
DEMONSTRATING GEOTECHNICAL SUITABILITY MATERIALS MANAGEMENT PLAN

Design of earthworks through the use of BS 1997, BS 6031 and BS 16907

6th March 2020

Agenda

- 'Factors' to be satisfied by the MMP
- Comparison of chemical and geotechnical requirements
- Geotechnical Standards
- Geotechnical Risk
- Geotechnical Design Process
- Earthworks Specification
- Verification Plan
- Auditing and Verification
- Geo references in the MMP

Wherever possible, direct quotes and references have been made to Current UK Guidance & British Standards

BUND 1 AND 2 TOPSOIL STRIP, INSPECTION AND OVER-EXCAVATION REQUIREMENTS

Legend Bund 1

- Topsoil strip
- Inspection by Geotechnical Engineer
- 1:1 sand fill over topsoil strip to be inspected together at same time
- Over excavation of adjacent areas with a minimum of 1:1 sand fill
- Over excavation of adjacent areas with a minimum of 1:1 sand fill

Legend Bund 2

- Topsoil strip
- Inspection by Geotechnical Engineer
- 1:1 sand fill over topsoil strip to be inspected together at same time
- Over excavation of adjacent areas with a minimum of 1:1 sand fill
- Over excavation of adjacent areas with a minimum of 1:1 sand fill

COMPACTION CONTROL AND MINIMUM PERFORMANCE FOR METHOD PLACEMENT AND TESTING TO BE CARRIED OUT BY THE CONTRACTOR

Method	Material	Moisture	Compaction	Minimum Performance
Hand	Class 2	10-15%	100%	95%
		15-20%	100%	95%
Hand	Class 3	10-15%	100%	95%
		15-20%	100%	95%
Hand	Class 4	10-15%	100%	95%
		15-20%	100%	95%
Hand	Class 5	10-15%	100%	95%
		15-20%	100%	95%
Hand	Class 6	10-15%	100%	95%
		15-20%	100%	95%
Hand	Class 7	10-15%	100%	95%
		15-20%	100%	95%
Hand	Class 8	10-15%	100%	95%
		15-20%	100%	95%
Hand	Class 9	10-15%	100%	95%
		15-20%	100%	95%
Hand	Class 10	10-15%	100%	95%
		15-20%	100%	95%
Hand	Class 11	10-15%	100%	95%
		15-20%	100%	95%
Hand	Class 12	10-15%	100%	95%
		15-20%	100%	95%
Hand	Class 13	10-15%	100%	95%
		15-20%	100%	95%
Hand	Class 14	10-15%	100%	95%
		15-20%	100%	95%
Hand	Class 15	10-15%	100%	95%
		15-20%	100%	95%
Hand	Class 16	10-15%	100%	95%
		15-20%	100%	95%
Hand	Class 17	10-15%	100%	95%
		15-20%	100%	95%
Hand	Class 18	10-15%	100%	95%
		15-20%	100%	95%
Hand	Class 19	10-15%	100%	95%
		15-20%	100%	95%
Hand	Class 20	10-15%	100%	95%
		15-20%	100%	95%
Hand	Class 21	10-15%	100%	95%
		15-20%	100%	95%
Hand	Class 22	10-15%	100%	95%
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Hand	Class 45	10-15%	100%	95%
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Hand	Class 46	10-15%	100%	95%
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Hand	Class 47	10-15%	100%	95%
		15-20%	100%	95%
Hand	Class 48	10-15%	100%	95%
		15-20%	100%	95%
Hand	Class 49	10-15%	100%	95%
		15-20%	100%	95%
Hand	Class 50	10-15%	100%	95%
		15-20%	100%	95%

BUND 2 - POND CROSS SECTION INCLUDING PROPOSED BORROW PIT

FILLING AND TESTING STRATEGY

APPENDIX 1/1 - TO BE CARRIED OUT BY THE CONTRACTOR

Item	Description	Quantity	Unit	Rate	Total
1	Hand	1000	m ³	10	10000
2	Hand	2000	m ³	10	20000
3	Hand	3000	m ³	10	30000
4	Hand	4000	m ³	10	40000
5	Hand	5000	m ³	10	50000
6	Hand	6000	m ³	10	60000
7	Hand	7000	m ³	10	70000
8	Hand	8000	m ³	10	80000
9	Hand	9000	m ³	10	90000
10	Hand	10000	m ³	10	100000

APPENDIX 1/2 - TO BE CARRIED OUT BY THE CONTRACTOR

Item	Description	Quantity	Unit	Rate	Total
1	Hand	1000	m ³	10	10000
2	Hand	2000	m ³	10	20000
3	Hand	3000	m ³	10	30000
4	Hand	4000	m ³	10	40000
5	Hand	5000	m ³	10	50000
6	Hand	6000	m ³	10	60000
7	Hand	7000	m ³	10	70000
8	Hand	8000	m ³	10	80000
9	Hand	9000	m ³	10	90000
10	Hand	10000	m ³	10	100000

Importance of a compliant MMP

Part III of the Finance Act 1996, which has been amended since 1st April 2018, states:

“The scope of landfill tax has been extended to cover any site (not exclusively landfills) operating without the appropriate environmental permit, appropriate exemption or, correctly applied use of the DoW CoP”

Use of DoW CoP and MMP’s not limited to contaminated sites, nor to the sole reuse of materials which require remediation.

3.2 Materials Management Plan

3.5 A MMP must be produced that documents how all of the materials to be excavated are to be dealt with. The MMP must be followed throughout the execution of the works.

3.6 The MMP must be produced prior to excavation. In summary the MMP provides:

- Details of the parties that will be involved with the implementation of the MMP;
- A description of the materials in terms of potential use and relative quantities of each category (see Box A below);
- The specification for use of materials against which proposed materials will be assessed, underpinned by an appropriate risk assessment related to the place where they are to be used;
- Details of where and, if appropriate, how these materials will be stored;
- Details of the intended final destination and use of these materials;
- Details of how these materials are to be tracked;
- Contingency arrangements that must be put in place prior to movement of these materials; and
- Verification Plan.

3.7 All material to be excavated should be capable of categorisation as indicated in Box A.

The talk is intended to assist a QP in their review and to ensure that the necessary Geotechnical information has been included in or referenced by the MMP

CL:AIRE Guidance Bulletin GB 3 – The Definition of Waste: Development Industry Code of Practice

The Principles for the use of Materials as Non-waste

1. Factor 1: Protection of human health and the environment

2. Factor 2: Suitability for use

The material must be suitable for its intended purpose in **ALL** aspects, in particular both its **CHEMICAL** and **GEOTECHNICAL** properties.

3. Factor 3: Certainty of use

4. Factor 4: Quantity of material

Geotechnical Standards & Design Guides

BS 1997:2004+A1:2013

BS 6031:2009

BS 16907:2018

SHW Series 600: 2016

DMRB CD 622: 2019
(formerly HD 22/08)

BRITISH STANDARD

BS EN
1997-1:2004

Eurocode 7: Geotechnical design —

Part 1: General rules

BS 6031:2009



BSI British Standards

Code of practice for earthworks

BS EN 16907-1

MANUAL OF CONTRACT DOCUMENTS FOR HIGHWAY WORKS
VOLUME 1 SPECIFICATION FOR HIGHWAY WORKS



BSI Standards Publication

SERIES 600 EARTHWORKS

Contents

Clause	Title	Page	Clause	Title	Page
#601	(02/16) Classification, Definitions and Uses of Earthworks Materials	3	623	(02/16) Earthworks for Corrugated Steel Buried Structures	26
602	(02/16) General Requirements	6	624	(02/16) Ground Anchorages	27
603	(02/16) Forming of Cuttings and Cutting	625	625	(02/16) Crib Walling	27

Design Manual for Roads and Bridges

Earthworks

Part 5: Quality control



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Geotechnics
General information

CD 622

Managing geotechnical risk

(formerly HD 22/08, BD 10/97, HA 120/08)

Revision 0

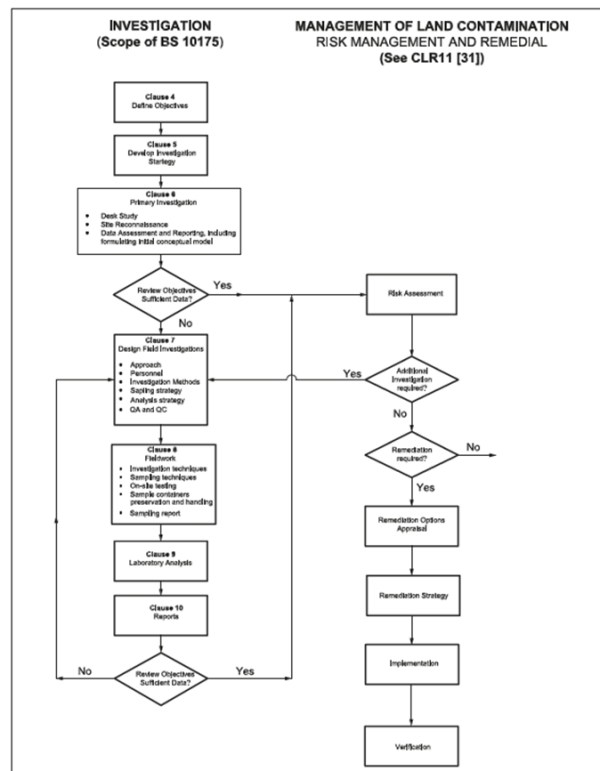
Summary

This document defines the technical approval and certification procedures to be used to ensure that the risks associated with geotechnical activities are appropriately managed.

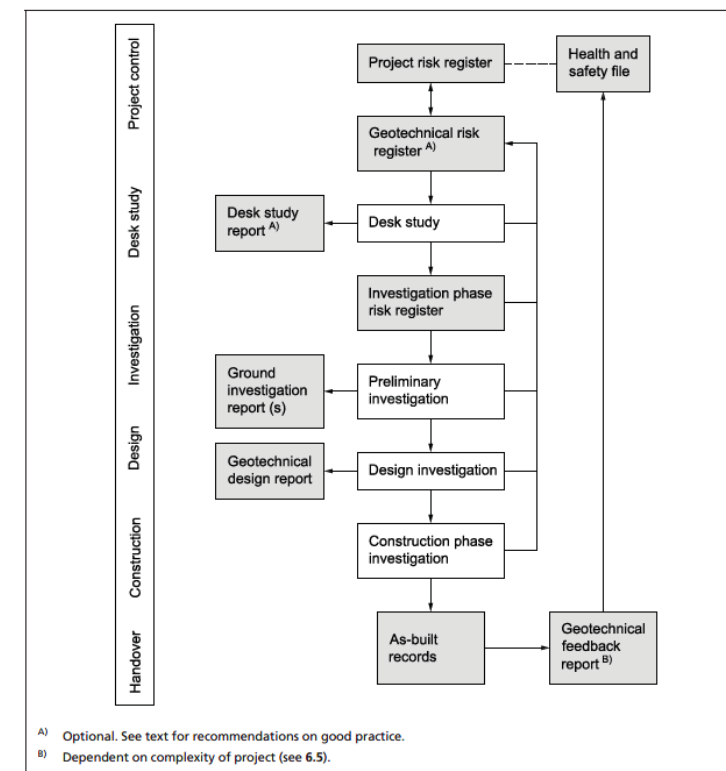
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Comparison between chemical & geotechnical

Chemical - BS 10175



Geotechnical - BS 6031



Comparison between chemical & geotechnical

Chemical - BS 10175

Desk Study & Primary SI
Risk Assessment

Additional SI Required

Remediation Required

Remediation Options Appraisal

Remediation Strategy

Implementation

Verification

Geotechnical - BS 6031

Project Risk Register

Geotechnical Risk Register

Ground Investigation

Preliminary Geotechnical Design
◦ Update Geo Risk Register

Additional Design SI

Detailed Geotechnical Design
◦ Update Geo Risk Register

Earthworks Specification

Earthworks & Verification
◦ Update Geo Risk Register

Why do you need a Geotechnical Design?

Because the MMP has to demonstrate geotechnical suitability.

Because the Code of Practice for Earthworks states you need a Design.

BS 1997-1:2004+A1:2013 Geotechnical Design

Mandatory since 2010

- Geotechnical Categories – CAT 1, 2 & 3
- CAT 2 & 3 require a Geotechnical Design
- CAT 1, negligible risk.
- CAT 2, conventional structures, which includes:
 - Rafts, Spread footings, **Embankments & Earthworks**, Piles, Retaining Walls etc.
- CAT 3, complex structure, which includes:
 - Very large or unusual structures
 - Structures involving abnormal risk
 - Unusual or difficult ground conditions

Why do you need a Geotechnical Design Report?

BS 8004:2015: Foundations

BS 8004:2015

BRITISH STANDARD

4.12.2 Geotechnical Design Report

The Geotechnical Design Report for a foundation should conform to BS EN 1997-1:2004+A1:2013, 2.8.

BS 6031: 2009: Code of Practice for Earthworks

6.4.2.3 Reporting of design investigation

A geotechnical design report (GDR) should conform to BS EN 1997-1:2004, 2.8. HD 22/08 [11] has been drafted in compliance with BS EN 1997 (both parts), with a particular emphasis on the requirements of a major earthworks project.

BS EN 16907: 2018: Earthworks

12 Fill construction monitoring

Supervision and monitoring of fills should follow the general provisions set out in Clause 4 of EN 1997-1:2004.

Fill construction should be carefully observed on all sites but where stability and /or settlement are deemed to be critical it will be essential to install appropriate instrumentation.

In all cases where a supervision and monitoring programme is required, the designer should present the detailed information and requirements in the Geotechnical Design Report. [EN 1997-1:2004, 12.7.3.]

Relationship between Design & Specification

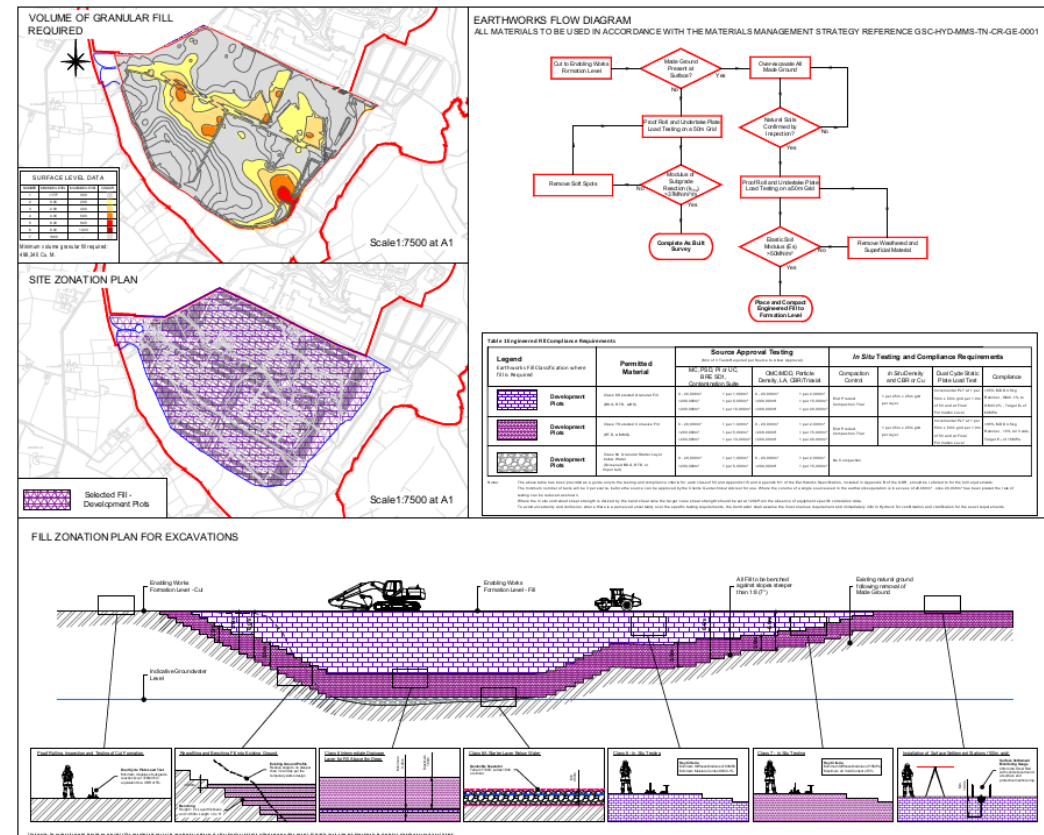
The Design needs a Specification to ensure it is built correctly

Compliance with the Specification is to ensure that the element is built as designed

The Specification sets out how compliance and verification is to be demonstrated

The responsibility sits with the Contractor to comply with the Specification

You can't complete an Earthworks Specification without defining Contract Specific values by Design (qualitative and quantitative)



Geotechnical Design

Guiding Principles from BS 1997

The data required for the design has been collected, recorded and interpreted by **appropriately qualified personnel**.

It is **designed by appropriately qualified and experienced personnel**.

There shall be adequate **continuity and communication** between the personnel involved in the **data collection, design and construction**.

There shall be **adequate supervision and quality control on site**.

The execution of the works shall be carried out **in accordance with the relevant standards and specifications**, by personnel having the appropriate **skill and experience**.

The construction **materials and products** used are as specified in the **design and accompanying specifications**

BS 1997-1:2004+A1:2013

1.3 Assumptions

(1) Reference is made to 1.3 of EN 1990:2002.

(2) The provisions of this standard are based on the assumptions given below:

- data required for design are collected, recorded and interpreted by appropriately qualified personnel;
- structures are designed by appropriately qualified and experienced personnel;
- adequate continuity and communication exist between the personnel involved in data-collection, design and construction;
- adequate supervision and quality control are provided in factories, in plants, and on site;
- execution is carried out according to the relevant standards and specifications by personnel having the appropriate skill and experience;
- construction materials and products are used as specified in this standard or in the relevant material or product specifications;
- the structure will be adequately maintained to ensure its safety and serviceability for the designed service life;
- the structure will be used for the purpose defined for the design.

(3) These assumptions need to be considered both by the designer and the client. To prevent uncertainty, compliance with them should be documented, e.g. in the geotechnical design report.

Geotechnical Risk Register

GEO HAZARD IDENTIFICATION REGISTER

Hazard category (excluding contamination issues)	Hazard status based on investigation findings and proposed development			Engineering considerations if hazard affects site
	Found to be present on site	Could be present but not found	Unlikely to be present and/or affect site	
Sudden lateral changes in ground conditions				Likely to affect ground engineering and foundation design and construction
Shrinkable clay soils				Design to NHBC Standards Chapter 4 or similar
Highly compressible and low bearing capacity soils, (including peat and soft clay)				Likely to affect ground engineering and foundation design and construction
Silt-rich soils susceptible to rapid loss of strength in wet conditions				Likely to affect ground engineering and foundation design and construction
Running sand at and below water table				Likely to affect ground engineering and foundation design and construction
Karstic dissolution features (including 'swallow holes' in Chalk terrain)				May affect ground engineering and foundation design and construction
Evaporite dissolution features and/or subsidence				May affect ground engineering and foundation design and construction
Ground subject to or at risk from landslides				Likely to require special stabilisation measures
Ground subject to peri-glacial valley cambering with gulls possibly present				Likely to affect ground engineering and foundation design and construction

Figure B.1 Example of a geotechnical risk register

Risk classification and required action

Likelihood		Severity				
		1	2	3	4	5
1	Extremely unlikely	1	2	3	4	5
2	Unlikely	2	4	6	8	10
3	Likely	3	6	9	12	15
4	Extremely likely	4	8	12	16	20
5	Almost certain	5	10	15	20	25

Potential severity of harm occurring

1	Minor	Minor damage or loss - (no human injury)
2	Moderate	Moderate damage or loss - (Slight injury or illness)
3	Serious	Substantial damage or loss - (Serious injury or illness)
4	Major	Major damage or loss - (Fatal injury)
5	Catastrophic	Catastrophic loss or damage - (Multiple fatalities)

Risk Classification	
Low (1-8)	Ensure assumed control measures are maintained and reviewed as necessary.
Medium (9-19)	Additional control measures needed to reduce risk rating to a level that is equivalent to a test of "reasonably required" for
High (20-25)	Activity not permitted. Hazard to be avoided or risk to be reduced to tolerable level.

The risk classification is the product of the likelihood and the severity

Risk ID	Hazard	Consequence	Likelihood	Severity	Risk	Mitigation	Likelihood	Severity	Residual risk
1	Solution features within areas underlain by limestone (including chalk).	Ground collapse.	5	4	20	Undertake appropriate ground investigations, including geophysics and dynamic probing where relevant, in areas of known risk. Use to inform suitable design/construction.	1	4	4
2	Compressible ground, such as peat and/or alluvium.	Instability during/after construction and relatively high settlement in earthworks/structures.	4	3	12	Develop appropriate ground model from PFSR and GIR to inform suitable design and construction controls.	1	3	3
3	Poorly backfilled/reinstated longitudinal service trenches and leaking pipework (e.g. drains, communications and electricity supply ducts) particularly at slope shoulders or mid-slope.	Water ingress into slope causing instability/failure.	4	4	16	Ensure appropriate specification documentation provided to site personnel to emphasise the need to mitigate this risk. Works to be supervised by an appropriately qualified and experienced geotechnical professional.	1	4	4
4	Settlement/heave during trenchless construction beneath the existing carriageway.	Damage to existing carriageway, services and related assets. Safety issues and disruption to road users.	4	3	12	Establish a survey network to allow live monitoring of the carriageway during and after works together with appropriate monitoring/control of drilling operations. Undertake works beneath carriageway within a single shift. Ensure appropriate emergency procedure in place, including traffic management and alternative route(s).	2	3	6

Note: the above entries are purely for example only and do not relate to any specific scheme.

How complex should the design be

Geotechnical Design

A geotechnical design is required to mitigate the risk

Complexity of the design should reflect the complexity of the risk

- Can be a single sheet of paper / drawing

A level of design is required to derive the Contract Specific values to complete the Earthworks Specification

Geotechnical Risk Register

Hazard	Location	Detail	Risk	Risk Before Mitigation			Design Mitigation
				P	I	R	
Deep Made Ground	Large area of the site as a result of historic landfilling	Made Ground present on site potentially up to 12m thick following site re-profiling. Material comprising non-engineered construction waste, landfill and relict sludge lagoons.	Bearing capacity failure of structures with shallow foundations. Excessive total and differential settlement and long-term creep affecting structures.	5	4	20 (Sv)	Complete removal of all Made Ground and unsuitable soils within the area of the development plots. Design of suitable engineered fill to support structural loads and mitigate long term settlement. Settlement analysis undertaken in order to derive minimum end-product criteria for the fill and achieve a minimum stiffness.
Highwalls	Edges of landfill and deep Made Ground	A highwall can create a large differential in ground stiffness over short distances.	Unacceptable differential settlement especially in relation to the high sensitivity ground bearing floor slabs.	4	4	16 (Sb)	Design of transition zones where highwalls are present.

TABLE 6/1: (02/16) Acceptable Earthworks Materials: Classification and Compaction Requirements (See footnotes) (continued)

Class				General Material Description	Typical Use	Permitted Constituents (All Subject to Requirements of Clause 601 and contract specific Appendix 6/1)	Material Properties Required for Acceptability (In Addition to Requirements on Use of Fill Materials in Clause 601 and Testing in Clause 631)				Compaction Requirements in Clause 612	Class		
							Property (See Exceptions in Previous Column)	Defined and Tested in Accordance with:	Acceptable Limits Within:					
									Lower	Upper				
G E N E R A L	2	A	-	Wet cohesive material	General Fill	Any material, or combination of materials, other than chalk.	(i) grading	BS 1377: Part 2	Tab 6/2	Tab 6/2	Tab 6/4 Method 1 except for materials with liquid limit greater than 50, determined by BS 1377: Part 2, only deadweight tamping or vibratory tamping rollers or grid rollers shall be used.	2	A	-
							(ii) plastic limit (PL)	BS 1377: Part 2	-	-				
							(iii) mc	BS 1377: Part 2 See Note 4	PL -4%	App 6/1				
							(iv) MCV	Clause 632	App 6/1	App 6/1				
							(v) Undrained shear strength of remoulded material	Clause 633	App 6/1	App 6/1				
C O H E S I V E	2	B	-	Dry cohesive material	General Fill	Any material, or combination of materials, other than chalk	(i) grading	BS 1377: Part 2	Tab 6/2	Tab 6/2	Tab 6/4 Method 2	2	B	-
							(ii) plastic limit (PL)	BS 1377: Part 2	-	-				
							(iii) mc	BS 1377: Part 2 See Note 4	App 6/1	PL -4%				
							(iv) MCV	Clause 632	App 6/1	App 6/1				
							(v) undrained shear strength of remoulded material	Clause 633	App 6/1	App 6/1				
F I L L	2	C	-	Stony cohesive material	General Fill	Any material, or combination of materials, other than chalk	(i) grading	BS 1377: part 2	Tab 6/2	Tab 6/2	Tab 6/4 Method 2	2	C	-
							(ii) plastic limit (PL)	BS 1377: part 2	-	-				
							(iii) mc	BS 1377: Part 2 See Note 4	App 6/1	App 6/1				
							(iv) MCV	Clause 632	App 6/1	-				
							(v) Undrained shear strength of remoulded material	Clause 633	App 6/1	-				



APPENDIX 6/1: TABLE 6/1(Continued): ACCEPTABLE EARTHWORKS MATERIALS: CLASSIFICATION AND COMPACTION REQUIREMENTS (SEE FOOTNOTES)

Class				General Material Description	Typical Use	Permitted Constituents	Material properties required for acceptability in additional to the requirements on use of fill materials in SHW Clause 601 and testing in SHW Clause 631				Compaction requirements in Clause 612 & additional notes	Class		
							Property (see exceptions in previous column)	Defined and testing in accordance with	Acceptable limits within					
									Lower	Upper				
GENERAL COHESIVE FILL	2	A	-	Wet cohesive material	General fill	Any material, or combination of materials other than material designated as Class 3 in the contract	(i) grading	BS 1377-2	SHW Table 6/2	SHW Table 6/2	SHW Table 6/4 Method 1 OMC/MDD determined using 2.5kg Rammer Except for materials with liquid limit greater than 50, only deadweight tamping or vibratory tamping rollers or grid rollers shall be used. ¹ The lower permitted moisture content is based on the moisture content where a horizontal line plotted at 105% of the MDD intersects the 5% Air void line. ² The upper permitted moisture content is based on the lower of: • the moisture content at 95% of the MDD; or • the moisture content where the undrained shear strength is 50 kPa. If the shear strength is less than 50 kPa the material will be deemed to be too wet.	2	A	-
							(ii) plasticity index (PI)	BS 1377-2	-	-				
							(iii) mc	BS 1377-2	¹ See compaction requirements	² See compaction requirements				
							(iv) undrained shear strength (c)	SHW Clause 633	50 kPa	-				
							(v) OMC/MDD	BS 1377-4	-	-				
							(vi) Particle Density	BS 1377-2	-	-				

Geotechnical Design

BS 1997-1

Use of Limit State approach, ULS & SLS

Site conditions, with respect to overall stability & ground movements

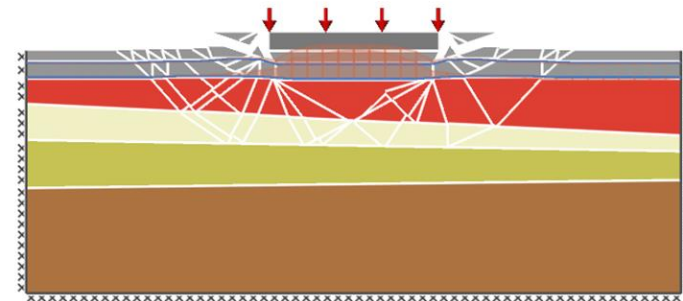
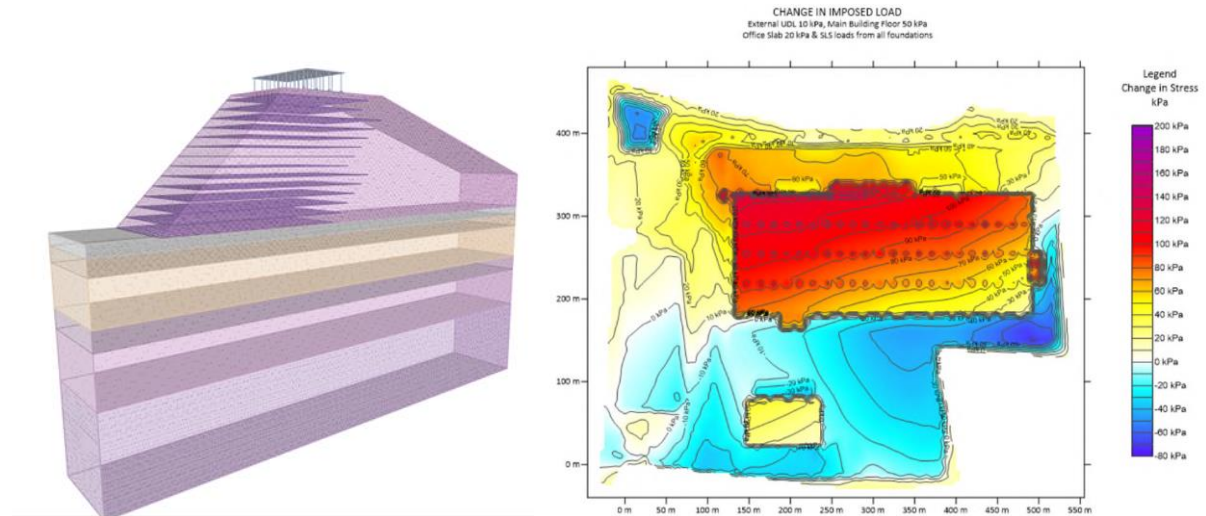
Nature and size of structure, including design life and serviceability requirements

What are the ground conditions?

What are the ground water conditions?

What will be the influence on the Environment?

Types of Analysis



Geotechnical Design

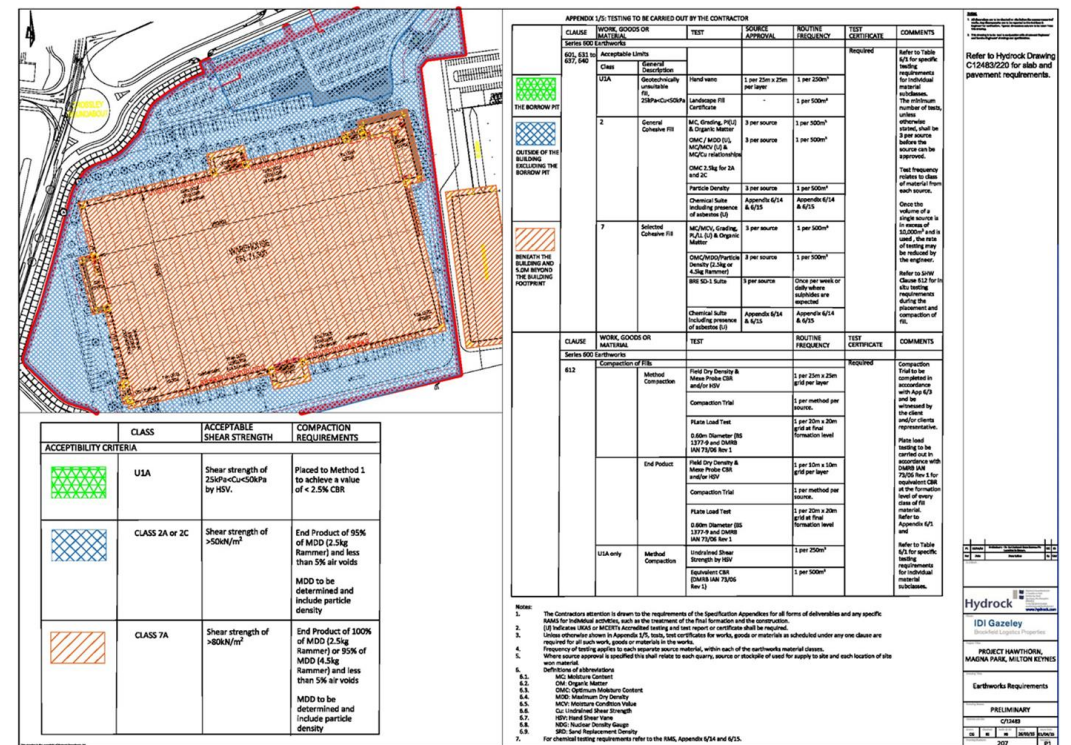
BS 6031 & CD 622

Full details of the interpretation of design data

Full details of the method of analysis, covering:

- Soil parameters and ground model
- Stability & permitted slope angles
- Drainage requirements
- Formation parameters
- Permissible bearing pressure
- Predicted settlement (primary & secondary)
- Maximum & typical depths of fill
- Contract Specific values for App 6/1
- Contamination and ground gas risks

Example of Design Drawing



Basis of the Earthworks Specification

- BS 6031:2009 defaults to the use of the SHW
- BS 16907-1:2018: Annex H states the UK approach is to use BS 6031 and the SHW
- Others such as NBS D20, which also refers to the SHW
- BRE FB 75 – Building on Fill, 2015 edition drafted to comply with BS 1997 & BS6031



Code of practice for earthworks

This revision of BS 6031 reflects the widespread UK practice of using the Specification for Highway Works (SHW) 600 series [1] for the construction of earthworks. Within this standard, the SHW has been set as the default approach for earthworks specification that applies unless the designer details an alternative form of specification/earthworks management system.

BS EN 16907-1:2018

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H.1 Introduction

This informative Annex briefly summarizes the standards that cover the field of earthworks in the United Kingdom. The UK practice satisfies the requirements of the set of TC396 standards.

The British Standard that covers the field of earthworks is BS 6031:2009 Code of practice for earthworks [3], it reflects the widespread UK practice of using the Specification for Highway Works (SHW) 600 series for the construction of earthworks [1]. This Annex to TC396 EN 16907-1 has been prepared as a brief summary of these documents to enable engineers who are not familiar with the UK earthworks system to consider utilizing it on projects where appropriate.

Earthworks

Part 1: Principles and general rules

Earthworks Specification Structure

Standard List of SHW Appendices

Contract Specific Appendices: Earthworks

1	2	3	4
<p>Table 2 List of Standard Appendices Referenced in the Specification for Highway Works</p> <p>Table 3 List of Standard Appendices Referenced in the Specification for Highway Works</p>	<p>Table 2 List of Standard Appendices Referenced in the Specification for Highway Works</p> <p>Table 3 List of Standard Appendices Referenced in the Specification for Highway Works</p>	<p>Table 2 List of Standard Appendices Referenced in the Specification for Highway Works</p> <p>Table 3 List of Standard Appendices Referenced in the Specification for Highway Works</p>	<p>Table 2 List of Standard Appendices Referenced in the Specification for Highway Works</p> <p>Table 3 List of Standard Appendices Referenced in the Specification for Highway Works</p>

EARTHWORKS

- 6/1 Requirements for Acceptability and Testing etc. of Earthworks Materials
- 6/2 Requirements for Dealing with Class U1B and Class U2 Unacceptable Materials (11/04)
- 6/3 Requirements for Excavation, Deposition, Compaction (Other than Dynamic Compaction)
- 6/4 Requirements for Class 3 Material
- 6/5 Geotextiles Used to Separate Earthworks Materials
- 6/6 Fill to Structures and Fill Above Structural Foundations
- 6/7 Sub-formation and Capping and Preparation and Surface Treatment of Formation
- 6/8 Topsoiling
- 6/9 Earthwork Environmental Bunds, Landscape Areas, Strengthened Embankments
- 6/10 Ground Anchorages, Crib Walling and Gabions
- 6/11 Swallow Holes and Other Naturally Occurring Cavities and Disused Mine Workings
- 6/12 Instrumentation and Monitoring
- 6/13 Ground Improvement
- 6/14 Limiting Values for Pollution of Controlled Waters (11/06)
- 6/15 Limiting Values for Harm to Human Health and the Environment (11/04)

6/1	6/2	6/3	6/4	6/5	6/6	6/7	6/8	6/9	6/10	6/11	6/12	6/13	6/14	6/15
Appendix 0-3	Appendix 0-4	Appendix 1-5	Appendix 1-23	Appendix 1-24	Appendix 6-1	Appendix 6-1	Appendix 6-2	Appendix 6-3	Appendix 6-4	Appendix 6-5	Appendix 6-6	Appendix 6-7	Appendix 6-8	Appendix 6-9

- APPENDIX 0-3_NUMBERED_APPS
- APPENDIX 0-4_DRAWINGS_&_REFERENC...
- APPENDIX 1-5_TESTING
- APPENDIX 1-23_H&S_RISK
- APPENDIX 1-24_QMS
- APPENDIX 6-1_ACCEPTABILITY
- APPENDIX 6-1_TABLE_6-1
- APPENDIX 6-2_CLASS-U_DISPOSAL
- APPENDIX 6-3_COMPACTON
- APPENDIX 6-4_CHALK
- APPENDIX 6-5_GEOTEXTILES
- APPENDIX 6-6_STRUCTURAL_FILL
- APPENDIX 6-7_SUB-FORMATION-CAPPIN...
- APPENDIX 6-8_TOPSOILING
- APPENDIX 6-9_BUNDS_LANDSCAPE
- APPENDIX 6-10_ANCHORAGE-CRIBB-GA...
- APPENDIX 6-11_VOIDS-NOT-COMPLETED
- APPENDIX 6-12_MONITORING
- APPENDIX 6-14_LIMITING-WATER
- APPENDIX 6-15_HUMAN-HEALTH

Amended to comply with BS 16907-1 to 6: 2018



BS 16907 Amendments to the SHW

SHW

Compaction control

- Method Placement
- End Product

Method Placement

- Material must be in an acceptable MC range, defined by GDR

End Product

- End product values defined and confirmed through GDR

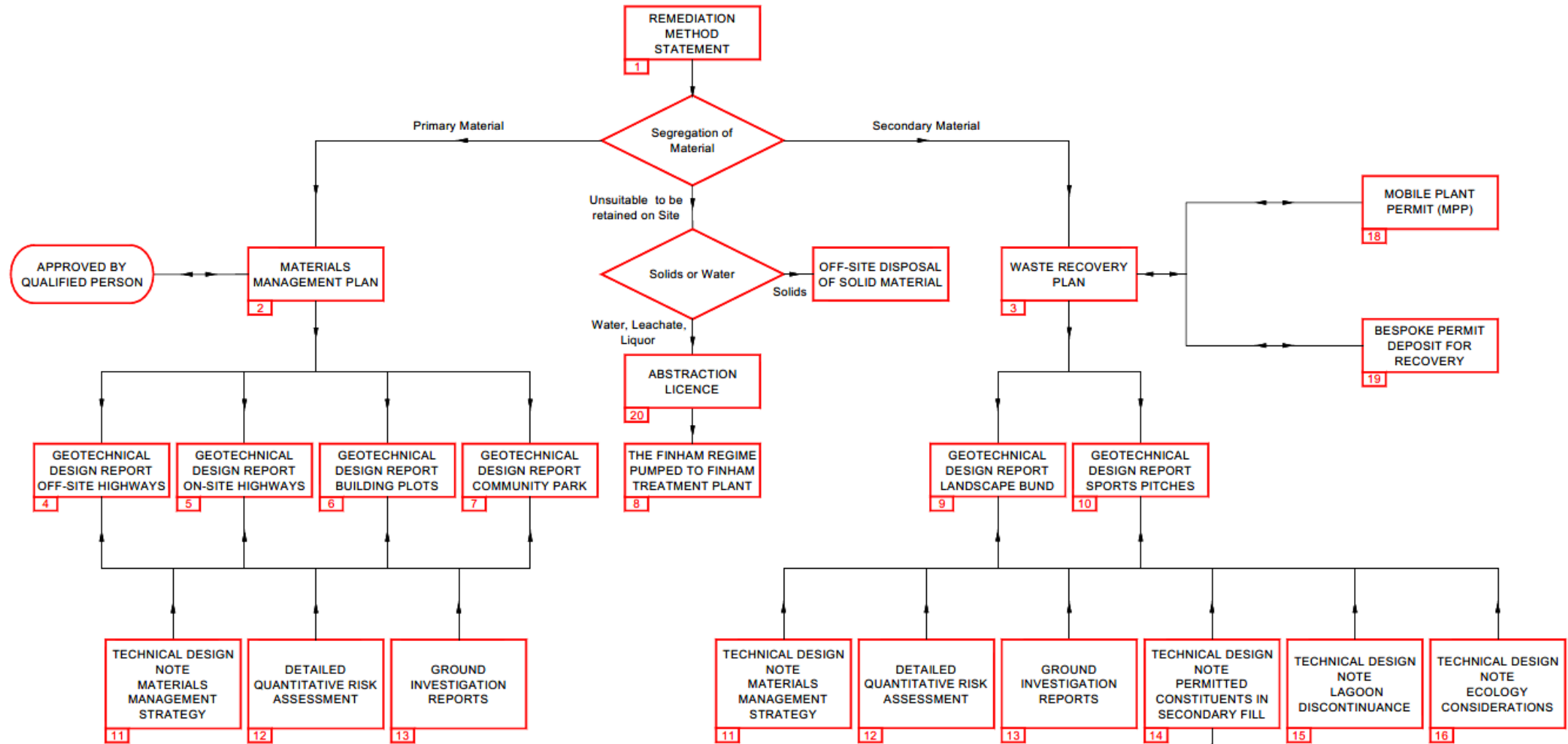
BS 16907

Where a gauge is used for density, a separate lab MC is required

Where method placement is used, factual evidence is required

- Not sufficient to just state “SHW Table 6/4”

Hierarchy of documents



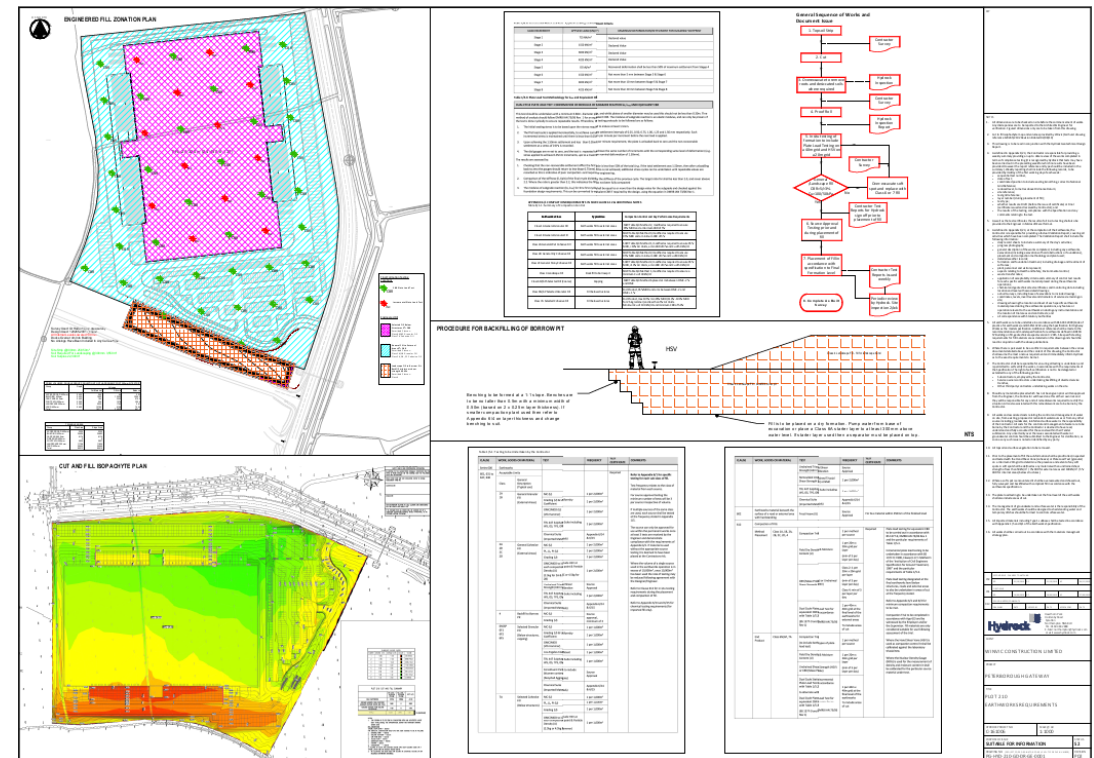
Verification Plan

BS 16907-5 & App 1/24 text example

3. TESTING

- 3.1 All aspects of quality control and quality assurance associated with the earthworks shall be undertaken accordance with the requirements defined in BS EN 16907-5: 2018 and as clarified by this Appendix.
- 3.2 The Contractor shall undertake all compliance testing required during the course of the filling operation to check the material classification, acceptance limits and, the method of compaction control as defined by Appendix 6/1. The minimum frequency of testing is defined in Appendix 1/5 of the specification with the material acceptance and compliance limits set out in Appendix 6/1 and specifically in Table 6/1.
- 3.3 The compliance testing of the earthworks materials shall be carried out by a laboratory which holds UKAS (for geotechnical tests) or MCERTS (for chemical and contaminations tests) accreditation for the specific test. Where it is not possible to obtain the testing of a material for a specific property to a UKAS or MCERTS accredited method, the Contractor shall obtain permission from the Employers Representative for the test that is to be completed by the proposed laboratory, before the test is undertaken.
- 3.4 The Contractor shall provide to Hydrock, by mid-day on the first working day of each week, an updated electronic summary (Microsoft Excel 2010 or earlier) of all testing which has been completed up to the end of works for the previous week.
- 3.5 The testing summary shall be in a form agreed with the Supervisor, and shall include the results of all in situ test results (if the final validated report has not been issued by the appointed laboratory, these results shall be denoted with a draft to show that they are not final results). The summary shall also include a list of all samples submitted for laboratory testing, and provide the results of those laboratory tests where report certificates have been issued.
- 3.6 The information to be included for the summary of testing shall include, but not be limited to, the following:
- 3.6.1 Unique test number.
 - 3.6.2 Date of test.
 - 3.6.3 Weather and site conditions at time of test.

Drawing example



Geotechnical references in the MMP

Geotechnical Risk Register

Geotechnical Design

Earthworks Specification – based on SHW

- App 0/3: What appendices form the specification
- App 0/4: What drawings are included in the specification
- App 1/5: What type of tests and at what frequency to prove suitability
- App 1/24: Quality Management System, validation & **verification plan**
- App 6/1: Acceptable limits – **Geotechnically suitable before use**
- App 6/2: How to deal with unsuitable material – **What to do if unsuitable**
- App 6/3: Compaction control and compliance – **Geotechnical suitable when used**
- App 6/14: Limiting values for Controlled waters – **Chemically suitable**
- App 6/15: Limiting values for Human Health & Environment - **Chemically suitable**

Earthworks Specification – not based on SHW

- All of the above, but in a ‘different’ format, fully compliant with BS 16907.

Thankyou

Any questions?