


Nearshore Sediment Sampling

Document: GEEGAW-TN12 Version: 0

Dawlish Warren & Exmouth Beach Recharge
Technical Appraisal Study

Environment Agency

November 2011



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Document history

Nearshore Sediment Sampling

Dawlish Warren & Exmouth Beach Recharge Technical Appraisal Study

Environment Agency

This document has been issued and amended as follows:

Version	Date	Description	Created by	Verified by	Approved by
0.0	16/11/11	First issue	F Loran	M Stannard	M Stannard

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1 Introduction

1.1 Site Location

Dawlish Warren and Exmouth Beach are located in the vicinity of the River Exe estuary near the resort of Exmouth on the south coast of Devon.

This report focuses on seabed samples taken from the vicinity of Pole Sands, an intertidal area in the mouth of the River Exe. The samples were taken on 3rd October 2011.

1.2 Background

The seabed samples were taken in order to find out more information about the nature of the seabed material in this area and whether it is potentially suitable for use as a source of recharge material for the beaches at Dawlish Warren and Exmouth. This information will be used in the assessment of alternative options in the Dawlish Warren & Exmouth Beach Recharge Technical Appraisal Study.

1.3 Purpose of this Report

The purpose of this report is to document the nearshore sediment sampling fieldwork that was undertaken. The results of the subsequent testing of these samples are also presented in this report.

1.4 Structure of this Report

The fieldwork that was undertaken is presented in Section 2 of this report. The results of the testing of the samples that were taken in the field are presented in Section 3.

2 Fieldwork

2.1 Sampling Locations

The sampling locations are indicated in Figure 1, with these locations summarised in Table 1. These locations were agreed with the client and were selected to provide information on seabed sediment characteristics in areas of interest as potential sources of recharge material and for which no details already existed. Whilst in the field, samples were taken as close as possible to these locations.

Samples were mostly taken in pairs to ensure consistency of results, all of the samples were located in intertidal areas. This meant that the fieldwork had to be carefully scheduled against tidal levels throughout the day and predicted weather conditions to ensure that there was sufficient depth of water to accommodate vessel draft whilst not being too deep for the sampling works to be undertaken. All samples were taken from the vessel as health and safety risks could be better managed in this way. The collection of samples by field staff working on foot on the intertidal areas at low tide was not considered to be a suitable approach for health and safety reasons, including:

- the risk of encountering soft ground, the location of which is uncertain;
- difficulties with the access for personnel and equipment from/ to the vessel;
- risk of changes to weather and marine conditions whilst in the field;
- time constraints on sample collection whilst tides were at suitable levels throughout the study area;
- time taken to walk between sampling locations, especially whilst carrying an increasing number of samples and given uncertain ground conditions.

Sample No.	OS Coordinates (Easting; Northing)	Latitude/ Longitude Position (deg, min, sec)	Anticipated Seabed Level @ Sample Location (mCD)*
S1	299221; 79208	50,36,12/ 3,25,27 (West)	+0.19 to +0.44
S2	299289; 79261	50,36,14/ 3,25,24 (West)	+0.44 to +0.69
S3	299678; 80204	50,36,44/ 3,25,5 (West)	+0.69 to +0.94
S4	299765; 80199	50,36,44/ 3,25,1 (West)	+0.44 to +0.69
S5	299930; 79776	50,36,31/ 3,24,52 (West)	+0.94 to +1.19
S6	300008; 79733	50,36,29/ 3,24,48 (West)	+0.94 to +1.19
S7	300543; 79577	50,36,25/ 3,24,21 (West)	+0.94 to +1.19
S8	301218; 79159	50,36,11/ 3,23,46 (West)	+0.94 to +1.19
S9	301665; 79417	50,36,20/ 3,23,23 (West)	+0.44 to +0.69
S10	301724; 79349	50,36,18/ 3,23,20 (West)	+0.69 to +0.94

Table 1: Details of Sample Locations (*see Bathymetry shown in Figure 1)

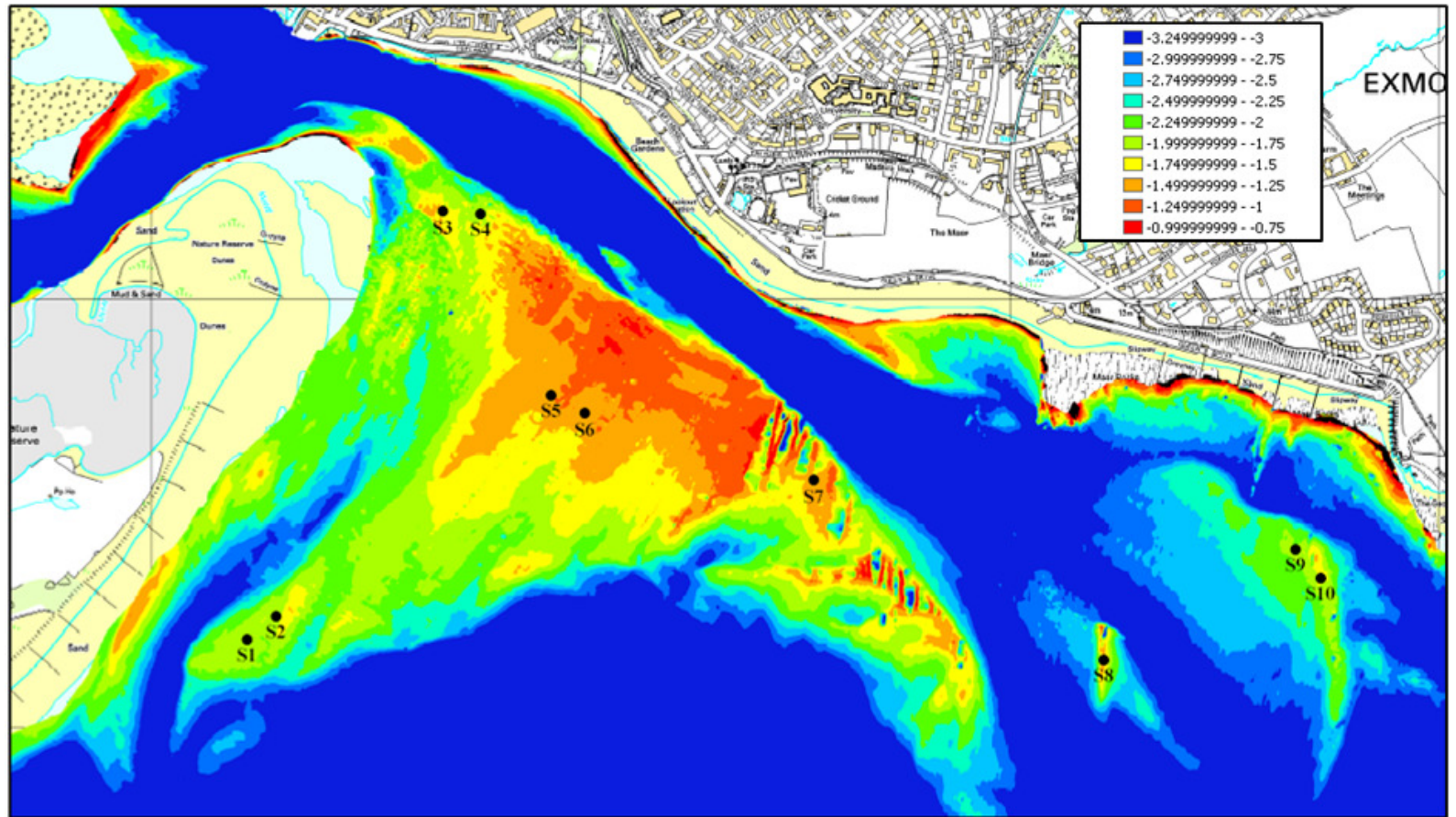


Figure 1: Sample Locations S1 to S10 inc (Bathymetry survey shown in mODN; CD 2.44m is below ODN (source: Admiralty))

2.2 Licences/ Permits

Prior to the commencement of field activities, it was necessary to obtain two licences for the sampling activities. These are described below:

- Marine Management Organisation (MMO) licence – the MMO administers the marine licensing system in England. In April 2011, it developed a new application form specifically for benthic grab sampling as part of its streamlined licensing process. A marine licence is a legal requirement under section 66 (8) of the Marine and Coastal Access Act 2009, which states that consent is required to use a vehicle, vessel, aircraft, marine structure or floating container to remove any substance or object from the sea bed within the UK marine licensing area. The changes to the licensing process introduced in April 2011, meant that a licence was required for this type of seabed sampling work whereas one had not previously been necessary. These changes occurred after Halcrow had submitted their proposal for the works to the EA; thus the licence application process was administered as a compensation event under the Technical Appraisal Study. Following approval of the compensation event by the EA, a licence application was made to the MMO. This was then considered by the MMO, who also undertook consultation as required by the nature of the works. The licence was granted by the MMO on 22nd September 2011.
- Crown Estates (CE) licence – as one of the consultees for the MMO licence, CE highlighted that it would be necessary to obtain a ‘NES4 No Objection’ form from them for the works. This is because the site work would entail the removal of materials from the intertidal zone and CE is the land owner with proprietary rights over the seabed and foreshore. A NES4 form was successfully obtained from CE on 30/09/11.

2.3 Fieldwork

The samples were taken on 3rd October 2011 in accordance with the method statement in Appendix A.

The quantity of material required for each test is stated in the method statement. As can be seen, this quantity varies according to the material encountered in the field. In this instance, all material retrieved was medium sized, and thus minimum sample volumes of 4.7kg were required.

Weather conditions on the day were very good. As a consequence, the fieldwork was completed ahead of schedule.

Predicted tide levels are stated in Table 2.

Tidal State	LW	HW	LW	HW
Time (British Summer Time)	04:27	11:25	16:55	23:56
Tide Level (mCD)	1.2	3.7	1.3	3.5

Table 2: Predicted Tides 3rd October 2011 (Source: Admiralty Easy Tide)

2.4 Methodology

The samples were undertaken in accordance with the method statement included in Appendix A. All samples were taken by personnel who remained onboard the vessel at all times. On arrival at each sampling location, a UXO survey was undertaken to identify any ordnance in the vicinity of the sampling location prior to the removal of any seabed material. Seabed material was removed by use of a Van Veen grab. Scales were used to ensure that a sufficient quantity of material was removed.

A copy of the site logs recorded in the field is included in Appendix B, along with accompanying photographs of the Van Veen grab and the material it retrieved at each location.

3 Sample Testing

3.1 Testing Process

For each sample, three tests were undertaken, namely:

- particle size distribution analysis. For this parameter, the combined wet sieve/ sedimentation test method was used as this gave the best information on the presence of sand as well as any material such as silt and clay, as such organic fractions could be detrimental to the recharge process;
- pH testing;
- Calcium tests.

Specific volumes of material from each sample were required for each test, thus it was important to ensure that a sufficient quantity of material was obtained from each sample location whilst in the field.

3.2 Test Results

Test results are presented in Appendix B and summarised in Table 3.

3.2.1 Particle Size

The results for of the particle size testing showed that most of the pairs of samples were generally in good agreement, with the exception of S5 and S6. There was a significant variation in the materials encountered across the site. The samples taken in the outer limits of the estuary (ie S1 & S2, S7 and S9 & S10) showed good agreement, apart from location S8. Four of the samples had very similar results, with a further two samples having relatively close agreement. For these six samples, the dominant material encountered in the samples was sand. The remaining four samples had relatively close agreement between themselves and the dominant material in these samples was gravel. All samples contained minimal silt and clay fractions, with the exception of sample S8 which has a small amount of these materials present.

3.2.2 pH

Regarding pH values, these were very similar across the site, the average value was 8.8. The exception to this was sample S8 which had a much lower pH value of 7.3.

3.2.3 Calcium Content

Regarding calcium content, there was a considerable variation in test results across the site. The calcium content of some of the pairs of samples varied considerably. There was little correlation in these test results for samples located on the inner or outer areas of the estuary, although it could be observed that samples S1 & S2 and S9 & S10 on the outer limits has reasonably similar results.

Sample No.	General Description	Mean Particle Size, D ₅₀ (mm)	% Fraction						pH	Calcium (mg/kg)
			Clay	Silt	Silt & Clay	Sand	Gravel	Cobble & Boulder		
S1	Light brown slightly clayey SAND with a little fine gravel	0.24	1	0	1	98	1	0	8.8	9050
S2	Light brown slightly silty SAND with some f-m gravel	0.32	0	1	1	87	12	0	8.8	6090
S3	Dark brown slightly silty very sandy GRAVEL	6.5	0	1	1	29	70	0	8.6	14580
S4	Mulicoloured sandy GRAVEL	11.0	0	0	0	17	83	0	8.8	308
S5	Light brown slightly clayey very sandy GRAVEL	3.2	1	0	1	35	64	0	8.9	29800
S6	Light brown slightly clayey SAND with much f-m gravel	0.4	1	0	1	75	24	0	8.7	10910
S7	Light brown slightly clayey SAND with a little fine gravel	0.28	1	0	1	98	1	0	8.8	3120
S8	Black silty very sandy GRAVEL	6.5	2	4	6	23	71	0	7.3	96150
S9	Light brown slightly clayey SAND with a little f-m gravel	0.32	1	0	1	96	3	0	8.9	8570
S10	Light brown slightly clayey SAND with a little f-m gravel	0.32	1	0	1	96	3	0	8.7	6800

Table 3 Summary of Test Results



Appendix A

Method Statement



Appendix A Method Statement

Project: Dawlish Warren & Exmouth Beach Recharge Technical Appraisal Study

Note: Near-shore Sediment Sampling Near-shore Sediment Sampling

Project	Dawlish Warren & Exmouth Beach Recharge Technical Appraisal Study	Date	28 September 2011
Note	Near-shore Sediment Sampling Method Statement	Ref	GEEGAW/TN
Author	Richard Khaira-Creswell / Fran Loran		

1 *Purpose*

The purpose of this method statement is to describe the field activities to be undertaken for the collection of sediment samples in the nearshore zone in the vicinity of Pole Sands within the mouth of the Exe Estuary.

2 *Objective*

Sediment samples will provide information on sediment size distribution at locations throughout the study area. This information will be used in the Beach Management Technical Appraisal Study to assess the potential for recycling this material as part of sustainable management of the Dawlish Warren and Exmouth beaches (Figure 2).

3 *Methodology Overview*

Samples will be collected at ten locations during part of the site work, as indicated on Figure 3. Once collected, the samples will be sent to a laboratory for analysis.

All sample log sheets must be completed prior to mobilisation to site. Co-ordinates for the intended locations of sample sites must be pre-programmed into the handheld GPS on board the vessel. Table 1 provides a summary of these locations. Samples will be collected as close to these positions as possible given site conditions on the day and the presence of any UXO that is identified during the site works. Actual sample locations must be recorded.

The site work is both weather and tide dependent. For this location, samples will be collected from the vessel as this is the best way to manage the health and safety risks associated with the fieldwork. Figure 4 shows the Admiralty tide tables for the study area. Samples will be collected from the vessel using a Van Veen grab (Figure 1).

Project: Dawlish Warren & Exmouth Beach Recharge Technical Appraisal Study

Note: Near-shore Sediment Sampling Method Statement

Sample Number	OS Coordinates (Easting; Northing)	Latitude/ Longitude Position (deg, min, sec)	Anticipated Seabed Level (Sample Location (mCD))*
S1	299221; 79208	50,36,11.8412/ 3,25,27.3968 (West)	+0.19 to +0.44
S2	299289; 79261	50,36,13.6136/ 3,25,23.9904 (West)	+0.44 to +0.69
S3	299678; 80204	50,36,44.3710/ 3,25,5.1329 (West)	+0.69 to +0.94
S4	299765; 80199	50,36,44.2678/ 3,25,0.6820 (West)	+0.44 to +0.69
S5	299930; 79776	50,36,30.6848/ 3,24,51.8627 (West)	+0.94 to +1.19
S6	300008; 79733	50,36,29.3173/ 3,24,47.8679 (West)	+0.94 to +1.19
S7	300543; 79577	50,36,24.6124/ 3,24,20.5247 (West)	+0.94 to +1.19
S8	301218; 79159	50,36,11.4980/ 3,23,45.7649 (West)	+0.94 to +1.19
S9	301665; 79417	50,36,20.1067/ 3,23,23.2703 (West)	+0.44 to +0.69
S10	301724; 79349	50,36,17.9401/ 3,23,20.2401 (West)	+0.69 to +0.94

Table 1: Details of Sample Locations (*see Bathymetry shown in Figure 3)

The volume of sediment to be collected at each location is determined by the grade of material that is encountered in the field. Table 2 below demonstrates the sample weight required for different material grades. It is anticipated that samples will be comprised of ‘medium’ material. One particle size distribution test will be performed along with two chemical tests, ie a total of three tests. A full sample volume is required for each test - thus for ‘medium’ material, the total sample volume required is (3.5kg (Particle size test) + 0.6kg (pH test) + 0.6kg (Calcium test)) =4.7kg, Thus a sample volume of 4.7kg will be required in locations where medium material is encountered in order for there to be a sufficient quantity of material for analysis.

Test 1 - Particle Size Distribution			Test 2 –Chemical (pH & Calcium)		
Size of Material Collected in Sample			Size of Material Collected in Sample		
Fine <0.063mm	Medium 0.063-63mm	Coarse >63mm	Fine <0.063mm	Medium 0.063-63m	Coarse >63mm
250g	3.5kg	20kg	150g	600g	3.5kg

Table 2: Sediment Sample Size (source: Geotechnical Engineering Laboratory)

The fieldwork is scheduled for Monday 3rd October 2011 and the predicted tides for the Exmouth Approaches area for this day are shown in Table 3.

Tidal State	LW	HW	LW	HW
Time (British Summer Time)	04:27	11:25	16:55	23:56
Tide Level mCD	1.2	3.7	1.3	3.5

Table 3: Predicted Tides 3rd October 2011 (Source: Admiralty Easy Tide)

Project: Dawlish Warren & Exmouth Beach Recharge Technical Appraisal Study

Note: Near-shore Sediment Sampling Method Statement

4 Detailed Methodology for Samples Collected from Vessel

The following methodology will be adopted for the collection of material at each of the sample locations:

- Survey Lead confirms required sample location to the Skipper,
- UXO sub-contractor deploys magnetometer and carries out survey of seabed prior to deployment of anchor. The magnetometer survey will be conducted as described in the attached UXO method statement.
- If the magnetometer detects metal objects on the seabed these shall be considered to be UXO. In this event, the location shall be noted using GPS and logged. The magnetometer will be retrieved, the all clear will be signalled to the skipper and the vessel will move away to another location and the process will begin again,
- Once “all clear” is given by UXO sub-contractor, the anchor can be deployed and vessel secured to provide a safe working platform,
- Skipper to communicate that the vessel is secure and engines are in neutral,
- Metocean team to record location using the GPS & check that vessel is stable (i.e. not moving position),
- The Metocean team can then deploy the grab sampler. After impact on the seabed pull the sampler up to the waterline by hand. Lift onto the deck and retrieve sediment,
- Fill the sample container and weigh to check that enough sediment is collected based on the sediment size. If required re-deploy sediment grab,
- Secure and label the container,
- Complete log sheet – e.g. sample number, GPS waypoint and any other pertinent information,
- Survey Team Leader gives confirmation to the skipper when the whole team and all equipment is back on the vessel before the skipper mobilises the vessel to the next designated sampling site.

5 Schedule for Collection of Samples

Samples are due to be collected on 3rd October 2011 according to the schedule in Table 3.

Time	Activity
07:04	Sunrise
07:04	Gardline and UXO staff meet vessel at Polly Steps, Teignmouth Harbour. Load vessel and leave harbour
07:15	Load vessel, leave harbour

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Note: Near-shore Sediment Sampling Method Statement

07:45	Arrive Exmouth Approaches
08:00	Arrive at S07site
08:00	Collect sample S07. UXO survey to be completed prior to anchoring.
09:00	Travel to locations S5 & S6
09:15	Collect samples S05 & S06. UXO survey to be completed prior to anchoring at each location.
10:45	Travel to locations S03 & S04
11:00	Collect samples S03 & S04. UXO survey to be completed prior to anchoring at each location.
(11:25)	(HW)
12:30	Travel to location S08.
12:45	Collect sample S07. UXO survey to be completed prior to anchoring.
13:30	Travel to locations S09 & S010
13:45	Collect samples S09 & S010. UXO survey to be completed prior to anchoring at each location.
15:15	Travel to locations S01 & S02
15:30	Collect samples S02 & S01 (in order due to low tide). UXO survey to be completed prior to anchoring at each location.
(16:55)	(LW)
17:00	Completion of sampling, travel back to Teignmouth
17:30	Arrival at Teignmouth, depart vessel..
17:45	Demobilise
18:35	Sunset

Table 3: Indicative Schedule for Sample Collection

6

Equipment

The equipment required for this works includes the following items:

- Suitable vessel with MCA coding that covers the whole study area,

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Note: Near-shore Sediment Sampling Method Statement

- Qualified skipper and crew,
- Grab sampler (Van Veen- see Figure 1),
- Rope (length greater than twice as long as deepest expected sample depth),
- Sediment sample containers (supplied by laboratory),
- Permanent marker pen to label sample containers,
- Logs sheets – sample number, location / waypoint,
- Handheld GPS;
- Portable weighing scales;
- Field ruler for scale referencing photos,
- Camera;
- PPE – buoyancy aid , gloves, safety boots, waders/ wellington boots overalls, appropriate clothing e.g. wet/cold weather gear to prevent exposure to the elements.

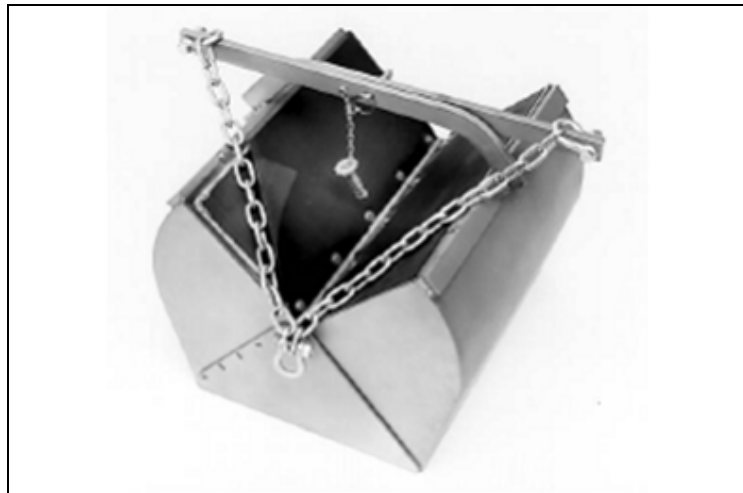


Figure 1: A Typical Van Veen Sampler

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Note: Near-shore Sediment Sampling Method Statement

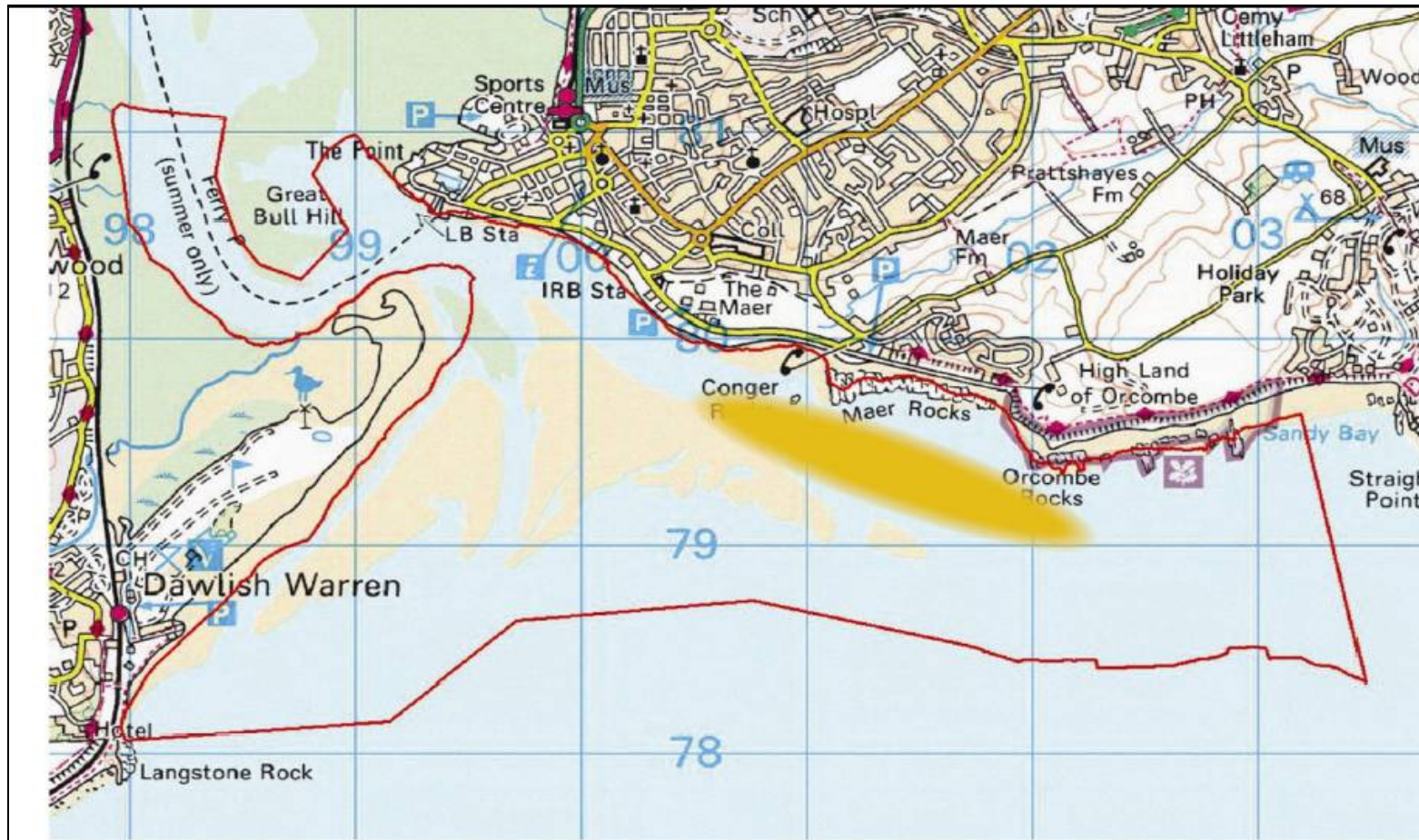


Figure 2: Dawlish Warren & Exmouth Beach Recharge Study Area (outlined in red)



Appendix B

Field Logs and Photographs



Appendix B Field Logs and Photographs



Photo B1, Sample Location 1



Photograph B2, Sample Location 2



Photograph B3, Sample Location 3



Photograph B4, Sample Location 4



Photograph B5, Sample Location 5



Photograph B6, Sample Location 6



Photograph B7, Sample Location 7



Photograph B8, Sample Location 8



Photograph B9, Sample Location 9



Photograph B10, Sample Location 10

4

APPENDIX A - FIELD SAMPLING LOGS

SEABED SAMPLING LOG SHEET (Deck)							QPRO-0755
Job No: 2953		Area: EX COUNTRY		Vessel: MV ?? PETREL		Operator: JV	
Date: from: dd-Mmm-yyyy to: dd-Mmm-yyyy		Page: 3-21-11 1 of 1		Client: HALCROW		Sieve Size: —	
Project: DAWLIST		HALCROW SURVEY					Equipment: MWI VAN JEEN
Sample Number	Station Number	Time	Load	Retention	Sieving Comments	Sediment Description	Comments
dd-Mmm-yyyy							
1	1	0831	60	—		Coarse SAND	
2	1		60	—		↓	
3	1		70	—			
4	1		70	—			
5	2	0833	70				Shelly coarse SAND
6	2		80			↓	
7	2		60				
8	3	0855	50			Pebbles/Gravel	
9	3		60			↓	
10	3		60				

APPENDIX A - FIELD SAMPLING LOGS

SEABED SAMPLING LOG SHEET (Deck)							QPRO-0755
Job No:		Area:		Vessel: MV ??		Operator:	
Date: from: dd-Mmm-yyyy to: dd-Mmm-yyyy		Page: 3-09-11 1 of 1		Client:		Sieve Size:	
Project:							Equipment:
Sample Number	Station Number	Time	Load	Retention	Sieving Comments	Sediment Description	Comments
dd-Mmm-yyyy							
1	3		60	-		Pebbles / Gravel	
2	4	0913	60	-		Pebbles	
3	4		50	-		↓	
4	4		50	-			
5	4		50	-			
6	5	0934	60	-		Gravel	
7	5		70	-		↓	
8	5		60	-			
9	6	1025	50			Gravelly SAND	
10	6		60			↓	

APPENDIX A - FIELD SAMPLING LOGS

SEABED SAMPLING LOG SHEET (Deck)							QPRO-0755
Job No:		Area:		Vessel: MV ??		Operator:	
Date: from: dd-Mmm-yyyy to: dd-Mmm-yyyy		Page: 3-001-11 1 of 1		Client:		Sieve Size:	
Project:						Equipment:	
Sample Number	Station Number	Time	Load	Retention	Sieving Comments	Sediment Description	Comments
dd-Mmm-yyyy							
1	6		80	-		Gravelly SAND	
2	7	1043	80	-		SAND	
3	7		60	✓		↓	
4	7		60	✓		↓	
5	8	1101	70	-		Mussel bed / gravel / silt	
6	8		70	-		↓	
7	8		70	-		↓	
8	9	1114	90			SAND	
9	9		90			↓	
10	10	1125	90			↓	

11 10 90

226 Dawlish Bus. Park

8x7 ONH



Appendix C

Site Photographs

Appendix C Site Photographs



Photograph C1 - General View From Land Behind Exmouth Beach Across Pole Sands

For details of your nearest Halcrow office, visit our website
halcrow.com





Photograph C2 – General View From Ground Behind Exmouth Beach Across Mouth of River Exe Estuary

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halcrow.com





Photograph C3 – View From Exmouth Beach Across Pole Sands at Low Tide (View 1 of 4)

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Photograph C4 – View From Exmouth Beach Across Pole Sands at Low Tide (View 2 of 4)

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Photograph C5 – View From Exmouth Beach Across Pole Sands at Low Tide (View 3 of 4)

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Photograph C6 – View From Exmouth Beach Across Pole Sands at Low Tide (View 4 of 4)

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Appendix D

Results of Sample Testing



Appendix D Results of Sample Testing



2718



Halcrow
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For the attention of Frances Loran

Date of Issue 18 October 2011


Page Number 1 of 14

TEST REPORT

PROJECT/SITE	DAWLISH WARREN AND EXMOUTH BEACH RECHARGE	Samples received	04/10/2011
GEL REPORT NUMBER	25995	Schedule received	04/10/2011
Your ref/PO:	GEEGAW310/	Testing commenced	07/10/2011

SUMMARY OF RESULTS ATTACHED

TEST METHOD & DESCRIPTION	QUANTITY	ACCREDITED TEST
BS1377: Part 2: 1990:9.2, Particle Size Distribution - Wet Sieve	10	YES
BS1377: Part 2: 1990:9.4, Particle Size Distribution - Pipette	10	YES
pH (subcontracted)	10	YES
Calcium Content (subcontracted)	10	NO

Remarks The report should not be reproduced except in full without written permission from this laboratory.	Approved Signatories: R Ewens (Laboratory Business Manager) R Pratt (Client Manager) W Jones (Laboratory Supervisor) J Hanson (Director) C Thomas (Consultant) 
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Doc TR01 Rev No. 4 Revision date 14/02/11 DC:JH

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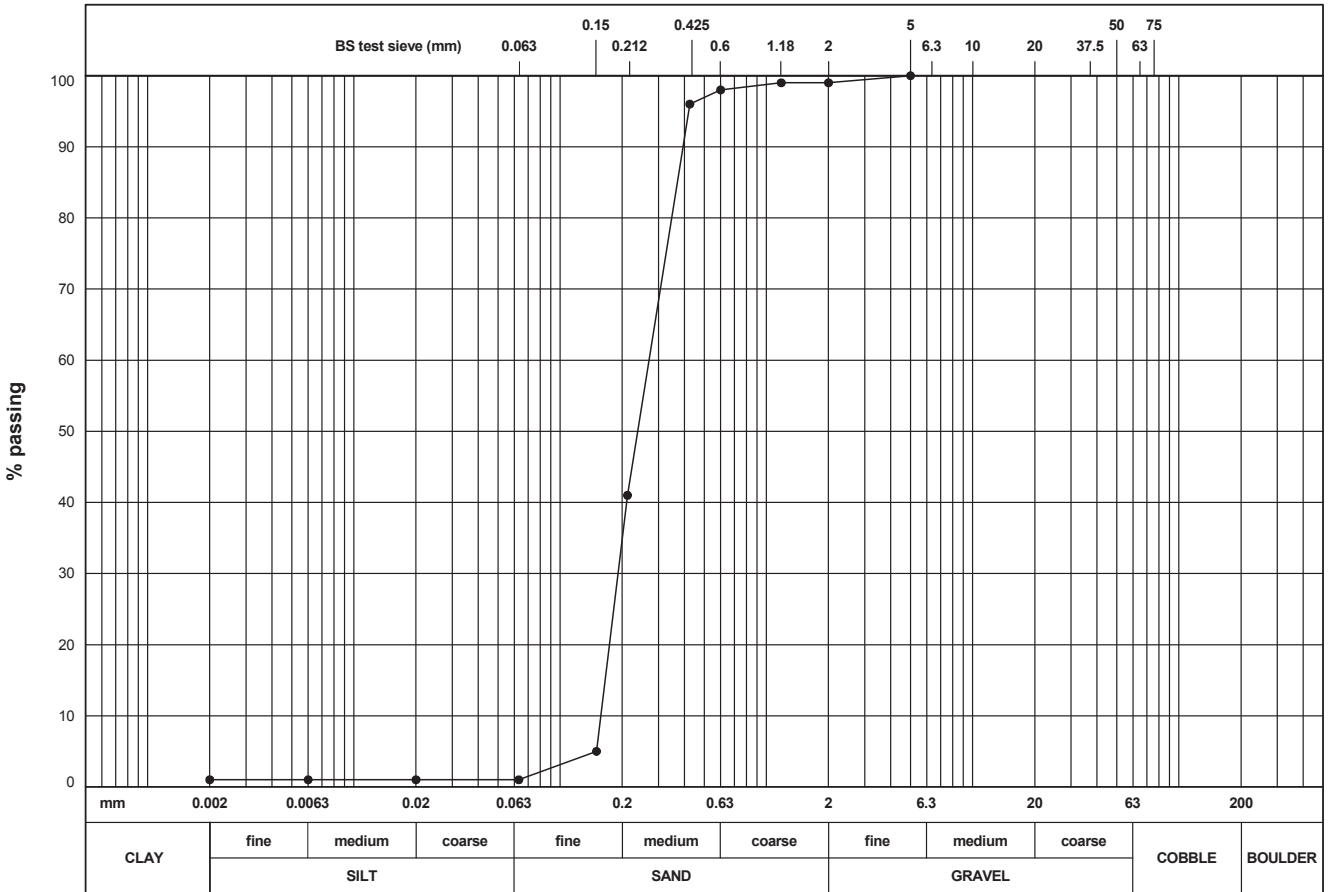
PARTICLE SIZE DISTRIBUTION



BS.1377 : Part 2 : 1990 : 9

CLIENT HALCROW GROUP LIMITED
 SITE DAWLISH WARREN AND EXMOUTH BEACH RECHARGE
 DESCRIPTION Light brown slightly clayey SAND with a little fine gravel

BH/TP No. STN01
 SAMPLE No./TYPE B
 SAMPLE DEPTH (m) 0.00
 SPECIMEN DEPTH (m) 0.00



soil type	% fraction	BS test sieve (mm)	% passing	BS test sieve (mm)	% passing	particle size (µm)	% finer
CLAY	1						
SILT	0	150		5	100	20	1
SILT & CLAY	1						
SAND	98	75		2	99	6	1
GRAVEL	1						
COBBLE & BOULDER	0						
test method(s)	9.2 & 9.4	50		0.6	98		
		37.5		0.425	96		
test method:		20		0.212	41		
9.2 - wet sieving		10		0.15	5		
9.3 - dry sieving		6.3		0.063	1		
9.4 - sedimentation by pipette							
9.5 - sedimentation by hydrometer							

remarks:
 # denotes sample tested is smaller than that which is recommended in accordance with BS1377

CONTRACT 25995	CHECKED WJ
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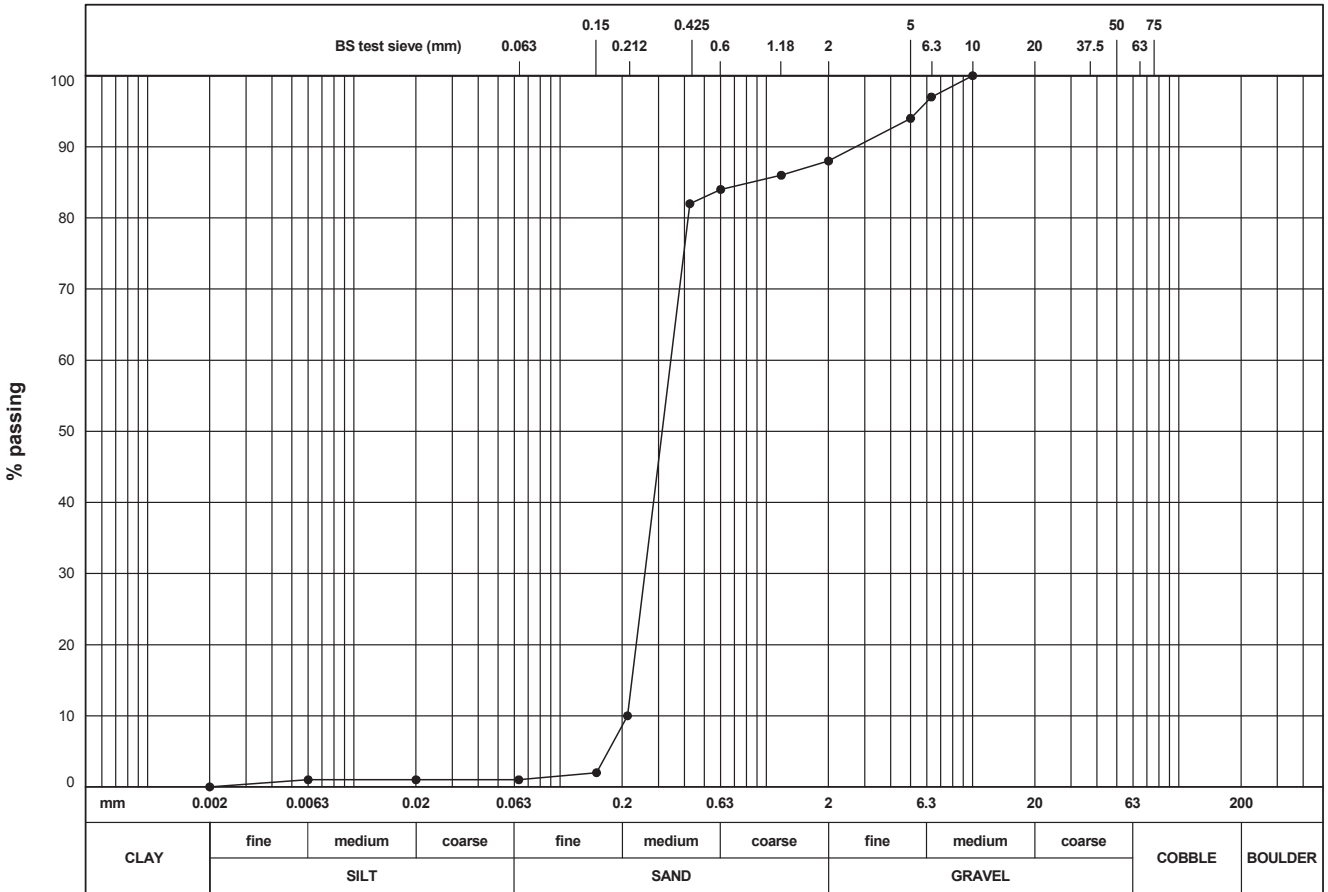
PARTICLE SIZE DISTRIBUTION



BS.1377 : Part 2 : 1990 : 9

CLIENT HALCROW GROUP LIMITED
 SITE DAWLISH WARREN AND EXMOUTH BEACH RECHARGE
 DESCRIPTION Light brown slightly silty SAND with some f-m gravel

BH/TP No. STN02
 SAMPLE No./TYPE B
 SAMPLE DEPTH (m) 0.00
 SPECIMEN DEPTH (m) 0.00



soil type	% fraction	BS test sieve (mm)	% passing	BS test sieve (mm)	% passing	particle size (µm)	% finer
CLAY	0						
SILT	1	150		5	94	20	1
SILT & CLAY	1	75		2	88	6	1
SAND	87						
GRAVEL	12	63		1.18	86	2	0
COBBLE & BOULDER	0						
test method(s)	9.2 & 9.4#	50		0.6	84		
		37.5		0.425	82		
test method:		20		0.212	10		
9.2 - wet sieving		10	100	0.15	2		
9.3 - dry sieving		6.3	97	0.063	1		
9.4 - sedimentation by pipette							
9.5 - sedimentation by hydrometer							

remarks:
 # denotes sample tested is smaller than that which is recommended in accordance with BS1377

CONTRACT 25995	CHECKED WJ
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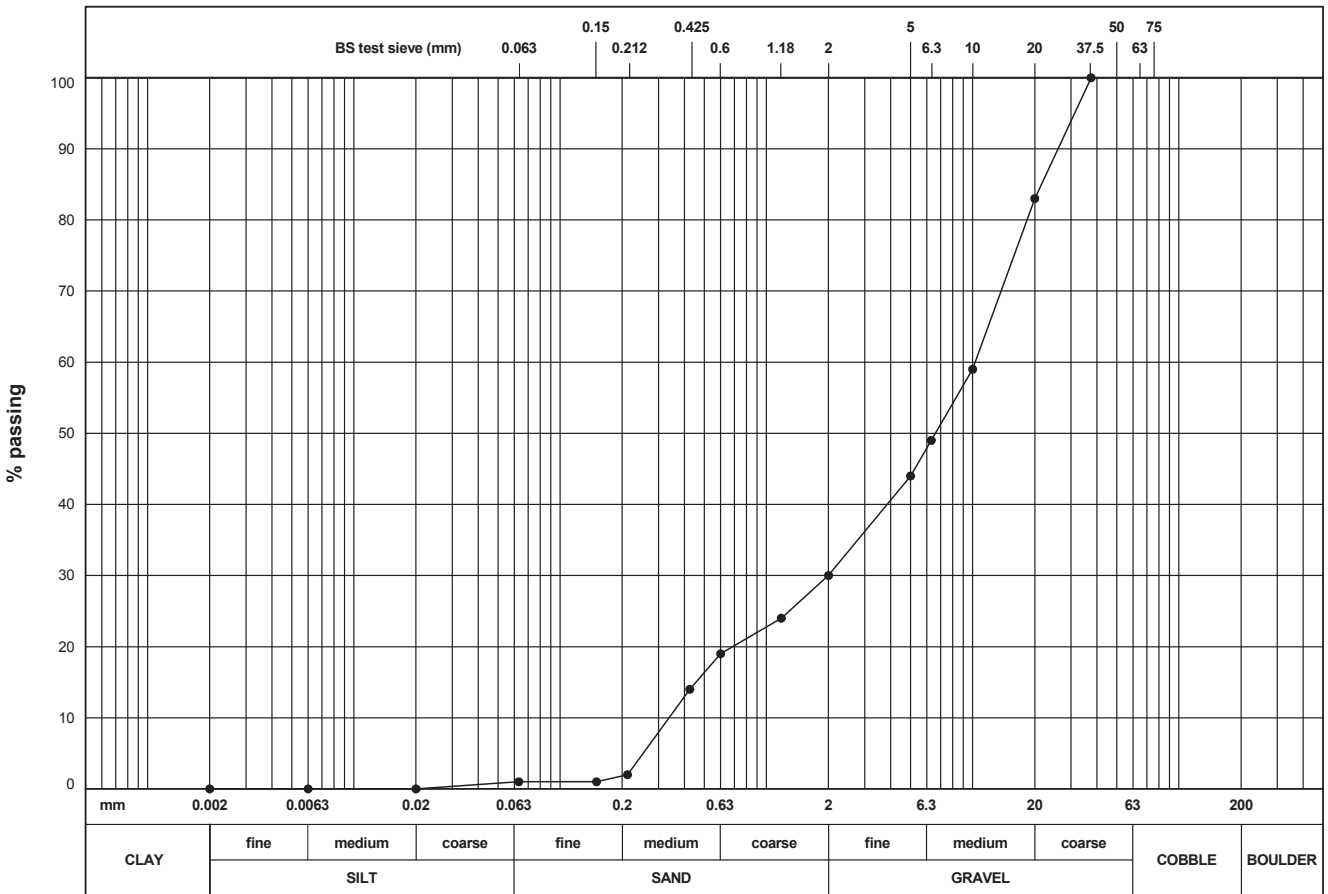
PARTICLE SIZE DISTRIBUTION



BS.1377 : Part 2 : 1990 : 9

CLIENT HALCROW GROUP LIMITED
 SITE DAWLISH WARREN AND EXMOUTH BEACH RECHARGE
 DESCRIPTION Dark brown slightly silty very sandy GRAVEL

BH/TP No. STN03
 SAMPLE No./TYPE B
 SAMPLE DEPTH (m) 0.00
 SPECIMEN DEPTH (m) 0.00



soil type	% fraction	BS test sieve (mm)	% passing	BS test sieve (mm)	% passing	particle size (µm)	% finer
CLAY	0						
SILT	1	150		5	44	20	0
SILT & CLAY	1						
SAND	29	75		2	30	6	0
GRAVEL	70	63		1.18	24	2	0
COBBLE & BOULDER	0						
test method(s)	9.2 & 9.4#	50		0.6	19		
test method:		37.5	100	0.425	14		
9.2 - wet sieving		20	83	0.212	2		
9.3 - dry sieving		10	59	0.15	1		
9.4 - sedimentation by pipette							
9.5 - sedimentation by hydrometer		6.3	49	0.063	1		
remarks: # denotes sample tested is smaller than that which is recommended in accordance with BS1377						CONTRACT 25995	CHECKED WJ

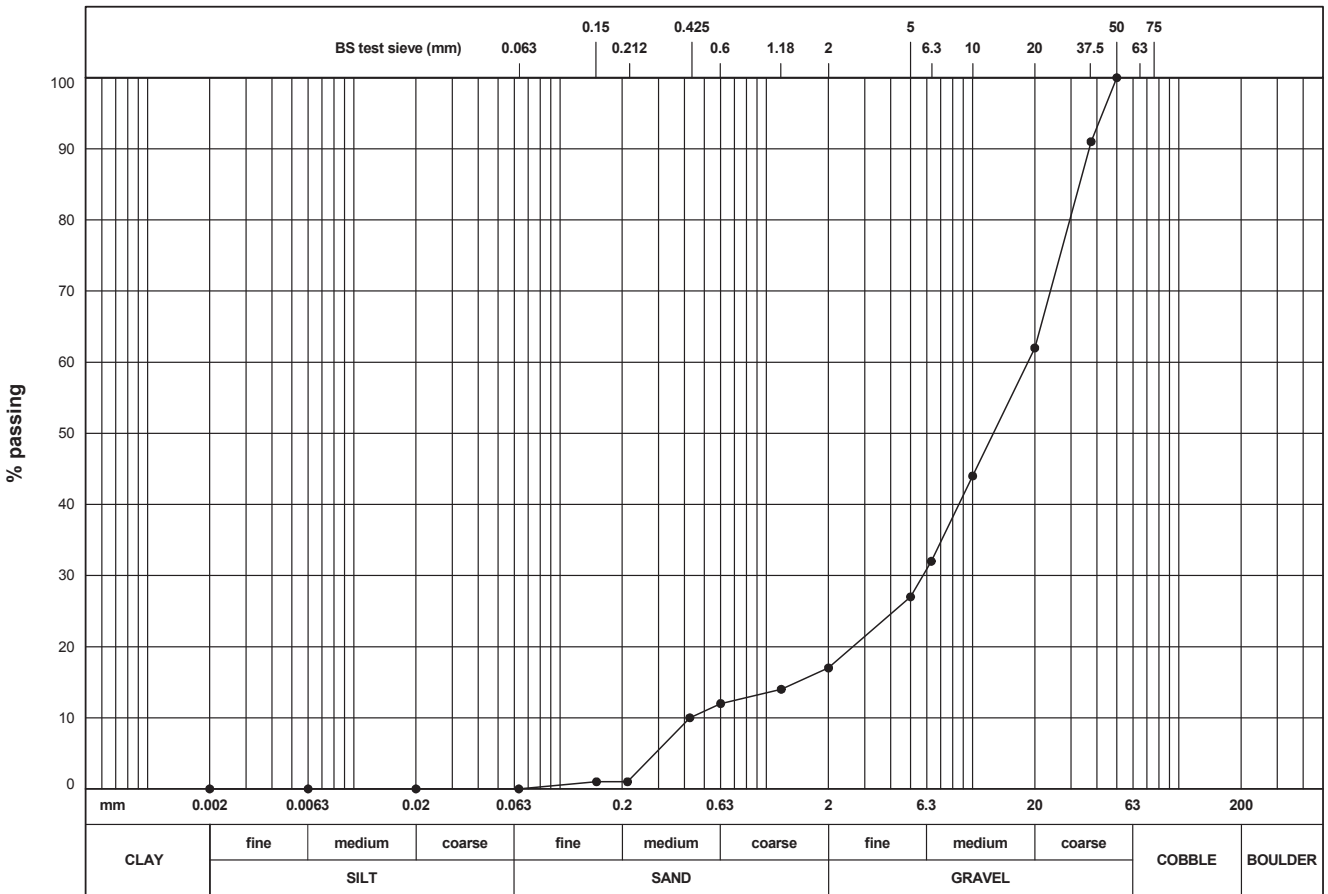
PARTICLE SIZE DISTRIBUTION



BS.1377 : Part 2 : 1990 : 9

CLIENT HALCROW GROUP LIMITED
 SITE DAWLISH WARREN AND EXMOUTH BEACH RECHARGE
 DESCRIPTION Multicoloured sandy GRAVEL

BH/TP No. STN04
 SAMPLE No./TYPE B
 SAMPLE DEPTH (m) 0.00
 SPECIMEN DEPTH (m) 0.00



soil type	% fraction	BS test sieve (mm)	% passing	BS test sieve (mm)	% passing	particle size (µm)	% finer
CLAY	0						
SILT	0	150		5	27	20	0
SILT & CLAY	0						
SAND	17	75		2	17	6	0
GRAVEL	83	63		1.18	14	2	0
COBBLE & BOULDER	0						
test method(s)	9.2 & 9.4#	50	100	0.6	12		
		37.5	91	0.425	10		
test method:		20	62	0.212	1		
9.2 - wet sieving		10	44	0.15	1		
9.3 - dry sieving		6.3	32	0.063	0		
9.4 - sedimentation by pipette							
9.5 - sedimentation by hydrometer							

remarks:
 # denotes sample tested is smaller than that which is recommended in accordance with BS1377

CONTRACT 25995	CHECKED WJ
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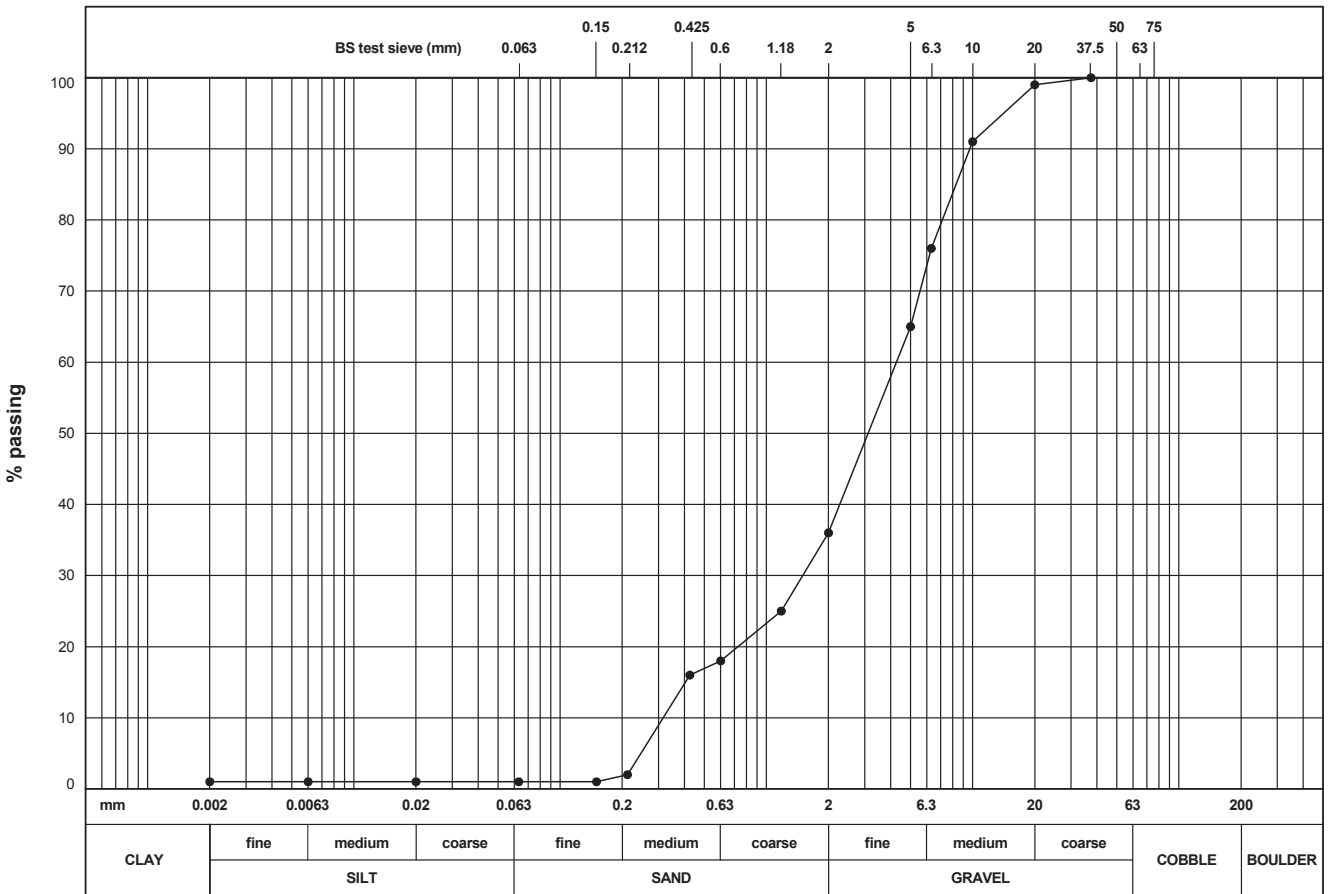
PARTICLE SIZE DISTRIBUTION



BS.1377 : Part 2 : 1990 : 9

CLIENT HALCROW GROUP LIMITED
 SITE DAWLISH WARREN AND EXMOUTH BEACH RECHARGE
 DESCRIPTION Light brown slightly clayey very sandy GRAVEL

BH/TP No. STN05
 SAMPLE No./TYPE B
 SAMPLE DEPTH (m) 0.00
 SPECIMEN DEPTH (m) 0.00



soil type	% fraction	BS test sieve (mm)	% passing	BS test sieve (mm)	% passing	particle size (µm)	% finer
CLAY	1						
SILT	0	150		5	65	20	1
SILT & CLAY	1	75		2	36	6	1
SAND	35						
GRAVEL	64	63		1.18	25	2	1
COBBLE & BOULDER	0						
test method(s)	9.2 & 9.4	50		0.6	18		
test method:		37.5	100	0.425	16		
9.2 - wet sieving		20	99	0.212	2		
9.3 - dry sieving		10	91	0.15	1		
9.4 - sedimentation by pipette		6.3	76	0.063	1		
9.5 - sedimentation by hydrometer							
remarks: # denotes sample tested is smaller than that which is recommended in accordance with BS1377						CONTRACT 25995	CHECKED WJ

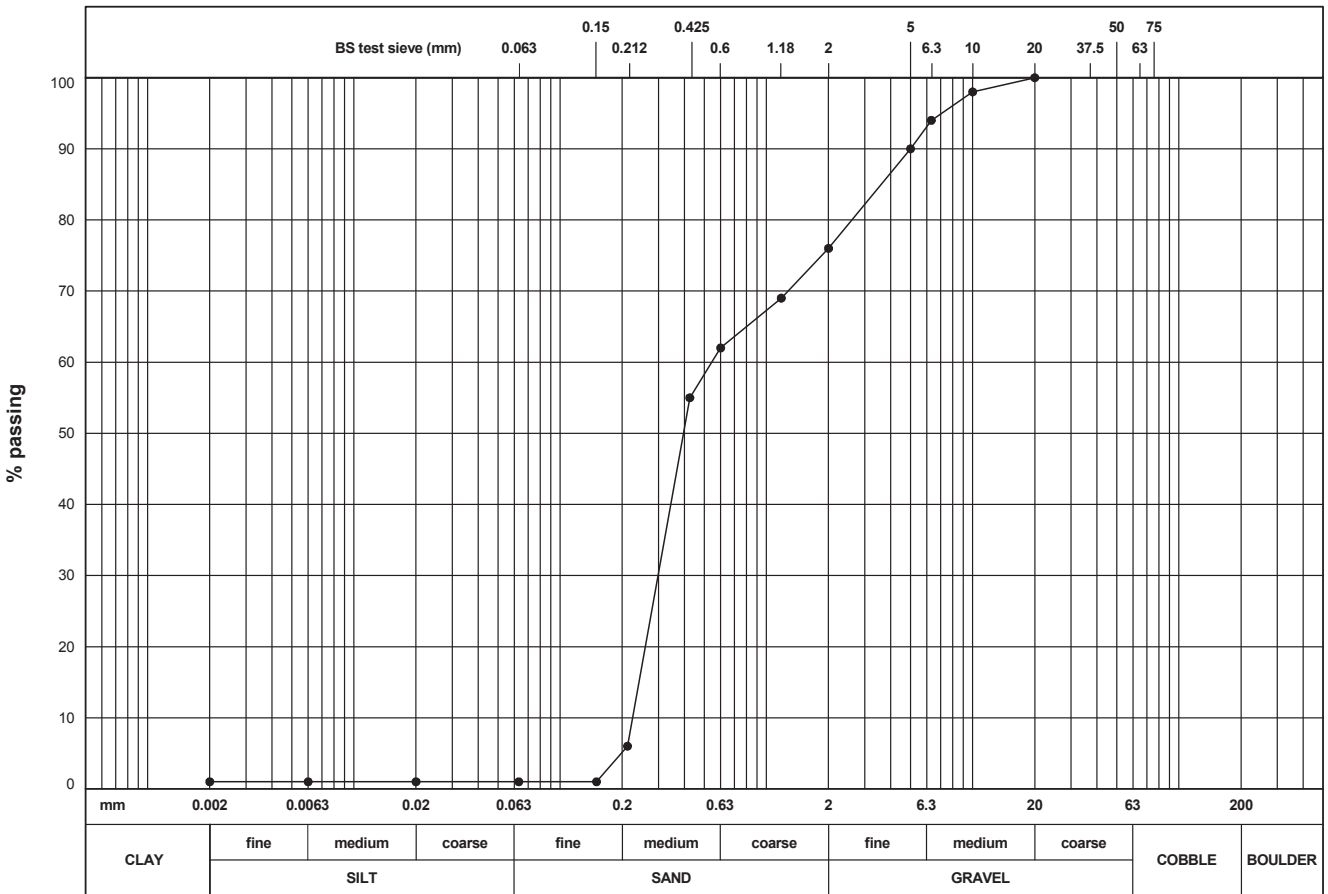
PARTICLE SIZE DISTRIBUTION



BS.1377 : Part 2 : 1990 : 9

CLIENT HALCROW GROUP LIMITED
 SITE DAWLISH WARREN AND EXMOUTH BEACH RECHARGE
 DESCRIPTION Light brown slightly clayey SAND with much f-m gravel

BH/TP No. STN06
 SAMPLE No./TYPE B
 SAMPLE DEPTH (m) 0.00
 SPECIMEN DEPTH (m) 0.00



soil type	% fraction	BS test sieve (mm)	% passing	BS test sieve (mm)	% passing	particle size (µm)	% finer
CLAY	1						
SILT	0	150		5	90	20	1
SILT & CLAY	1	75		2	76	6	1
SAND	75						
GRAVEL	24	63		1.18	69	2	1
COBBLE & BOULDER	0						
test method(s)	9.2 & 9.4	50		0.6	62		
		37.5		0.425	55		
test method:		20	100	0.212	6		
9.2 - wet sieving		10	98	0.15	1		
9.3 - dry sieving		6.3	94	0.063	1		
9.4 - sedimentation by pipette							
9.5 - sedimentation by hydrometer							
remarks: # denotes sample tested is smaller than that which is recommended in accordance with BS1377						CONTRACT 25995	CHECKED WJ

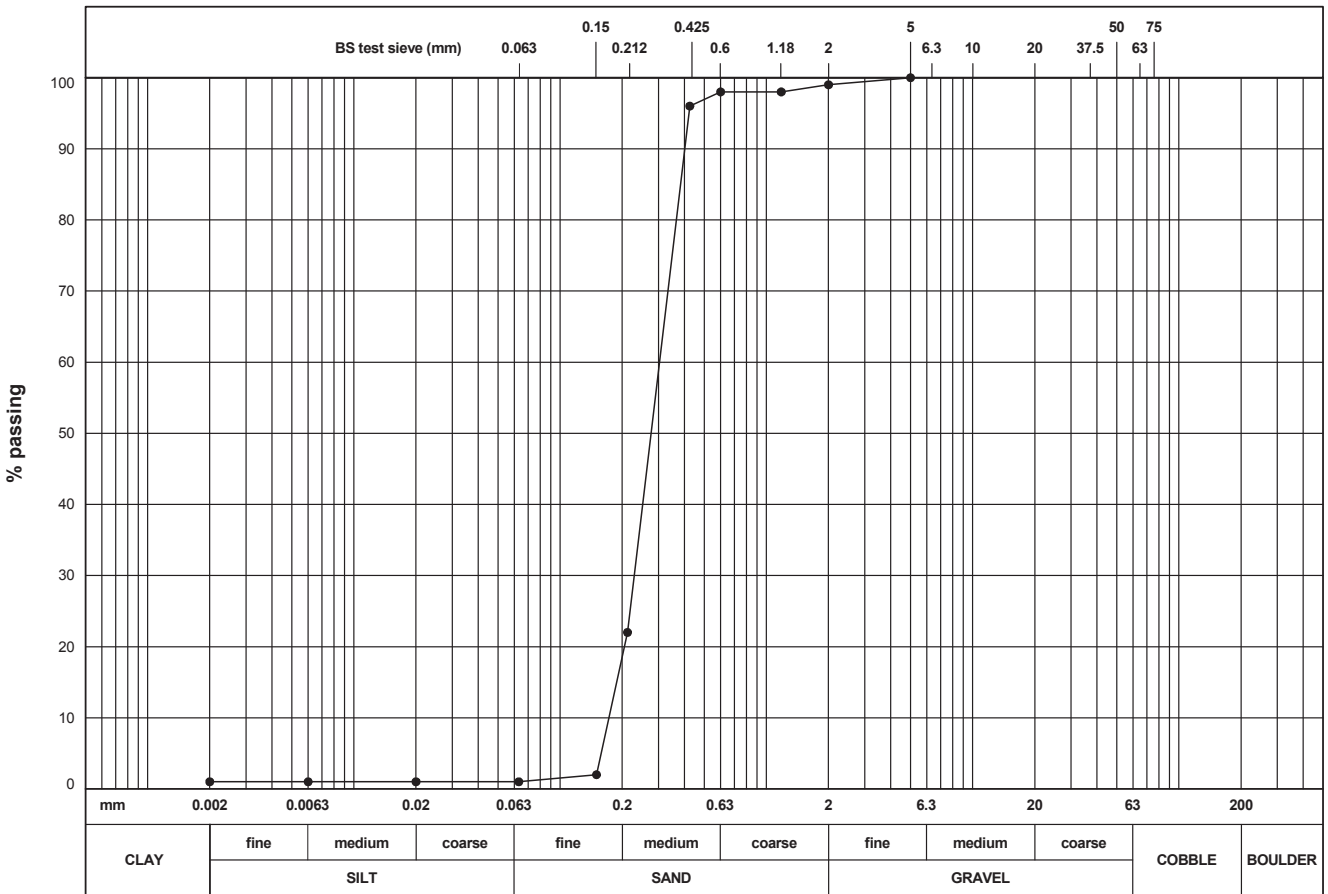
PARTICLE SIZE DISTRIBUTION



BS.1377 : Part 2 : 1990 : 9

CLIENT HALCROW GROUP LIMITED
 SITE DAWLISH WARREN AND EXMOUTH BEACH RECHARGE
 DESCRIPTION Light brown slightly clayey SAND with a little fine gravel

BH/TP No. STN07
 SAMPLE No./TYPE B
 SAMPLE DEPTH (m) 0.00
 SPECIMEN DEPTH (m) 0.00



soil type	% fraction	BS test sieve (mm)	% passing	BS test sieve (mm)	% passing	particle size (µm)	% finer
CLAY	1						
SILT	0	150		5	100	20	1
SILT & CLAY	1						
SAND	98	75		2	99	6	1
GRAVEL	1						
COBBLE & BOULDER	0	63		1.18	98	2	1
test method(s)	9.2 & 9.4	50		0.6	98		
test method:		37.5		0.425	96		
9.2 - wet sieving		20		0.212	22		
9.3 - dry sieving		10		0.15	2		
9.4 - sedimentation by pipette		6.3		0.063	1		
9.5 - sedimentation by hydrometer							
remarks: # denotes sample tested is smaller than that which is recommended in accordance with BS1377						CONTRACT 25995	CHECKED WJ

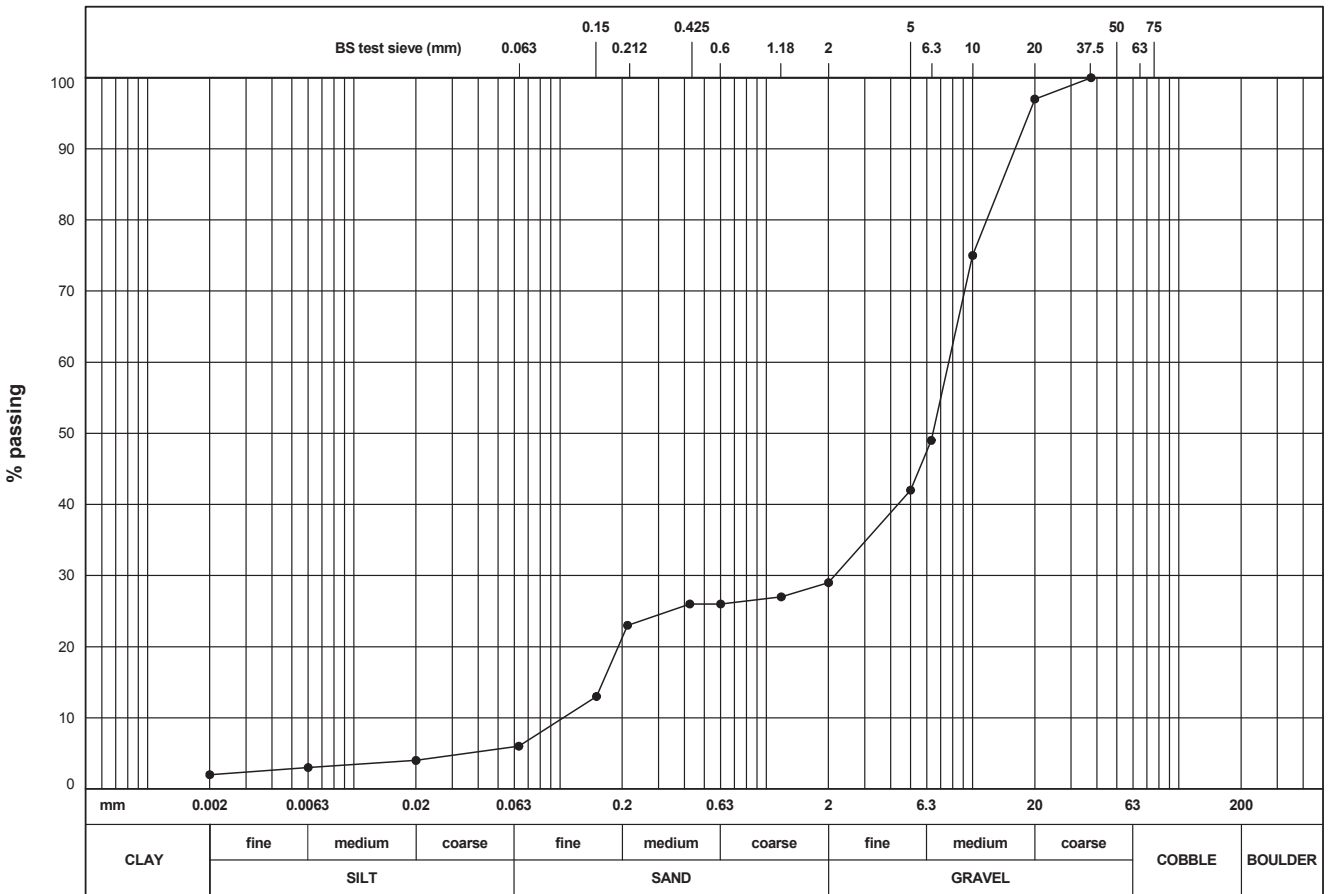
PARTICLE SIZE DISTRIBUTION



BS.1377 : Part 2 : 1990 : 9

CLIENT HALCROW GROUP LIMITED
 SITE DAWLISH WARREN AND EXMOUTH BEACH RECHARGE
 DESCRIPTION Black silty very sandy GRAVEL

BH/TP No. STN08
 SAMPLE No./TYPE B
 SAMPLE DEPTH (m) 0.00
 SPECIMEN DEPTH (m) 0.00



soil type	% fraction	BS test sieve (mm)	% passing	BS test sieve (mm)	% passing	particle size (µm)	% finer
CLAY	2						
SILT	4	150		5	42	20	4
SILT & CLAY	6	75		2	29	6	3
SAND	23						
GRAVEL	71	63		1.18	27	2	2
COBBLE & BOULDER	0						
test method(s)	9.2 & 9.4	50		0.6	26		
test method:		37.5	100	0.425	26		
9.2 - wet sieving		20	97	0.212	23		
9.3 - dry sieving		10	75	0.15	13		
9.4 - sedimentation by pipette		6.3	49	0.063	6		
9.5 - sedimentation by hydrometer							
remarks: # denotes sample tested is smaller than that which is recommended in accordance with BS1377						CONTRACT 25995	CHECKED WJ

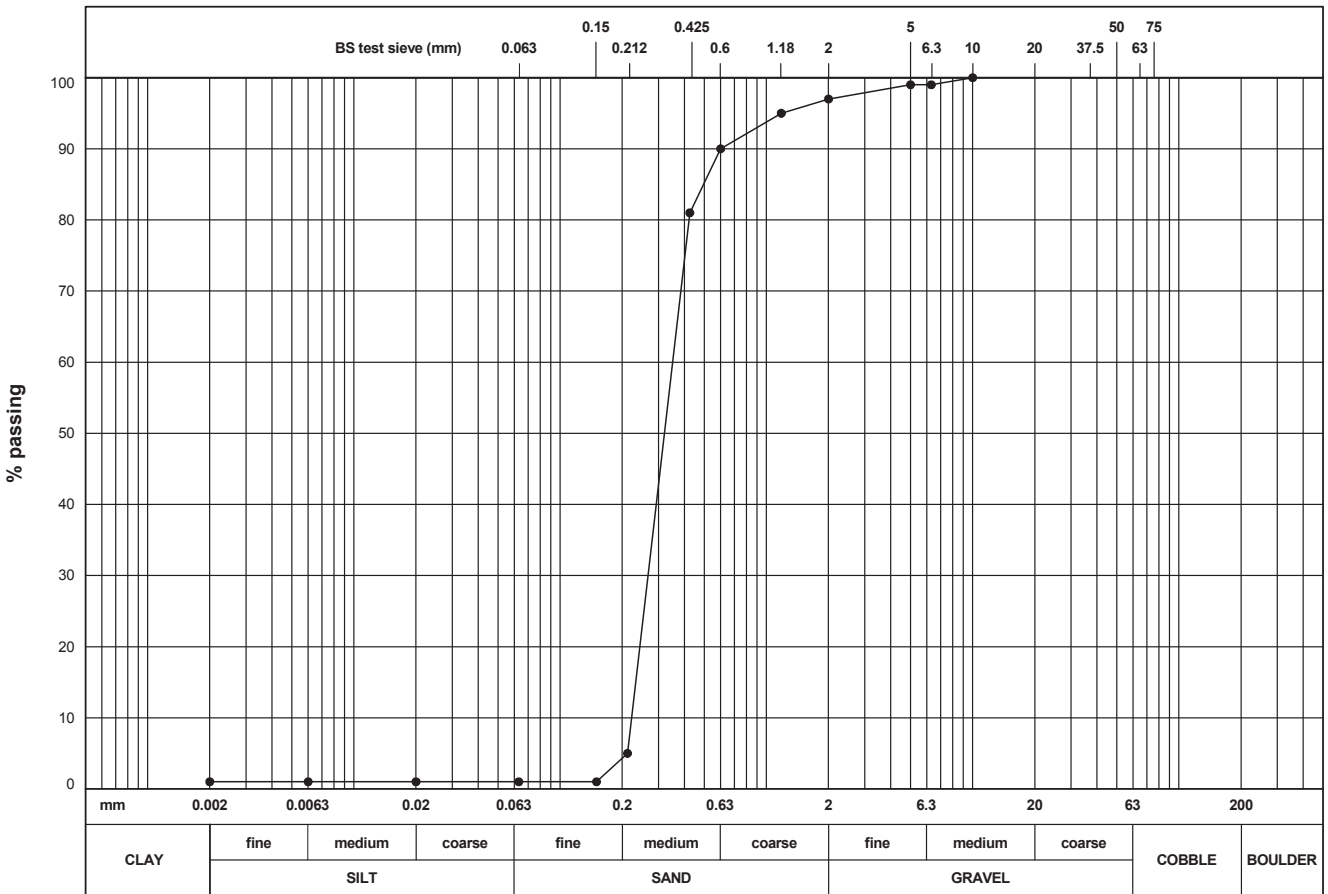
PARTICLE SIZE DISTRIBUTION



BS.1377 : Part 2 : 1990 : 9

CLIENT HALCROW GROUP LIMITED
 SITE DAWLISH WARREN AND EXMOUTH BEACH RECHARGE
 DESCRIPTION Light brown slightly clayey SAND with a little f-m gravel

BH/TP No. STN09
 SAMPLE No./TYPE B
 SAMPLE DEPTH (m) 0.00
 SPECIMEN DEPTH (m) 0.00



soil type	% fraction	BS test sieve (mm)	% passing	BS test sieve (mm)	% passing	particle size (µm)	% finer
CLAY	1						
SILT	0	150		5	99	20	1
SILT & CLAY	1	75		2	97	6	1
SAND	96						
GRAVEL	3	63		1.18	95	2	1
COBBLE & BOULDER	0						
test method(s)	9.2 & 9.4	50		0.6	90		
		37.5		0.425	81		
test method:		20		0.212	5		
9.2 - wet sieving		10	100	0.15	1		
9.3 - dry sieving		6.3	99	0.063	1		
9.4 - sedimentation by pipette							
9.5 - sedimentation by hydrometer							
remarks:	# denotes sample tested is smaller than that which is recommended in accordance with BS1377					CONTRACT	CHECKED
						25995	WJ

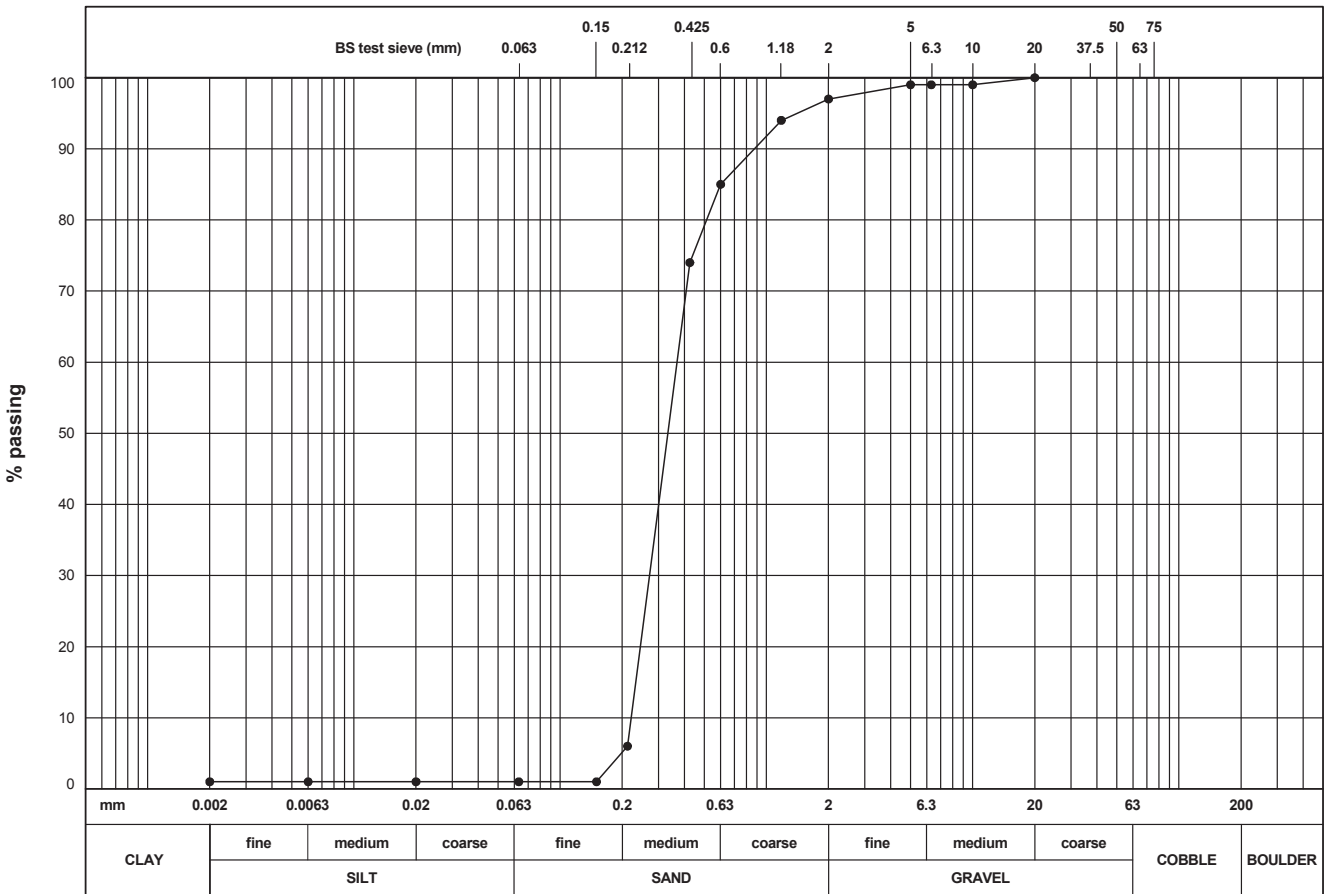
PARTICLE SIZE DISTRIBUTION



BS.1377 : Part 2 : 1990 : 9

CLIENT HALCROW GROUP LIMITED
 SITE DAWLISH WARREN AND EXMOUTH BEACH RECHARGE
 DESCRIPTION Light brown slightly clayey SAND with a little f-m gravel

BH/TP No. STN10
 SAMPLE No./TYPE B
 SAMPLE DEPTH (m) 0.00
 SPECIMEN DEPTH (m) 0.00



soil type	% fraction	BS test sieve (mm)	% passing	BS test sieve (mm)	% passing	particle size (µm)	% finer
CLAY	1						
SILT	0	150		5	99	20	1
SILT & CLAY	1	75		2	97	6	1
SAND	96						
GRAVEL	3	63		1.18	94	2	1
COBBLE & BOULDER	0						
test method(s)	9.2 & 9.4	50		0.6	85		
		37.5		0.425	74		
test method:		20	100	0.212	6		
9.2 - wet sieving		10	99	0.15	1		
9.3 - dry sieving		6.3	99	0.063	1		
9.4 - sedimentation by pipette							
9.5 - sedimentation by hydrometer							

remarks:
 # denotes sample tested is smaller than that which is recommended in accordance with BS1377

CONTRACT 25995	CHECKED WJ
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Geotechnical Engineering Ltd
Centurion House
Olympus Park, Quedgeley
Gloucester
GL2 4NF

FAO Rachel Pratt
17 October 2011

Dear Rachel Pratt

Test Report Number **59866**
Your Project Reference **Dawlish Warren and Exmouth Beach Recharge 25995**

Please find enclosed the results of analysis for the samples received 11 October 2011.

All soil samples will be retained for a period of one month and all water samples will be retained for 7 days following the date of the test report. Should you require an extended retention period then please detail your requirements in an email to customerservices@chemtest.co.uk. Please be aware that charges may be applicable for extended sample storage.

If you require any further assistance, please do not hesitate to contact the Customer Services team.

Yours sincerely



Authorised Signatory

<input type="checkbox"/>	Darrell Hall	Director
<input type="checkbox"/>	Phil Hellier	Director
<input checked="" type="checkbox"/>	Keith Jones	Technical Manager
<input type="checkbox"/>	John Crawford	Quality Manager
<input type="checkbox"/>	Malcolm Avis	Director



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Notes to accompany report:

- *The sign < means 'less than'*
- *Tests marked 'U' hold UKAS accreditation*
- *Tests marked 'M' hold MCertS (and UKAS) accreditation*
- *Tests marked 'N' do not currently hold UKAS accreditation*
- *Tests marked 'S' were subcontracted to an approved laboratory*
- *n/e means 'not evaluated'*
- *i/s means 'insufficient sample'*
- *u/s means 'unsuitable sample'*
- *Comments or interpretations are beyond the scope of UKAS accreditation*
- *The results relate only to the items tested*

