - natural, size 4/10.
  - Thickness (minimum): 100 mm.
- Surround:
  - Material: Concrete (general) for trafficked areas.
  - Thickness (minimum): 150 mm.
- Backfilling: Granular material - natural, size 4/10, to 100 mm above crown of pipes, then selected fill.
  - Compaction: By hand in 100 mm layers.
- Concrete collar:
  - Material: Concrete (general).
  - Thickness (minimum): 150 mm.
  - Width (minimum): 150 mm.

743 INSTALLING CONCRETE MANHOLES

- Bases:
  - Material: Concrete (general).
  - Thickness (minimum): 225 mm.
- Surround:
  - Material: Concrete (general).
  - Thickness (minimum): 150 mm.
  - Height: Full height.
- Backfilling:
  - Material: Selected fill.
  - Compaction: By hand in 100 mm layers.

747 INSTALLING OIL AND PETROL SEPARATOR UNITS

- Base:
  - Material: Concrete (general).
  - Thickness (minimum): 200 mm.
- Surround:
  - Material: Concrete (general).
  - Thickness (minimum): 150 mm.
- Backfilling: Selected fill.
  - Compaction: By hand in 100 mm layers.
- Installation: Fill tank with water then encase tank and access shafts with concrete to fully support tank.
- Vent pipe termination: 2.4 m (minimum) above ground level.

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757 LAYING CONVENTIONAL CHANNELS, BRANCHES AND BENCHING

- Main channel: Bed solid in 1:3 cement/sand mortar.
  - Branches: Connect to channel, preferably at half pipe level, so that discharge flows smoothly in direction of main flow.
  - Branches greater than nominal size 150 mm: Connect the branch soffit level with the main drain soffit.
  - Connecting angles more than 45° to direction of flow: Use three-quarter section channel bends.
- Benching:
  - Material: Concrete (general).
  - Profile: Rise vertically from top of main channel to a level not lower than soffit of outlet pipe, then slope upwards at 10% to walls.
  - Topping:

    Material: Concrete (structural).

    Application: Before benching concrete has set, and with dense smooth uniform finish.

771 INSTALLING OUTFALLS

- Pipe outflow invert (minimum): Seasonal peak level or 150 mm above normal water level, whichever is the higher.
- Pipe surround and backfill to the last 2 m run of drain: Excavated subsoil, rammed home.

773 INSTALLING ACCESS COVERS AND FRAMES

- Seating: Brickwork.
- Bedding and haunching of frames: Continuously.
  - Material: 1:3 cement:sand mortar.
  - Top of haunching: 30 mm below surrounding surfaces.
- Horizontal positioning of frames:
  - Centred over openings.
  - Square with joints in surrounding paving.
- Vertical positioning of frames:
  - Level; or
  - Marry in with levels of surrounding paving.
- Permissible deviation in level of external covers and frames: +0 to -6 mm.

776 EXPOSED OPENINGS IN INSPECTION CHAMBERS, ACCESS POINTS AND EQUIPMENT

- General: Fit purpose made temporary caps. Protect from site traffic.

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COMPLETION

901 REMOVAL OF DEBRIS AND CLEANING

- Preparation: Lift covers to manholes, inspection chambers and access points. Remove mortar droppings, debris and loose wrappings.
- Timing: Before cleaning, final testing, CCTV inspection if specified, and immediately before handover.
- Cleaning: Thoroughly flush pipelines with water to remove silt and check for blockages. Rod pipelines between access points if there is any indication that they may be obstructed.
- Washings and detritus: Do not discharge into sewers or watercourses.
- Covers: Securely replace after cleaning and testing.

921 FINAL TESTING OF PRIVATE GRAVITY DRAINS AND SEWERS

- Before testing:
  - Cement mortar jointing: Leave 24 h.
  - Solvent welded pipelines: Leave 1 h.
- Standard: To Building Regulations.
- Method: Contractor's choice.

941 WATER TESTING OF MANHOLES AND INSPECTION CHAMBERS

- Timing: Before backfilling.
- Standard:
  - Exfiltration: To BS EN 1610.
  - Method: Testing with water (method W).

  Infiltration: No identifiable flow of water penetrating the chamber.

951 TESTING OF ANCILLARY COMPONENTS

- Components:
  - Petrol interceptors;
  - Surface water storage tanks;
  - Grey water storage tanks; and
  - Foul water storage tanks.
- Standard: To BS EN 1610.
  - Tests: Manufacturers recommendations.

  Method: Manufacturers recommendations.

971 CCTV INSPECTION OF PRIVATE PIPELINES

- General: Carry out and record internal inspection using CCTV equipment.
  - Locations to be inspected: Foul and surface water drains and Adoptable foul and surface water sewers.
- Illumination: Of adequate intensity.
- Recording: Provide continuous position recording, still photographs and stopping of the camera at any point.

972 CCTV INSPECTION OF ADOPTABLE PIPELINES

- General: Permit the Adopting Authority or its agent to provide equipment and personnel to carry out and record internal CCTV inspection of foul and surface water sewers and associated manholes after completion.
- Pipelines under highways: Complete all construction except for laying of wearing course before inspection.
- Remedying of defects that are revealed: Obtain instructions.

978 LIFTING KEYS

- Lifting keys: Supply suitable keys for each type of access cover.
  - Timing: At completion.

980 INSTRUCTIONS FOR HEALTH & SAFETY FILE

- Manufacturer's user and maintenance instructions: Submit for oil and petrol separator units.

OPUS

Flood Risk Assessment & Drainage Strategy

Site at Station Road

Hayling Island, Hants

Flood Risk Assessment & Drainage Strategy

Site at Station Road

Hayling Island, Hants

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Issue 2	21/10/15	Updated to show revised site layout and S98 Offsite sewer work proposed by Southern Water
Issue 3	10/12/15	Updated layout plan ST-10-03 rev M to Appendix A Updated layout has no material impact on impermeable areas so Appendix C drawing not updated.

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Appendices

Appendix A Existing and Proposed Site Layout
Appendix B SFRA Map Data, EA Data, Sewer Data
Appendix C Proposed Drainage Data
Appendix D Conditions & Limitations

1 Introduction

1.1 Instructions were received from Barratt Homes to undertake a Flood Risk Assessment (FRA) for the development of 76 residential dwellings and 1,000 m² of light industrial accommodation (use class B1) with associated parking, access, landscaping and surface water drainage on land at Station Road, Hayling Island, Hants.

1.2 This assessment has been prepared by A P Traves BSC CEng MIStructE MCIHT.

1.3 The client's attention is drawn to the conditions and limitations contained in Appendix D.

2 Development Description & Location

2.1 The development site comprises some 2.8 Ha of land at Station Road, Hayling Island, Hants (grid reference SZ 710 997). The land is identified on the aerial photograph in Appendix A.

2.2 The site use currently comprises agricultural use.

2.3 It is proposed to develop the site for an estate of 76 residential dwellings (2.4Ha) and 1,000 m² of light industrial accommodation (0.4 Ha) (use class B1) with associated parking, access, landscaping and surface water drainage. The proposed layout for the site is shown on Urban Design drawing ST-10-03 rev M, a copy of which is contained in Appendix A.

3 Local Development Documents & Strategic Flood Risk Assessment

3.1 The Partnership for Urban South Hampshire (PUSH) Strategic Flood Risk Assessment (SFRA) has been reviewed (refer to appendix for local mapping) and this indicates the following.

3.2 SFRA Map 1A indicates the site is located wholly within Flood Zone 1 (FZ1).

3.3 SFRA Map 1B indicates no flood zone 3 hazard within the site.

3.4 SFRA Map 1D indicates that the site is not at risk from breaching of defences.

3.5 SFRA Map 1E indicates the site remains wholly within FZ1 inclusive of climate change to 2115AD.

3.6 SFRA Map 1F2 indicates no history of groundwater flooding at the site and indicates a low generic bedrock permeability.

3.7 SFRA Map 1F5 indicates no history of sewer flooding at the site.

3.8 The Environment Agency (EA) historic flood map within the SFRA indicates no historic flood events within the site.

3.9 Flood mapping data has also been reviewed from the EA website (refer to Appendix for local mapping). This indicates the following:

3.10 The EA mapping indicates the site is wholly in FZ1.

3.11 The EA mapping indicates the site is in the lowest classification for river and sea flood risk (FZ1)

3.12 The EA mapping indicates the site is not in an area at risk of flooding from reservoirs.

3.13 The EA mapping indicates the site is at a 'very low' risk of flooding from surface water.

3.14 The EA mapping indicates the site is not located within a groundwater source protection zone.

3.15 The EA mapping indicates the site is not within a surface water or groundwater protection area for drinking water.

3.16 Groundwater attributes are further discussed in section 5.

4 Catchment Flood Management & Shoreline Management Plans

4.1 The site is at an elevation of some 6m AOD and is remote from the influence of tidal flooding. Shoreline Management Plans are not applicable to this location.

4.2 The South east Hampshire Catchment Flood Management Plan summary – December 2009 (CFMP) indicates the site falls within sub-area 1, Portsmouth and Langstone Harbours. The CFMP states that Policy 5 is the preferred policy approach:

- *"Areas of moderate to high flood risk where we can generally take further action to reduce flood risk. This policy will tend to be applied to those areas where the case for further action to reduce flood risk is most compelling, for example where there are many people at high risk, or where changes in the environment have already increased risk. Taking further action to reduce risk will require additional appraisal to assess whether there are socially and environmentally sustainable, technically viable and economically justified options."*

4.3 Overall the CFMP does not present any issues that would prohibit the development of this site with respect to flood issues provided the surface water drainage is based on SuDS principles.

5 Catchment Data

5.1 The site lies in a coastal location remote from terrestrial main rivers and does not lie within a gauged catchment. Surface water drainage of the site currently comprises ditches to the

eastern and western boundaries, both of which drain to the north. The eastern ditch also extends partly along the southern boundary. The ditches constitute surface watercourses and are dry when rainfall is light, typically for much of the summer. The ditches also receive outfall from a few small diameter public surface water sewers of limited catchment and serving some of the urban area immediately to the south.

5.2 The BGS Geology of Britain viewer indicates the site bedrock geology to be London Clay with undifferentiated superficial River Terrace deposits of sand silt and clay.

5.3 The site falls slightly to the north.

5.4 The site soils investigation works to date is reported on by Messrs Wilson Bailey in their report J1510-9/DB/c01 dated 5 June 2015. Reference should be made to this report for full details but particular issues are summarised in the following paragraphs.

5.5 Twelve small diameter boreholes were drilled across the site to depths of up to 5.00m below ground level. The ground conditions have been found to comprise a significant depth of topsoil between 0.40 m and 0.65 m. Underlying the topsoil a soft brickearth type silty clay has been encountered to depths of between 0.95 m and 1.5 m below ground level, beneath which a generally medium to coarse sand with variable gravel content has been encountered to depths of less than about 4.00 m, whereupon stiff grey clay soils of the London Clay have been encountered

5.6 Groundwater was encountered in each exploratory hole at depths of about 1.50 m, although subsequent limited groundwater monitoring has indicated a groundwater rest level at a depth of less than about a metre. Monitoring carried out during the morning and during the afternoon at times consistent with a high and low tide on a non-peak sprint tide indicate that the groundwater is tidally influenced, with a variation of between 0.05m and 0.12 m. Assessed groundwater flow direction is to the northeast. The monitoring suggests that the groundwater is under a sub-artesian pressure, with the groundwater level higher than the base of the overlying (confining) clay. The site has soil permeability within the granular soils underlying the clay, with preliminary falling head tests suggest a permeability in the mid E-5m/s range. Discharge to these granular soils would entail a direct discharge to groundwater as there is no partially saturated zone over the groundwater in which to form a soakaway. It is therefore considered that traditional soakaways would not be viable at this site.

5.7 The current and historical use of the site as open agricultural land is not considered to pose a risk of ground contamination. The adjoining historical site land uses of a railway sidings to the west and a former gas works to the south present potentially significant sources of off site potentially mobile ground contamination, albeit mitigate by the time that has elapsed since the potentially contaminative activities were carried out on these adjoining areas. The ground investigation has not identified any visual or olfactory indications of ground contaminants and elevated concentrations of a wide range of potential soil contaminants have not been detected within the selected representative soil and groundwater samples recovered from the site.

5.8 Discussion with Messrs Wilson Bailey determined that the existing ditches either side of the site are cut down to an invert similar to the base of the clay/top of the underlying sand, and as such will tend to reflect groundwater levels when this becomes elevated and also tends to constrain groundwater levels as surface flows to discharge the groundwater will develop once

ditch invert level is reached. The applicant has instructed Messrs Wilson Bailey to continue monitoring of the groundwater to ensure a robust assessment of the seasonal variations of the groundwater at this site. Based upon the advice of Messrs Wilson Bailey and interim value for the seasonal high groundwater level of 0.75m below existing ground level will be used.

6 Sewerage Authority Data

6.1 The site is not currently connected to the public foul sewer network. The public foul sewer is located to the site frontage within Station Road (200mm DN). An extract of the local sewer plan in contained in Appendix B.

6.2 A capacity check has been undertaken by Southern Water. This identifies that their existing gravity sewer network has insufficient capacity to support the proposed development. Southern Water have assessed their network further through stage 1 S98 requisition process and have identified a requirement to upgrade 46m of 225mm DN sewer in West Lane to 300mm DN in order to provide the capacity required to serve the development. The necessary works will be requisitioned from Southern Water to facilitate the development. A copy of the Southern Water S98 off-site sewer works proposal in contained in appendix B.

7 Walkover Survey

7.1 A site reconnaissance was made on 4th August 2015. The site comprises 2.4Ha of arable field, a small rectangular element of which, immediately affronting Station Road, is not currently laid to crop due to the local geometry. This element is currently fallow. The site slopes gently from South to North.

7.2 The site contains two ditches, both falling to the north. One on the eastern boundary and one on the western boundary. The eastern ditch also extends partly along the southern boundary. The ditches are indicated to support a number of outfalls from the local public surface water sewer system.

7.3 Beyond the application site to the north is an East-West field boundary ditch.

7.4 The land use to the north is farmland. The land use to the west comprises and existing light industrial estate. The land use to the East comprises residential dwellings. The existing land use affronting Station Road to the south of the site comprises a mixture of residential and commercial uses.

8 Source-Pathway-Receptor Assessments

8.1 The site is at an elevation of approximately 6m AOD and is remote from the effects of tidal flooding. The site is not therefore at risk of tidal flooding.

8.2 The EA mapping indicates the site is wholly in FZ1. The site is therefore considered to be at a low risk of fluvial flooding.

8.3 The site is not located in the vicinity of any reservoirs and EA flood risk from reservoirs mapping does not indicate any reservoir flood risk to the site.

8.4 The site is not in a location with sewer flooding incidents and is not considered to be at risk of sewer flooding.

8.5 The SFRA and EA mapping do not indicate the site to be at risk of groundwater flooding.

8.6 The SFRA and EA mapping indicate the site is not within a pluvial or surface water flood risk area.

8.7 The critical flood source is surface water pluvial flooding and run-off within the site. The site surface water system will accord with the principles of CIRIA C697.

8.8 The new flood receptors of the development would be:

- New dwellings
- New commercial units
- Residents in the dwellings
- Employees and visitors of the commercial uses

8.9 The proposed development and existing site classifications to Table 2 of NPPF Technical Guidance are as follows:

- Existing agricultural use — Less vulnerable
- Proposed commercial use — Less vulnerable
- Proposed residential use — More vulnerable

8.10 Overall the site is low flood risk.

9 Flood Probability

9.1 The Environment Agency (EA) flood zones shown on the outputs and included in the Appendix represents current best estimates of zone 2 and zone 3 flooding as defined in Table 1 of the Technical Guidance to the National Planning Policy Framework. It does not take account of potential climate change impacts.

Zone 2	Medium Probability of tidal flooding (0.5%-0.1%)
Zone 3a	High Probability of tidal flooding (>1%)
Zone 3b	Functional Floodplain (>5% probability of flooding)

The flood map does not differentiate between zones 3a and 3b.
Zone 3b is only considered appropriate for water-compatible development.
Zone 3a is additionally considered appropriate for less vulnerable uses.

9.2 The site is located wholly in flood Zone 1 (low risk <0.1%).

10 Climate Change

10.1 Assuming a design life of 100 years, increase in rainfall (Table 5 of NPPF Technical Guidance) due to climate change is +30% to current rates. The SFRA mapping indicates the site would continue to be located in FZ1 in 2115AD.

10.2 Surface water drainage strategy is discussed in section 11. The volumes and flows for this strategy have been derived in accordance with CIRIA C697 and include for climate change effects.

11 Detailed Development Proposals & Surface Water Strategy

11.1 The site soils investigation works by Messrs Wilson Bailey (report J1510-9/DB/c01 dated 5 June 2015) included falling head permeability tests which indicated a permeability of the underlying sand/gravel in the mid E-5 m/s range. Based upon the advice of Messrs Wilson Bailey an interim value for the seasonal high groundwater level of 0.75m below existing ground level has been adopted for consideration of the surface water drainage system. Considering these two parameters in combination leads to a conclusion that whilst surface water by discharge is possible in terms of hydraulic conductivity options for location of the attenuation storage will be constrained by the seasonal high groundwater level. Soakaways would have to be excavated below the clay Brickearth and could therefore be expected to be completely below seasonal high groundwater level at some times of the year, thus rendering the storage volume ineffective at these times. An infiltration basin/pond is however viable based upon the information contained in the Wilson Bailey soils report. At times of low groundwater level it will empty completely, at times of high groundwater it will empty down to the seasonal groundwater level. The operational storage volume that can be relied upon is therefore the volume above the seasonal high groundwater level.

11.2 It is proposed to provide an infiltration basin to the northeast corner of the development. The development will comprise three reticulated surface water catchment areas; one serving the commercial area and two serving the residential area. These will drain to a surface water swale along the northern boundary to the built development area. The swale will discharge to the basin. An impermeable areas schematic is contained in Appendix C :

1 Commercial	2,351m²	(16%)
2 Residential (W)	5,950 m²	(42%)
3 Residential (E)	5,956 m²	(42%)
	14,257	

11.3 Two calculation sheets are included in Appendix C for the sizing of the infiltration basin. The first sheet determines the critical storm period and storage volume required in the basin for an invert size of 49 x 21 m for 14,300m² of impermeable surface with a soil permeability of 3 x 10^{-5} m/sec under a 1% AEP + climate change storm. This indicates a required storage volume of 780 m³, a critical storm period of 6 hours and a half drain down time of 7 hours.

The second sheet determines the water storage level required above a seasonal high groundwater level of 0.75m below existing ground level required to store the 780m³ attenuation volume. The results demonstrate that an extreme flood depth (EFD) of 0.6m above a seasonal groundwater level of 0.75m below existing ground would store all but a few cubic metres of this volume. These few cubic metres of storage would be provided within the swale volume.

Comparing the log from borehole 5 and the topographic survey indicates that for the basin location:

Top of gravel/sand	approx. 4.0m AOD
Existing GL	5.1-5.2m AOD
Seasonal GWL	approx. 4.35m AOD
(1%AEP + CC) EFD level	approx. 4.95m AOD
Existing GL freeboard	0.2m

In order to improve the basin freeboard it is proposed to raise the basin rim to 5.6m AOD thus increasing freeboard to more than 0.6m. The basin will also have a high level overflow fitted above EFD to convey discharge for events in excess of 1%AEP + CC to the existing eastern ditch.

It should be noted that the existing ground levels in the development built area are approx. 5.4-6.0m AOD so the proposed development will not be at flood risk from an EFD level of 4.95m AOD in the basin and collection system.

A schematic of the proposed drainage system is also contained in Appendix C.

11.4 Water butts should be installed to intercept roof water run-off. These will reduce the annual volume of surface water discharge but will not make any material contribution to regulation of critical run-off as these tend to be full during winter months as there is minimal demand for garden irrigation in these months.

11.5 In summary source control will be provided by:

- Discharge to infiltration basin as outlined in paragraph 11.3
- Provision of water butts as outlined in paragraphs 11.4

11.6 A Water quality assessment has been undertaken using the UKSuDS methodology. Section 3.3 of the CIRIA C697 SUDS Manual identifies the pavement to the commercial area to require 3 treatment stages the residential pavement 2 stages and the roofs one stage. The treatment train for all stages includes the swale and infiltration basin (2 stages). The commercial development discharge will be passed through an oil interceptor prior to discharge to the swale so as to provide the third stage. The assessment results indicate a WQS_{SUDS} of 0.3 compared to a $WQS_{traditional}$ of 5.76, representing a 95% reduction compared to traditional systems. The WQS assessment is contained in Appendix C.

11.6 Foul drainage arrangements for the development are discussed in section 5 and the Foul Sewage and Utilities Assessment report. In summary the site will be served by a gravity foul water system within the development connecting to the existing public foul sewer in Station Road. The existing public foul sewer has capacity for the development. A small increase in pumping capacity at the Newton Lane WPS is required. The modifications to the pumping

station will be requisitioned from Southern Water by S98 requisition. The schematic of the site drainage contained in Appendix C also shows the proposed foul sewer spines.

12 Sequential & Exception Tests

12.1 The site is located wholly within FZ1. The development accords with paragraph 4 of the Technical Guidance to the NPPF. The proposals are therefore considered to meet the sequential test.

12.2 Application of the Exceptions Test is not required on this basis.

13 Flood Risk Management Measures

13.1 The source pathway receptor assessment is contained in Chapter 8.

13.2 Paragraph 8.7 identifies that management of the overland flow from surface run-off is the governing flood source. The management of the storage and conveyance of these volumes and flows is provided for by the surface water strategy set out in Chapter 11. The strategy accords with CIRIA C697 SuDS Manual.

13.3 The surface water strategy mimics the existing run-off regime. There will therefore be no adverse impact on flood flow rates outside the site.

14 Off Site Impacts

14.1 The surface water strategy mimics and improves on the existing run-off regime. There will therefore be no adverse impact on flood flow rates outside the site.

15 Residual Risks

15.1 The proposed surface water strategy for the development provides for flood events up to 1:100 year 2015AD +30% rainfall. The residual flood risk is therefore events in excess of 1:100 year 2015AD +30% rainfall.

APPENDIX A:

Existing & Proposed Site Layout



Aerial view on site



View SW to NE across site



View NE to S across site



View on Western ditch

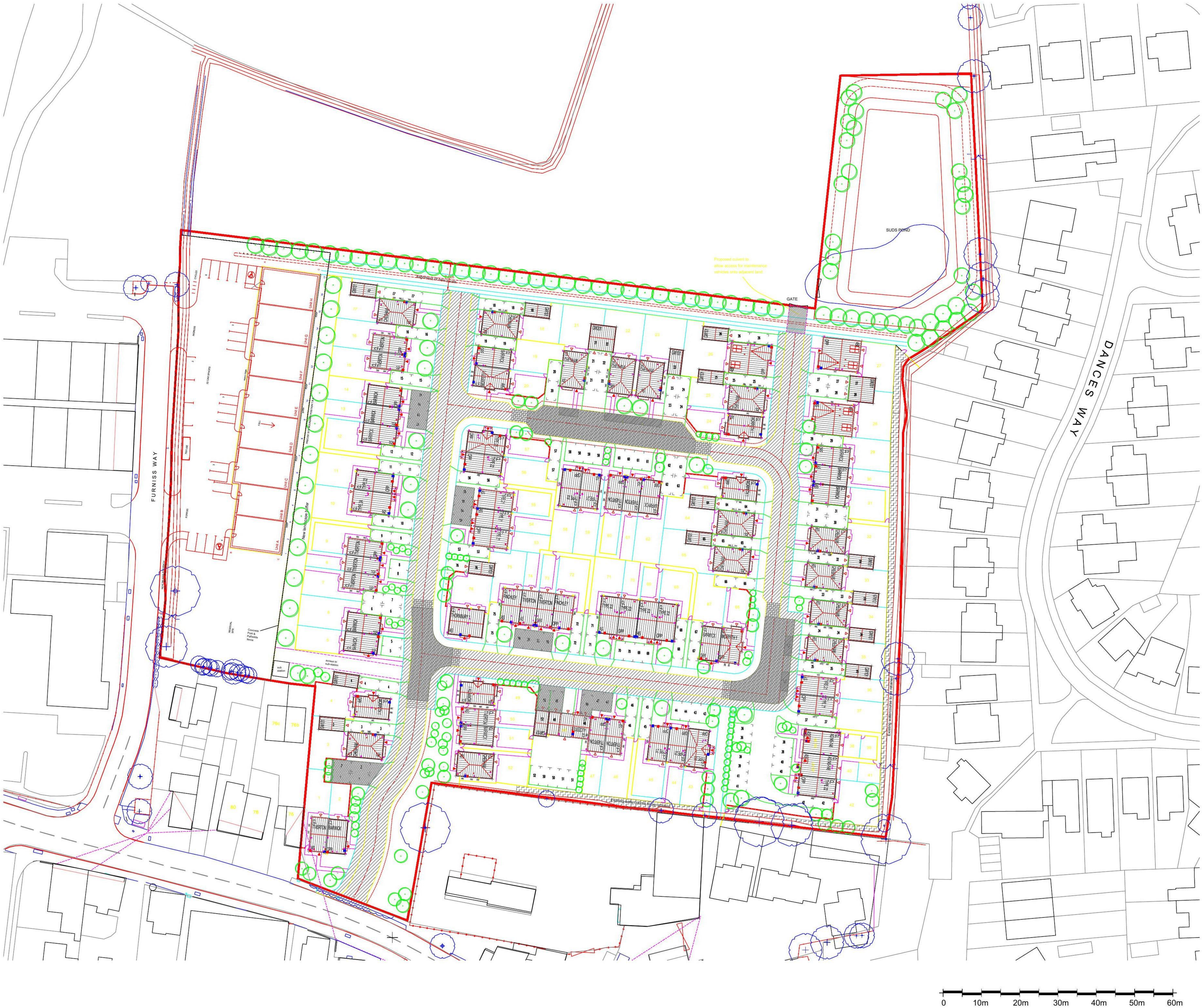


View on eastern ditch



View on southern ditch

Station Road - Hayling Island				14.10.15
House Type - Private	**No. of Beds**	**No.**	**Sq. Ft.**	**Total Sq. Ft.**
Alcester	2	1	687	687
Tiverton	2	13	731	9503
Barwick	3	13	831	10803
Finchley	3	2	831	1662
Morpeth	3	6	956	5736
Chesham	4	14	1149	16086
Thornbury	4	1	1203	1203
4BB	4	3	1409	4227
Total		**53**		**49907**
House Type - Affordable (30%)				
AG145 (Maisonette)	1	2	489	978
AG146 (Maisonette)	1	2	489	978
T21	2	8	842	6736
T22	3	8	926	7408
T24	4	1	1104	1104
T28	3	2	1052	2104
Total		**23**		**19308**
Totals		**76**		**69215**





KEY:

Ecological receptor comprising of grassland habitat

Rev	Description	Date	Drawn	Chk'd
M	Plots 10-11, 38-42, 43-45, 50-51, 58-59, 60-62 and 72-75 adjusted so that all ridge line's run through. No's 76b & 76c added to rear of Plots 3-4.	25.11.15	SJN	
L	Amended to suit Planners comments.	20:11:15	SJN	
K	Amended to suit Planners comments.	12.11.15	SJN	
J	Amended as per notes from division sent on 16.10.15	19.10.15	RC	
H	Amended as per notes from division sent on 05.10.15 and 08.10.15	14.10.15	RC	
G	Handing notation amended to Plots 6, 10, 12, 18, 20, 21, 30, 32, 62, 66 & 67	21.08.15		
F	Garage plot 36 added, parking bays modified	11.08.15		
E	Schedule updated	29.07.15		
D	Plots to eastern boundary amended	20.07.15		
C	Red line boundary amended	14.07.15		

Urban Design

Urban Design
Barratt House
Forest Business Park
Bardon Hill
Leicestershire
LE67 1UB

01530 276276

Project

Hayling Island

Land off Station Road
Hayling Island

Drawing Title

Planning Layout

Scale

1:500 @ A1

Date

10.06.15

Drawn By

SW

Drawing Ref

ST-10-03 M

BARRATT HOMES

*When printing to scale, please ensure that your printer settings are set to Page Scaling = None. Do not allow any 'fit to page' settings as this will alter the scale of the drawing. You can use the scale bar or grid to check the printed drawing.

APPENDIX B:

SFRA Map Data, EA Data & Sewer Data

APPENDIX C:

Proposed Drainage Data

APPENDIX D:

Conditions & Limitations

OPUS

ENGINEER'S INSPECTION

CONDITIONS AND LIMITATIONS

1. The report is a record of a visual inspection carried out by, or under the direction of a Chartered Structural Engineer and must not be misinterpreted as a Structural Survey such as would be carried out by a Chartered Surveyor. The report is not a Valuation Survey.

2. The inspection is strictly limited to the items requested and these will be detailed in Clause 1 of the report. No consideration will be given to any other aspects or parts of the building.

3. The report is confidential to the Client(s) stated in Clause 1 and has been prepared to their instructions for their own purposes only and it is not permitted to disclose this report to any other parties (except the Clients own Solicitors, Surveyors, Building Societies or Estate Agents) without the prior consent of Opus.

4. The copyright of this report remains the property of Opus.

5. No liability for the contents of this report is accepted to any parties other than the Client(s) stated in Clause 1.1. No parties other than the client stated in Clause 1.1 should rely upon this report.

6. Unless specifically stated otherwise:-

   a) Trial holes will not be excavated prior to the preparation of the report and the depth and construction of the foundations and type of sub-soil will not be inspected.

   b) All external observations will be carried out by eye from the ground level only. Internal inspection is made within the limits of ready accessibility and it is not normal practice to lift floor coverings or floor boards, remove fixtures, panels or plaster, or move heavy items of furniture or bulky goods or materials.

   c) No inspection will be made of any roof voids, floor joists, wall cavities, drainage pipework or any other hidden or inaccessible parts.

   d) No timbers will be checked for damp, rot, infestation by wood-boring insects or other defects.

   e) It should not be construed that any parts of the construction comply with the requirements of the Building Regulations Act or standard practice either current or as current at the time of original construction. No enquiries to any Authorities will be made.

   f) No testing or enquiries into the presence of or susceptibility to pollution, contamination, radiation, methane, radon or other gases or hazardous substances has been carried out.

7. Unless specifically stated otherwise in the report, any recommendations for works given in the report are outline only and are to be confirmed or modified as appropriate at detailed design stage.

8. Where trial holes are specifically included in our instructions the condition of the footing and the founding soil relates only to the point of excavation and does not necessarily confirm a continuation of the same conditions throughout the non-inspected areas of the structure. Whilst such trial pits will usually provide a reasonable indication as to the general state of the foundations and ground conditions, these cannot be determined with complete certainty.

9. Under the Construction (Design & Management) Regulations latest edition, the Client has obligations for ensuring Health and Safety arising from any construction work. If it is proposed to proceed with construction work based upon information or recommendations contained in this report, these regulations probably apply. Further details of any issues arising from our report or the Clients obligations generally are available on request.

10. Unless dealt with more specifically above the Association of Consulting Engineers Conditions of Engagement Short Form Agreement 2002 apply.

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OPUS

Foul Sewage and Utilities Assessment

Site at Station Road

Hayling Island, Hants

Foul Sewage and Utilities Assessment

Site at Station Road

Hayling Island, Hants

Prepared By

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Date: 12 August 2015
Reference: EF1682 FSUA/APT
Status: Issue 1

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Contents

1 Introduction 1

2 Electricity 1

3 Gas 1

4 Potable Water 1

5 British Telecom 1

6 Foul Sewage 2

7 Surface Water Drainage 2

Appendices

Appendix A Utility Information
Appendix B Conditions & Limitations

1 Introduction

1.1 This report summarises the existing utilities and means of utility provision to the propsed development.

1.2 The related asset maps are contained in Appendix A.

1.3 The client's attention is drawn to the conditions and limitations contained in Appendix B.

2 Electricity

2.1 There are existing buried LV electricity services within Station Road. Refer to plan in Appendix A.

2.2 The points of proposed connection are indicated on the Plan in Appendix A new services would be brought into the site off Station Road to a new substation located at the end of the access track alongside and to the rear of plot 4 garage. From here supplies for the residential properties and the commercial units will be distributed.

3 Gas

3.1 The Station Road frontage contains 1 no 250mm PE LP main and 1 no 180mm PE LP main. Refer to plan in Appendix A.

3.2 An LP connection will be made to the existing apparatus and an LP service distributed to the residential and commercial properties. A gas governor station is not required.

4 Potable Water

4.1 The Station Road frontage contains 1 no 12 " water main and 1 no 4" water main. Refer to plan in Appendix A.

4.2 A connection will be made to the existing 12" main and distributed to the residential and commercial properties.

5 British Telecom

5.1 British Telecom network is present to the Station Road frontage. Refer to plan in Appendix A.

5.2 Connections will be made to the existing apparatus and the network service distributed to the proposed residential and commercial properties.

6 Foul Sewage

6.1 The Southern Water public foul sewer within Station road is 200mm DN. Refer to plan in Appendix A.

6.2 Southern Water have identified that whilst the gravity foul sewer in station Road has capacity to service the proposed development a small increase in pumping capacity at the nearby Newton Lane Pumping station will be required. A stage 1 s98 Water Industry Act requisition has been submitted to southern water for the necessary off site pumping station alterations.

6.3 Within the site new network of gravity foul sewers will be laid and connected to the existing public gravity foul sewer in Station Road. The indicative foul sewer network proposed is shown on the drawings contained in the Flood Risk Assessment and Drainage Strategy for the site.

7 Surface Water Drainage

7.1 Surface water run off from the existing site drains to a series of surface water ditches that drain to the north. These ditches are being retained and will continue to support run-off received from other sources outside the site.

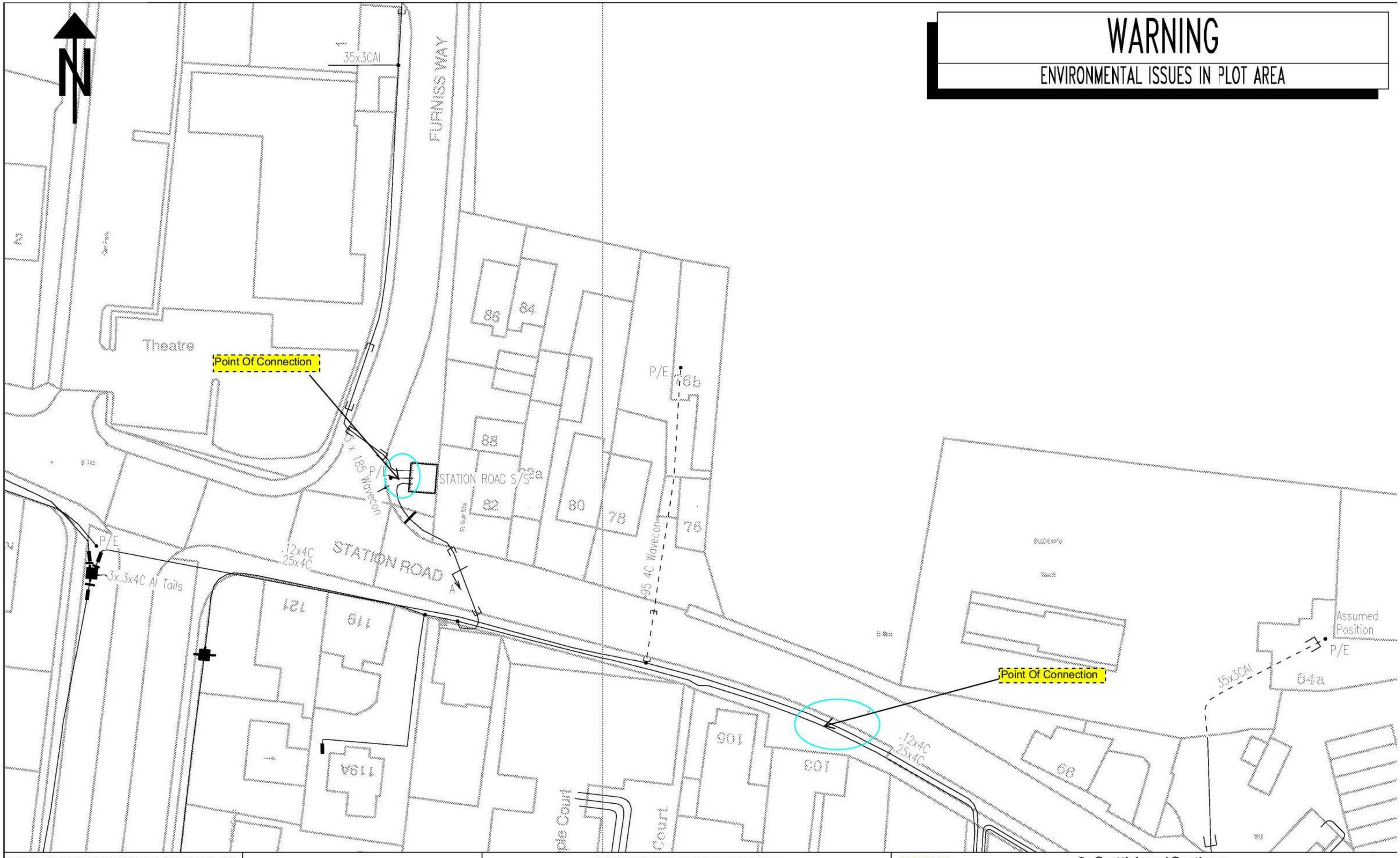
7.2 Run-off from within the site will drain to a series of surface water drains into a separate swale along the northern edge of the proposed development and into a new infiltration basin off the Northeast corner of the proposed housing area. There will be no increase in flows to the existing ditch network as a result of the proposed development. Reference should be made to the Flood Risk Assessment and Drainage Strategy which contains further information and drawings of the propoised arrangements.

APPENDIX A:

Utility Information

WARNING

ENVIRONMENTAL ISSUES IN PLOT AREA



NORMAL DEPTH TO THE TOP OF THE CABLE WHEN LAID				
	services	l.v.	h.v.	e.h.v.
FOOTPATH	0.40m	0.45m	0.60m	0.75m
ROAD CROSSING	0.60m	0.60m	0.75m	0.90m

l.v./services – up to 1000V.
h.v. – over 1000V. to 11,000V.
e.h.v. – 22,000V. to 132,000V.

WARNING

There may have been subsequent alterations to the surface levels. Trial holes must be taken to determine positions and depth of cables. HS (G) 47 Booklet from the Health and Safety Executive – Avoiding Danger from Buried Cables – should be consulted before commencing excavation work. (available from HMSO)

WHEN WORKING IN THE VICINITY OF OVERHEAD LINES THE HEALTH AND SAFETY GUIDANCE NOTE GS6 SHOULD BE CONSULTED. (AVAILABLE FROM HMSO)

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Template: SIAS NRSWA GW 43.plot

Scottish and Southern Electricity plc.
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Registered Office: Inveralmond House
200 Dunkeld Road,
Perth, PH1 3AQ.

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Subject to Revision Master held at:

EAX784

Scottish and Southern Energy

L.V. MAINS RECORD

PORTSMOUTH
023-9262-4200

Grid Ref: SZ71019973

Scale: 1:500

Date: 17/04/2015

Abandoned asbestos main.
Pipe starts in Sea Front road and continues in f/p up Staunton Ave to end in Station Road junction.
726m long.
PON0629116910
Dated: 11/08/82
DR4 Ref:ASB30117

180mm PE main found in this location. Remainder of pipe route is unconfirmed.
Dated : 12/04/2010
DR4 : SoE101809

WARNING
B.G GEOG
SEE D.O.(11/093)

D219
D1188

D
1188

Valve Card
9151

Valve Card
9152

651015203

650645493

8in over culvert 450c

DOC 0.8

SNAIH LANE

ST THOMAS AVENUE

RICHMOND DRIVE

HEMFIELD DRIVE

CHARLESTON

WEST TOWN

Builder's Yard

Car Park

Play Area

Fountain

Sub Sta

USER ID: faapt0
DATE: 12 Aug 2015
EXTRACT DATE: 14 Jul 2015
MAP REF: SZ7199NW
CENTRE: 471050, 99749
SCALE: 1:1,601

LP Mains
MP Mains
IP Mains
LHP Mains
NHP Mains

Valve
Depth of Cover
Syphon
Diameter Change
Material Change

This plan shows those pipes owned by Scotia Gas Networks plc in their role as a Licensed Gas Transporter (GT). Gas pipes owned by other GTs, or otherwise privately owned, may be present in this area. Information with regard to such pipes should be obtained from the relevant owners. The information shown on this plan is given without warranty, the accuracy thereof cannot be guaranteed. Service pipes, valves, syphons, stub connections, etc. are not shown but their presence should be anticipated. No liability of any kind whatsoever is accepted by Scotia Gas Networks plc or their agents, servants or contractors for any error or omission. Safe digging practices, in accordance with HS(G)47, must be used to verify and establish the actual position of mains, pipes, services and other apparatus on site before any mechanical plant is used. It is your responsibility to ensure that this information is provided to all persons (either direct labour or contractors) working for you on or near gas apparatus. The information included on this plan should not be referred to beyond a period of 28 days from the date of issue.

Product: UtilityMaps
Version: 1.6.6.1
Template: 'Scotia Gas Networks (A3 Landscape)'

N

Scotia Gas Networks
Delivering gas safely, reliably and efficiently

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470900 471000 471100 471200 471300

99900 99800 99700

A3

1006

2069C

903

H3489C

RCW0403C

Hayling Billy Coastal Path

Drain

Drain

FURNISS WAY 125mm MDPE (BF) 1990

Car Park

Theatre

El Sub Sta

El Sub Sta

CHARLESTON CLOSE

3" 1967

4" CI 1954

125mm HPPE (BF) 2004

4" CI 1954

125mm HPPE (BF) 2004

125mm HPPE (BF) 2004

15" CI 1966 Main in Easement

8" CI 1966

12" 1966

12" 1966

4" CI 1966

4" CI 1966

5.8m

Builder's Yard

Garage

Cedar Court

Court

WEST LANE

EXISTING MAIN	WASHOUT FIRE HYDRANT	COMPANY WASHOUT	'C'	FH TO BE CUT OUT UNLESS PURCHASED BY LOCAL AUTHORITY
ABANDONED MAIN	FIRE HYDRANT	'C'	WO TO BE CUT OUT UNLESS PURCHASED BY LOCAL AUTHORITY	'C'	WOFH TO BE CUT OUT UNLESS PURCHASED BY LOCAL AUTHORITY
PROPOSED MAIN	PROPOSED FIRE HYDRANT				

Portsmouth Water

Registered Office
P.O. BOX NO. 8, West Street, Havant, Hampshire. PO9 1LG.
Registered in England No. 2536455
Telephone: (023) 9249 9888
Fax: (023) 9245 3632
Website: www.portsmouthwater.co.uk

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The information supplied is given in good faith as a guide to locating underground apparatus. Its accuracy cannot be guaranteed, nor does it include comprehensive information about the existence or location of service pipes or cables to individual premises.The responsibility for locating and avoiding damage to apparatus on site shall be that of the person proposing to excavate in the street who shall be liable to the apparatus owner and any third party who may be affected in any way for any loss or damage caused by their failure to do so.

Drg No:	
Job No:	
OS Ref:	SU6804SW
Scale:	1:1,250
Date:	14/10/2013

Maps by email Plant Information Reply



IMPORTANT WARNING

Information regarding the location of BT apparatus is given for your assistance and is intended for general guidance only. No guarantee is given of its accuracy. It should not be relied upon in the event of excavations or other works being made near to BT apparatus which may exist at various depths and may deviate from the marked route.

DIAL BEFORE YOU DIG

FOR PROFESSIONAL ON SITE ASSISTANCE PRIOR TO COMMENCEMENT OF EXCAVATION WORKS

ADVANCE NOTICE REQUIRED
(Office hours: Monday-Friday 08.00 to 17.00)

Tel: 0800 9173993
E-mail: dbyd@openreach.co.uk
Website: www.dialbeforeyoudig.com

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KEY TO BT SYMBOLS

- UNDERGROUND PLANT
- A/C, D/W or W — OVERHEAD PLANT
- JOINT BOX
- 456 OR 456 — DISTRIBUTION POINT
- OR 72 — MANHOLE
- DP BOUNDARY
- OR — OTHER BT BOUNDARY
- POLE
- CABINET
- BURIED JOINT
- J — JOINTING POST
- PROPOSED U/G
- A/C, D/W or W — PROPOSED O/H
- PROPOSED BOX

Other proposed plant is shown using dashed lines. BT symbols not listed above may be disregarded. Existing BT plant may not be recorded. Information valid at the time of preparation.

openreach
a BT Group business

BT Ref : LTR04153I
Map Reference : (centre) SZ7107499787
Easting/Northing : (centre) 471074,99787
Issued : 12/08/2015 16:16:01

FOOTNOTE: WARNING IT IS ESSENTIAL THAT YOU CONTACT NATIONAL NETWORK HANDLING CENTRE BY EMAIL nnhc@openreach.co.uk BEFORE PROCEEDING WITH ANY WORK IN THE HATCHED AREA

SOUTHERN WATER



The positions of pipes shown on this plan are believed to be correct, but Southern Water Services Ltd accept no responsibility in the event of inaccuracy. The actual positions should be determined on site.

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Southern Water

O.S. REF: SZ7199NW | Scale: 1:1250

N

Printed By: Roopa | Date: 7-5-2014

Sewer Plot

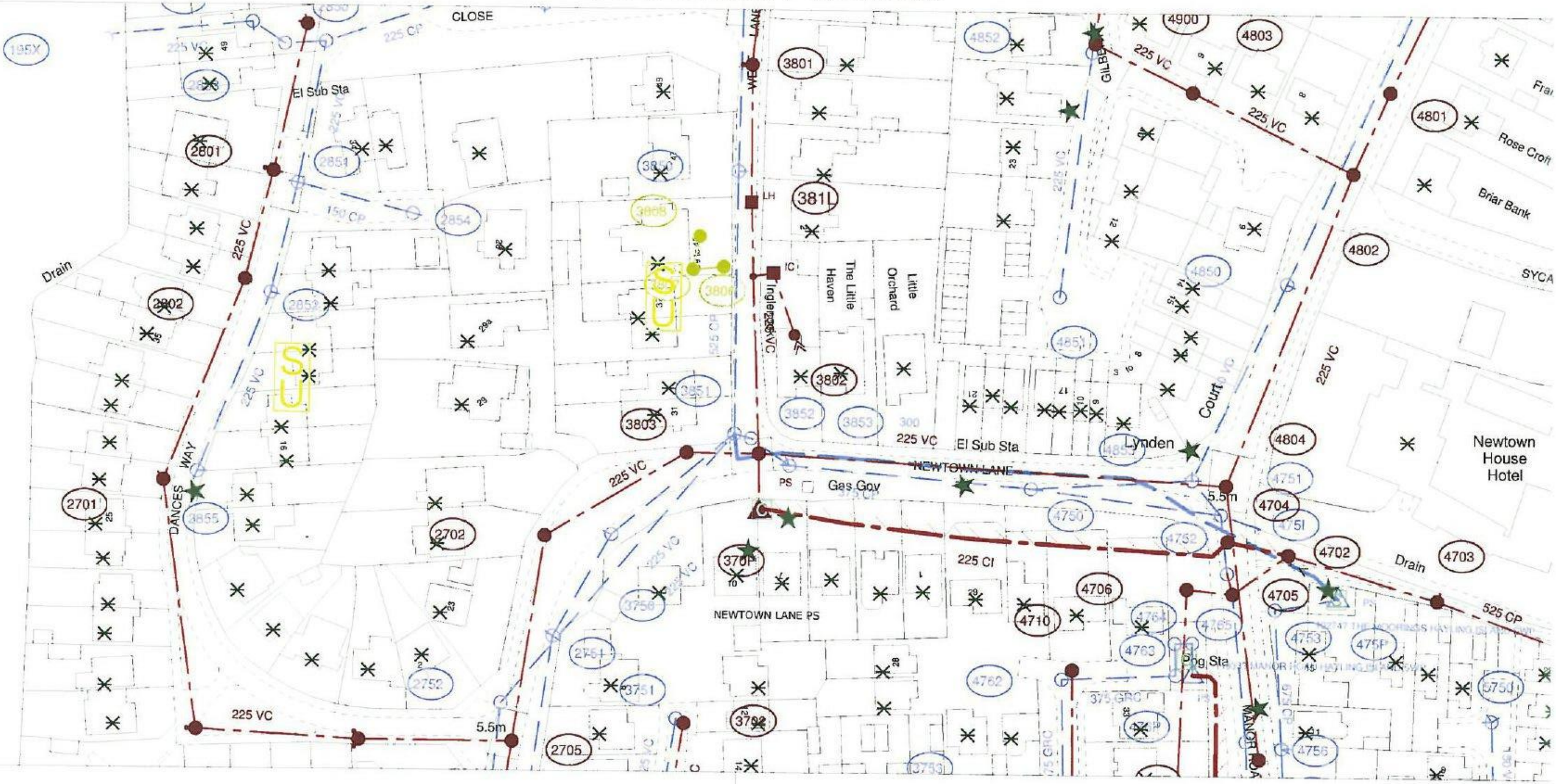
Site location plan

WARNING: BAC pipes are constructed of Bonded Asbestos Cement

WARNING: Unknown (UNK) materials may include Bonded Asbestos Cement

Requested By:

SOUTHERN WATER



The positions of pipes shown on this plan are believed to be correct, but Southern Water Services Ltd accept no responsibility in the event of inaccuracy. The actual positions should be determined on site.

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Southern Water

O.S. REF: SZ7199NW

Scale: 1:1250

N

Printed By: Gouri

Date: 22-5-2014

Screen Print

Improvements

Requested By:

WARNING: BAC pipes are constructed of Bonded Asbestos Cement

WARNING: Unknown (UNK) materials may include Bonded Asbestos Cement

Amended Title boundary

Current Title boundary

Alignment of new swale

7.0m

Outfall for surface water from commercial premises designed by others.

Ø450

Ø375

Ø300

Ø225

Ø150

New landscape Mound

Proposed 450Ø culvert to allow access for maintenance vehicles onto adjacent land

GATE

SUDS POND
BASE IL: 4.00

300 Ø

IL: 4.90

IL: 4.10

Concrete Post & Wiremesh Fence

sub station

access to sub station

Relocate existing chamber and gully

Existing watercourse to be retained

Existing watercourse to be retained

N

STANDARD NOTES:

1. This drawing is to be read in conjunction with all other OPUS drawings, and with all relevant Architect's and Engineer's drawings and specification.
2. No dimensions are to be scaled from this drawing. Unless noted otherwise all dimensions are in millimeters and all levels are in metres from the site datum. All dimensions to be checked on site. All details and dimensions relating to sub-Contractors work must be checked and agreed between the sub-Contractor or supplier and the general Contractor.
3. The electronic information from this drawing cannot be guaranteed as dimensionally drawn exact. Figured dimensions must be used for setting out and detailing. OPUS logos and company information must be removed from copies if information is re-used."
4. The main Contractor is responsible for the design of all temporary works, and is also responsible for the safe maintenance and stability of existing buildings at all times.
5. The main Contractor is responsible for the mitigation of all occurrences of ground water during the construction period.
6. Any information given regarding existing underground services is given in good faith after consultation with the relevant authority, however accuracy is not guaranteed. The main Contractor is responsible for checking all information on site prior to work commencing and taking due care and attention whilst undertaking the works.
7. The contractor must comply with all current legislation relating to Health & Safety.

DRAINAGE NOTES:

1. All works to be conducted in strict accordance with specification of the Local Authority, BS8301: 1985 & BSEN:752-1.
2. All pipe runs near buildings to comply with the Building Regulations 2002 Part H1. Where a pipe is within 1m of a foundation the trench shall be filled with class GEN3 concrete up to the lowest level of the foundation. Where the trench is further than 1m from the foundation, the trench shall be filled with class GEN3 concrete to a level below the lowest level for the foundation equal to the distance from the foundation less 150mm. In both cases the pipe shall be bedded and surrounded in 150mm thick class GEN3 concrete.
3. Where pipes, external to the structures, have a depth to soffit from ground level of less than 450mm they shall have a class GEN3 concrete encasement (150mm thick).
4. Where a pipe, under a carriageway, has a depth of cover of less than 1.2m the pipe shall be laid in a class Z bedding.
5. Where pipes are bedded and surrounded in concrete, flexible joints should be provided. Compressable boards (fibreboard or polystyrene) shall be provided at a maximum of 8m centres (coinciding with pipe joints). The boards shall be pre-cut to pipe diameter and to a height and width equal to the concrete cross section. A board thickness of 18mm for pipes up to 450mm nominal diameter and 36mm for pipes over 450mm nominal diameter.
6. All private building drainage shall be constructed in strict accordance with BSEN.752-1.
7. Unless otherwise specified, building drainage to be 100mm internal diameter.
8. Minimum gradient for Ø100mm surface drainage pipes is 1:60, and Ø150mm is 1:100.
9. Minimum gradients for foul drainage pipes:
   Ø100mm: 1:40 where flow is less than 1l/s, or where no WCs are connected.
   Ø100mm: 1:78 where flow is 1l/s or greater, or where at least 1No. WC is connected.
   Ø150mm: 1:150 where flow is less than 5l/s, or where up to 5No. WCs are connected.
   Ø150mm: 1:150 where flow is 5l/s or greater, or where 5No. or more WCs are connected
10. All gullies not connected to inspection chambers are to be roddable.
11. All gully connections other than those at manholes to be made via 'Y' junctions.
12. Gullies coincident with pedestrian/drive crossings to have pedestrian type gully covers.
13. All road gully connections to be 150mm diameter.
14. All stub stacks to be fitted with air admittance valves where branch drain exceeds 12m except at the head of the run. Soil vent pipes located at the head of a run to be installed with roof tile vent.
15. All connections to be made from soffit to soffit.
16. Trench temporary formwork is required to all excavations exceeding 1.2m depth to provide adequate support and stability at all times.
17. Sewers are to be constructed in single sections between manholes only. Trenches to be backfilled prior to excavating the succeeding sewer run.
18. All concrete and concrete products to be in accordance with BRE 363 for sulphates.
19. Where sewer or drains are to be abandoned they shall be removed or infilled by grouting in accordance with the Civil Engineer Specification for the Water Industry 7th Edition, clause 5.23.

BACKGROUND IS BASED ON THE ARCHITECT'S GA DRAWING

ANY DISCREPANCIES OR UNCERTAINTY WITH THE CONTENT OF THIS DRAWING ARE TO BE REPORTED TO THE ENGINEER PRIOR TO CONSTRUCTION.

LEGEND:

- PROPOSED FOUL MANHOLE WITH INVERT LEVEL ON ADOPTABLE SEWER.
- PROPOSED TYPE 3 FOUL PPIC WITH INVERT LEVEL ON ADOPTABLE SEWER.
- PROPOSED TYPE 3 FOUL PPIC ON PRIVATE DRAIN.
- PROPOSED TYPE 4 FOUL PPIC WITH INVERT LEVEL ON ADOPTABLE LATERAL.
- PROPOSED TYPE 4 FOUL PPIC ON PRIVATE DRAIN.
- PROPOSED SPOT LEVEL.
- PROPOSED STORM WATER SCUPPER.
- PROPOSED STORM MANHOLE WITH INVERT LEVEL ON ADOPTABLE SEWER (ADOPTABLE HIGHWAY ONLY).
- PROPOSED TYPE 3 STORM PPIC WITH INVERT LEVEL ON ADOPTABLE SEWER.
- PROPOSED TYPE 3 STORM PPIC ON PRIVATE DRAIN.
- PROPOSED TYPE 4 STORM PPIC WITH INVERT LEVEL ON ADOPTABLE LATERAL.
- PROPOSED TYPE 3 STORM PPIC ON PRIVATE DRAIN.
- PROPOSED STORM MANHOLE WITH INVERT LEVEL ON PRIVATE DRAIN
- PROPOSED PERFORATED PRIVATE DRAIN PIPE (BLOCK PAVED AREAS ONLY).

PRELIMINARY

Revision	Amendment	Approved	Revision Date
P2	LAYOUT UPDATE AND DRAINAGE MODIFIED	APT	11.08.2015
P1	FIRST ISSUE.	APT	04.08.2015

BARRATT HOMES

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Drawn	Designed	Approved	Revision Date
CAA	CAA	APT	04.08.2015

Project No.: FA E-F1682.00
Scale: 1:250

Project:
Station Road,
Hayling Island

Sheet:
DRAINAGE STRATEGY

Drawing No.	Sheet No.	Revision
001	1 of 1	P2

1:1 @ A0
0 10 20 30 40 50 60 70 80 90 100 mm

Original Sheet Size A0 [1189x841] Plot Date 12 Aug 2015 @ 11:32 AM Path G:\Projects EF\EF1000-EF1999\EF1600-EF1699\EF1682\04 CAD\Current Working Drawings\FA E-F1682 001 Drainage Strategy.dwg 001

APPENDIX B:

Conditions & Limitations

OPUS

ENGINEER'S INSPECTION

CONDITIONS AND LIMITATIONS

1. The report is a record of a visual inspection carried out by, or under the direction of a Chartered Structural Engineer and must not be misinterpreted as a Structural Survey such as would be carried out by a Chartered Surveyor. The report is not a Valuation Survey.

2. The inspection is strictly limited to the items requested and these will be detailed in Clause 1 of the report. No consideration will be given to any other aspects or parts of the building.

3. The report is confidential to the Client(s) stated in Clause 1 and has been prepared to their instructions for their own purposes only and it is not permitted to disclose this report to any other parties (except the Clients own Solicitors, Surveyors, Building Societies or Estate Agents) without the prior consent of Opus.

4. The copyright of this report remains the property of Opus.

5. No liability for the contents of this report is accepted to any parties other than the Client(s) stated in Clause 1.1. No parties other than the client stated in Clause 1.1 should rely upon this report.

6. Unless specifically stated otherwise:-

   a) Trial holes will not be excavated prior to the preparation of the report and the depth and construction of the foundations and type of sub-soil will not be inspected.

   b) All external observations will be carried out by eye from the ground level only. Internal inspection is made within the limits of ready accessibility and it is not normal practice to lift floor coverings or floor boards, remove fixtures, panels or plaster, or move heavy items of furniture or bulky goods or materials.

   c) No inspection will be made of any roof voids, floor joists, wall cavities, drainage pipework or any other hidden or inaccessible parts.

   d) No timbers will be checked for damp, rot, infestation by wood-boring insects or other defects.

   e) It should not be construed that any parts of the construction comply with the requirements of the Building Regulations Act or standard practice either current or as current at the time of original construction. No enquiries to any Authorities will be made.

   f) No testing or enquiries into the presence of or susceptibility to pollution, contamination, radiation, methane, radon or other gases or hazardous substances has been carried out.

7. Unless specifically stated otherwise in the report, any recommendations for works given in the report are outline only and are to be confirmed or modified as appropriate at detailed design stage.

8. Where trial holes are specifically included in our instructions the condition of the footing and the founding soil relates only to the point of excavation and does not necessarily confirm a continuation of the same conditions throughout the non-inspected areas of the structure. Whilst such trial pits will usually provide a reasonable indication as to the general state of the foundations and ground conditions, these cannot be determined with complete certainty.

9. Under the Construction (Design & Management) Regulations latest edition, the Client has obligations for ensuring Health and Safety arising from any construction work. If it is proposed to proceed with construction work based upon information or recommendations contained in this report, these regulations probably apply. Further details of any issues arising from our report or the Clients obligations generally are available on request.

10. Unless dealt with more specifically above the Association of Consulting Engineers Conditions of Engagement Short Form Agreement 2002 apply.

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WILSON BAILEY
GEOTECHNICAL & ENVIRONMENTAL

Carters Barn
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BA12 0SN
Tel: 01985 850882

5 June 2015

Your ref:
Planning ref:
Our ref: J15109/DB/c01a

Jason Shakespeare
BDW Southampton
Tollbar House
Tollbar Way
Hedge End
Southampton
Hampshire
SO30 2UH

Dear Mr Shakespeare,

RE: LAND NORTH OF STATION ROAD, HAYLING ISLAND

LAND CONAMINATION ASSESSMENT LETTER REPORT FOR THE PROPOSED RESIDENTIAL REDEVELOPMENT

Further to instruction from BDW Southampton, we have carried out a pre-purchase site walkover, desk study and ground investigation at the above site in order to formulate a pre-purchase Land Contamination Assessment. This letter provides our report on the works carried out and is provided in accordance with our standard term conditions and limitations.

Scope of Work

A site walkover survey, pre-purchase desk study and pre-purchase ground investigation has been carried out to provide information to assist with the design of new spread foundations, pavements, soakaways and floor slabs and to facilitate inspection of soils and recovery of a samples for laboratory geotechnical and contaminated land testing.

In accordance with current best practice the desk study has been used to guide the scope of the ground investigation and the findings of both the desk study and the ground investigation have been used to formulate a conceptual model for the site and facilitate a preliminary qualitative risk assessment. This assessment has been used as the basis of a discussion of the implications of any identified issues of potential concern with regards to ground contamination in order to determine the requirement for further assessment or remedial action as part of the redevelopment of this site for residential purposes.

Site Description

The main northern part of the site comprises a roughly rectangular and sensibly level agricultural field that measures approximately 200m by 150 m and at the time of the initial phase of investigation was lain fallow with remnants of various previous crops including oil seed and maize, with variable weeds and grass coverage. At the time of the subsequent second phase of works the site had been seeded with a new maize crop. The southewestern part of the site comprises a further rectangular area with maximum dimensions of approximately 40 m by 30 m, which is currently occupied by long rough grass together with various stockpiles of discarded building materials and a series of concrete filled trenches that would appear to the foundations to a development that was started but not completed.

The eastern site boundary is formed by a shallow ditch, beyond which are the variable site boundaries of the adjoining residential properties, comprising fences, hedges and open garden areas. The western boundary is formed by a mature hedge, beyond which is a small commercial / light industrial business estate formed on the former station and railway sidings of the former Hayling Island railway terminus.

The northern boundary to the site is formed by further areas of open agricultural land, whilst the southern boundary to the site is more complex; The eastern part of the southern boundary is formed by a shallow ditch, beyond which is a former commercial yard area which, at the time of investigation was in the early stages of being redeveloped through the construction of five new houses together with areas of hardstanding for car parking and areas of private domestic garden. The central southern part of the site boundary is formed by the extent of the adjoining builder's merchants building and security fenced yard area. The central western part of the site boundary is formed by Station Road itself, which also has a heavily overgrown access gateway into the southern part of the site where the stockpiled discarded building materials are located. The western part of the southern site boundary is formed by the extent of rear gardens to adjoining residential properties, with this boundary formed of a mixture of hedges, recent and older sections of fencing.

The site is sensibly level and absent of mature vegetation other than the various remnant crops and grass. There are a number of substantial mature and semi-mature tress within the various parts of the southern, eastern and western site boundaries.

Site History and Environmental Site Setting Summary

A review of publically available historical maps indicates that the site has not been previously developed and has been in use as open agricultural land since at least 1896, the date of the first map studied. By that time the Hayling Island Railway and associated terminus is shown to have been present to the west of the site, in the area now occupied by the light industrial / commercial buildings, whilst the area now occupied by the builder's merchants to the south is shown to have been occupied by the town gasworks.

The gas works to the south is shown to have undergone several periods of expansion and the construction of several fairly substantial gas holders on the site to the south before subsequent closure of the gas works. The site was subsequently used as a coal yard and transport depot, until 1981, when the site was closed and the existing builder's merchants is understood to have taken over the premises. It is understood that the former gas works site included the usual structures including retorts, purifiers, condensers, coal stores, tar tanks in addition to the gas holders.

Information provided by the British Geological Survey indicates the site to be underlain by River Terrace Deposits overlying clay soils of the London Clay Formation. Information provided by the Environment Agency indicates the site and the surrounding area to be underlain by a Secondary 'A' Superficial Aquifer but that the site is not shown to be located within the source protection zone of any registered abstraction wells.

Data searches have indicated the site to be located within an area of concern with regards to the potential ingress of Radon gas, although a requirement for Radon protection is confirmed as not being required. This slightly anomalous recommendation for no Radon protection requirement will need to be confirmed by the NHBC or other Building Control service in due course.

Development Proposals

It is understood that consideration is being given to the construction of a residential housing development incorporating a range of residential houses with areas of hardstanding for car parking, access roads and areas of private domestic gardens.

Preliminary Conceptual Site Model Summary and Risk Assessment

The historical use of the site as open agricultural land is not considered to be of concern with regards to potential ground contamination although the former railway sidings to the west and the former town gas works to the south present potentially significant offsite sources of ground contamination that could potentially migrate onto site. In particular there is considered to be a potential risk that potentially mobile groundwater or soil gas contaminants could migrate northwards from the former gas works site to the south.

Ground Investigation Sampling Strategy
The ground investigation has comprised a series of 12 small diameter boreholes drilled across the site to depths of up to 5.00 m below ground level.

The location of the boreholes has been selected to provide an acceptable pre-purchase coverage of the site together with a more detailed focus upon the ground conditions along the southern site boundary, including the installation of four combined soil gas and groundwater monitoring standpipes along this southern site boundary.

Combined soil gas and groundwater monitoring standpipes have been installed in a further two boreholes located remote from the southern site boundary to act as a control and facilitate an assessment of the groundwater flow regime across the site.

The soils encountered in the boreholes were inspected by a Chartered Geologist and representative soil samples were recovered for subsequent laboratory testing for geotechnical properties and for contaminated land soil analyses to determine the presence of a wide range of potential soil contaminants. Soil samples were screened for the presence of VOCs by means of headspace testing using a PID. Following headspace screening, samples for soil contamination testing were placed into appropriate brown glass jars with Teflon coated lids that were provided by the MECRTS accredited soils testing laboratory before being placed into a chilled cool box for courier collection and transportation directly to the testing laboratory.

For this investigation the analytical suite of testing was selected to comprise routine metallic contaminants, polyaromatic hydrocarbons (PAHs) speciated hydrocarbons (TPH CWG) and screening for the presence of asbestos carried out as part of the second phase of investigation. For budgetary reasons it has not been possible to analyse every soil sample recovered from every borehole although a total of 8 soil samples have been submitted for laboratory analyses from locations across the site at a range of depths within the near surface soils.

Ground Conditions
The records of the exploratory holes and a site plan are enclosed. The ground conditions have been found to comprise a significant depth of relatively poor quality topsoil between 0.40 m and 0.65 m, which is consistent with the cultivation of the land and use of a plough as part of the current and historical agricultural land use; at the time of investigation the site was planted with a seedling maize crop. The topsoil has been locally recorded as made ground due to the presence of occasional brick and tile fragments and occasional organic matter, the latter of which is likely to have been added to the topsoil to improve its fertility.

Underlying the topsoil a soft Brickearth silty clay has been encountered to depths of between 0.95 m and 1.50 m below ground level, beneath which a generally medium to coarse sand with variable gravel content has been encountered to depths of less than about 4.00 m, whereupon stiff grey clay soils of the London Clay have been encountered and proved to the maximum depth of investigation at 4.50m below ground level.

Groundwater was encountered in each exploratory hole at depths of about 1.50 m, although subsequent limited groundwater monitoring has indicated a groundwater rest level at a depth of less than about a metre. Monitoring carried out during the morning and during the afternoon at times consistent with a high and low tide on a non-peak sprint tide indicate that the groundwater is tidally influenced, with a variation of between 0.05m and 0.12 m. Assessed groundwater flow direction is to the northeast. The monitoring suggests that the groundwater is under a sub-artesian pressure, with the groundwater level higher than the base of the overlying (confining) clay.

Limited soil gas monitoring carried out to date has not indicated any elevated concentrations of potentially hazardous or noxious soil gasses.

Soil geotechnical and contaminated land laboratory testing has been carried out together with groundwater contaminated land testing of samples recovered from the monitoring standpipes installed along the southern boundary of the site with the former gas works, with the results of these analyses discussed below. No visual or olfactory indications of ground contamination were however identified as part of the field work phase of ground investigation.

Foundation Design Discussion

Whilst the near surface firm and soft clay soils of the Brickearth may normally considered as a suitable founding stratum for wide and lightly loaded spread foundations, at this site it is considered that these soils will not provide a suitable founding stratum for a number of reasons;

Foundations would normally be required to be installed at a minimum depth of 1.25m below ground level in medium plasticity clay soils following the removal of the near surface layer of topsoil, in order to allow for the use of 'restricted' future planting in accordance with the NHBC guidelines (Table 3 of Chapter 4.2) or 0.90 m if no planting were to be allowable. Locally the depth below existing ground level to the base of these clay soils has been encountered at 0.95 below ground level, with more than half of the boreholes indicating the base of the clay soils to be encountered at a depth of 1.20 m below existing ground level or less, such that spread foundation would necessarily bypass these soils. Normal practice is to ensure that a minimum of 300mm of founding strata is anticipated to be present below the base of the proposed foundations, which would require the base of the clay to extend below 1.20 m or 1.55m respectively, which cannot be consistently achieved on the basis of the ground investigation information obtained to date for this site.

Whilst founding within the near surface clay soils could potentially present a viable solution to selected plots, it will not provide a site wide solution strategy and will require plot specific ground investigation to confirm the extent of any locations where a sufficient depth of post topsoil removal clay soils remain. Foundations to any one plot or set of linked plots and structures would require to be formed within a single founding stratum to mitigate the risk of differential settlements.

It is therefore considered that the near surface clay soils at this site will not provide a suitable founding stratum for spread foundations. Whilst the underlying granular soils may normally be expected to provide a suitable founding stratum, the limited groundwater monitoring carried out to date has indicated that groundwater is present within these granular soils is under a sub-artesian pressure, such that the groundwater level in the gravel is higher than the top of the gravel, consequently, upon excavating into the granular soils, groundwater would be expected to be encountered and rise above the base of the excavation. It is expected that groundwater would not be able to be dealt with by sump pumping as the falling head permeability testing would suggest that these soils are readily permeable and the water ingress is not from localised perched waters of limited volume.

There is a potential that during the typically dryer summer months, the excavation into the granular sols could become viable, although this would require confidence to be gained as part of a long term groundwater monitoring programme including at least one full annual cycle. The ground water regime at this site is further complicated by the tidal influence upon ground water levels, which could also further limit the opportunities for the possible formation of dry excavation into the granular soils even in the traditionally drier summer months.

On the basis of the above it is considered that shallow spread foundations are unlikely to be viable other than for selected plots at certain times of the year and at certain tidal conditions, such that spread foundations are not considered to present a suitably robust site wide strategy for the development of this site.

As an alternative to spread foundations, consideration could be given to the use of pled foundations, vibro ground improvement or raft foundations, the relative advantages of which are discussed below;

Raft foundations could be a viable alternative, although it they have been considered on other BDW Southampton developments in similar geological settings and have been discounted as an acceptable alternative to vibro ground improvement.

Vibro ground improvement by means of stone columns would have the effect of improving the shallow bearing capacity of the near surface soils and facilitating a shallow ring beam type foundation design at a depth of potentially as shallow as 0.60 m below ground level in locations remote from trees. A foundation at this depth would not be expected to encounter groundwater complications and could potentially be designed on the basis of an assumed net allowable bearing capacity of 125 kPa, although detailed discussions would need to be held with prospective vibro ground improvement contractors to confirm the finalised design of vibro ground improvement units.

The eastern and western site boundaries are lined with a range of semi-mature and mature trees. Whilst we have not carried out a detailed zone influence assessment of these trees, it is likely that some units will be located in the vicinity of trees and as such will require precautions to mitigate the effects of trees. Even with ground improvement, foundations would need to be deepened in the vicinity of trees, such that should a seasonal and tidal constraint for the excavation of foundations to any such plots not be acceptable, then recourse to a piled foundation solution would be locally required. Further ground investigation by means of deep cable percussion boreholes would be required to inform a piled foundation solution for this site.

Road Pavement Design

MEXE cone assessment of CBR values has been carried out and indicates a low CBR value of between 2% and 4% is provided by the existing soils at this site. Further details CBR testing may be of benefit once proposed road layout and levels are confirmed. This preliminary low CBR value would suggest a requirement for a full capping thickness for adoptable roads.

Surface Water Management Strategy

We have discussed this site with your appointed Civil Engineers. The site has a drainage potential within the granular soils underlying the clay, with preliminary falling head tests suggest a permeability in the mid E-5m/s range. It is however important to note that any discharge to these granular soils would entail a direct discharge to groundwater as there is no partially saturated zone over the groundwater in which to form a soakaway. It is therefore considered likely that the drainage strategy would require an attenuated discharge to the existing ditch networks to mimic the existing green field runoff rate and that traditional soakaways would not be viable at this site

Potable Water Supply

The requirement for protection of underground sections of potable water supplies will need to be confirmed through discussions with the proposed statutory provider of mains water to the site, although precautions are not likely to be required for the development at this site.

Soil Contamination Test Results

Part IIA of the Environmental Protection Act 1990, which was inserted into that Act by Section 57 of the Environment Act 1995, provides the main regulatory regime for the identification and remediation of contaminated land. The determination of contaminated sites is based on a "suitable for use" approach which involves managing the risks posed by contaminated land by making risk-based decisions. This risk assessment is carried out on the basis of a source-pathway-receptor approach. The results of comprehensive laboratory analyses carried out by an MCERTS accredited laboratory on a limited number of soil and groundwater samples recovered from this site are enclosed.

The significance of the measured soil concentrations of any chemicals of concern has been assessed in relation to the available SGVs together with the revised and updated values that have been adopted by the Chartered Institute of Environmental Health (CIEH)[1]. Whilst the values that have been adopted by the CIEH are not statutory, they are widely accepted as providing a suitable initial screening value against which measured concentrations of potential contaminants can be assessed to determine the requirement for site specific quantitative risk assessment. From a review of the enclosed results it is apparent that elevated concentrations of a wide range of potential soil contaminants, including potential contaminants associated with the identified potential off site sources of ground contamination have not been detected within the selected representative soil samples submitted to laboratory analyses.

Contaminated Land Discussion

The current and historical use of the site as open agricultural land is not considered to pose a risk of ground contamination. The adjoining historical site land uses of a railway sidings to the west and a former gas works to the south present potentially significant sources of off site potentially mobile ground contamination, albeit mitigated by the time that has elapsed since the potentially contaminative activities were carried out on these adjoining areas.

The ground investigation has not identified any visual or olfactory indications of ground contaminants and elevated concentrations of a wide range of potential soil contaminants have not been detected within the selected representative soil and groundwater samples recovered from the site.

As with any site however, there remains a perhaps limited potential for localized contaminants to be present at this site and as such it is considered that the ground works for the proposed redevelopment at this site should be carried out under a geo-environmental watching brief in order that should any suspicious or contaminated soils be encountered, they can be appropriately investigated by a geo-environmental engineer and appropriately dealt with in consultation with the regulatory authorities. Site workers should be made aware of the perhaps limited potential for contamination to be present and a programme of working should be identified to protect workers handling any soil. The method of site working should be in accordance with guidelines set out by HSE[2] and CIRIA[3] and the requirements of the Local Authority Environmental Health Officer (EHO).

Further Work

Further monitoring of the groundwater would be of benefit to ensure a robust assessment of the seasonal and tidal variations of groundwater at this site and the soil gas regime.

We would strongly recommend formal discussions with the Local Authority Contaminated Land Officer as soon as possible in order to address any concerns with regards to ground contamination at this site as a result of the historical land uses of the adjoining former railway sidings and gas works sites

We trust that this letter provides sufficient information although please do not hesitate to contact me should you have any questions or queries.

Yours sincerely
Wilson Bailey Partnership

Dominic Brightman
BSc MSc DIC FGS CGeol ARSM

Encs

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1 *The LQM/CIEH Generic Assessment Criteria for Human Health Risk Assessment (2nd Edition) July 2009.*

2 *HSE (1992) HS(G)66 Protection of workers and the general public during the development of contaminated land HMSO*

3 *CIRIA (1996) A guide for safe working on contaminated site Report 132, Construction Industry Research & Information Association*

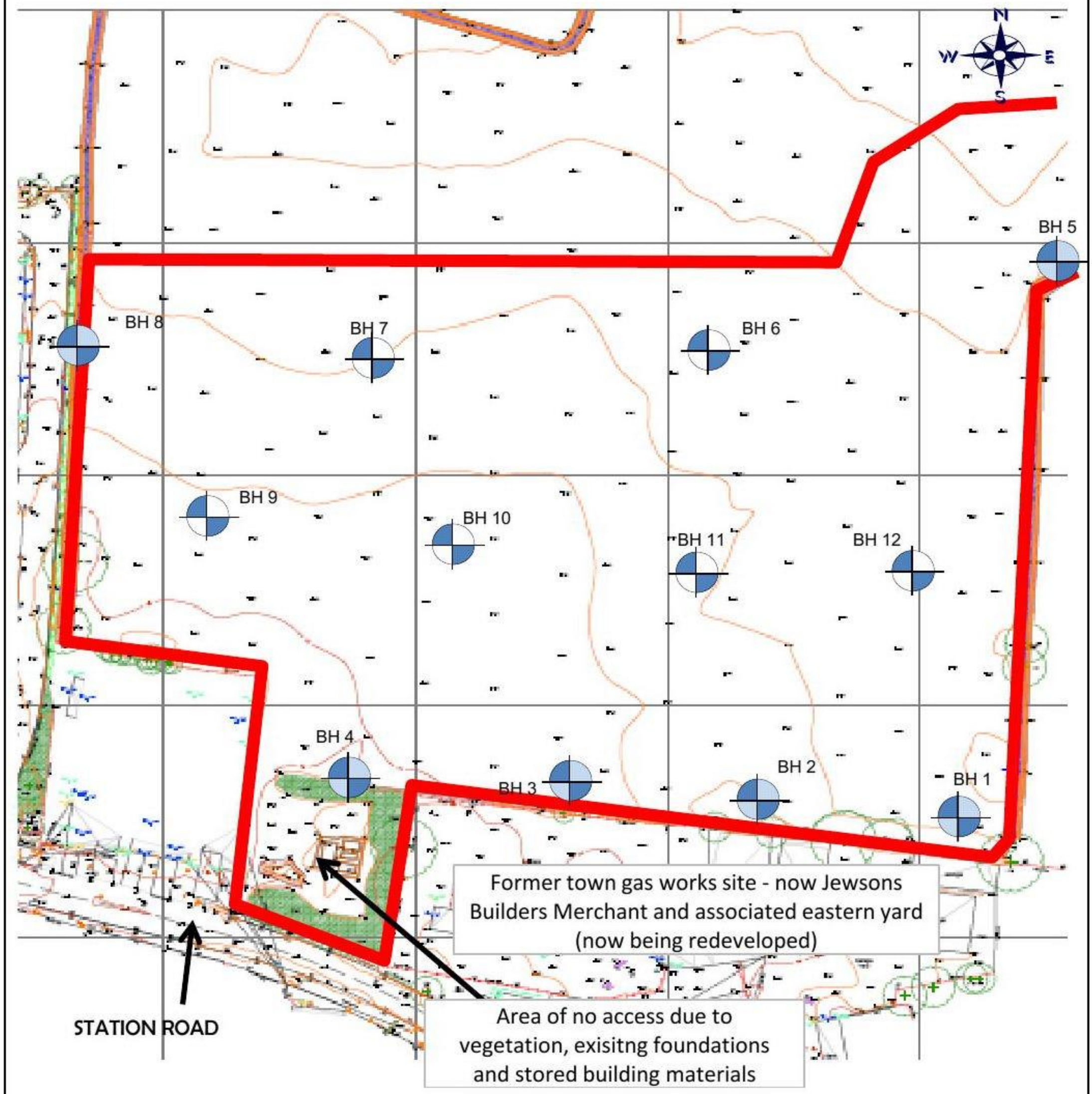
WILSON BAILEY
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Carters Barn
Sherrington
Wiltshire
BA12 0SN

Site Plan

Site Land North of Station Road, Hayling Island, Hampshire

Client BDW Southampton



Borehole completed with a monitoring standpipe for soil gas and groundwater

Borehole backfilled with a cememtitious grount within clay soils to match existing ground permeabilities

0 25 50 75

Approximate Scale in metres

WILSON BAILEY
GEOTECHNICAL & ENVIRONMENTAL

Borehole No
BH1
Sheet 1 of 1

Project Name Hayling Island	Project No. J15109	Co-ords: -	Hole Type WLS
Location:		Level: -	Scale 1:50
Client: BDW Southapton		Dates: 12/03/2015	Logged By DPB

Well	Water Strikes	Samples & In Situ Testing Depth (m)	Type	Results	Depth (m)	Level (m AOD)	Legend	Stratum Description
		0.25	D		0.40			TOPSOIL
		0.50	D					Firm locally soft brown silty sandy CLAY
		1.00	SPT	N=20	1.00			
		1.00	D	(3,5/ 5,5,5,5)				Pale grey silty sandy CLAY with abundant fine flint gravel
					1.30			Pale grey coarse silty SAND with occasional fine flint gravel
		1.50	D		1.60			Medium dense pale yellowish brown coarse silty SAND with occasional fine to medium flint gravel
	▽	2.00	SPT	N=13				
		2.00	D	(2,2/ 3,3,4,3)				
		2.50	D					
		3.00	SPT	N=12				
		3.00	D	(3,3/ 3,3,3,3)				
		3.50	D					
					3.80			Stiff dark grey slightly silty CLAY
		4.00	SPT	N=29				
		4.00	D	(5,5/ 6,7,8,8)				
		4.45	D		4.45			End of Borehole at 4.45 m

Type | Results

Remarks: Damp below 1.00m. Groundwater encountered at 2.00m. Sradpipe installed with a response zone form 0.50m to 4.00m. Borehole used for soakage testing - results presented seperatley.

AGS

WILSON BAILEY
GEOTECHNICAL & ENVIRONMENTAL

Borehole No
BH2
Sheet 1 of 1

Project Name Hayling Island	Project No. J15109	Co-ords: -	Hole Type WLS
Location:		Level: -	Scale 1:50
Client: BDW Southapton		Dates: 12/03/2015	Logged By DPB

Well	Water Strikes	Samples & In Situ Testing Depth (m)	Type	Results	Depth (m)	Level (m AOD)	Legend	Stratum Description
		0.50	D		0.60			TOPSOIL
		0.75	D					Firm pale brown silty sandy CLAY
		1.00	D		0.95			Pale greyish brown silty coarse SAND with scattered fine flint gravel
		1.50	D		1.50			Pale yellowish brown silty fine to medium coarse SAND with scattered fine flint gravel
	▽	2.00	D					
		2.50	D		2.70			Soft pale brown silty very sandy CLAY
		3.00	D		3.10			Pale yellowish brown silty fine to medium coarse SAND with scattered fine gravel
		3.50	D		3.90			Stiff grey sandy silty CLAY
					4.00			End of Borehole at 4.00 m

Remarks: Grdoundwater encountered at 2.00m. Standpipe installed with a response zone from 0.50m to 3.50m. Borehole used for soakage testing - results presented seperately.

AGS

WILSON BAILEY
GEOTECHNICAL & ENVIRONMENTAL

Borehole No
BH3
Sheet 1 of 1

Project Name Hayling Island	Project No. J15109	Co-ords: -	Hole Type WLS
Location:		Level: -	Scale 1:50
Client: BDW Southapton		Dates: 12/03/2015	Logged By DPB

Well	Water Strikes	Samples & In Situ Testing Depth (m)	Type	Results	Depth (m)	Level (m AOD)	Legend	Stratum Description
		0.25	D					TOPSOIL
		0.50	D		0.45			Soft pale brown silty sandy CLAY with occasional locally abundant fine to medium coarse flint gravel
	▽	1.00	D		1.10			Pale yellowish brown and pale greyish brown fine to medium coarse SAND with scatered medium flint gravel
		1.50	D		1.60			Pale yellowish brown and orange-brown silty fine to medium coarse SAND with occasional fine flint gravel
		2.00	D					
		2.50	D					
		3.00	D					
		3.50	D					
					3.80			Stiff grey silty CLAY
					4.00			End of Borehole at 4.00 m

Remarks: Groudnwater encountered at 1.30m. Standpipe installed with a response zone from 0.50m to 4.00m.

AGS

WILSON BAILEY
GEOTECHNICAL & ENVIRONMENTAL

Borehole No
BH4
Sheet 1 of 1

Project Name Hayling Island	Project No. J15109	Co-ords: -	Hole Type WLS
Location:		Level: -	Scale 1:50
Client: BDW Southapton		Dates: 12/03/2015	Logged By DPB

Well	Water Strikes	Samples & In Situ Testing Depth (m)	Type	Results	Depth (m)	Level (m AOD)	Legend	Stratum Description
		0.50	D		0.60			TOPSOIL
		1.00	SPT	N=7				Soft pale orange-brown and brown silty sandy CLAY
		1.00	D	(1,1/ 1,1,2,3)				
	▽	1.50	D		1.50			Pale grey fine to medium coarse SAND with scattered becoming abundant fine to medium flint gravel
		2.00	SPT	N=26				Pale yellowish brown fine to medium coarse SAND with occasional locally abundant fine flint gravel
		2.00	D	(2,3/ 4,7,8,7)				
		2.50	D					
		3.00	SPT	N=4				
		3.00	D	(1,2/ 1,0,1,2)				
		3.50	D					
					4.00			End of Borehole at 4.00 m

Type | Results

Remarks: Groundwater encountered at 1.50m. Standpipe installed with a response ozone from 0.50m to 2.50m. Borehole collapsed.

AGS

WILSON BAILEY
GEOTECHNICAL & ENVIRONMENTAL

Borehole No
BH5
Sheet 1 of 1

Project Name Hayling Island	Project No. J15109	Co-ords: -	Hole Type WLS
Location:		Level: -	Scale 1:50
Client: BDW Southapton		Dates: 09/04/2015	Logged By DPB

Well	Water Strikes	Samples & In Situ Testing Depth (m)	Type	Results	Depth (m)	Level (m AOD)	Legend	Stratum Description
					0.40			TOPSOIL
		0.50	D					Firm locally soft orange-brown and brown silty sandy CLAY
		1.00	D					
					1.20			
	▽	1.50	D		1.40			Brown very clayey GRAVEL
		2.00	D					Yellowish brown fine silty SAND with occasional fine to medium flint gravel
		2.50	D					
		3.00	D					
		3.50	D					
					3.85			Stiff dark bluish grey fissured CLAY
		4.00	D		4.00			End of Borehole at 4.00 m

Remarks: Groundwater encountered at 1.50m. Standpipe installed with a response zone from 1.00m to 4.00m.

AGS

WILSON BAILEY
GEOTECHNICAL & ENVIRONMENTAL

Borehole No
BH6
Sheet 1 of 1

Project Name Hayling Island	Project No. J15109	Co-ords: -	Hole Type WLS
Location:		Level: -	Scale 1:50
Client: BDW Southapton		Dates: 09/04/2015	Logged By DPB

Well	Water Strikes	Samples & In Situ Testing Depth (m)	Type	Results	Depth (m)	Level (m AOD)	Legend	Stratum Description
					0.30			TOPSOIL
		0.50	D					Soft pale orange-brown and brown silty sandy CLAY
		1.00	SPT	N=24				
	▽	1.00	D	(5,7/ 9,8,4,3)	1.20			
					1.30			Brown clayey GRAVEL
		1.50	D					Pale yellowish brown silty fine SAND
					2.00			End of Borehole at 2.00 m

Type | Results

Remarks: Groundwater encountered at 1.30m.

AGS

WILSON BAILEY
GEOTECHNICAL & ENVIRONMENTAL

Borehole No
BH7
Sheet 1 of 1

Project Name Hayling Island	Project No. J15109	Co-ords: -	Hole Type WLS
Location:		Level: -	Scale 1:50
Client: BDW Southapton		Dates: 09/04/2015	Logged By DPB

Well	Water Strikes	Samples & In Situ Testing Depth (m)	Type	Results	Depth (m)	Level (m AOD)	Legend	Stratum Description
								TOPSOIL
		0.50	D		0.40			MADE GROUND (reworked soft pale brown clay with occasional decayed rootlets and clay land drain at 0.70m.)
	▽	1.00	D		0.80			Soft brown silty sandy CLAY with occasional fine to medium flint gravel
		1.50	D		1.20			Fine pale yellowish brown silty SAND
		2.00	D					
		2.50	D					
					3.00			End of Borehole at 3.00 m

Remarks: Groundwater encountered at 1.20m.

AGS

WILSON BAILEY
GEOTECHNICAL & ENVIRONMENTAL

Borehole No
BH8
Sheet 1 of 1

Project Name Hayling Island	Project No. J15109	Co-ords: -	Hole Type WLS
Location:		Level: -	Scale 1:50
Client: BDW Southapton		Dates: 09/04/2015	Logged By DPB

Well	Water Strikes	Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description
		Depth (m)	Type	Results				
		0.50	D		0.35			TOPSOIL
		1.00	D					Soft pale brown and orange-brown silty sandy CLAY
	▽	1.50	D		1.30 1.50			Orange-brown very clayey silty sandy fine to medium flint GRAVEL Pale yellowish orange-brown silty fine SAND
					2.00			End of Borehole at 2.00 m

Remarks: Groundwater encountered at 1.50m.

AGS

WILSON BAILEY
GEOTECHNICAL & ENVIRONMENTAL

Borehole No
BH9
Sheet 1 of 1

Project Name: Hayling Island	Project No.: J15109	Co-ords: -	Hole Type: WLS
Location:		Level: -	Scale: 1:50
Client: BDW Southapton		Dates: 09/04/2015	Logged By: DPB

Well	Water Strikes	Samples & In Situ Testing: Depth (m)	Type	Results	Depth (m)	Level (m AOD)	Legend	Stratum Description
					0.45			TOPSOIL
		0.50	D					Soft locally firm brown silty sandy CLAY becoming unstable below 1.20m
		1.00	D					
	▽	1.50	D		1.50			
					1.70			Brown and pale grey very clayey silty sandy fine to medium flint GRAVEL
		2.00	D					Pale yellowish brown silty fine SAND with occasional fine flint gravel
		2.50	D					
		3.00	D					
		3.50	D					
		4.00	D					
					4.20			Stiff dark greyish blue silty sandy CLAY
		4.50	D					
					5.00			End of Borehole at 5.00 m

Type | Results

Remarks: Groundwater encountered at 1.50m. Standpipe installed with a response zone from 1.00m to 5.00m.

AGS

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GEOTECHNICAL & ENVIRONMENTAL

Borehole No
BH10
Sheet 1 of 1

Project Name Hayling Island	Project No. J15109	Co-ords: -	Hole Type WLS
Location:		Level: -	Scale 1:50
Client: BDW Southapton		Dates: 09/04/2015	Logged By DPB

Well	Water Strikes	Samples & In Situ Testing Depth (m)	Type	Results	Depth (m)	Level (m AOD)	Legend	Stratum Description
		0.50	D		0.35			TOPSOIL
		1.00	D					Firm soft pale brown and orange-brown silty sandy CLAY
	▽	1.50	D		1.20			Pale grey silty sandy fine to medium flint GRAVEL
					1.60			Orange-brown and brown silty fine SAND
					2.00			End of Borehole at 2.00 m

Remarks: Groundwater encountered at 1.60m.

AGS

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GEOTECHNICAL & ENVIRONMENTAL

Borehole No
BH11
Sheet 1 of 1

Project Name Hayling Island	Project No. J15109	Co-ords: -	Hole Type WLS
Location:		Level: -	Scale 1:50
Client: BDW Southapton		Dates: 09/04/2015	Logged By DPB

Well	Water Strikes	Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description
		Depth (m)	Type	Results				
		0.50	D		0.40			TOPSOIL
		1.00	D					Soft locally firm pale brown silty sandy CLAY
	▽	1.50	D		1.30 1.50			Pale orange-brown and pale grey silty sandy fine to medium flint GRAVEL
		2.00	D					Pale grey and pale yellowish brown silty fine SAND
		2.50	D					
					3.00			End of Borehole at 3.00 m

Remarks: Groundwater encountered at 1.50m.

AGS

WILSON BAILEY
GEOTECHNICAL & ENVIRONMENTAL

Borehole No
BH12
Sheet 1 of 1

Project Name Hayling Island	Project No. J15109	Co-ords: -	Hole Type WLS
Location:		Level: -	Scale 1:50
Client: BDW Southapton		Dates: 09/04/2015	Logged By DPB

Well	Water Strikes	Samples & In Situ Testing Depth (m)	Type	Results	Depth (m)	Level (m AOD)	Legend	Stratum Description
		0.50	D		0.25			TOPSOIL
	▽	1.00	D		1.00			Firm pale brown silty sandy CLAY
		1.50	D		1.20			Pale grey very silty sand clayey fine to medium flint GRAVEL
		2.00	D					Pale yellowish brown silty SAND with scattered fine flint gravel
		2.50	D					
					3.00			End of Borehole at 3.00 m

Remarks: Groundwater encountered at 1.20m.

AGS

Project Name:	Hayling Island	**Samples Received:**	13/04/2015
		Project Started:	24/04/2015
Client:	Wilson Bailey Geotechnical & Environmental	**Testing Started:**	06/05/2015
Project No:	- **Our job/report no:** 18731	**Date Reported:**	09/05/2015

K4 SOILS

Borehole No:	Sample No:	Depth (m)	Description	Moisture content (%)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Passing 0.425 mm (%)	Remarks
BH5	-	1.00	Brown, grey and orange brown slightly sandy silty CLAY with rare fm sub-angular gravel	27	56	22	34	98	
BH6	-	1.00	Brown and greyish brown slightly sandy silty CLAY with rare fine gravel	22	47	18	29	99	
BH8	-	1.00	Brown slightly sandy silty CLAY with rare fine gravel	24	48	21	27	99	
BH9	-	1.50	Brown and orange brown slightly sandy silty CLAY with rare fine gravel	25	53	21	32	99	
BH9	-	4.50	Grey slightly sandy silty CLAY	27	53	22	31	100	
BH11	-	1.00	Brown and orange brown slightly sandy silty CLAY with rare fm sub-angular gravel	22	44	20	24	98	
BH12	-	1.00	Brown and greyish brown slightly sandy silty CLAY with rare fine gravel	25	40	20	20	98	

UKAS TESTING 2519

Summary of Test Results

BS 1377 : Part 2 : Clause 4.4 : 1990 Determination of the liquid limit by the cone penetrometer method.

BS 1377 : Part 2 : Clause 5 : 1990 Determination of the plastic limit and plasticity index.

BS 1377 : Part 2 : Clause 3.2 : 1990 Determination of the moisture content by the oven-drying method.

Checked and Approved

Initials: K.P

Date: 08/05/2015

Test Report by K4 SOILS LABORATORY Unit 8 Olds Close Olds Approach Watford Herts WD18 9RU

Test Results relate only to the sample numbers shown above. Approved Signatories: K.Phaure (Tech.Mgr) J.Phaure (Lab.Mgr)

All samples connected with this report ,incl any on 'hold' will be stored and disposed off according to Company policy.Acopy of this policy is available on request.

MSF-11/R2

Project Name:	Hayling Island		
Client:	Wilson Bailey Geotechnical &	Project no:	-
		Our job no:	18731

K4 SOILS

Borehole No:	Sample No:	Depth m	Description	pH	Sulphate content (g/l)
BH8	-	1.00	Brown slightly sandy silty CLAY with rare fine gravel	7.9	1.12
BH9	-	1.50	Brown and orange brown slightly sandy silty CLAY with rare fine gravel	7.7	0.48
BH11	-	1.00	Brown and orange brown slightly sandy silty CLAY with rare fm sub-angular gravel	7.9	0.14

Date
09/05/2015

Summary of Test Results

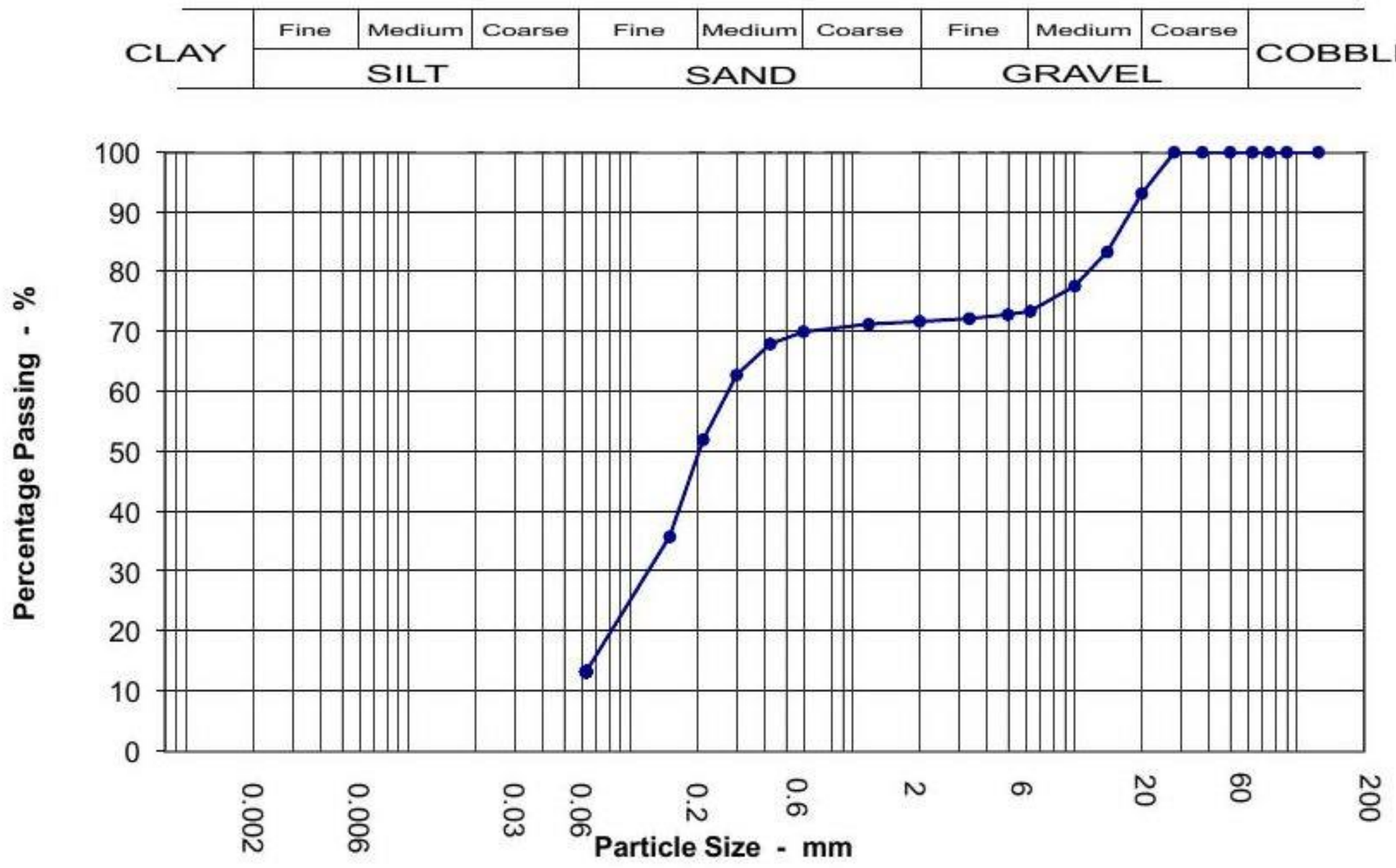
BS 1377 : Part 3 :Clause 5 : 1990

Determination of sulphate content of soil and ground water : gravimetric method

Checked and Approved
Initials : kp

Unit 8 Olds Close Olds Approach Watford Herts WD18 9RU

K4 SOILS	PARTICLE SIZE DISTRIBUTION BS 1377 : Part 2 : 1990 : Clause 9	Our Report No:	18731
		Project No:	-
Location	Hayling Island	Borehole / Trial Pit No:	BH12
		Depth	2.00 m
Visual Soil Description	Brown and orange brown clayey very gravelly SAND (gravel is fmc and sub-angular to rounded)	Sample Type/No	-



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	93		
14	83		
10	78		
6.3	73		
5	73		
3.35	72		
2	72		
1.18	71		
0.6	70		
0.425	68		
0.3	63		
0.212	52		
0.15	36		
0.063	13		

Test Method	
BS 1377 : Part 2 : 1990	
Sieving	Clause 9.2
Sedimentation	N/A
Suitable Amount Of Sample Received	Yes

Sample Proportions	
Cobbles	0.0
Gravel	28.2
Sand	58.5
Silt & Clay	13.3

Grading Analysis	
D100	125.0
D60	0.3
D10	
Uniformity Coefficient	N/A

K4 SOILS LABORATORY
Unit 8 Olds Close Olds Approach
Watford Herts WD18 9RU.
E-mail: k4soils@aol.com

Approved Signatories:
K.Phaure(Tech.Mgr) J.Phaure(Lab.Mgr)

Test results relate only to the sample numbers shown above

Checked and Approved
Initials: kp
Date: 09/05/2015

UKAS TESTING

Dominic Brightman
Wilson Bailey Geotechnical & Environmental Ltd
Carters Cottage
Sherrington
Wiltshire
BA12 0SN

QTS Environmental Ltd
Unit 1
Rose Lane Industrial Estate
Rose Lane
Lenham Heath
Kent
ME17 2JN
t: 01622 850410
russell.jarvis@qtsenvironmental.com

QTS Environmental Report No: 15-29866

Site Reference:	Hayling Island
Project / Job Ref:	None Supplied
Order No:	None Supplied
Sample Receipt Date:	18/03/2015
Sample Scheduled Date:	20/03/2015
Report Issue Number:	1
Reporting Date:	25/03/2015

Authorised by:

Russell Jarvis
Director
On behalf of QTS Environmental Ltd

Authorised by:

Kevin Old
Director
On behalf of QTS Environmental Ltd

QTS Environmental Ltd
Unit 1, Rose Lane Industrial Estate
Rose Lane
Lenham Heath
Maidstone
Kent ME17 2JN
Tel : 01622 850410

4480

Soil Analysis Certificate							
QTS Environmental Report No: 15-29866	Date Sampled	None Supplied	None Supplied	None Supplied	None Supplied	
Wilson Bailey Geotechnical & Environmental Ltd	Time Sampled	None Supplied	None Supplied	None Supplied	None Supplied	
Site Reference: Hayling Island	TP / BH No	BH1	BH2	BH3	BH3	
Project / Job Ref: None Supplied	Additional Refs	None Supplied	None Supplied	None Supplied	None Supplied	
Order No: None Supplied	Depth (m)	0.25	0.50	0.25	0.60	
Reporting Date: 25/03/2015	QTSE Sample No	141409	141410	141411	141412	

Determinand	Unit	RL	Accreditation					
Asbestos Screen	N/a	N/a	ISO17025	Not Detected	Not Detected	Not Detected	Not Detected	
pH	pH Units	N/a	MCERTS	6.9	6.9	6.7	7.0	
W/S Sulphate as SO4 (2:1)	g/l	< 0.01	MCERTS	0.01	0.05	0.03	0.01	
Total Organic Carbon (TOC)	%	< 0.1	MCERTS	2.4	1.2	1.5	0.7	
Arsenic (As)	mg/kg	< 2	MCERTS	6	6	6	3	
W/S Boron	mg/kg	< 1	NONE	< 1	< 1	< 1	< 1	
Cadmium (Cd)	mg/kg	< 0.2	MCERTS	0.4	< 0.2	0.3	< 0.2	
Chromium (Cr)	mg/kg	< 2	MCERTS	25	22	22	32	
Chromium (hexavalent)	mg/kg	< 2	NONE	< 2	< 2	< 2	< 2	
Copper (Cu)	mg/kg	< 4	MCERTS	20	14	15	10	
Lead (Pb)	mg/kg	< 3	MCERTS	53	41	42	17	
Mercury (Hg)	mg/kg	< 1	NONE	< 1	< 1	< 1	< 1	
Nickel (Ni)	mg/kg	< 3	MCERTS	17	15	13	17	
Selenium (Se)	mg/kg	< 3	NONE	< 3	< 3	< 3	< 3	
Zinc (Zn)	mg/kg	< 3	MCERTS	70	42	49	52	
Total Phenols (monohydric)	mg/kg	< 2	NONE	< 2	< 2	< 2	< 2	

Analytical results are expressed on a dry weight basis where samples are dried at less than 30°C

Analysis carried out on the dried sample is corrected for the stone content

The samples have been examined to identify the presence of asbestiform minerals by polarising light microscopy and dispersion staining technique to In-House Procedures QTSE600 Determination of Asbestos in Bulk Materials; Asbestos in Soils/Sediments (fibre screening and identification)

This report refers to samples as received, and QTS Environmental Ltd, takes no responsibility for the accuracy or competence of sampling by others.

The material description shall be regarded as tentative and is not included in our scope of UKAS Accreditation.

Opinions and interpretations expressed herein are outside the scope of UKAS Accreditation.

Asbestos Analyst: Graham Revell

RL: Reporting Limit

Pinch Test: Where pinch test is positive it is reported "Loose Fibres - PT" with type(s).

Subcontracted analysis $^{(S)}$

QTS Environmental Ltd
Unit 1, Rose Lane Industrial Estate
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Soil Analysis Certificate - Speciated PAHs							
QTS Environmental Report No: 15-29866	Date Sampled	None Supplied	None Supplied	None Supplied	None Supplied	
Wilson Bailey Geotechnical & Environmental L	Time Sampled	None Supplied	None Supplied	None Supplied	None Supplied	
Site Reference: Hayling Island	TP / BH No	BH1	BH2	BH3	BH3	
Project / Job Ref: None Supplied	Additional Refs	None Supplied	None Supplied	None Supplied	None Supplied	
Order No: None Supplied	Depth (m)	0.25	0.50	0.25	0.60	
Reporting Date: 25/03/2015	QTSE Sample No	141409	141410	141411	141412	

Determinand	Unit	RL	Accreditation					
Naphthalene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	
Acenaphthylene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	
Acenaphthene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	
Fluorene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	
Phenanthrene	mg/kg	< 0.1	MCERTS	0.16	< 0.1	< 0.1	< 0.1	
Anthracene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	
Fluoranthene	mg/kg	< 0.1	MCERTS	0.44	0.22	0.17	< 0.1	
Pyrene	mg/kg	< 0.1	MCERTS	0.37	0.18	0.14	< 0.1	
Benzo(a)anthracene	mg/kg	< 0.1	MCERTS	0.26	0.12	< 0.1	< 0.1	
Chrysene	mg/kg	< 0.1	MCERTS	0.24	0.13	< 0.1	< 0.1	
Benzo(b)fluoranthene	mg/kg	< 0.1	MCERTS	0.33	0.18	0.13	< 0.1	
Benzo(k)fluoranthene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	
Benzo(a)pyrene	mg/kg	< 0.1	MCERTS	0.22	0.12	< 0.1	< 0.1	
Indeno(1,2,3-cd)pyrene	mg/kg	< 0.1	MCERTS	0.13	< 0.1	< 0.1	< 0.1	
Dibenz(a,h)anthracene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	
Benzo(ghi)perylene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	
Total EPA-16 PAHs	mg/kg	< 1.6	MCERTS	2.2	< 1.6	< 1.6	< 1.6	

Analytical results are expressed on a dry weight basis where samples are dried at less than 30°C

QTS Environmental Ltd
Unit 1, Rose Lane Industrial Estate
Rose Lane
Lenham Heath
Maidstone
Kent ME17 2JN
Tel : 01622 850410

4480

Soil Analysis Certificate - TPH CWG Banded							
QTS Environmental Report No: 15-29866	Date Sampled	None Supplied	None Supplied	None Supplied	None Supplied		
Wilson Bailey Geotechnical & Environmental L	Time Sampled	None Supplied	None Supplied	None Supplied	None Supplied		
Site Reference: Hayling Island	TP / BH No	BH1	BH2	BH3	BH3		
Project / Job Ref: None Supplied	Additional Refs	None Supplied	None Supplied	None Supplied	None Supplied		
Order No: None Supplied	Depth (m)	0.25	0.50	0.25	0.60		
Reporting Date: 25/03/2015	QTSE Sample No	141409	141410	141411	141412		

Determinand	Unit	RL	Accreditation					
Aliphatic >C5 - C6	mg/kg	< 0.01	NONE	< 0.01	< 0.01	< 0.01	< 0.01	
Aliphatic >C6 - C8	mg/kg	< 0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05	
Aliphatic >C8 - C10	mg/kg	< 2	MCERTS	< 2	< 2	< 2	< 2	
Aliphatic >C10 - C12	mg/kg	< 2	MCERTS	< 2	< 2	< 2	< 2	
Aliphatic >C12 - C16	mg/kg	< 3	MCERTS	< 3	< 3	< 3	< 3	
Aliphatic >C16 - C21	mg/kg	< 3	MCERTS	< 3	< 3	< 3	< 3	
Aliphatic >C21 - C34	mg/kg	< 10	MCERTS	< 10	< 10	< 10	< 10	
Aliphatic (C5 - C34)	mg/kg	< 21	NONE	< 21	< 21	< 21	< 21	
Aromatic >C5 - C7	mg/kg	< 0.01	NONE	< 0.01	< 0.01	< 0.01	< 0.01	
Aromatic >C7 - C8	mg/kg	< 0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05	
Aromatic >C8 - C10	mg/kg	< 2	MCERTS	< 2	< 2	< 2	< 2	
Aromatic >C10 - C12	mg/kg	< 2	MCERTS	< 2	< 2	< 2	< 2	
Aromatic >C12 - C16	mg/kg	< 2	MCERTS	< 2	< 2	< 2	< 2	
Aromatic >C16 - C21	mg/kg	< 3	MCERTS	< 3	< 3	< 3	< 3	
Aromatic >C21 - C35	mg/kg	< 10	MCERTS	< 10	< 10	< 10	< 10	
Aromatic (C5 - C35)	mg/kg	< 21	NONE	< 21	< 21	< 21	< 21	
Total >C5 - C35	mg/kg	< 42	NONE	< 42	< 42	< 42	< 42	

Analytical results are expressed on a dry weight basis where samples are dried at less than 30°C

QTS Environmental Ltd
Unit 1, Rose Lane Industrial Estate
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Maidstone
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4480

Soil Analysis Certificate - BTEX / MTBE							
QTS Environmental Report No: 15-29866	Date Sampled	None Supplied	None Supplied	None Supplied	None Supplied	
Wilson Bailey Geotechnical & Environmental L	Time Sampled	None Supplied	None Supplied	None Supplied	None Supplied	
Site Reference: Hayling Island	TP / BH No	BH1	BH2	BH3	BH3	
Project / Job Ref: None Supplied	Additional Refs	None Supplied	None Supplied	None Supplied	None Supplied	
Order No: None Supplied	Depth (m)	0.25	0.50	0.25	0.60	
Reporting Date: 25/03/2015	QTSE Sample No	141409	141410	141411	141412	

Determinand	Unit	RL	Accreditation					
Benzene	ug/kg	< 2	MCERTS	< 2	< 2	< 2	< 2	
Toluene	ug/kg	< 5	MCERTS	< 5	< 5	< 5	< 5	
Ethylbenzene	ug/kg	< 2	MCERTS	< 2	< 2	< 2	< 2	
p & m-xylene	ug/kg	< 2	MCERTS	< 2	< 2	< 2	< 2	
o-xylene	ug/kg	< 2	MCERTS	< 2	< 2	< 2	< 2	
MTBE	ug/kg	< 5	MCERTS	< 5	< 5	< 5	< 5	

Analytical results are expressed on a dry weight basis where samples are dried at less than 30°C

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Soil Analysis Certificate - Sample Descriptions	
QTS Environmental Report No: 15-29866	
Wilson Bailey Geotechnical & Environmental Ltd	
Site Reference: Hayling Island	
Project / Job Ref: None Supplied	
Order No: None Supplied	
Reporting Date: 25/03/2015	

QTSE Sample No	TP / BH No	Additional Refs	Depth (m)	Moisture Content (%)	Sample Matrix Description
^ 141409	BH1	None Supplied	0.25	19.6	Brown clay
^ 141410	BH2	None Supplied	0.50	14.9	Brown clay
^ 141411	BH3	None Supplied	0.25	18.3	Brown clay
^ 141412	BH3	None Supplied	0.60	16.4	Light brown clay

Moisture content is part of procedure E003 & is not an accredited test

Insufficient Sample I/S

Unsuitable Sample U/S

^ no sampling date provided; unable to confirm if samples are within acceptable holding times

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Soil Analysis Certificate - Methodology & Miscellaneous Information
QTS Environmental Report No: 15-29866
Wilson Bailey Geotechnical & Environmental Ltd
Site Reference: Hayling Island
Project / Job Ref: None Supplied
Order No: None Supplied
Reporting Date: 25/03/2015

Matrix	Analysed On	Determinand	Brief Method Description	Method No
Soil	D	Boron - Water Soluble	Determination of water soluble boron in soil by 2:1 hot water extract followed by ICP-OES	E012
Soil	AR	BTEX	Determination of BTEX by headspace GC-MS	E001
Soil	D	Cations	Determination of cations in soil by aqua-regia digestion followed by ICP-OES	E002
Soil	D	Chloride - Water Soluble (2:1)	Determination of chloride by extraction with water & analysed by ion chromatography	E009
Soil	AR	Chromium - Hexavalent	Determination of hexavalent chromium in soil by extraction in water then by acidification, addition of 1,5 diphenylcarbazide followed by colorimetry	E016
Soil	AR	Cyanide - Complex	Determination of complex cyanide by distillation followed by colorimetry	E015
Soil	AR	Cyanide - Free	Determination of free cyanide by distillation followed by colorimetry	E015
Soil	AR	Cyanide - Total	Determination of total cyanide by distillation followed by colorimetry	E015
Soil	D	Cyclohexane Extractable Matter (CEM)	Gravimetrically determined through extraction with cyclohexane	E011
Soil	AR	Diesel Range Organics (C10 - C24)	Determination of hexane/acetone extractable hydrocarbons by GC-FID	E004
Soil	AR	Electrical Conductivity	Determination of electrical conductivity by addition of saturated calcium sulphate followed by electrometric measurement	E022
Soil	AR	Electrical Conductivity	Determination of electrical conductivity by addition of water followed by electrometric measurement	E023
Soil	D	Elemental Sulphur	Determination of elemental sulphur by solvent extraction followed by GC-MS	E020
Soil	AR	EPH (C10 – C40)	Determination of acetone/hexane extractable hydrocarbons by GC-FID	E004
Soil	AR	EPH Product ID	Determination of acetone/hexane extractable hydrocarbons by GC-FID	E004
Soil	AR	EPH TEXAS (C6-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C40)	Determination of acetone/hexane extractable hydrocarbons by GC-FID for C8 to C40. C6 to C8 by headspace GC-MS	E004
Soil	D	Fluoride - Water Soluble	Determination of Fluoride by extraction with water & analysed by ion chromatography	E009
Soil	D	FOC (Fraction Organic Carbon)	Determination of fraction of organic carbon by oxidising with potassium dichromate followed by titration with iron (II) sulphate	E010
Soil	D	Loss on Ignition @ 450oC	Determination of loss on ignition in soil by gravimetrically with the sample being ignited in a muffle furnace	E019
Soil	D	Magnesium - Water Soluble	Determination of water soluble magnesium by extraction with water followed by ICP-OES	E025
Soil	D	Metals	Determination of metals by aqua-regia digestion followed by ICP-OES	E002
Soil	AR	Mineral Oil (C10 - C40)	Determination of hexane/acetone extractable hydrocarbons by GC-FID fractionating with SPE cartridge	E004
Soil	AR	Moisture Content	Moisture content; determined gravimetrically	E003
Soil	D	Nitrate - Water Soluble (2:1)	Determination of nitrate by extraction with water & analysed by ion chromatography	E009
Soil	D	Organic Matter	Determination of organic matter by oxidising with potassium dichromate followed by titration with iron (II) sulphate	E010
Soil	AR	PAH - Speciated (EPA 16)	Determination of PAH compounds by extraction in acetone and hexane followed by GC-MS with the use of surrogate and internal standards	E005
Soil	AR	PCB - 7 Congeners	Determination of PCB by extraction with acetone and hexane followed by GC-MS	E008
Soil	D	Petroleum Ether Extract (PEE)	Gravimetrically determined through extraction with petroleum ether	E011
Soil	AR	pH	Determination of pH by addition of water followed by electrometric measurement	E007
Soil	AR	Phenols - Total (monohydric)	Determination of phenols by distillation followed by colorimetry	E021
Soil	D	Phosphate - Water Soluble (2:1)	Determination of phosphate by extraction with water & analysed by ion chromatography	E009
Soil	D	Sulphate (as SO4) - Total	Determination of total sulphate by extraction with 10% HCl followed by ICP-OES	E013
Soil	D	Sulphate (as SO4) - Water Soluble (2:1)	Determination of sulphate by extraction with water & analysed by ion chromatography	E009
Soil	D	Sulphate (as SO4) - Water Soluble (2:1)	Determination of water soluble sulphate by extraction with water followed by ICP-OES	E014
Soil	AR	Sulphide	Determination of sulphide by distillation followed by colorimetry	E018
Soil	D	Sulphur - Total	Determination of total sulphur by extraction with aqua-regia followed by ICP-OES	E024
Soil	AR	SVOC	Determination of semi-volatile organic compounds by extraction in acetone and hexane followed by GC-MS	E006
Soil	AR	Thiocyanate (as SCN)	Determination of thiocyanate by extraction in caustic soda followed by acidification followed by addition of ferric nitrate followed by colorimetry	E017
Soil	D	Toluene Extractable Matter (TEM)	Gravimetrically determined through extraction with toluene	E011
Soil	D	Total Organic Carbon (TOC)	Determination of organic matter by oxidising with potassium dichromate followed by titration with iron (II) sulphate	E010
Soil	AR	TPH CWG (ali: C5- C6, C6-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C34, aro: C5-C7, C7-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C35)	Determination of hexane/acetone extractable hydrocarbons by GC-FID fractionating with SPE cartridge for C8 to C35. C5 to C8 by headspace GC-MS	E004
Soil	AR	TPH LQM (ali: C5-C6, C6-C8, C8-C10, C10-C12, C12-C16, C16-C35, C35-C44, aro: C5-C7, C7-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C35, C35-C44)	Determination of hexane/acetone extractable hydrocarbons by GC-FID fractionating with SPE cartridge for C8 to C44. C5 to C8 by headspace GC-MS	E004
Soil	AR	VOCs	Determination of volatile organic compounds by headspace GC-MS	E001
Soil	AR	VPH (C6-C8 & C8-C10)	Determination of hydrocarbons C6-C8 by headspace GC-MS & C8-C10 by GC-FID	E001

D Dried
AR As Received

4480

Dominic Brightman
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QTS Environmental Report No: 15-30658

Site Reference:	Hayling Island
Project / Job Ref:	None Supplied
Order No:	None Supplied
Sample Receipt Date:	13/04/2015
Sample Scheduled Date:	16/04/2015
Report Issue Number:	1
Reporting Date:	22/04/2015

Authorised by: [redacted]

Russell Jarvis
Director
On behalf of QTS Environmental Ltd

Authorised b [redacted]

Kevin Old
Director
On behalf of QTS Environmental Ltd

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Water Analysis Certificate						
QTS Environmental Report No: 15-30658	Date Sampled	None Supplied	None Supplied	None Supplied	None Supplied	
Wilson Bailey Geotechnical & Environmental Ltd	Time Sampled	None Supplied	None Supplied	None Supplied	None Supplied	
Site Reference: Hayling Island	TP / BH No	BH1	BH2	BH3	BH4	
Project / Job Ref: None Supplied	Additional Refs	None Supplied	None Supplied	None Supplied	None Supplied	
Order No: None Supplied	Depth (m)	1.00	3.00	1.00	3.00	
Reporting Date: 22/04/2015	QTSE Sample No	145066	145067	145068	145069	

Determinand	Unit	RL	Accreditation					
pH	pH Units	N/a	ISO17025	7.1	7.1	7.1	7.1	
Total Cyanide	ug/l	< 5	NONE	< 5	< 5	< 5	< 5	
Total Organic Carbon (TOC)	mg/l	< 0.1	NONE	44.8	49.7	48.8	51.1	
Arsenic (dissolved)	ug/l	< 5	ISO17025	< 5	< 5	< 5	< 5	
Boron (dissolved)	ug/l	< 5	ISO17025	111	130	191	198	
Cadmium (dissolved)	ug/l	< 0.4	ISO17025	< 0.4	< 0.4	< 0.4	< 0.4	
Chromium (dissolved)	ug/l	< 5	ISO17025	< 5	< 5	< 5	< 5	
Chromium (hexavalent)	ug/l	< 5	NONE	< 5	< 5	< 5	< 5	
Copper (dissolved)	ug/l	< 5	ISO17025	< 5	< 5	< 5	< 5	
Lead (dissolved)	ug/l	< 5	ISO17025	< 5	< 5	< 5	< 5	
Mercury (dissolved)	ug/l	< 0.05	ISO17025	< 0.05	< 0.05	< 0.05	< 0.05	
Nickel (dissolved)	ug/l	< 5	ISO17025	< 5	< 5	< 5	< 5	
Selenium (dissolved)	ug/l	< 5	ISO17025	< 5	< 5	< 5	< 5	
Zinc (dissolved)	ug/l	< 2	ISO17025	< 2	< 2	5	< 2	
Total Phenols (monohydric)	ug/l	< 0.5	NONE	< 0.5	< 0.5	< 0.5	< 0.5	

Subcontracted analysis (S)
Insufficient sample I/S
Unsuitable Sample U/S

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Water Analysis Certificate - Speciated PAH							
QTS Environmental Report No: 15-30658	Date Sampled	None Supplied	None Supplied	None Supplied	None Supplied		
Wilson Bailey Geotechnical & Environmental L	Time Sampled	None Supplied	None Supplied	None Supplied	None Supplied		
Site Reference: Hayling Island	TP / BH No	BH1	BH2	BH3	BH4		
Project / Job Ref: None Supplied	Additional Refs	None Supplied	None Supplied	None Supplied	None Supplied		
Order No: None Supplied	Depth (m)	1.00	3.00	1.00	3.00		
Reporting Date: 22/04/2015	QTSE Sample No	145066	145067	145068	145069		

Determinand	Unit	RL	Accreditation					
Naphthalene	ug/l	< 0.01	NONE	< 0.01	< 0.01	< 0.01	< 0.01	
Acenaphthylene	ug/l	< 0.01	NONE	< 0.01	< 0.01	< 0.01	< 0.01	
Acenaphthene	ug/l	< 0.01	NONE	< 0.01	< 0.01	< 0.01	< 0.01	
Fluorene	ug/l	< 0.01	NONE	< 0.01	< 0.01	< 0.01	< 0.01	
Phenanthrene	ug/l	< 0.01	NONE	< 0.01	< 0.01	< 0.01	< 0.01	
Anthracene	ug/l	< 0.01	NONE	< 0.01	< 0.01	< 0.01	< 0.01	
Fluoranthene	ug/l	< 0.01	NONE	< 0.01	< 0.01	< 0.01	< 0.01	
Pyrene	ug/l	< 0.01	NONE	< 0.01	< 0.01	< 0.01	< 0.01	
Benzo(a)anthracene	ug/l	< 0.01	NONE	< 0.01	< 0.01	< 0.01	< 0.01	
Chrysene	ug/l	< 0.01	NONE	< 0.01	< 0.01	< 0.01	< 0.01	
Benzo(b)fluoranthene	ug/l	< 0.01	NONE	< 0.01	< 0.01	< 0.01	< 0.01	
Benzo(k)fluoranthene	ug/l	< 0.01	NONE	< 0.01	< 0.01	< 0.01	< 0.01	
Benzo(a)pyrene	ug/l	< 0.01	NONE	< 0.01	< 0.01	< 0.01	< 0.01	
Indeno(1,2,3-cd)pyrene	ug/l	< 0.01	NONE	< 0.01	< 0.01	< 0.01	< 0.01	
Dibenz(a,h)anthracene	ug/l	< 0.01	NONE	< 0.01	< 0.01	< 0.01	< 0.01	
Benzo(ghi)perylene	ug/l	< 0.01	NONE	< 0.01	< 0.01	< 0.01	< 0.01	
Total EPA-16 PAHs	ug/l	< 0.01	NONE	< 0.01	< 0.01	< 0.01	< 0.01	

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Water Analysis Certificate - TPH CWG Banded						
QTS Environmental Report No: 15-30658	Date Sampled	None Supplied	None Supplied	None Supplied	None Supplied	
Wilson Bailey Geotechnical & Environmental L	Time Sampled	None Supplied	None Supplied	None Supplied	None Supplied	
Site Reference: Hayling Island	TP / BH No	BH1	BH2	BH3	BH4	
Project / Job Ref: None Supplied	Additional Refs	None Supplied	None Supplied	None Supplied	None Supplied	
Order No: None Supplied	Depth (m)	1.00	3.00	1.00	3.00	
Reporting Date: 22/04/2015	QTSE Sample No	145066	145067	145068	145069	

Determinand	Unit	RL	Accreditation					
Aliphatic >C5 - C6	ug/l	< 10	NONE	< 10	< 10	< 10	< 10	
Aliphatic >C6 - C8	ug/l	< 10	NONE	< 10	< 10	< 10	< 10	
Aliphatic >C8 - C10	ug/l	< 10	NONE	< 10	< 10	< 10	< 10	
Aliphatic >C10 - C12	ug/l	< 10	NONE	< 10	< 10	< 10	< 10	
Aliphatic >C12 - C16	ug/l	< 10	NONE	< 10	< 10	< 10	< 10	
Aliphatic >C16 - C21	ug/l	< 10	NONE	< 10	< 10	< 10	< 10	
Aliphatic >C21 - C34	ug/l	< 10	NONE	< 10	< 10	< 10	< 10	
Aliphatic (C5 - C34)	ug/l	< 70	NONE	< 70	< 70	< 70	< 70	
Aromatic >C5 - C7	ug/l	< 10	NONE	< 10	< 10	< 10	< 10	
Aromatic >C7 - C8	ug/l	< 10	NONE	< 10	< 10	< 10	< 10	
Aromatic >C8 - C10	ug/l	< 10	NONE	< 10	< 10	< 10	< 10	
Aromatic >C10 - C12	ug/l	< 10	NONE	< 10	< 10	< 10	< 10	
Aromatic >C12 - C16	ug/l	< 10	NONE	< 10	< 10	< 10	< 10	
Aromatic >C16 - C21	ug/l	< 10	NONE	< 10	< 10	< 10	< 10	
Aromatic >C21 - C35	ug/l	< 10	NONE	< 10	< 10	< 10	< 10	
Aromatic (C5 - C35)	ug/l	< 70	NONE	< 70	< 70	< 70	< 70	
Total >C5 - C35	ug/l	< 140	NONE	< 140	< 140	< 140	< 140	

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Water Analysis Certificate - BTEX / MTBE							
QTS Environmental Report No: 15-30658	Date Sampled	None Supplied	None Supplied	None Supplied	None Supplied		
Wilson Bailey Geotechnical & Environmental L	Time Sampled	None Supplied	None Supplied	None Supplied	None Supplied		
Site Reference: Hayling Island	TP / BH No	BH1	BH2	BH3	BH4		
Project / Job Ref: None Supplied	Additional Refs	None Supplied	None Supplied	None Supplied	None Supplied		
Order No: None Supplied	Depth (m)	1.00	3.00	1.00	3.00		
Reporting Date: 22/04/2015	QTSE Sample No	145066	145067	145068	145069		

Determinand	Unit	RL	Accreditation					
Benzene	ug/l	< 1	ISO17025	< 1	< 1	< 1	< 1	
Toluene	ug/l	< 5	ISO17025	< 5	< 5	< 5	< 5	
Ethylbenzene	ug/l	< 5	ISO17025	< 5	< 5	< 5	< 5	
p & m-xylene	ug/l	< 10	ISO17025	< 10	< 10	< 10	< 10	
o-xylene	ug/l	< 5	ISO17025	< 5	< 5	< 5	< 5	
MTBE	ug/l	< 10	ISO17025	< 10	< 10	< 10	< 10	

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Water Analysis Certificate - Semi Volatile Organic Compounds (SVOC)							
QTS Environmental Report No: 15-30658	Date Sampled	None Supplied	None Supplied	None Supplied	None Supplied		
Wilson Bailey Geotechnical & Environmental L	Time Sampled	None Supplied	None Supplied	None Supplied	None Supplied		
Site Reference: Hayling Island	TP / BH No	BH1	BH2	BH3	BH4		
Project / Job Ref: None Supplied	Additional Refs	None Supplied	None Supplied	None Supplied	None Supplied		
Order No: None Supplied	Depth (m)	1.00	3.00	1.00	3.00		
Reporting Date: 22/04/2015	QTSE Sample No	145066	145067	145068	145069		

Determinand	Unit	RL	Accreditation					
Phenol	ug/l	< 0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	
1,2,4-Trichlorobenzene	ug/l	< 0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	
2-Nitrophenol	ug/l	< 0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	
Nitrobenzene	ug/l	< 0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	
0-Cresol	ug/l	< 0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	
bis(2-chloroethoxy)methane	ug/l	< 0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	
bis(2-chloroethyl)ether	ug/l	< 0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	
2,4-Dichlorophenol	ug/l	< 0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	
2-Chlorophenol	ug/l	< 0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	
1,3-Dichlorobenzene	ug/l	< 0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	
1,4-Dichlorobenzene	ug/l	< 0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	
1,2-Dichlorobenzene	ug/l	< 0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	
2,4-Dimethylphenol	ug/l	< 0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	
Isophorone	ug/l	< 0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	
Hexachloroethane	ug/l	< 0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	
p-Cresol	ug/l	< 0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	
2,4,6-Trichlorophenol	ug/l	< 0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	
2,4,5-Trichlorophenol	ug/l	< 0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	
2-Nitroaniline	ug/l	< 0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	
4-Chloro-3-methylphenol	ug/l	< 0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	
2-Methylnaphthalene	ug/l	< 0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	
Hexachlorocyclopentadiene	ug/l	< 0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	
Hexachlorobutadiene	ug/l	< 0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	
2,6-Dinitrotoluene	ug/l	< 0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	
Dimethyl phthalate	ug/l	< 0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	
2-Chloronaphthalene	ug/l	< 0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	
4-Chloroanaline	ug/l	< 0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	
4-Nitrophenol	ug/l	< 0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	
4-Chlorophenyl phenyl ether	ug/l	< 0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	
3-Nitroaniline	ug/l	< 0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	
4-Nitroaniline	ug/l	< 0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	
4-Bromophenyl phenyl ether	ug/l	< 0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	
Hexachlorobenzene	ug/l	< 0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	
2,4-Dinitrotoluene	ug/l	< 0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	
Diethyl phthalate	ug/l	< 0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	
Dibenzofuran	ug/l	< 0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	
Azobenzene	ug/l	< 0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	
Dibutyl phthalate	ug/l	< 0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	
Carbazole	ug/l	< 0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	
bis(2-ethylhexyl)phthalate	ug/l	< 0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	
Benzyl butyl phthalate	ug/l	< 0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	
Di-n-octyl phthalate	ug/l	< 0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	

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Soil Analysis Certificate - Methodology & Miscellaneous Information
QTS Environmental Report No: 15-30658
Wilson Bailey Geotechnical & Environmental Ltd
Site Reference: Hayling Island
Project / Job Ref: None Supplied
Order No: None Supplied
Reporting Date: 22/04/2015

Matrix	Analysed On	Determinand	Brief Method Description	Method No
Water	UF	Alkalinity	Determination of alkalinity by titration against hydrochloric acid using bromocresol green as the end point	E103
Water	UF	BTEX	Determination of BTEX by headspace GC-MS	E101
Water	F	Cations	Determination of cations by filtration followed by ICP-MS	E102
Water	UF	Chemical Oxygen Demand (COD)	Determination using a COD reactor followed by colorimetry	E112
Water	F	Chloride	Determination of chloride by filtration & analysed by ion chromatography	E109
Water	F	Chromium - Hexavalent	Determination of hexavalent chromium by acidification, addition of 1,5 diphenylcarbazide followed by co	E116
Water	UF	Cyanide - Complex	Determination of complex cyanide by distillation followed by colorimetry	E115
Water	UF	Cyanide - Free	Determination of free cyanide by distillation followed by colorimetry	E115
Water	UF	Cyanide - Total	Determination of total cyanide by distillation followed by colorimetry	E115
Water	UF	Cyclohexane Extractable Matter (CEM)	Gravimetrically determined through liquid:liquid extraction with cyclohexane	E111
Water	F	Diesel Range Organics (C10 - C24)	Determination of liquid:liquid extraction with hexane followed by GC-FID	E104
Water	F	Dissolved Organic Content (DOC)	Determination of DOC by filtration followed by low heat with persulphate addition followed by IR detect	E110
Water	UF	Electrical Conductivity	Determination of electrical conductivity by electrometric measurement	E123
Water	F	EPH (C10 – C40)	Determination of liquid:liquid extraction with hexane followed by GC-FID	E104
Water	F	EPH TEXAS (C6-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C40)	Determination of liquid:liquid extraction with hexane followed by GC-FID for C8 to C40. C6 to C8 by headspace GC-MS	E104
Water	F	Fluoride	Determination of Fluoride by filtration & analysed by ion chromatography	E109
Water	F	Hardness	Determination of Ca and Mg by ICP-MS followed by calculation	E102
Leachate	F	Leachate Preparation - NRA	Based on National Rivers Authority leaching test 1994	E301
Leachate	F	Leachate Preparation - WAC	Based on BS EN 12457 Pt1, 2, 3	E302
Water	F	Metals	Determination of metals by filtration followed by ICP-MS	E102
Water	F	Mineral Oil (C10 - C40)	Determination of liquid:liquid extraction with hexane followed by GI-FID	E104
Water	F	Nitrate	Determination of nitrate by filtration & analysed by ion chromatography	E109
Water	UF	Monohydric Phenol	Determination of phenols by distillation followed by colorimetry	E121
Water	F	PAH - Speciated (EPA 16)	Determination of PAH compounds by concentration through SPE cartridge, collection in dichloromethane followed by GC-MS	E105
Water	F	PCB - 7 Congeners	Determination of PCB compounds by concentration through SPE cartridge, collection in dichloromethane	E108
Water	UF	Petroleum Ether Extract (PEE)	Gravimetrically determined through liquid:liquid extraction with petroleum ether	E111
Water	UF	pH	Determination of pH by electrometric measurement	E107
Water	F	Phosphate	Determination of phosphate by filtration & analysed by ion chromatography	E109
Water	UF	Redox Potential	Determination of redox potential by electrometric measurement	E113
Water	F	Sulphate (as SO4)	Determination of sulphate by filtration & analysed by ion chromatography	E109
Water	UF	Sulphide	Determination of sulphide by distillation followed by colorimetry	E118
Water	F	SVOC	Determination of semi-volatile organic compounds by concentration through SPE cartridge, collection in dichloromethane followed by GC-MS	E106
Water	UF	Toluene Extractable Matter (TEM)	Gravimetrically determined through liquid:liquid extraction with toluene	E111
Water	UF	Total Organic Carbon (TOC)	Low heat with persulphate addition followed by IR detection	E110
Water	F	TPH CWG (ali: C5-C6, C6-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C34, aro: C5-C7, C7-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C35)	Determination of liquid:liquid extraction with hexane, fractionating with SPE followed by GC-FID for C8 to C35. C5 to C8 by headspace GC-MS	E104
Water	F	TPH LQM (ali: C5-C6, C6-C8, C8-C10, C10-C12, C12-C16, C16-C35, C35-C44, aro: C5-C7, C7-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C35, C35-C44)	Determination of liquid:liquid extraction with hexane, fractionating with SPE followed by GC-FID for C8 to C44. C5 to C8 by headspace GC-MS	E104
Water	UF	VOCs	Determination of volatile organic compounds by headspace GC-MS	E101
Water	UF	VPH (C6-C8 & C8-C10)	Determination of hydrocarbons C6-C8 by headspace GC-MS & C8-C10 by GC-FID	E101

Key

F Filtered
UF Unfiltered

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QTS Environmental Report No: 15-30539

Site Reference:	Hayling Island
Project / Job Ref:	None Supplied
Order No:	None Supplied
Sample Receipt Date:	13/04/2015
Sample Scheduled Date:	14/04/2015
Report Issue Number:	1
Reporting Date:	17/04/2015

Authorised by: [redacted]

Russell Jarvis
Director
On behalf of QTS Environmental Ltd

Authorised b [redacted]

Kevin Old
Director
On behalf of QTS Environmental Ltd

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Soil Analysis Certificate						
QTS Environmental Report No: 15-30539	Date Sampled	None Supplied	None Supplied	None Supplied	None Supplied	
Wilson Bailey Geotechnical & Environmental Ltd	Time Sampled	None Supplied	None Supplied	None Supplied	None Supplied	
Site Reference: Hayling Island	TP / BH No	BH5	BH8	BH10	BH12	
Project / Job Ref: None Supplied	Additional Refs	None Supplied	None Supplied	None Supplied	None Supplied	
Order No: None Supplied	Depth (m)	1.00	2.00	3.00	0.50	
Reporting Date: 17/04/2015	QTSE Sample No	144453	144454	144455	144456	

Determinand	Unit	RL	Accreditation					
Asbestos Screen (S)	N/a	N/a	ISO17025	Not Detected	Not Detected	Not Detected	Not Detected	
pH	pH Units	N/a	MCERTS	6.3	6.5	6.6	6.6	
Total Organic Carbon (TOC)	%	< 0.1	MCERTS	1.7	1.8	0.6	0.8	
Arsenic (As)	mg/kg	< 2	MCERTS	9	8	5	7	
W/S Boron	mg/kg	< 1	NONE	1.2	< 1	< 1	< 1	
Cadmium (Cd)	mg/kg	< 0.2	MCERTS	0.6	0.3	< 0.2	0.3	
Chromium (Cr)	mg/kg	< 2	MCERTS	34	24	27	31	
Chromium (hexavalent)	mg/kg	< 2	NONE	< 2	< 2	< 2	< 2	
Copper (Cu)	mg/kg	< 4	MCERTS	18	14	9	13	
Lead (Pb)	mg/kg	< 3	MCERTS	85	39	18	34	
Mercury (Hg)	mg/kg	< 1	NONE	< 1	< 1	< 1	< 1	
Nickel (Ni)	mg/kg	< 3	MCERTS	19	15	15	21	
Selenium (Se)	mg/kg	< 3	NONE	< 3	< 3	< 3	< 3	
Zinc (Zn)	mg/kg	< 3	MCERTS	142	57	50	57	
Total Phenols (monohydric)	mg/kg	< 2	NONE	< 2	< 2	< 2	< 2	

Analytical results are expressed on a dry weight basis where samples are dried at less than 30°C
Analysis carried out on the dried sample is corrected for the stone content
Subcontracted analysis (S)

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Soil Analysis Certificate - Speciated PAHs							
QTS Environmental Report No: 15-30539	Date Sampled	None Supplied	None Supplied	None Supplied	None Supplied		
Wilson Bailey Geotechnical & Environmental L	Time Sampled	None Supplied	None Supplied	None Supplied	None Supplied		
Site Reference: Hayling Island	TP / BH No	BH5	BH8	BH10	BH12		
Project / Job Ref: None Supplied	Additional Refs	None Supplied	None Supplied	None Supplied	None Supplied		
Order No: None Supplied	Depth (m)	1.00	2.00	3.00	0.50		
Reporting Date: 17/04/2015	QTSE Sample No	144453	144454	144455	144456		

Determinand	Unit	RL	Accreditation					
Naphthalene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	
Acenaphthylene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	
Acenaphthene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	
Fluorene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	
Phenanthrene	mg/kg	< 0.1	MCERTS	0.15	< 0.1	< 0.1	< 0.1	
Anthracene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	
Fluoranthene	mg/kg	< 0.1	MCERTS	0.51	< 0.1	< 0.1	< 0.1	
Pyrene	mg/kg	< 0.1	MCERTS	0.45	< 0.1	< 0.1	< 0.1	
Benzo(a)anthracene	mg/kg	< 0.1	MCERTS	0.23	< 0.1	< 0.1	< 0.1	
Chrysene	mg/kg	< 0.1	MCERTS	0.35	< 0.1	< 0.1	< 0.1	
Benzo(b)fluoranthene	mg/kg	< 0.1	MCERTS	0.49	< 0.1	< 0.1	< 0.1	
Benzo(k)fluoranthene	mg/kg	< 0.1	MCERTS	0.19	< 0.1	< 0.1	< 0.1	
Benzo(a)pyrene	mg/kg	< 0.1	MCERTS	0.30	< 0.1	< 0.1	< 0.1	
Indeno(1,2,3-cd)pyrene	mg/kg	< 0.1	MCERTS	0.22	< 0.1	< 0.1	< 0.1	
Dibenz(a,h)anthracene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	
Benzo(ghi)perylene	mg/kg	< 0.1	MCERTS	0.19	< 0.1	< 0.1	< 0.1	
Total EPA-16 PAHs	mg/kg	< 1.6	MCERTS	3.1	< 1.6	< 1.6	< 1.6	

Analytical results are expressed on a dry weight basis where samples are dried at less than 30°C

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Soil Analysis Certificate - TPH CWG Banded							
QTS Environmental Report No: 15-30539	Date Sampled	None Supplied	None Supplied	None Supplied	None Supplied	
Wilson Bailey Geotechnical & Environmental L	Time Sampled	None Supplied	None Supplied	None Supplied	None Supplied	
Site Reference: Hayling Island	TP / BH No	BH5	BH8	BH10	BH12	
Project / Job Ref: None Supplied	Additional Refs	None Supplied	None Supplied	None Supplied	None Supplied	
Order No: None Supplied	Depth (m)	1.00	2.00	3.00	0.50	
Reporting Date: 17/04/2015	QTSE Sample No	144453	144454	144455	144456	

Determinand	Unit	RL	Accreditation					
Aliphatic >C5 - C6	mg/kg	< 0.01	NONE	< 0.01	< 0.01	< 0.01	< 0.01	
Aliphatic >C6 - C8	mg/kg	< 0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05	
Aliphatic >C8 - C10	mg/kg	< 2	MCERTS	< 2	< 2	< 2	< 2	
Aliphatic >C10 - C12	mg/kg	< 2	MCERTS	< 2	< 2	< 2	< 2	
Aliphatic >C12 - C16	mg/kg	< 3	MCERTS	< 3	< 3	< 3	< 3	
Aliphatic >C16 - C21	mg/kg	< 3	MCERTS	< 3	< 3	< 3	< 3	
Aliphatic >C21 - C34	mg/kg	< 10	MCERTS	< 10	< 10	< 10	< 10	
Aliphatic (C5 - C34)	mg/kg	< 21	NONE	< 21	< 21	< 21	< 21	
Aromatic >C5 - C7	mg/kg	< 0.01	NONE	< 0.01	< 0.01	< 0.01	< 0.01	
Aromatic >C7 - C8	mg/kg	< 0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05	
Aromatic >C8 - C10	mg/kg	< 2	MCERTS	< 2	< 2	< 2	< 2	
Aromatic >C10 - C12	mg/kg	< 2	MCERTS	< 2	< 2	< 2	< 2	
Aromatic >C12 - C16	mg/kg	< 2	MCERTS	< 2	< 2	< 2	< 2	
Aromatic >C16 - C21	mg/kg	< 3	MCERTS	< 3	< 3	< 3	< 3	
Aromatic >C21 - C35	mg/kg	< 10	MCERTS	17	< 10	< 10	< 10	
Aromatic (C5 - C35)	mg/kg	< 21	NONE	< 21	< 21	< 21	< 21	
Total >C5 - C35	mg/kg	< 42	NONE	< 42	< 42	< 42	< 42	

Analytical results are expressed on a dry weight basis where samples are dried at less than 30°C

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Soil Analysis Certificate - BTEX / MTBE							
QTS Environmental Report No: 15-30539	Date Sampled	None Supplied	None Supplied	None Supplied	None Supplied	
Wilson Bailey Geotechnical & Environmental L	Time Sampled	None Supplied	None Supplied	None Supplied	None Supplied	
Site Reference: Hayling Island	TP / BH No	BH5	BH8	BH10	BH12	
Project / Job Ref: None Supplied	Additional Refs	None Supplied	None Supplied	None Supplied	None Supplied	
Order No: None Supplied	Depth (m)	1.00	2.00	3.00	0.50	
Reporting Date: 17/04/2015	QTSE Sample No	144453	144454	144455	144456	

Determinand	Unit	RL	Accreditation					
Benzene	ug/kg	< 2	MCERTS	< 2	< 2	< 2	< 2	
Toluene	ug/kg	< 5	MCERTS	< 5	< 5	< 5	< 5	
Ethylbenzene	ug/kg	< 2	MCERTS	< 2	< 2	< 2	< 2	
p & m-xylene	ug/kg	< 2	MCERTS	< 2	< 2	< 2	< 2	
o-xylene	ug/kg	< 2	MCERTS	< 2	< 2	< 2	< 2	
MTBE	ug/kg	< 5	MCERTS	< 5	< 5	< 5	< 5	

Analytical results are expressed on a dry weight basis where samples are dried at less than 30°C

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Soil Analysis Certificate - Sample Descriptions	
QTS Environmental Report No: 15-30539	
Wilson Bailey Geotechnical & Environmental Ltd	
Site Reference: Hayling Island	
Project / Job Ref: None Supplied	
Order No: None Supplied	
Reporting Date: 17/04/2015	

QTSE Sample No	TP / BH No	Additional Refs	Depth (m)	Moisture Content (%)	Sample Matrix Description
^ 144453	BH5	None Supplied	1.00	16.2	Brown clay with stones
^ 144454	BH8	None Supplied	2.00	18	Brown clay with rubble
^ 144455	BH10	None Supplied	3.00	15	Light brown clay
^ 144456	BH12	None Supplied	0.50	16.8	Brown clay

Moisture content is part of procedure E003 & is not an accredited test

Insufficient Sample I/S

Unsuitable Sample U/S

^ no sampling date provided; unable to confirm if samples are within acceptable holding times

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Soil Analysis Certificate - Methodology & Miscellaneous Information
QTS Environmental Report No: 15-30539
Wilson Bailey Geotechnical & Environmental Ltd
Site Reference: Hayling Island
Project / Job Ref: None Supplied
Order No: None Supplied
Reporting Date: 17/04/2015

Matrix	Analysed On	Determinand	Brief Method Description	Method No
Soil	D	Boron - Water Soluble	Determination of water soluble boron in soil by 2:1 hot water extract followed by ICP-OES	E012
Soil	AR	BTEX	Determination of BTEX by headspace GC-MS	E001
Soil	D	Cations	Determination of cations in soil by aqua-regia digestion followed by ICP-OES	E002
Soil	D	Chloride - Water Soluble (2:1)	Determination of chloride by extraction with water & analysed by ion chromatography	E009
Soil	AR	Chromium - Hexavalent	Determination of hexavalent chromium in soil by extraction in water then by acidification, addition of 1,5 diphenylcarbazide followed by colorimetry	E016
Soil	AR	Cyanide - Complex	Determination of complex cyanide by distillation followed by colorimetry	E015
Soil	AR	Cyanide - Free	Determination of free cyanide by distillation followed by colorimetry	E015
Soil	AR	Cyanide - Total	Determination of total cyanide by distillation followed by colorimetry	E015
Soil	D	Cyclohexane Extractable Matter (CEM)	Gravimetrically determined through extraction with cyclohexane	E011
Soil	AR	Diesel Range Organics (C10 - C24)	Determination of hexane/acetone extractable hydrocarbons by GC-FID	E004
Soil	AR	Electrical Conductivity	Determination of electrical conductivity by addition of saturated calcium sulphate followed by electrometric measurement	E022
Soil	AR	Electrical Conductivity	Determination of electrical conductivity by addition of water followed by electrometric measurement	E023
Soil	D	Elemental Sulphur	Determination of elemental sulphur by solvent extraction followed by GC-MS	E020
Soil	AR	EPH (C10 – C40)	Determination of acetone/hexane extractable hydrocarbons by GC-FID	E004
Soil	AR	EPH Product ID	Determination of acetone/hexane extractable hydrocarbons by GC-FID	E004
Soil	AR	EPH TEXAS (C6-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C40)	Determination of acetone/hexane extractable hydrocarbons by GC-FID for C8 to C40. C6 to C8 by headspace GC-MS	E004
Soil	D	Fluoride - Water Soluble	Determination of Fluoride by extraction with water & analysed by ion chromatography	E009
Soil	D	FOC (Fraction Organic Carbon)	Determination of fraction of organic carbon by oxidising with potassium dichromate followed by titration with iron (II) sulphate	E010
Soil	D	Loss on Ignition @ 450oC	Determination of loss on ignition in soil by gravimetrically with the sample being ignited in a muffle furnace	E019
Soil	D	Magnesium - Water Soluble	Determination of water soluble magnesium by extraction with water followed by ICP-OES	E025
Soil	D	Metals	Determination of metals by aqua-regia digestion followed by ICP-OES	E002
Soil	AR	Mineral Oil (C10 - C40)	Determination of hexane/acetone extractable hydrocarbons by GC-FID fractionating with SPE cartridge	E004
Soil	AR	Moisture Content	Moisture content; determined gravimetrically	E003
Soil	D	Nitrate - Water Soluble (2:1)	Determination of nitrate by extraction with water & analysed by ion chromatography	E009
Soil	D	Organic Matter	Determination of organic matter by oxidising with potassium dichromate followed by titration with iron (II) sulphate	E010
Soil	AR	PAH - Speciated (EPA 16)	Determination of PAH compounds by extraction in acetone and hexane followed by GC-MS with the use of surrogate and internal standards	E005
Soil	AR	PCB - 7 Congeners	Determination of PCB by extraction with acetone and hexane followed by GC-MS	E008
Soil	D	Petroleum Ether Extract (PEE)	Gravimetrically determined through extraction with petroleum ether	E011
Soil	AR	pH	Determination of pH by addition of water followed by electrometric measurement	E007
Soil	AR	Phenols - Total (monohydric)	Determination of phenols by distillation followed by colorimetry	E021
Soil	D	Phosphate - Water Soluble (2:1)	Determination of phosphate by extraction with water & analysed by ion chromatography	E009
Soil	D	Sulphate (as SO4) - Total	Determination of total sulphate by extraction with 10% HCl followed by ICP-OES	E013
Soil	D	Sulphate (as SO4) - Water Soluble (2:1)	Determination of sulphate by extraction with water & analysed by ion chromatography	E009
Soil	D	Sulphate (as SO4) - Water Soluble (2:1)	Determination of water soluble sulphate by extraction with water followed by ICP-OES	E014
Soil	AR	Sulphide	Determination of sulphide by distillation followed by colorimetry	E018
Soil	D	Sulphur - Total	Determination of total sulphur by extraction with aqua-regia followed by ICP-OES	E024
Soil	AR	SVOC	Determination of semi-volatile organic compounds by extraction in acetone and hexane followed by GC-MS	E006
Soil	AR	Thiocyanate (as SCN)	Determination of thiocyanate by extraction in caustic soda followed by acidification followed by addition of ferric nitrate followed by colorimetry	E017
Soil	D	Toluene Extractable Matter (TEM)	Gravimetrically determined through extraction with toluene	E011
Soil	D	Total Organic Carbon (TOC)	Determination of organic matter by oxidising with potassium dichromate followed by titration with iron (II) sulphate	E010
Soil	AR	TPH CWG (ali: C5- C6, C6-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C34, aro: C5-C7, C7-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C35)	Determination of hexane/acetone extractable hydrocarbons by GC-FID fractionating with SPE cartridge for C8 to C35. C5 to C8 by headspace GC-MS	E004
Soil	AR	TPH LQM (ali: C5-C6, C6-C8, C8-C10, C10-C12, C12-C16, C16-C35, C35-C44, aro: C5-C7, C7-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C35, C35-C44)	Determination of hexane/acetone extractable hydrocarbons by GC-FID fractionating with SPE cartridge for C8 to C44. C5 to C8 by headspace GC-MS	E004
Soil	AR	VOCs	Determination of volatile organic compounds by headspace GC-MS	E001
Soil	AR	VPH (C6-C8 & C8-C10)	Determination of hydrocarbons C6-C8 by headspace GC-MS & C8-C10 by GC-FID	E001

D Dried
AR As Received