S/NMSB/DMF/ESSD21/03

New Milton Sand and Ballast

Downton Manor Farm Quarry

Downton, Hampshire

Application for Variation of Waste Recovery Permit to Encompass Extension of Site Restoration Using Imported Inert Infill

Environmental Setting & Site Design

Version 3
16th April 2021

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BCL CONSULTANT HYDROGEOLOGISTS' EXPERIENCE & QUALIFICATIONS

BCL is an independent consultancy specialising in all aspects of hydrogeology and hydrology as they relate to minerals extraction, waste disposal, water supply and related industries.

Peter Simpson (the author of this report) holds an honours degree (B.Sc. Environmental Science) conferred by The University of Birmingham in 2005 and a Masters Degree (M.Sc. Hydrogeology), also conferred by The University of Birmingham, in 2011.

BCL has provided specialist services, advice and reporting to the extractive, waste and related industries since 1990. During this time a collective 100+ years of experienced has been earned from involvement with wide variety of assignments. BCL's work has included:

- Installation and management of information collection systems;
- Data interpretation;
- Conceptualisation of hydrogeological systems;
- Identification of potential impacts;
- Formulation of mitigation measures;
- Management and undertaking of operational impact monitoring and impact assessment;
- Review and auditing of contingency mitigation schemes;

1 INTRODUCTION

1.1 Report Context

1.1.1 In October 2017, a planning application (the Application) was submitted to Hampshire County Council (HCC) for the lateral extension of Downton Manor Farm Quarry, Downton, Hampshire (the Site), as operated by New Milton Sand and Ballast Company (NMSB).

1.1.2 The Application sought consent for the extension of existing quarry operations (the Western Extension) over an area of 19.41 hectares (ha) to release some 762,150 tonnes of additional mineral reserve (sands and gravels).

1.1.3 The Application further detailed the proposed restoration of the Western Extension, being facilitated through the progressive importation of inert infill materials (the Recovery Operation) to return the restored Site to approximately pre-development ground elevations.

1.1.4 The Application was successfully determined in 2017 (Application No. 17/11406, the Planning Permission). Pre-application advice received from the Environment Agency (EA) in October 2018 (Ref: EPR/GB3701FM/A001) confirmed the Recovery Operation to constitute a Waste Recovery Operation.

1.1.5 The Recovery Operation thus requires application for an Environmental Permit (EP), Waste Recovery Activity, as issued by the EA, in support of which an Environmental Setting and Site Design (ESSD) is required to be submitted (The EP Application).

1.1.6 BCL Consultant Hydrogeologists Limited (BCL) have thus been appointed by Land and Mineral Management (LMM), agents of NMSB, to draft an ESSD with regards to the Recovery Operation.

1.1.7 BCL's wider work at the Site has included the drafting in 2017 of a Hydrogeological and Hydrological Impact Assessment (H&HIA, Ref: S/LM/H&HIA17/002) and associated Flood Risk Assessment (FRA, Ref: S/LM/DMFQ/FRA17/002) in support of the Application, and the drafting in 2021 of a Hydrogeological Risk Assessment (HRA, Ref: S/NMSB/DMF/HRA21/01) as part of the EP Application with which this report should be read (and within which additional detail is available).

1.2 Site Details

1.2.1 Site Location and Access

1.2.1.1 The Site is located between the towns of New Milton and Milford on Sea, being situated some 0.9km to the south west of the village of Everton, to the immediate east of the village of Downton, and some 0.9km to the north of Hordle Cliff Beach. The Site is approximately centred upon National Grid Reference (NGR) $^{4}72851\ ^{0}93183$ (*figure 1*).

1.2.1.2 Access to the Site is exclusively made via a road spur connecting to the A337, Christchurch Road, upon the northern Site boundary.

1.2.2 Application Boundaries and Security

1.2.2.1 The Western Extension external boundary encompasses the Western Extension (and thus Recovery Operation) along with existing, consented mineral extraction operations with subsequent inert infill within the wider Site (The Existing Site) as at *figure 1*.

1.2.2.2 The Recovery Operation is to be extended to encompass the western and southern sections of the Site as at *figure 1* (the area covered by the Planning Permission).

1.2.2.3 The Site boundary is completed with agricultural fencing, with a security fence and locking gate being provided to the Site entrance on the A337.

1.2.3 Topography and Land Use

1.2.3.1 The local area is semi-rural, with numerous towns and small villages situated in the locality, set within a broader landscape of pastoral and arable agriculture, forestry and heathland. This gives way to greater urbanisation to the south upon the coastline of the Solent.

1.2.3.2 Regional ground elevations generally fall away to the south towards the coastline, with the Site being located upon a plateau delineated by the valley of Danes Stream to the west and the valley of the Blackbush Stream to the east.

1.2.3.3 Local ground elevations across the Site range from approximately 26maOD in the north of the Site to 10.5maOD in the Sites south, falling away to the south, east and west.

1.2.4 Site Context (0.5km radius)

Residential and Recreational

1.2.4.1 There are a small number of residential and agricultural buildings to the north of the Site upon the A337. Further nearby residences are present within the village of Downton upon the western Site boundary. Further residential properties of low density are present to the south east of the Site.

1.2.4.2 The Site is bounded to the southwest by a holiday park (Downton Holiday Park), incorporating numerous static caravans and associated facilities.

Hydrological

1.2.4.3 There are 2 no. surface watercourses in proximity to the Site in the form of Danes Stream, which passes some 150m to the south, and its tributary, Blackbush Stream, which passes through the eastern Site boundary (though maintains a standoff from areas of the Site within which mineral extraction works and subsequent restoration have / are scheduled to occur).

1.2.4.4 There are a number of small, isolated, waterbodies in the surrounding area, principally to the south and east of the Site.

1.2.4.5 There are a series of lakes upon the eastern boundary of the Site (the Restoration Lakes). These form part of the Site water management system.

Sites of Ecological Importance

1.2.4.6 The locations of known sites of ecological importance (including those with and without statutory designations) are presented at *figure 2*.

1.2.4.7 There are no statutorily protected site within 0.5km of the Site.

1.2.4.8 Details of non-statutorily protected sites local to the Site have been provided courtesy of Hampshire Biodiversity Information Centre; outline details for which are given below at *table 1*.

Table 1 Non-Statutorily Protected Sites

Number (*figure 2*)	Name	Distance* from Western Extension (km)	Summary Description
3	Studland Meadow	0.4 S	Grassland
4	Hordle Copse	0.2 S	Woodland
5	Studland Common	0.3 S	Grassland
6	Blackbush Copse	0 SE	Woodland / wetland
8	Pleasure Grounds	0.15 S	Woodland / wetland
9	Shorefield Copse	0.4 SE	Woodland
10	Newlands Wood	0.5 NE	Woodland / wetland

*-at shortest distance from the Western Extension

1.2.4.9 There are no non-statutorily protected sites within or directly abutting the Western Extension.

1.2.4.10 There is one Site of Importance for Nature Conservation (SINC) within the boundaries of the existing Site in the form of Blackbush Copse SINC, which encompasses the Blackbush Stream and associated woodland / wetland habitats.

Historic Landfill

1.2.4.11 The locations of operational and historical landfills local to the Site, as provided by the EA, are illustrated at *figure 3,* outline details for which are provided at *table 2*.

Table 2 Summary Detail for Landfill in the Vicinity of the Site

Identification	Distance (km)*	Status	Class	Note
Downton Manor Farm	0	Historic	I, C&I	Gas Control
Upper Barnes Lane	0.35	Historic	I	Gas Control

*At shortest distance from the Western Extension boundary.

1.2.4.12 Downton Manor Farm Landfill (DMFL), locally known as 'The Squeek', is located immediately adjacent to Phase 6 of the Western Extension. This forms a 7,156m^2 historic landfill having received inert, industrial and commercial wastes of unknown composition at some point between 1963 and 1965. Historic gas control measures are indicated to have been implemented by EA records though are not presently in operation.

1.2.4.13 Condition 9 of the Planning Permission requires the undertaking of further investigations into the potential hazard posed by DMFL in the form of a 'Ground Contamination Assessment' prior to the working of Phase 6. Such assessment is yet to be undertaken though associated data gathering is presently in progress.

1.2.4.14 Upper Barns Lane landfill site is located within separate surface water catchments to the Site and is considered to be hydraulically isolated from it.

1.2.5 Site Classification

1.2.5.1 It is approved that the Western Extension is restored to viable agricultural afteruse by using the minimum required volume of imported inert waste material to achieve the desired landform, this being used in place of non-waste materials that would otherwise be needed to achieve the same outcome. The EA have thus approved recovery status for the operation by letter dated October 2018 (Ref: EPR/GB3701FM/A001).

1.2.5.2 The EA consider that 'The Environment Agency's Approach to Groundwater Protection', Version 1.2, February 2018 (EAAGP) is applicable not just to landfills but also to the Deposit for recovery schemes such as are already approved at the Site and which are the subject of this variation.

1.2.5.3 The EAAGP states that 'An inert landfill does not pose a potential hazard to groundwater (and hence it is not necessary to collect leachate and no drainage system is required), the EA will not object in principle to such a landfill on the basis of the location position statement E1, unless the Site falls within SPZ1'.

1.2.5.4 The extended recovery to facilitate restoration of the Western Extension will solely consist of the importation of inert waste materials. As discussed at *section 3.3.1*, the Site is not located within any Groundwater Source Protection Zone (SPZ), including any area of SPZ1 (Inner Zone). It is therefore considered that the restoration of the Western Extension is acceptable within the EA's position statement guidance.

2 SOURCE

2.1 Site Development

2.1.1 Historical Development

2.1.1.1 Historic landuse at the Site has principally been agricultural. As discussed at *section 1.2.4*, a small area adjacent to the Site (the Squeek) is understood to have been used for the deposition of unknown wastes between 1963 and 1965.

2.1.1.2 Mineral extraction operations at the Site have been undertaken since the granting of historic planning permission at Appeal in 2009 (Application Number APP/Q1770/A/06/2014823 as relating to the Existing Site). This allows the extraction of mineral and subsequent low-level restoration via inert waste recovery without use of an Engineered Barrier System (EBS). This is undertaken in line with the existing EP Ref: EPR/AP3523KT, within phases 1, 2, 9, 10 & 11, *figure 4*.

2.1.1.3 Mineral extraction operations are currently being undertaken within Phase 2 of the Existing Site. Restoration works have been completed within Phase 1, and are presently progressing behind mineral extraction works within Phase 2. The extension of the quarry has revised its overall phasing as shown at *figure 4*. The phases subject to this variation are those shown as Phases 3-8.

2.1.1.4 Although this application is for a variation of an existing Permit to encompass the extension of the Site, due to the age of the existing Permit, no ESSD was drafted, therefore this ESSD has been prepared relative to the extension details, but not seeking to retrospectively deal with the Existing Site as currently Permitted, except in that there are many shared characteristics.

2.1.2 Proposed Development

Proposed Waste Acceptance

2.1.2.1 Inert wastes are defined by the Landfill Directive (1999/31/EC), article 2(e) as: '*waste that does not undergo any significant physical, chemical or biological transformations. Inert waste will not dissolve, burn or otherwise physically or chemically react, biodegrade or adversely affect other matter with which it comes into contact in a way likely to give rise to environmental pollution or harm human health. The total leachability and pollutant content of the waste and the ecotoxicity of the leachate must be insignificant, and in particular not endanger the quality of surface water and / or groundwater*'.

2.1.2.2 Section 2.1.1 of the 2002 Council Decision, *'Establishing Criteria and Procedures for the Acceptance of Waste at Landfills Pursuant to Article 16 of and Annex II to Directive 1999/31/EC' (the Landfill Directive)*, lists a number of waste types that are considered inert without need for testing (subject to being single stream of a single waste type or combination of types).

2.1.2.3 Other waste types are also classified as inert provided that they meet the leaching limit values (determined by testing) outlined at section 2.1.2.1 of the Council Decision.

2.1.2.4 It is proposed that all wastes to be imported to the Site will meet with the above criteria, and any accepted wastes that are not listed at Section 2.1.1 of the Council decision will be tested to ensure compliance with section 2.1.2.1 of that decision.

The Recovery Operation is to accept such materials under the European Waste Codes (EWC) outlined below at *table 3*. This is the same as the extant Permit, with the addition of 19 02 06, which has been confirmed by the EA through pre-application advice as the code they consider covers silt generated in washing recycled aggregates.

Table 3 European Waste Codes to be Accepted by the Recovery Operation	
EWC	Description
01 01 02	Wastes from non-metalliferous excavation
01 04 08	Waste gravel and crushed rocks other than those containing dangerous substances
01 04 09	Waste sand and clays
17 01 01	Concrete
17 01 02	Bricks
17 01 03	Tiles and ceramics
17 01 07	Mixtures of concrete, bricks, tiles and ceramics
17 05 04	Soil and stones
19 02 06	Silt arising from washing of inert wastes to form recycled product
19 12 09	Minerals (for example sand and stones)
20 02 02	Soil and stones (excluding topsoil and peat)

2.1.2.5 Acceptance of materials to the Recovery Operation will be controlled through Waste Acceptance Procedure (WAP). The WAP will require all waste producers to provide waste characterisation information prior to its delivery, with loads being subjected to Waste Transfer Note (WTN) checks and visual inspections on arrival at the Site. This information will be assessed by technically competent Site staff to ensure that accepted wastes are inert, from uncontaminated sites and within the conditions of the EP. Unsuitable materials will be declined and full records of accepted / rejected loads will be kept.

Site Development and Phasing

2.1.2.6 The Recovery Operation has been designed on the basis of the extraction of sand and gravel to the underlying clays of the Headon Beds (HB). This is to occur in 6 no. phases working from north to south (Phases 3 to 8, *figure 4*), removing 2m to 7m of aquifer material.

2.1.2.7 On completion of mineral extraction within each phase, a clay EBS (formed from materials native to the Site) will be installed prior to the commencement of infilling, which will also proceed from north to south, progressively following on from mineral extraction.

2.1.2.8 On the completion of infilling within each phase, the subsequent phase will be joined to those previously worked, in order to ultimately form a single cell across the Western Extension.

Final Landform and Afteruse

2.1.2.9 Infilling will be made to recover original ground levels over the majority of the Western Extension enabling restoration back to agriculture. This will be facilitated via the placement of stripped and stored soils over the infill material upon the completion of each phase. The proposed restoration landform is as shown at *figure 5*.

3 PATHWAY AND RECEPTOR

3.1 Geology

3.1.1 Regional Geology

3.1.1.1 The geology of the Site and its surroundings comprises superficial drift deposits overlying solid strata of Palaeogene and Cretaceous age, as illustrated at *figure 6*.

3.1.1.2 The Site is located within the Hampshire basin, which comprises regionally pervasive Palaeogene sands and clays surrounded by a rim of chalk hills. The Site is situated within the centre of this basin, and is thus underlain by the laterally bedded sands and clays of the Osborne and Headon Beds and successively older strata, overlying Cretaceous Chalks at depth.

3.1.1.3 The solid geological strata are locally obscured by the presence of drift deposits, principally in the form of Alluvium and Plateau Gravels, where the latter have not been eroded by local surface watercourses.

3.1.1.4 The stratigraphy of the region presented below at *table 4*.

Table 4 Stratigraphic Sequence

Age	Group	Formation	Lithology
Pleistocene & Recent	Alluvium		Clay, silt, sand.
	Plateau Gravels		Sands and Gravels.
Paleogene	Headon Hill Formation	Osbourne and Headon Beds	Clays with silts, sands and gravels, ~76m thickness.
	Barton Group	Barton Sands	Sands / clays, 27-46m thick.
		Barton Clay	Clays / sands, 46-47m thickness
	Bracklesham Group		Sands / clays, 91-174m thickness
	London Clay Formation		Clay, 91-122m thickness
Cretaceous	Chalk Group		Chalk

3.1.2 Local Geology

3.1.2.1 The area encompassing the Site is underlain by the clays with silts, sands and gravels of the Headon Beds (HB). This unit has an estimated thickness of some 49m at the Site location. Investigative drilling within the Site indicates the HB to principally comprise brown / grey silty clays.

3.1.2.2 The HB are overlain by the sands and gravels of the Plateau Gravels (PG) which form the economic mineral of the Site. Site drilling records indicate this unit to vary in thickness from 1m to 7m, with an average thickness of 3.6m, being overlain by a thin layer of topsoil with occasional clay or clay rich subsoil overburden (0.2m - 2.7m in thickness).

3.1.2.3 Site drilling logs indicate the PG to principally comprise coarse sand and gravel, being more silty and clayey towards the top and base of the deposit.

3.1.2.4 Drilling logs prove the presence of the PG further to the east than is implied by published geological mapping, though at limited thickness (<2m).

3.2 Hydrology

3.2.1 Hydrological Setting

Surface Watercourses

3.2.1.1 The Site falls entirely within the catchment of Danes Stream, this being directly for the majority of the Western Extension. The Existing Site and Phase 8 of the Western Extension fall within the sub-catchment of the Blackbush Stream (a minor tributary of Danes Stream).

3.2.1.2 Danes Stream rises to the north of the town of New Milton, some 6km to the northwest of the Site, before flowing southwards and eastwards, passing to the south of the Site at a distance of some 150m, before discharging to the Solent via the salt marshes of Keyhaven.

3.2.1.3 Flow data for Danes Stream has been obtained from the EA, and shows a mean flow of some 168l/s at Milford Flood Barrier, adjacent to the Site, and of 196l/s at New Valley Road, downstream of the Site (thus gaining flow along this reach of watercourse).

3.2.1.4 Blackbush Stream rises some 200m to the north of the Site at Leagreen Farm, before flowing southwards upon the eastern boundary of the Site and discharging to Danes Stream 230m to the south. Although this watercourse passes through the Site boundary, it does not pass within areas included within the phased development plan, with mineral extraction maintaining an approximately 50m standoff from the watercourse at all times.

Springs / Seepages

3.2.1.5 Previous hydrological investigations undertaken at the Site have identified a series of 6 no. fresh water flushes upon the western bank of the Blackbush Stream. These flushes have been shown to be supported by the seepage of groundwater perched upon the HB, emerging as the PG thin out to the east, with said waters ultimately draining to the Blackbush Stream. The flushes are now further supported by seepage from the Restoration Lakes upon the Site's eastern boundary in line with the approved restoration of the Existing Site.

3.2.1.6 There is an area of wet woodland / wetland within Downton Holiday Park adjacent to Danes Stream. This area is indicated by published geological mapping to be coincident with the outcrop of the HB and thus the limit of the distribution of the PG, and is therefore considered in part to be supported by groundwater seepage from the PG.

Surface Waterbodies

3.2.1.7 There are no surface waterbodies within or directly abutting the Site that do not form elements of the Site water management system or approved restoration, with only the Restoration Lakes seen to be present. There are no surface waterbodies within or adjacent to the Western Extension. There are no surface waterbodies within or directly abutting the Site boundary.

3.2.1.8 There are a number of small surface waterbodies in the local area, these typically forming small ponds. The majority of these waterbodies are either located outwith the surface water catchment encompassing the Site, and / or are located outwith the distribution of the PG.

3.2.1.9 There is one surface waterbody located upon the PG in the same surface water catchment as the Site, this being a small pond some 400m to the north at Leagreen Farm. This pond is situated up hydraulic gradient from the Site.

3.2.2 Flooding

3.2.2.1 Published EA modelled fluvial flood extent mapping is illustrated at *figure 7*.

3.2.2.2 The Site is located within FRZ1, the lowest risk classification of FRZ, defined as areas with an Annual Exceedance Probability (AEP) of less than 0.01 (risk of fluvial flooding of less than 1 in 1,000 in each year). FRZ1 is applied to all areas not classed as being within FRZ2 or FRZ3.

3.2.2.3 Areas classed as within FRZ2 are defined as having an AEP of between 0.01 and 0.1 (risk of fluvial flooding of between 1 in 1,000 and 1 in 100 in each year). The closest areas of FRZ2 to the Site are upon the course of Danes Stream, some 130m to the south of the Site.

3.2.2.4 As indicated by EA pluvial flooding mapping data, with the exception of areas in direct proximity to the Blackbush Stream, the Site lies within an area classed as being at 'Very Low' risk of flooding from surface waters. Areas classed as being at 'Low' to 'High' risk of surface water flooding are present upon the course of the Blackbush Stream and Danes Stream.

3.2.3 Surface Water Quality

3.2.3.1 Surface water quality data for the Blackbush Stream / Danes Stream has been obtained by NMSB via the collection and analysis of surface water samples taken from locations SWS2 and SWS4 respectively (*figure 8*), being located downstream of the Site on both watercourses.

3.2.3.2 The available data covers the period November 2018 to December 2020 at a maximum fortnightly resolution.

3.2.3.3 *Table 5* below shows minimum, maximum and average concentrations for a selected number of representative chemical species established from the data for the Blackbush Stream / Danes Stream, together with the most relevant Regulatory Water Quality Standard (RWQS).

Table 5 Summary Surface Water Quality Data					
Determinand	Units	RWQS	Minimum	Maximum	Average*
Ammoniacal Nitrogen	mg/l	0.5	<0.02	0.51	0.077
Antimony	mg/l	0.005	<0.003	0.007	0.003
Arsenic	mg/l	0.01	<0.003	<0.007	0.006
Barium	mg/l	0.1	0.03	0.0677	0.044
Cadmium	mg/l	0.005	<0.0008	<0.0008	<0.0008
Chloride	mg/l	250	40	214	55.76
Chromium	mg/l	0.05	<0.001	<0.001	<0.001
Copper	mg/l	2	<0.008	<0.008	<0.008
Dissolved Organic Carbon (DOC)	mg/l	NA	3.12	15.2	7.685
Fluoride	mg/l	1.5	<0.01	0.35	0.063
Lead	mg/l	0.025	<0.004	<0.004	<0.004
Mercury	mg/l	0.001	<0.0001	<0.0001	<0.0001
Molybdenum	mg/l	0.07	<0.0001	0.0026	0.001
Nickel	mg/l	0.02	<0.0008	0.0061	0.002
PCBs	mg/l	N/A	<1	<3	1.07
pH	pH Units	N/A	6.29	9.97	7.26
Selenium	mg/l	0.01	<0.006	0.02	0.007
Sulphate	mg/l	250	15.3	73.6	36.72
Total Dissolved Solids (TDS)	mg/l	N/A	200	555	304.55
PAHs	mg/l	0.0001	<0.2	<0.2	<0.2
Phenols	mg/l	0.0005	<0.01	<0.05	0.02
Total Petroleum Hydrocarbons (TPH)	mg/l	0.3	<0.05	<26	24.46
Zinc	mg/l	5	<0.002	0.029	0.004
*Where recorded at the Limit of Detection (LOD), this value has been applied.					

3.2.4 Ecological Importance & Quality of Surface Water Features

3.2.4.1 The catchment of Danes Stream (including its tributaries) falls within the Lymington and Beaulieu Operational Catchment of the New Forest Management Catchment.

3.2.4.2 Danes Stream has an overall water body classification of 'moderate' with a status objective of good by 2027, with an ecological classification of 'moderate' and a chemical classification of 'good'.

3.2.4.3 The Blackbush Stream and associated fresh water flushes fall within the Blackbush Copse SINC.

3.2.4.4 As discussed, the local surface water features do not fall under any statutory ecological designations. It should be noted however that such designations are present downstream of the Site within Danes Stream catchment, in the form of Hurst Castle & Lymington River Estuary SSSI, Solent and Southampton Water RAMSAR / SPA and Solent Maritime SAC, as at *figure 2*.

3.3 Hydrogeology

3.3.1 Aquifer Characteristics

Aquifer Classification

3.3.1.1 The sands and gravels of the PG are defined by the EA as a 'Secondary A Aquifer', defined as permeable layers capable of supporting abstraction at the local scale and in some cases forming an important element of river baseflow.

3.3.1.2 The PG form an unconfined granular aquifer (the Aquifer) which is indicated to be largely homogenous, with a degree of vertical anisotropy being present as a result of increased clay / silt content upon the upper and lower boundaries of the Aquifer. Groundwater flow is anticipated to be diffuse and intergranular.

3.3.1.3 The underlying HB are also classified by the EA as a 'Secondary A Aquifer'.

3.3.1.4 This unit is however summarised within the EA / BGS Minor Aquifer Properties Handbook[1] to 'dominantly act as an aquiclude' though also states that 'where sandy strata are developed, yields sufficient for domestic or small agricultural requirements have been obtained from shallow wells'.

3.3.1.5 Where identified during mineral exploration drilling, the HB were described as firm to stiff, mottled very silty clay.

3.3.1.6 Installation data for an abstraction well at Pinetops Nursery (NGR: $^{4}32150$ $^{0}97150$), which is located upon the same geological succession as the Site, has been obtained from the British Geological Survey (BGS) Well Records Database. The borehole installation data shows the HB to be acting as an aquiclude, recording groundwater both perched above it (within the PG) and confined below it (within the Barton Sands).

3.3.1.7 It is therefore considered that, at the Site location, the HB function as a low permeability aquiclude, forming a barrier to groundwater flow / infiltration. Localised heteregoneity within the HB can however lead to sufficient lateral permeability to allow the transmission of limited volumes of groundwater where sandy horizons are present.

Aquifer Distribution and Boundaries

3.3.1.8 The Aquifer is effectively unconfined with its upper boundary thus being formed by ground surface.

3.3.1.9 The Aquifer is underlain by the regionally extensive HB aquiclude which forms its base and is assumed to hydraulically isolate the Aquifer from underlying strata.

3.3.1.10 To the east, south and west, the lateral boundaries of The Aquifer are formed by the extent of outcrop defined by the valleys associated with the Blackbush and Danes Streams. To the north, the Aquifer is considered to be of effectively unlimited areal extent at the scale of interest.

[1] Environment Agency / British Geological Survey, 'The Physical Properties of Minor Aquifers in England and Wales', Hydrogeology Group Technical Report No. WD/00/04, EA R&D Publication 68, 2000.

Aquifer Properties

3.3.1.11 As discussed in the HRA, representative permeability for the PG is assumed to fall within the upper end of that indicated by historic field test data, ranging from 2m/d to 6m/d.

3.3.1.12 Representative permeability for the HB is assumed to range from 0.04m/d to 0.65m/d, though lower permeability may prevail within the HB at the local scale and where compaction has occurred (recorded as low as $9.5E^{-6}$m/d in laboratory tests).

Abstraction

3.3.1.13 Data regarding the locations of licensed abstractions within the local area have been obtained from the EA. The identified abstractions are located as presented at *figure 9* with summary detail at *table 6* below.

Table 6 Licenced Abstractions

Licence No.	Licence Holder	Distance from Site (km)	Source	Use
35/066	Barton-On-Sea Golf Club	1km W	GW: New Forest chalk / greensands	Spray irrigation
11/42/4/6	Philipson Estates Everton	1.4km NE	GW: Plateau Gravels	Spray irrigation
11/42/3.2/2	New Milton Sand & Ballast Co.	2km NW	SW	Mineral Washing
11/42/11/10CA	Philipson Estates Everton	2.1km NE	SW	Spray irrigation

GW: Groundwater, SW: Surface Water

3.3.1.14 Abstraction 35/066 is indicated to be located outwith the distribution of the PG, drawing upon chalk / greensand as its source of supply. This abstraction is thus considered to be hydraulically isolated from the Site.

3.3.1.15 Abstraction 11/42/4/6 is indicated to have the PG as its source of supply, though the outcrop upon which it is located is up hydraulic gradient from the Site, and spatially separated from it by intervening areas of HB outcrop. This abstraction is thus also considered to be hydraulically isolated form the Site.

3.3.1.16 Abstractions 11/42/3.2/2 and 11/42/11/10CA are both surface water abstractions made from surface waterbodies located upon HB outcrop. Though some flow to these features may be sourced from locally adjacent PG outcrop areas, these areas are also separated from the Site by intervening HB outcrop, precluding any hydraulic continuity between the Site and these abstractions.

3.3.1.17 Details of de-regulated abstraction (private water supplies of $<20m^3/d$) have been provided courtesy of New Forest District Council (NFDC). The available data shows there to be no known de-regulated abstractions within the local area.

3.3.1.18 Details of groundwater Source Protection Zones (SPZs) in the vicinity of the Site have been provided by the EA. There are no SPZs present within the local area.

3.3.2 Groundwater Flow

Groundwater Occurrence, Levels and Flow Direction

3.3.2.1 Groundwater levels across the Site are manually recorded on a fortnightly basis by Site operatives within a series of 11 groundwater monitoring piezometers (located as shown at *figure 8)*. The available data extends from 2004 to 2020.

3.3.2.2 Groundwater levels demonstrate high winter groundwater elevations followed by a summer recession, with a subdued response to individual rainfall events. Maximum groundwater elevations within the Aquifer are seen to range from 16.39maOD to 25.01maOD with a maximum observed inter-annual range of some 2.09m. Groundwater elevations within the central section of the Site have been observed to fall to the base of deposit during dry periods.

3.3.2.3 Groundwater flow occurs to the south from the bulk of the local Aquifer, before flowing radially towards the Aquifer boundaries and local surface watercourses (to the east, south and west). Average groundwater elevations are presented at *figure 10*.

3.3.2.4 Aquifer unsaturated thickness is seen to vary from 0.1m to 4.7m, being generally lowest within the south / west section of the Site and largest to the north and towards the Site boundaries.

3.3.2.5 Aquifer maximum saturated thickness is seen to vary from 1m to 6.2m, being generally largest to the east and within the central section of the Site, and reducing to the south. Under minimum groundwater elevations, saturated thickness is seen to reduce to zero within the south and central section of the Site.

3.3.2.6 Though the underlying HB are known to be water bearing, groundwater within it is expected to be largely isolated from units above and below, within interbedded sandy horizons (within which lateral permeability is anticipated to be elevated relative to vertical permeability). Local to the Site the unit is considered to function as an aquiclude of relatively low permeability.

3.3.2.7 Local surface watercourses are seen to have eroded the PG exposing the underlying HB. These watercourses are assumed to be in hydraulic continuity with the water bearing horizons within the HB.

3.3.2.8 Where the Aquifer thins and gives way to the HB outcrop, springs and flushes are known to occur (notably upon the eastern margins of the Site) as groundwater perched upon the HB emerges at the ground surface. The Aquifer therefore contributes a component of baseflow to local surface watercourses via these features.

Groundwater Elevations Relative to the Recovery Operation

3.3.2.9 The Western Extension is to be worked to the full depth of deposit and will therefore require sub-watertable working facilitated by dewatering operations. The Recovery Operation will thus extend below groundwater elevations within the Aquifer (to its full saturated thickness).

3.3.3 Groundwater Quality

3.3.3.1 Groundwater quality data for piezometers 1 and 11, *figure 8*, has been obtained by NMSB. The available data covers the period November 2018 to December 2020 at a maximum fortnightly resolution.

3.3.3.2 Full presentation of the collected data is contained within the HRA. Summary details are presented below at *table 7*.

Table 7 Summary Groundwater Quality Data

Determinand	Units	RWQS	Minimum	Maximum	Average*
Ammoniacal Nitrogen	mg/l	0.5	<0.02	1.11	0.13
Antimony	mg/l	0.005	<0.003	0.018	0.0035
Arsenic	mg/l	0.01	<0.003	0.007	0.0060
Barium	mg/l	0.1	0.0105	0.0931	0.04
Cadmium	mg/l	0.005	<0.0008	<0.0008	<0.0008
Chloride	mg/l	250	15.1	327	119.11
Chromium	mg/l	0.05	<0.001	0.004	0.0011
Copper	mg/l	2	<0.008	<0.008	<0.008
Dissolved Organic Carbon (DOC)	mg/l	NA	<2	12.9	4.55
Fluoride	mg/l	1.5	<0.01	0.26	0.05
Lead	mg/l	0.025	<0.004	0.005	0.0041
Mercury	mg/l	0.001	<0.0001	<0.0001	<0.0001
Molybdenum	mg/l	0.07	<0.001	0.0027	0.0011
Nickel	mg/l	0.02	<0.0008	0.0074	0.0022
PCBs	mg/l	N/A	<1	<2	1.02
pH	pH Units	N/A	6.22	8.57	7.13
Selenium	mg/l	0.01	<0.006	0.023	0.0067
Sulphate	mg/l	250	10.8	135	28.61
Total Dissolved Solids (TDS)	mg/l	N/A	63	955	383.24
PAHs	mg/l	0.0001	<0.2	<0.2	<0.2
Phenols	mg/l	0.0005	<0.01	<0.05	0.01
Total Petroleum Hydrocarbons (TPH)	mg/l	0.3	<25	<25	<25
Zinc	mg/l	5	<0.002	0.031	0.0060

*Where recorded at the Limit of Detection (LOD), this value has been applied.

3.4 Man Made Sub-Surface Pathways

3.4.1 There are no known man-made sub-surface pathways within or in proximity to the Site.

3.5 Receptors and Compliance Points

3.5.1 Groundwater

3.5.1.1 Groundwaters within the Aquifer are considered to form the primary receptor for any contaminant release from the Recovery Operation, with the Point of Compliance (POC) selected being piezometer 11 (*figure 8*), which is located immediately upon the down gradient boundary of the Site.

3.5.2 Surface Water

3.5.2.1 As discussed, flows within both Danes Stream and Blackbush stream are known to be in part supported by groundwater baseflow derived from the Aquifer. Any linkage between the Recovery Operation and these watercourses will be via groundwater flow within the Aquifer, and thus the primary receptor and POC detailed above.

3.5.3 Amenity (Nuisance and Health)

Receptors

3.5.3.1 There are a number of potentially sensitive receptors in proximity to Downton Manor Farm Quarry, including Controlled Waters, a variety of woodland habitats, residential properties, and the adjacent Shorefield Country Park. However, an Environmental Statement submitted as part of planning application (Ref: 17-11406), and the submitted Environmental Risk Assessment, demonstrate that, with the appropriate controls and mitigation measures in place, the risk to these receptors from the recovery operation is low.

Safeguarded Aerodromes

3.5.3.2 There are no Safeguarded Aerodromes in proximity to Downton Manor Farm Quarry that might be affected by the activities on site.

Habitats

3.5.3.3 An Ecological Assessment completed as part of the planning application for the Western Extension (Ref: 17/11392) demonstrated that adverse ecological impacts have been removed or significantly reduced by the correct positioning of the proposed quarry extension, which is located in an area of intensively managed arable land, and protects key habitats found within the study area including the boundary hedgerow and field margins. Implementation of a protection and mitigation scheme for badger setts is required by planning condition.

4 POLLUTION CONTROL MEASURES

4.1 Site Engineering

4.1.1 Basal and Side Slope Engineering

4.1.1 The Recovery Operation, as varied for the Western Extension Only, is to be constructed upon the basis of engineered containment, and thus requires an EBS with an attenuating effect equivalent to $1x10^{-7}$ m/s at 1m thickness, with liner thickness being determined by the permeability of the available lining materials (The Design Standard), upon the base and sidewalls of the Recovery Operation.

4.1.2 It is proposed that the sidewall lining of the Recovery Operation be formed using the basal clays native to the Site (HB).

4.1.3 Given the range in permeability observed for the HB, it is considered that through careful selection of liner material from the base of works, and through its compaction, the attainment of a sidewall liner of significantly lower permeability than the Design Standard can be achieved. A liner thickness of 1m is therefore not considered to be required.

4.1.4 Due to the practical limitations of liner creation, it is however considered that a liner of a thickness of at least 0.5m is required regardless of the permeability of the lining material to ensure its function.

4.1.5 The lining material required to meet the Design Standard at 0.5m thickness has been estimated within the HRA to require a permeability of $2.6*10^{-8}$m/s. This permeability is within the range of permeability indicated for the HB, and is thus considered to be achievable using clays native to the Site.

4.1.6 It is proposed that the basal lining of the Recovery Operation be formed by the in-situ clays native to the Site as present within the base of works, which will be compacted prior to the deposition of infill materials.

4.1.7 Given the intended compaction of the upper surface of the HB, its estimated in-situ thickness (49m), and its low vertical permeability, it is considered that the basal liner will achieve an attenuating capacity in excess of that for the sidewall liner (due to its greater thickness).

4.1.2 Capping

4.1.2.1 It is understood that the Site is to be completed without use of engineered capping. The waste mass is to be topped with soils native to the Site only.

4.1.2.2 The Site is to receive solely inert waste materials which are expected to be of low permeability and will not require landfill gas or leachate management.

4.2 Restoration

4.2.1 Pollution control measures further to those described above are not considered to be required as part of the restoration of the Site.

4.2.2 The land surrounding the quarry is generally flat and therefore, following the techniques outlined in the submitted Environmental Management System, it is considered that the

soils will be contained by the adjacent land, with no side slopes that could give rise to a potential for significant subsidence.

4.2.3 Additionally the nature of quarry restoration using inert materials does not usually give rise to differential settlement to such a degree that any more than routine works are required to address. Topographical surveys on closure of the site or surrender of the Permit will confirm this.

4.3 Surface Water Management

4.3.1 Current Surface Water Management

4.3.1.1 The active working areas of the Site form closed depressions in which all runoff waters are captured and contained. Intermittent dewatering of accumulating surface waters and groundwaters within the works is undertaken via diesel suction pump, with discharge being made to the northernmost Restoration Lake (permitted through transitional abstraction licensing arrangements).

4.3.1.2 The Restoration Lakes form a series of perched lakes created using imported inert material of low permeability (during restoration of Phase 1 of the Existing Site).

4.3.1.3 Undisturbed in-Situ material has been left in place upon the eastern margins of the Restoration Lakes to allow the diffuse dissipation of waters within the lakes to groundwater. This has been undertaken to maintain flows to a series of groundwater flushes present upon the western banks of the adjacent Blackbush Stream.

4.3.1.4 The water levels within the Restoration Lakes are controlled by a series of overflow pipelines with levels reducing from north to south, promoting drainage to the southernmost lake.

4.3.1.5 The Restoration Lakes receive runoff from across the un-worked and restored areas of the Site in addition to the dewatering discharge.

4.3.1.6 Discharge from the lakes is made intermittently under gravity via a buried pipeline connecting the southernmost lake to the Blackbush Stream. The Site hold an Environmental Permit (EP) for this activity (Also EPR/AP3523KT), consenting the '*discharge of trade effluent comprising quarry waters*' derived from '*dewatering on Site*'.

4.3.1.7 The Restoration Lakes have been designed to ensure that post restoration discharge from the Site will not exceed greenfield rates / volumes for up to and including a 1 in 100 year storm event.

4.3.2 Proposed Surface Water Management

4.3.2.1 The proposed management of surface waters for the Site as a whole was designed, assessed and approved as part of the Planning Application, and is summarised below.

4.3.2.2 The existing approach to water management is to be continued throughout the working / restoration of the Existing Site and Western Extension.

4.3.2.3 As each phase of the Recovery Operation is fully worked, and the EBS is formed, a clay bund will be formed upon its southern limit to ensure no runoff from the completed phases is allowed to drain to unlined phases during mineral extraction. These bunds will

be removed on completion of lining of the subsequent phase to form a single cell on completion of Site development.

4.3.2.4 Runoff from across restored areas of the Recovery Operation will be collected by a perimeter ditch upon the western Site boundary, before being channelled to a settlement and attenuation lagoon in the Phase 7 / 8 area of the Site. This lagoon will discharge to the Restoration Lakes, for ultimate discharge to the Blackbush Stream, as detailed above (in line with the existing EP held in this regard).

4.3.2.5 The proposed surface water management for the Recovery Operation upon its completion is presented at ***figure 11***.

4.4 Post-Closure Controls

4.4.1 Monitoring and Maintenance

4.4.1.1 The Recovery Operation is to be completed without need for any long term active management systems including leachate or gas control measures. Associated monitoring and maintenance is thus not required.

4.4.1.2 The HRA specifies requirement for control and compliance monitoring to be undertaken, in conjunction with wider surveillance monitoring, with regards to groundwater / surface water levels / quality. HRA requirements in this regard are presented at *table 8*, with control levels / compliance limits being specified at *table 9*.

Table 8 Recommended Monitoring

Location (*figure 8*)	Purpose	Monitoring Requirements	Frequency
Piezometer 11*	Control and compliance monitoring. Surveillance monitoring, down hydraulic gradient groundwater.	<u>Field Determinands:</u> Water Elevation, pH, temperature, Electrical Conductivity, Redox potential, Dissolved Oxygen. <u>Laboratory Determinands:</u> Ammoniacal Nitrogen, Arsenic, Cadmium, Chloride, Mercury, Nickel, Sulphate, Zinc.	Quarterly
		<u>Additional Laboratory Determinands:</u> Antimony, Barium, Chromium, Copper, Dissolved Organic Carbon, Fluoride, Lead, Molybdenum, PCBs, Selenium, Total Organic Carbon, Total Dissolved Solids, PAHs, Phenols, Total Petroleum Hydrocarbons.	Annually
Piezometer 1	Surveillance monitoring, up hydraulic gradient groundwater	As for Piezometer 11.	Quarterly
		As for Piezometer 11.	Annually
SWS1	Surveillance monitoring, surface watercourses.	As for Piezometer 11.	Quarterly
SWS2		As for Piezometer 11.	Annually
*Control and Compliance monitoring point subject to associated limits described at *table 9*			

Table 9 Control Levels and Compliance Limits		
Chemical	Control Level*	Compliance Limit*
Nickel	0.005	0.007
Sulphate	59	83
Zinc	0.03	0.061
All units in mg/l *Applicable to Piezometer 11 only (the Point of Compliance).		

4.4.1.3 Monitoring and maintenance of the surface water management system is to be undertaken in line with the requirements outlined as part of the Application within BCL's 2018 'Technical Note, Drainage System Maintenance Schedule', S/LM/DMFQ/DMS/001, within which regular maintenance, occasional tasks and remedial works are specified in this regard.

4.4.2 Post Closure Management

4.4.2.1 The site will be restored in accordance with the prevailing planning permission, including restoration and aftercare for the statutory period. The Environmental Permit will be surrendered on completion of the recovery operations in accordance with the legislation currently in place.

4.4.3 Likelihood of Subsidence /Differential Settlement

4.4.3.1 Waste types to be imported at the Site will be inert and therefore the Site will not be subject to significant settlement. Waste materials will be placed in the restoration following good practice techniques. A stability risk assessment has not been provided for this Site due to the scale and nature of the proposed restoration.

4.4.4 Conditions Where Permit Surrender is Acceptable

4.4.4.1 Permit surrender for Recovery Permits is set out in RGN9 and this is the guidance that will be used when submitting an application for surrender. The application will follow the legal test for surrender which is – 'that the necessary measures have been taken – (a) to avoid a pollution risk resulting from the operation of the regulated facility; and (b) to return the site of the regulated facility to a satisfactory state, having regard to the state of the site before the facility was put into operation'.

4.4.4.2 Groundwater and surface water data will be collected throughout the life of the Recovery Operation. Monitoring requirements will be reviewed annually, as set out in the submitted Hydrometric Monitoring Scheme. NMSB will ensure that sufficient data is collected to demonstrate that there are no unacceptable releases from the site that have the potential to cause damage to, or deterioration of, the environment and risk to human health.

5 MONITORING

5.1 Weather

5.1.1 Data Sources and Availability

5.1.1.1 There is presently no meteorological data collection in operation at the Site. Third party data is available for the EA's Stem Lane rain gauge. This represents the closest active gauge to the Site, being located at NGR: $^{4}23359$ $^{0}95741$.

5.1.1.2 A privately operated amateur weather station for which data including wind speed and direction is available online[2] is present within Downton Holiday Park, to the immediate south west of the Site.

5.1.2 Precipitation

5.1.2.1 Rainfall data for the locality, as provided from Stem Lane rain gauge, is summarised below at *table 10*.

Table 10 Rain Gauge Data

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
2011							38.2	94.4	47.2	44	40	83.8	
2012	37	22.2	20.2	137	33	137	118	48.8	88.2	120	110	160	1031
2013	104	33.4	72.8	41	51.2	25.8	19.6	28.2	45.4	123	57.6	161	764
2014	186	125	41.2	94.2	98.2	25.4	34.4	108	21.4	117	170	39.8	1061
2015	108	57.4	25.2	23.6	56.1	28.2	47.2	136	72.6	59.6	89.7	100	804
2016	182	65.8	84.5	58.4	74.6	88.8							
Mean	124	60.8	48.8	70.8	62.6	61	51.4	83.1	55	92.8	93.3	109	915

5.1.2.2 The Standard Annual Average Rainfall (SAAR) for the Site, as recorded by the Centre for Ecology and Hydrology's (CEH) Flood Estimation Handbook (FEH) Web Service, is 760mm.

5.1.2.3 Long-term average monthly rainfall data[3] for the Site area is given below at *table 11*.

Table 11 Area Long Term Average Monthly Rainfall and Potential Transpiration

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Tot
Area Average Rainfall	79	60	50	50	56	50	60	72	70	78	95	87	807
Potential Evaporation	4	11	32	57	82	98	97	79	47	24	9	3	543

5.1.2.4 The available rainfall data has been utilised to derive estimates for monthly effective rainfall for vegetated surfaces, bare ground and open water, using the methods of Grindley[4] and EA R&D Handbook W6-043/HBRef.13[5] as presented below at *table 12*.

2 https://www.wunderground.com/dashboard/pws/IENGLAND969/table/2019-03-26/2019-03-26/monthly

3 "Climate & Drainage", Technical Bulletin No. 34, Ministry of Agriculture Fisheries & Food (MAFF), September 1976.

4 "The Calculation of Actual Evaporation and Soil Moisture Deficit over Specified Catchment Areas", Grindley J, November 1969, Hydrological Memorandum 38, Meteorological Office, Bracknell, UK.

5 "Estimation of Open Water Evaporation, Guidance for Environment Agency Practitioners", R&D Handbook W6-043/HB, Finch JW and Hall RL, October 2001.

Table 12 Derivation of Effective Rainfall for Differing Surfaces													
Bare Earth (rc = 0mm)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Rf	79	60	50	50	56	50	60	72	70	78	95	87	807
Pe	4	11	32	57	82	98	97	79	47	24	9	3	543
rf-Pe	75	49	18	-7	-26	-48	-37	-7	23	54	86	84	264
dPsmd	0	0	0	7	26	48	37	7	-23	-54	-48	0	
dAsmd	0	0	0	7	21	12	3	2	-23	-22	0	0	
Asmd	0	0	0	7	33	81	118	125	102	48	0	0	514
Psmd	0	0	0	7	28	40	43	45	22	0	0	0	185
Ae	4	11	32	57	77	62	63	74	47	24	9	3	463
ERF	75	49	18	0	0	0	0	0	0	32	86	84	344
Permanent Grassland (rc = 75mm)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Rf	79	60	50	50	56	50	60	72	70	78	95	87	807
Pe	4	11	32	57	82	98	97	79	47	24	9	3	543
rf-Pe	75	49	18	-7	-26	-48	-37	-7	23	54	86	84	264
dPsmd	0	0	0	7	26	48	37	7	-23	-54	-48	0	
dAsmd	0	0	0	7	26	48	27	2	-23	-54	-33	0	
Asmd	0	0	0	7	33	81	118	125	102	48	0	0	514
Psmd	0	0	0	7	33	81	108	110	87	33	0	0	459
Ae	4	11	32	57	82	98	87	74	47	24	9	3	528
ERF	75	49	18	0	0	0	0	0	0	0	53	84	279
Open Water													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Correction Constants	1.4	1.1	0.9	1.0	0.9	1.0	1.2	1.4	1.5	2.0	2.3	2.0	
Ae	5.7	12.5	29.4	54.2	74.6	100.0	120.3	108.2	69.1	47.8	20.6	5.9	648.3
ERF	73.3	47.5	20.6	-4.2	-18.6	-50.0	-60.3	-36.2	0.9	30.2	74.4	81.2	158.8

rc: Root Constant, Rf: Rainfall, Pe: Potential Evaporation, Psmd: Potential Soil Moisture Deficit. Asmd: Actual Soil Moisture Deficit, Ae: Actual Evaporation, ERF: Effective Rainfall. All units other than correction constants are millimetres.
Note: Estimates of effective rainfall for bare earth and grassland cover are identical due to the preponderance of rainfall over evapotranspiratton in the area which militates against the development of significant SMD during average climatic years.

5.2 Gas Monitoring & Infrastructure

5.2.1.1 In-waste gas wells will not be installed and a programme of monitoring is not deemed necessary since the Waste Acceptance Procedures in place will prevent the acceptance of non-inert waste at the site. Inert waste has a negligible risk if creating landfill gas. Should any biodegradable material be contained in the loads when they have been tipped on site, the on-site checks will pick that up and it can be removed. The waste acceptance procedures and site procedures are adopted to ensure that the waste used for restoration is inert.

6 SITE CONDITION REPORT

6.1 Overview

6.1.1 The full area of the Recovery Operation is to receive the permanent deposit of inert materials. A Site Condition Report (SCR) is thus not required to be undertaken.

7 SUMMARY AND CONCLUSIONS

7.1 An Environmental Setting and Site Design (ESSD) has been undertaken with respect of the proposed deposition of inert materials at Downton Manor Farm Quarry, Downton, Hampshire, under waste recovery permit, to restore mineral workings to agricultural afteruse.

7.2 Available data regarding the history and current environmental setting has been presented to provide an understanding of the Recovery Operation in the context of its hydrological and hydrogeological setting.

7.3 The report concludes that, subject to the adoption of mitigation measures and controls proposed to be undertaken at the Site, the Recovery Operation is appropriate in the context of the surrounding environment.

Peter Simpson, BSc, MSc,FGS
Senior Hydrogeologist

BCL Consultant Hydrogeologists Limited
16th April 2021

S/NMSB/DMF/ESSD21/03

New Milton Sand and Ballast

Downton Manor Farm Quarry

Downton, Hampshire

Application for Variation of Waste Recovery Permit to Encompass Extension of Site Restoration Using Imported Inert Infill

Environmental Setting & Site Design

Version 3
16th April 2021

Figures

BCL HYDRO
BCL Consultant Hydrogeologists Limited

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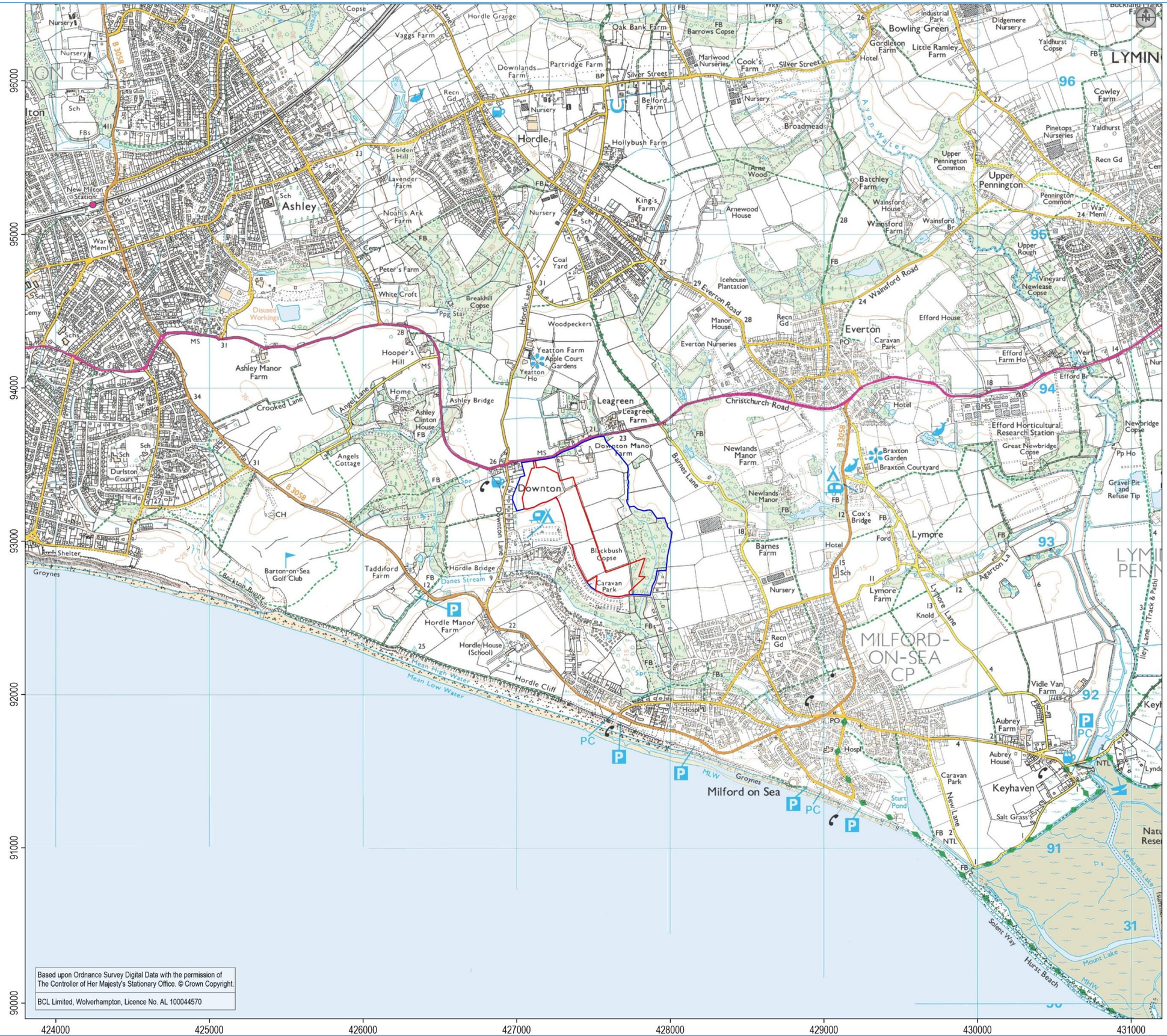
Registered in England & Wales. Company Registration Number: 4043373


Site Boundary
Western Extension
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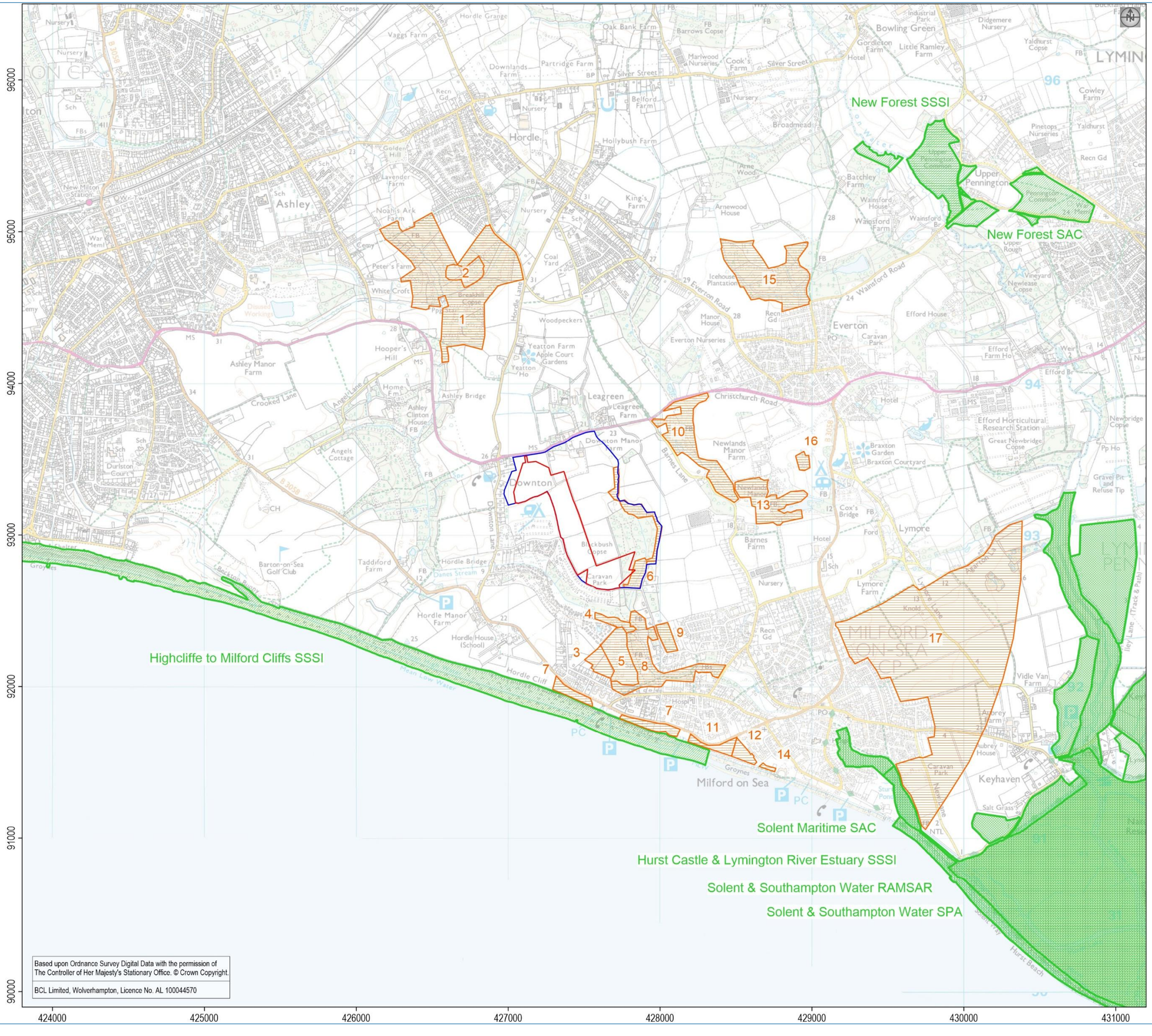
96000
95000
94000
93000
92000
91000
90000
424000
425000
426000
427000
428000
429000
430000
431000
Hordle
Ashley
Downton
Everton
Milford on Sea
Keyhaven
Lymore
Upper Pennington
Bowling Green
Christchurch Road
Everton Road
Wainsford Road
Silver Street
Hordle Lane
Barnes Lane
Downton Lane
Crooked Lane
Angel Lane
Efford Horticultural Research Station
Braxton Garden
Braxton Courtyard
Barton-on-Sea Golf Club
Hordle Cliff
Mean High Water
Mean Low Water
Solent Way
Hurst Beach
Mount Lake
Keyhaven Lake
Gravel Pit and Refuse Tip
MILFORD-ON-SEA CP
LYMINGTON AND PENNINGTON
S/NMSB/DMF/ESSD21/03
New Milton Sand and Ballast
Downton Manor Farm Quarry, Downton, Hampshire
Environmental Setting & Site Design
Version 3
Figure 1 Site Location and Setting
Drawn By: PS
Scale: 1:24,000
Date: 11/03/2021
Format: A3L



Site Boundary

Western Extension

Designated Site

Non-Designated Site

S/NMSB/DMF/ESSD21/03

New Milton Sand and Ballast

Downton Manor Farm Quarry, Downton, Hampshire

Environmental Setting & Site Design

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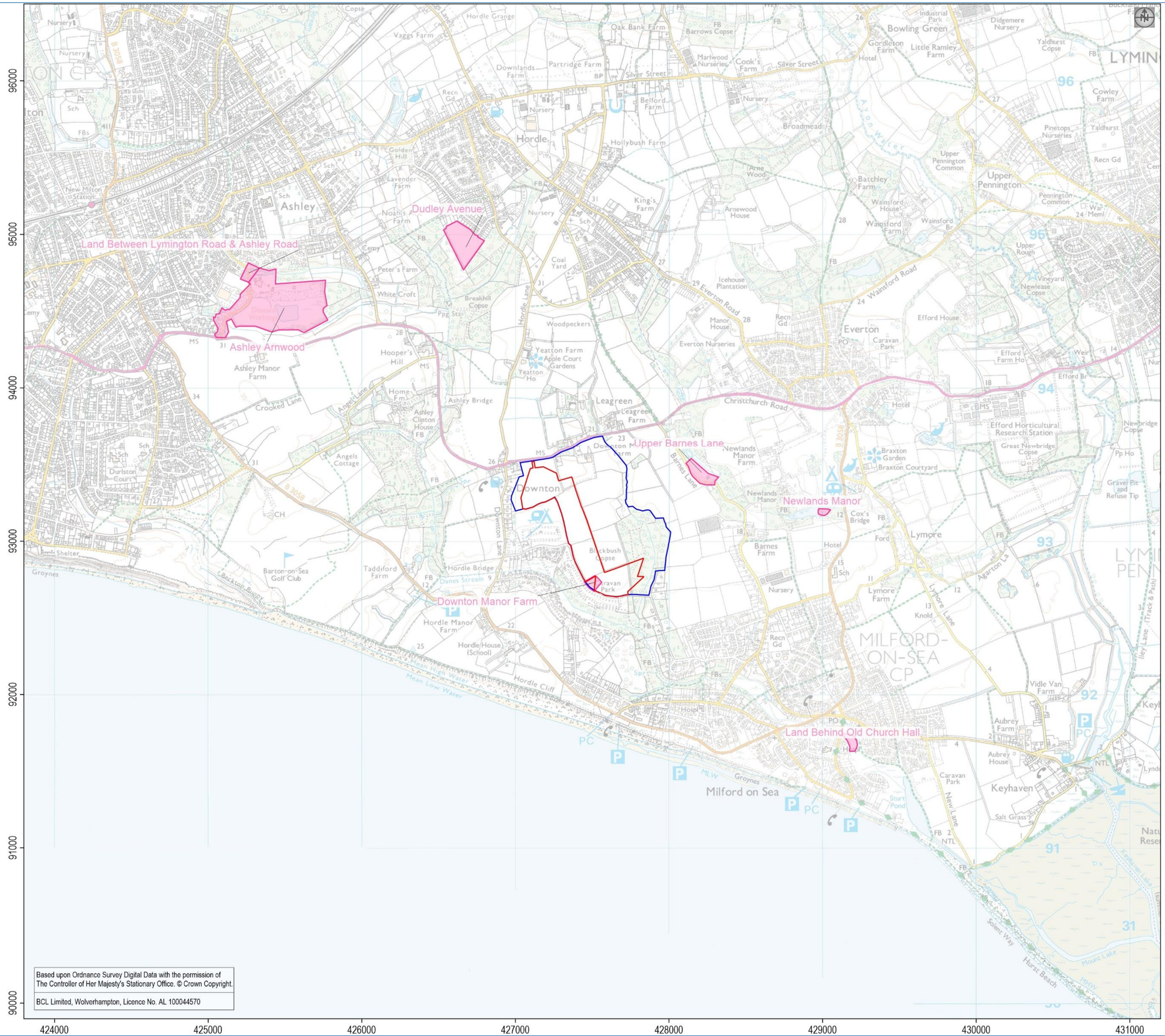
Figure 2 Ecological Sites

Drawn By: PS	**Scale: 1:24,000**
Date: 11/03/2021	**Format: A3L**



Site Boundary

Western Extension

Historic Landfill

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New Milton Sand and Ballast

Downton Manor Farm Quarry, Downton, Hampshire

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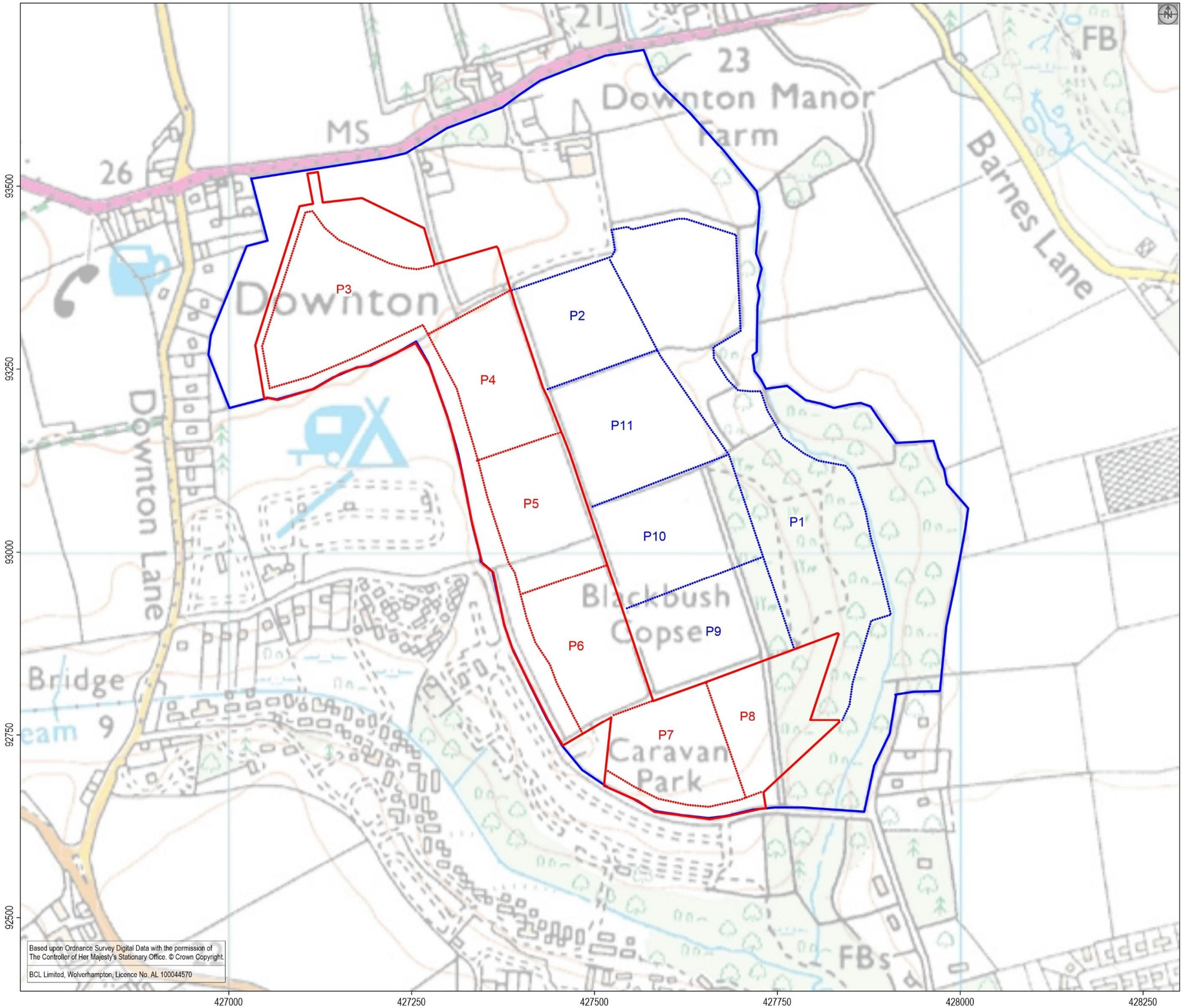
Figure 3 Landfill Sites

Drawn By: PS	**Scale: 1:24,000**
Date: 11/03/2021	**Format: A3L**



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New Milton Sand and Ballast

Downton Manor Farm Quarry, Downton, Hampshire

Environmental Setting & Site Design

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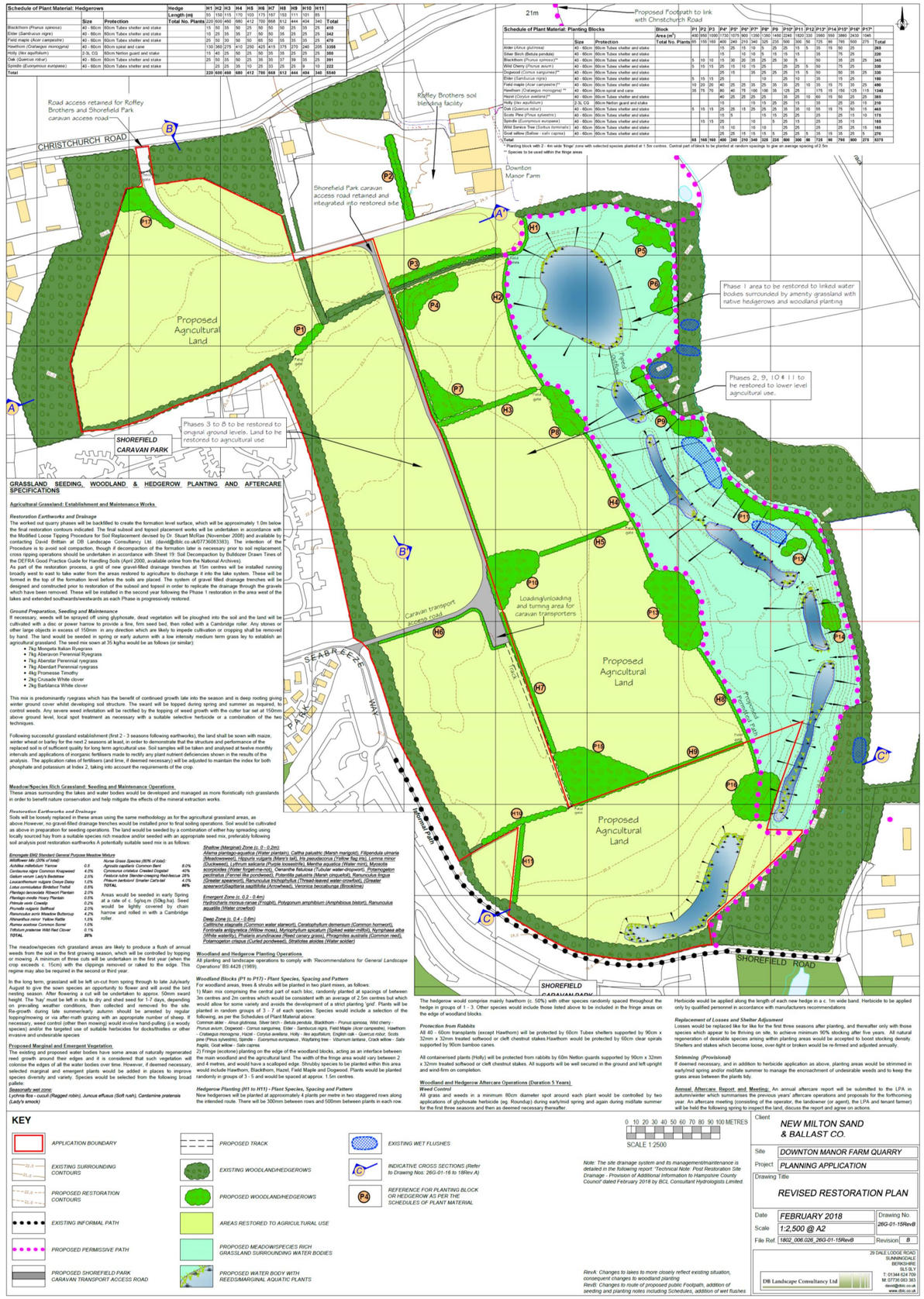
Figure 4 Site Layout and Phasing

Drawn By: PS	**Scale: 1:5,000**
Date: 11/03/2021	**Format: A3L**



Schedule of Plant Material: Hedgerows			Hedge Length (m)	H1 55	H2 150	H3 115	H4 170	H5 103	H6 175	H7 167	H8 153	H9 111	H10 101	H11 35	
	Size	Protection	Total No. Plants	220	600	460	680	412	700	668	612	444	404	340	Total
Blackthorn (*Prunus spinosa*)	40 - 60cm	60cm Tubex shelter and stake			15	50	35	50	25	50	50	35	25	25	410
Elder (*Sambucus nigra*)	40 - 60cm	60cm Tubex shelter and stake			10	25	35	35	27	50	50	35	25	25	342
Field maple (*Acer campestre*)	40 - 60cm	60cm Tubex shelter and stake			25	50	30	50	50	65	50	35	35	25	470
Hawthorn (*Crataegus monogyna*)	40 - 60cm	60cm spiral and cane			130	360	275	410	250	425	415	375	270	240	3350
Holly (*Ilex aquifolium*)	2-3L CG	60cm Nelton guard and stake			15	40	25	50	25	50	35	35	25	25	350
Oak (*Quercus robur*)	40 - 60cm	60cm Tubex shelter and stake			25	50	35	50	35	35	37	39	35	25	391
Spindle (*Euonymous europaea*)	40 - 60cm	60cm Tubex shelter and stake				25	25	35	10	25	33	25	25	9	222
Total				220	600	460	680	412	700	668	612	444	404	340	5540

Schedule of Plant Material: Planting Blocks			Block	P1	P2	P3	P4*	P5*	P6*	P7*	P8*	P9	P10*	P11	P12	P13*	P14	P15*	P16*	P17*	
			Area (m²)	400	950	1100	1130	1075	960	1330	1360	1450	2240	1820	320	3580	950	3880	2430	1040	
	Size	Protection	Total No. Plants	65	150	160	400	240	210	340	325	235	500	300	50	725	90	795	500	275	Total
Alder (*Alnus glutinosa*)	40 - 60cm	60cm Tubex shelter and stake						15	25	15	10	5	25	25	15	5	35	15	50	25		265
Silver Birch (*Betula pendula*)	40 - 60cm	60cm Tubex shelter and stake						15		10	10	5	15	15	15		35		75	25		220
Blackthorn (*Prunus spinosa*)**	40 - 60cm	60cm Tubex shelter and stake			5	10	10	15	30	20	35	25	25	25	35	5	7	50	25	25	25	365
Wild Cherry (*Prunus avium*)	40 - 60cm	60cm Tubex shelter and stake			5	15	15	25	15	10	15	25		25	25	5	50		75	25		330
Dogwood (*Cornus sanguinea*)**	40 - 60cm	60cm Tubex shelter and stake						25	15		35	25	25	25	15	5	50		50	35	25	330
Elder (*Sambucus nigra*)	40 - 60cm	60cm Tubex shelter and stake			5	15	15	25				10		25	10		35		15	25		180
Field maple (*Acer campestre*)**	40 - 60cm	60cm Tubex shelter and stake			10	20	20	40	25	25	35	25	35	35	25	10	35	15	75	35	25	490
Hawthorn (*Crataegus monogyna*) **	40 - 60cm	60cm spiral and cane			35	75	75	80	40	75	100	100	35	125	25		175	15	150	125	115	1340
Hazel (*Corylus avellana*)**	40 - 60cm	60cm Tubex shelter and stake						40	25	25	25	25		35	25	10	60	15	50	25	25	385
Holly (*Ilex aquifolium*)	2-3L CG	60cm Nelton guard and stake						15			15	15	25	25	15		35		25	25	15	210
Oak (*Quercus robur*)	40 - 60cm	60cm Tubex shelter and stake			5	15	15	25	25	15	25	25	25	35	35	10	55	15	75	50	15	465
Scots Pine (*Pinus sylvestris*)	40 - 60cm	60cm Tubex shelter and stake						15	5			15	15	25	25		25		25	15	10	175
Spindle (*Euonymous europaea*)	40 - 60cm	60cm Tubex shelter and stake				15	15	25			10		5	25	15		25		35	15		185
Wild Service Tree (*Sorbus torminalis*)	40 - 60cm	60cm Tubex shelter and stake						15	10		10	10		25	25		25		25	25	15	185
Goat willow (*Salkow - salix caprea*)	40 - 60cm	60cm Tubex shelter and stake						25	25	15	15	15	5	25	25	5	35	15	35	25	5	270
Total				65	150	160	400	240	210	340	325	235	500	300	50	725	90	795	500	275	5375

* Planting block with 2 - 4m wide 'fringe' zone with selected species planted at 1.5m centres. Central part of block to be planted at random spacings to give an average spacing of 2.5m

** Species to be used within the fringe areas

GRASSLAND SEEDING, WOODLAND & HEDGEROW PLANTING AND AFTERCARE SPECIFICATIONS

Agricultural Grassland: Establishment and Maintenance Works

Restoration Earthworks and Drainage

The worked out quarry phases will be backfilled to create the formation level surface, which will be approximately 1.0m below the final restoration contours indicated. The final subsoil and topsoil placement works will be undertaken in accordance with the Modified Loose Tipping Procedure for Soil Replacement devised by Dr. Stuart McRae (November 2008) and available by contacting David Brittain at DB Landscape Consultancy Ltd. (david@dblc.co.uk07736083383). The intention of the Procedure is to avoid soil compaction, though if decompaction of the formation later is necessary prior to soil replacement cross ripping operations should be undertaken in accordance with Sheet 19: Soil Decompaction by Bulldozer Drawn Tines of the DEFRA Good Practice Guide for Handling Soils (April 2000, available online from the National Archives).

As part of the restoration process, a grid of new gravel-filled drainage trenches at 15m centres will be installed running broadly west to east to take water from the areas restored to agriculture to discharge it into the lake system. These will be formed in the top of the formation level before the soils are placed. The system of gravel filled drainage trenches will be designed and constructed prior to restoration of the subsoil and topsoil in order to replicate the drainage through the gravels which have been removed. These will be installed in the second year following the Phase 1 restoration in the area west of the lakes and extended southwards/westwards as each Phase is progressively restored.

Ground Preparation, Seeding and Maintenance

If necessary, weeds will be sprayed off using glyphosate, dead vegetation will be ploughed into the soil and the land will be cultivated with a disc or power harrow to provide a fine, firm seed bed, then rolled with a Cambridge roller. Any stones or other large objects in excess of 150mm in any direction which are likely to impede cultivation or cropping shall be removed by hand. The land would be seeded in spring or early autumn with a low intensity medium term grass ley to establish an agricultural grassland. The seed mix sown at 35 kg/ha would be as follows (or similar):

- 7kg Mongeta Italian Ryegrass
- 7kg Aberavon Perennial Ryegrass
- 7kg Aberstar Perennial ryegrass
- 7kg Aberdart Perennial ryegrass
- 4kg Promesse Timothy
- 2kg Crusade White clover
- 3kg Barbianca White clover

This mix is predominantly ryegrass which has the benefit of continued growth late into the season and is deep rooting giving winter ground cover whilst developing soil structure. The sward will be topped during spring and summer as required, to control weeds. Any severe weed infestation will be rectified by the topping of weed growth with the cutter bar set at 150mm above ground level, local spot treatment as necessary with a suitable selective herbicide or a combination of the two techniques.

Following successful grassland establishment (first 2 - 3 seasons following earthworks), the land shall be sown with maize, winter wheat or barley for the next 2 seasons at least, in order to demonstrate that the structure and performance of the replaced soil is of sufficient quality for long term agricultural use. Soil samples will be taken and analysed at twelve monthly intervals and applications of inorganic fertilisers made to rectify any plant nutrient deficiencies shown in the results of the analysis. The application rates of fertilisers (and lime, if deemed necessary) will be adjusted to maintain the index for both phosphate and potassium at Index 2, taking into account the requirements of the crop.

Meadow/Species Rich Grassland: Seeding and Maintenance Operations.

These areas surrounding the lakes and water bodies would be developed and managed as more floristically rich grasslands in order to benefit nature conservation and help mitigate the effects of the mineral extraction works.

Restoration Earthworks and Drainage

Soils will be loosely replaced in these areas using the same methodology as for the agricultural grassland areas, as above.However, no gravel-filled drainage trenches would be installed prior to final soiling operations. Soil would be cultivated as above in preparation for seeding operations. The land would be seeded by a combination of either hay spreading using locally sourced hay from a suitable species rich meadow and/or seeded with an appropriate seed mix, preferably following soil analysis post restoration earthworks A potentially suitable seed mix is as follows:

Emorgate EM2 Standard General Purpose Meadow Mixture

Wildflower Mix (25% of total)		*Grass Species (80% of total)*	
Achillea millefolium Yarrow	0.5	*Agrostis capillaris* Common Bent	8.0%
Centaurea nigra Common Knapweed	4.0%	*Cynosurus cristatus* Crested Dogstail	40%
Galium verum Lady's Bedstraw	2.5%	*Festuca rubra* Slender-creeping Red-fescue	28%
Leucanthemum vulgare Daisy Daisy	4.0%	*Phleum bertolonii* Smaller Cat's-tail	4.0%
Lotus corniculatus Birdsfoot Trefoil	0.5%	**TOTAL**	**80%**
Plantago lanceolata Ribwort Plantain	2.0%		
Plantago media Hoary Plantain	0.5%		
Primula veris Cowslip	0.2%		
Prunella vulgaris Selfheal	2.0%		
Ranunculus acris Meadow Buttercup	4.2%		
Rhinanthus minor Yellow Rattle	1.5%		
Rumex acetosa Common Sorrel	1.0%		
Trifolium pratense Wild Red Clover	0.1%		
TOTAL	**20%**		

Areas would be seeded in early Spring at a rate of c. 5g/sq.m (50kg/ha). Seed would be lightly covered by chain harrow and rolled in with a Cambridge roller.

The meadow/species rich grassland areas are likely to produce a flush of annual weeds from the soil in the first growing season, which will be controlled by topping or mowing. A minimum of three cuts will be undertaken in the first year (when the crop exceeds c. 15cm) with the clippings removed or raked to the edge. This regime may also be required in the second or third year.

In the long term, grassland will be left un-cut from spring through to late July/early August to give the sown species an opportunity to flower and will avoid the bird nesting season. After flowering a cut will be undertaken to approx. 50mm sward height. This 'hay' must be left in situ to dry and shed seed for 1-7 days, depending on prevailing weather conditions, then collected and removed fro the site. Re-growth during late summer/early autumn should be arrested by regular topping/mowing or via after-math grazing with an appropriate number of sheep. If necessary, weed control (other than topping) would involve hand-pulling (i.e woody species) and/or the targeted use of suitable herbicides for docks/thistles or other invasive and undesirable species

Proposed Marginal and Emergent Vegetation.

The existing and proposed water bodies have some areas of naturally regenerated reed growth around their edges and it is considered that such vegetation will colonise the edges of all the water bodies over time. However, if deemed necessary, selected marginal and emergent plants would be added in places to improve species diversity and variety. Species would be selected from the following broad pallete:

Seasonally wet zone:

Lythrum flos - cuculi (Ragged robin), Juncus effusus (Soft rush), Cardamine pratensis (Lady's smock)

Shallow (Marginal) Zone (c. 0 - 0.2m):

Alisma plantago-aquatica (Water plantain), Caltha palustris (Marsh marigold), Filipendula ulmaria (Meadowsweet), Hippuris vulgaris (Mare's tail), Iris pseudacorus (Yellow flag iris), Lemna minor (Duckweed), Lythrum salicaria (Purple loosestrife), Mentha aquatica (Water mint), Myosotis scorpioides (Water forget-me-not), Oenanthe fistulosa (Tubular water-dropwort), Potamogeton pectinatus (Fennel like pondweed), Potentilla palustris (Marsh cinquefoil), Ranunculus lingua (Greater spearwort), Ranunculus trichophyllus (Thread-leaved water-crowfoot), (Greater spearwort)Sagittaria sagittifolia (Arrowhead), Veronica beccabunga (Brooklime)

Emergent Zone (c. 0.2 - 0.4m):

Hydrocharis morsus-ranae (Frogbit), Polygonum amphibium (Amphibious bistort), Ranunculus aquatilis (Water crowfoot)

Deep Zone (c. 0.4 - 0.8m):

Callitriche stagnalis (Common water starwort), Ceratophyllum demersum (Common hornwort), Fontinalis antipyretica (Willow moss), Myriophyllum spicatum (Spiked water-milfoil), Nymphaea alba (White waterlily), Phalaris arundinacea (Reed canary grass), Phragmites australis (Common reed), Potamogeton crispus (Curled pondweed), Stratiotes aloides (Water soldier)

Woodland and Hedgerow Planting Operations.

All planting and landscape operations to comply with *'Recommendations for General Landscape Operations'* BS:4428 (1989).

Woodland Blocks (P1 to P17) - Plant Species, Spacing and Pattern

For woodland areas, trees & shrubs will be planted in two plant mixes, as follows:

1) Main mix comprising the central part of each bloc, randomly planted at spacings of between 3m centres and 2m centres which would be consistent with an average of 2.5m centres but which would allow for some variety and avoids the development of a strict planting 'grid'. Plants will be planted in random groups of 3 - 7 of each species. Species would include a selection of the following, as per the Schedules of Plant Material above:

Common alder - Alnus glutinosa, Silver birch - Betula pendula, Blackthorn - Prunus spinosa, Wild cherry - Prunus avium, Dogwood - Cornus sanguinea, Elder - Sambucus nigra, Field Maple (Acer campestre), Hawthorn - Crataegus monogyna, Hazel - Corylus avellana, Holly - Ilex aquifolium, English oak - Quercus robur, Scots pine (Pinus sylvestris), Spindle - Euonymus europaeus , Wayfaring tree - Viburnum lantana , Crack willow - Salix fragilis, Goat willow - Salix caprea.

2) Fringe (ecotone) planting on the edge of the woodland blocks, acting as an interface between the main woodland and the agricultural land. The width of the fringe area would vary between 2 and 4 metres, and would have a scalloped edge. Shrubby species to be planted within this area would include Hawthorn, Blackthorn, Hazel, Field Maple and Dogwood. Plants would be planted randomly in groups of 3 - 5 and would be spaced at approx. 1.5m centres.

Hedgerow Planting (H1 to H11) - Plant Species, Spacing and Pattern

New hedgerows will be planted at approximately 4 plants per metre in two staggered rows along the intended route. There will be 300mm between rows and 500mm between plants in each row.

The hedgerow would comprise mainly hawthorn (c. 50%) with other species randomly spaced throughout the hedge in groups of 1 - 3. Other species would include those listed above to be included in the fringe areas on the edge of woodland blocks.

Protection from Rabbits

All 40 - 60cm transplants (except Hawthorn) will be protected by 60cm Tubex shelters supported by 90cm x 32mm x 32mm treated softwood or cleft chestnut stakes.Hawthorn would be protected by 60cm clear spirals supported by 90cm bamboo canes.

All containerised plants (Holly) will be protected from rabbits by 60m Nelton guards supported by 90cm x 32mm x 32mm treated softwood or cleft chestnut stakes. All supports will be well secured in the ground and left upright and wind-firm on completion.

Woodland and Hedgerow Aftercare Operations (Duration 5 Years).

Weed Control

All grass and weeds in a minimum 80cm diameter spot around each plant would be controlled by two applications of glyphosate herbicide (eg. Roundup) during early/mid spring and again during mid/late summer for the first three seasons and then as deemed necessary thereafter.

Herbicide would be applied along the length of each new hedge in a c. 1m wide band. Herbicide to be applied only by qualified personnel in accordance with manufacturers recommendations

Replacement of Losses and Shelter Adjustment

Losses would be replaced like for like for the first three seasons after planting, and thereafter only with those species which appear to be thriving on site, to achieve minimum 90% stocking after five years. All natural regeneration of desirable species arising within planting areas would be accepted to boost stocking density. Shelters and stakes which become loose, over-tight or broken would be re-firmed and adjusted annually.

Strimming (Provisional)

If deemed necessary, and in addition to herbicide application as above, planting areas would be strimmed in early/mid spring and/or mid/late summer to manage the encroachment of undesirable weeds and to keep the grass areas between the plants tidy.

Annual Aftercare Report and Meeting: An annual aftercare report will be submitted to the LPA in autumn/winter which summarises the previous years' aftercare operations and proposals for the forthcoming year. An aftercare meeting (consisting of the operator, the landowner (or agent), the LPA and tenant farmer) will be held the following spring to inspect the land, discuss the report and agree on actions.

KEY

- APPLICATION BOUNDARY
- EXISTING SURROUNDING CONTOURS
- PROPOSED RESTORATION CONTOURS
- EXISTING INFORMAL PATH
- PROPOSED PERMISSIVE PATH
- PROPOSED SHOREFIELD PARK CARAVAN TRANSPORT ACCESS ROAD
- PROPOSED TRACK
- EXISTING WOODLAND/HEDGEROWS
- PROPOSED WOODLAND/HEDGEROWS
- AREAS RESTORED TO AGRICULTURAL USE
- PROPOSED MEADOW/SPECIES RICH GRASSLAND SURROUNDING WATER BODIES
- PROPOSED WATER BODY WITH REEDS/MARGINAL AQUATIC PLANTS
- EXISTING WET FLUSHES
- INDICATIVE CROSS SECTIONS (Refer to Drawing Nos: 26G-01-16 to 18Rev A)
- REFERENCE FOR PLANTING BLOCK OR HEDGEROW AS PER THE SCHEDULES OF PLANT MATERIAL

0 10 20 30 40 50 60 70 80 90 100 METRES

SCALE 1:2500

Note: The site drainage system and its management/maintenance is detailed in the following report: "Technical Note: Post Restoration Site Drainage - Provision of Additional Information to Hampshire County Council" dated February 2018 by BCL Consultant Hydrologists Limited.

RevA: Changes to lakes to more closely reflect existing situation, consequent changes to woodland planting

RevB: Changes to route of proposed public Footpath, addition of seeding and planting notes including Schedules, addition of wet flushes

Client: NEW MILTON SAND & BALLAST CO.

Site: DOWNTON MANOR FARM QUARRY

Project: PLANNING APPLICATION

Drawing Title: REVISED RESTORATION PLAN

Date: FEBRUARY 2018 | Drawing No.: 26G-01-15RevB

Scale: 1:2,500 @ A2 | Revision: B

File Ref: 1802_006.026_26G-01-15RevB

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S/NMSB/DMF/ESSD21/03

NEW MILTON SAND AND BALLAST
maintaining the environment

BCL HYDRO

New Milton Sand and Ballast

Downton Manor Farm Quarry, Downton, Hampshire

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Figure 5 Restoration

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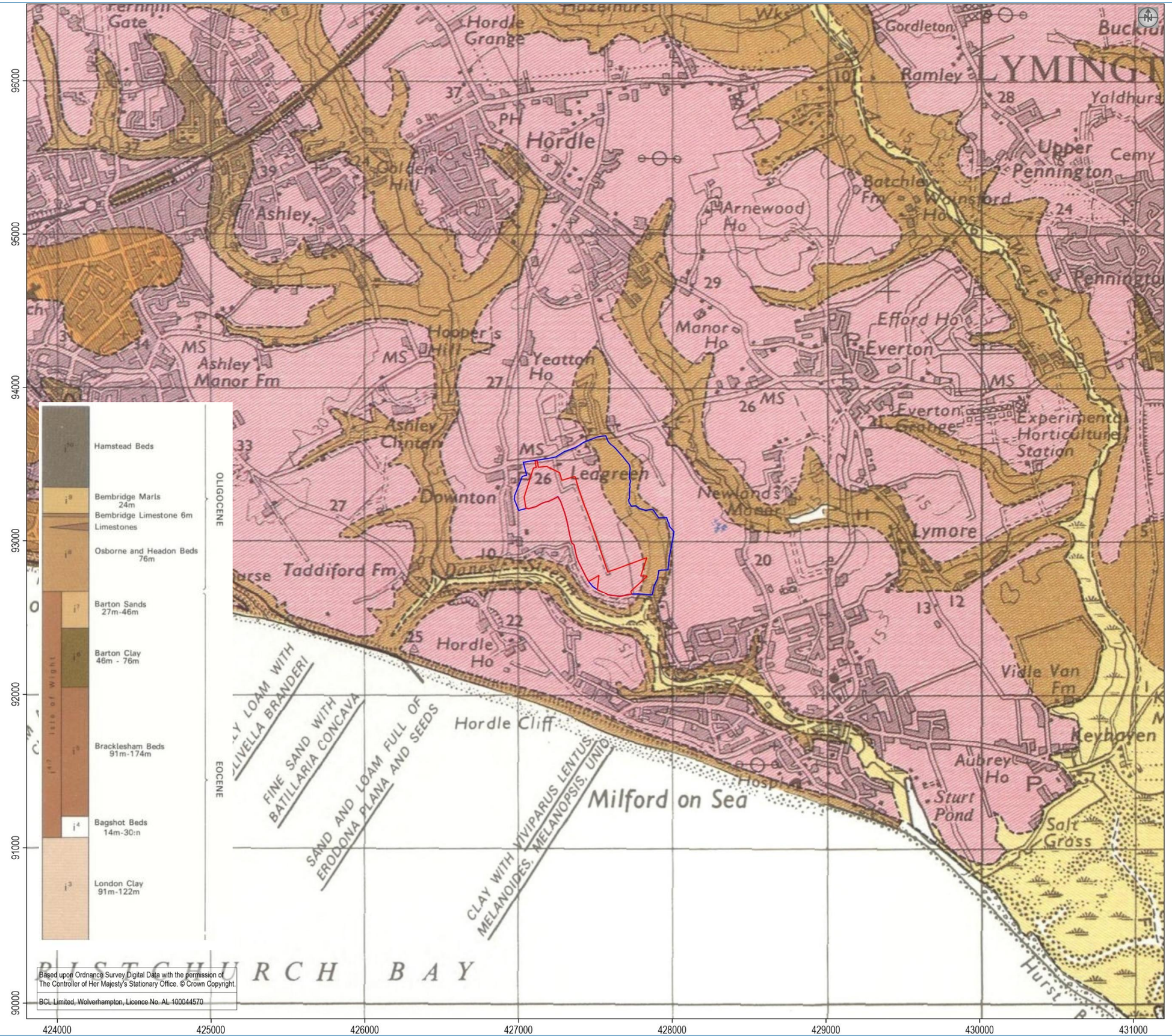
Date: 11/03/2021 | **Format: A3L**



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NEW MILTON SAND AND BALLAST

BCL HYDRO

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Environmental Setting & Site Design

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Figure 6 Geology

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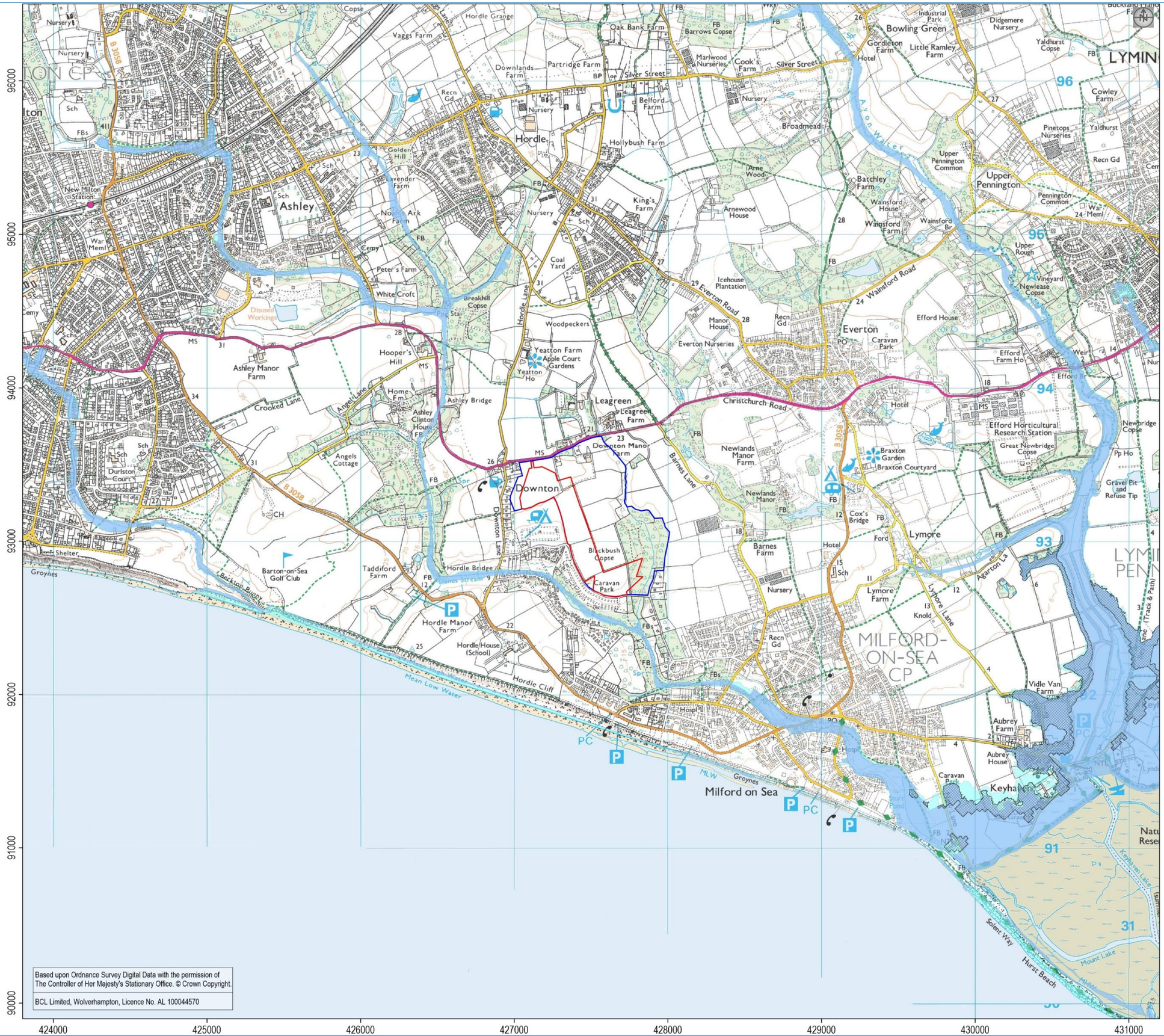

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New Milton Sand and Ballast

Downton Manor Farm Quarry, Downton, Hampshire

Environmental Setting & Site Design

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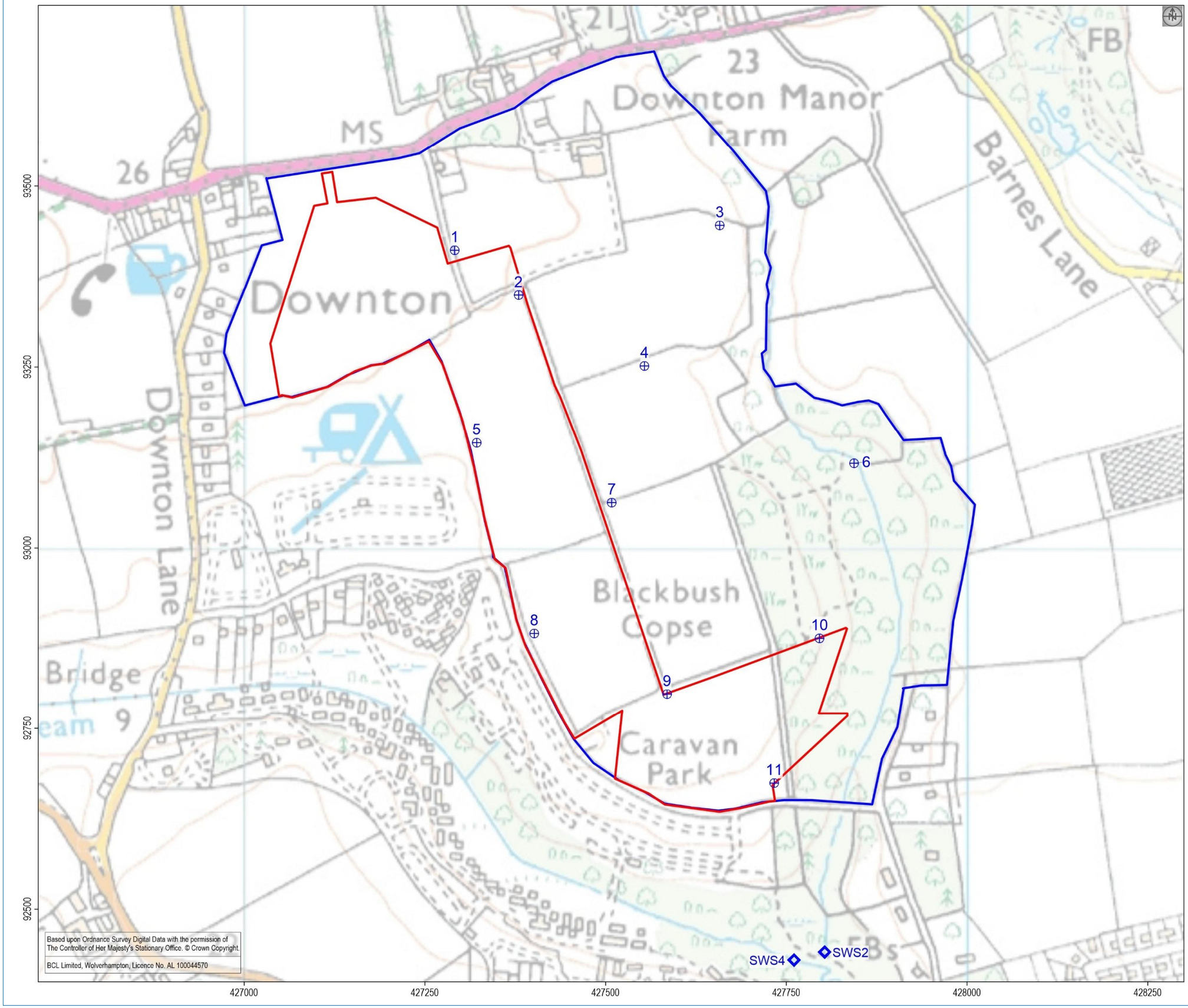
Figure 7 Flooding

Drawn By: PS	**Scale: 1:24,000**
Date: 11/03/2021	**Format: A3L**



Site Boundary

Western Extension

Piezometer Location

Surface Water Sample Location

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Downton Manor Farm Quarry, Downton, Hampshire

Environmental Setting & Site Design

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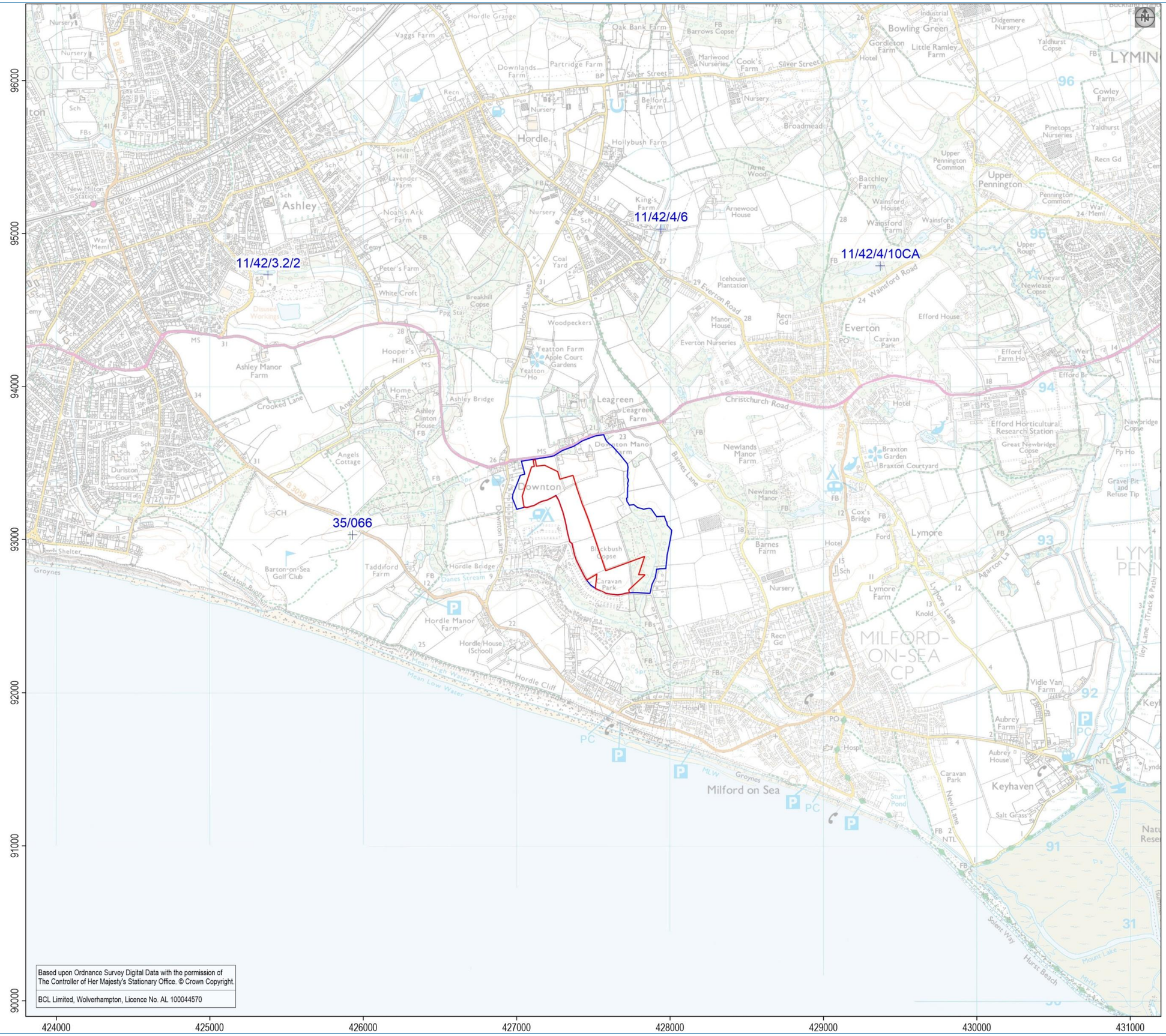
Figure 8 Monitoring Locations

Drawn By: PS	**Scale: 1:24,000**
Date: 11/03/2021	**Format: A3L**



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New Milton Sand and Ballast

Downton Manor Farm Quarry, Downton, Hampshire

Environmental Setting & Site Design

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Figure 9 Abstractions

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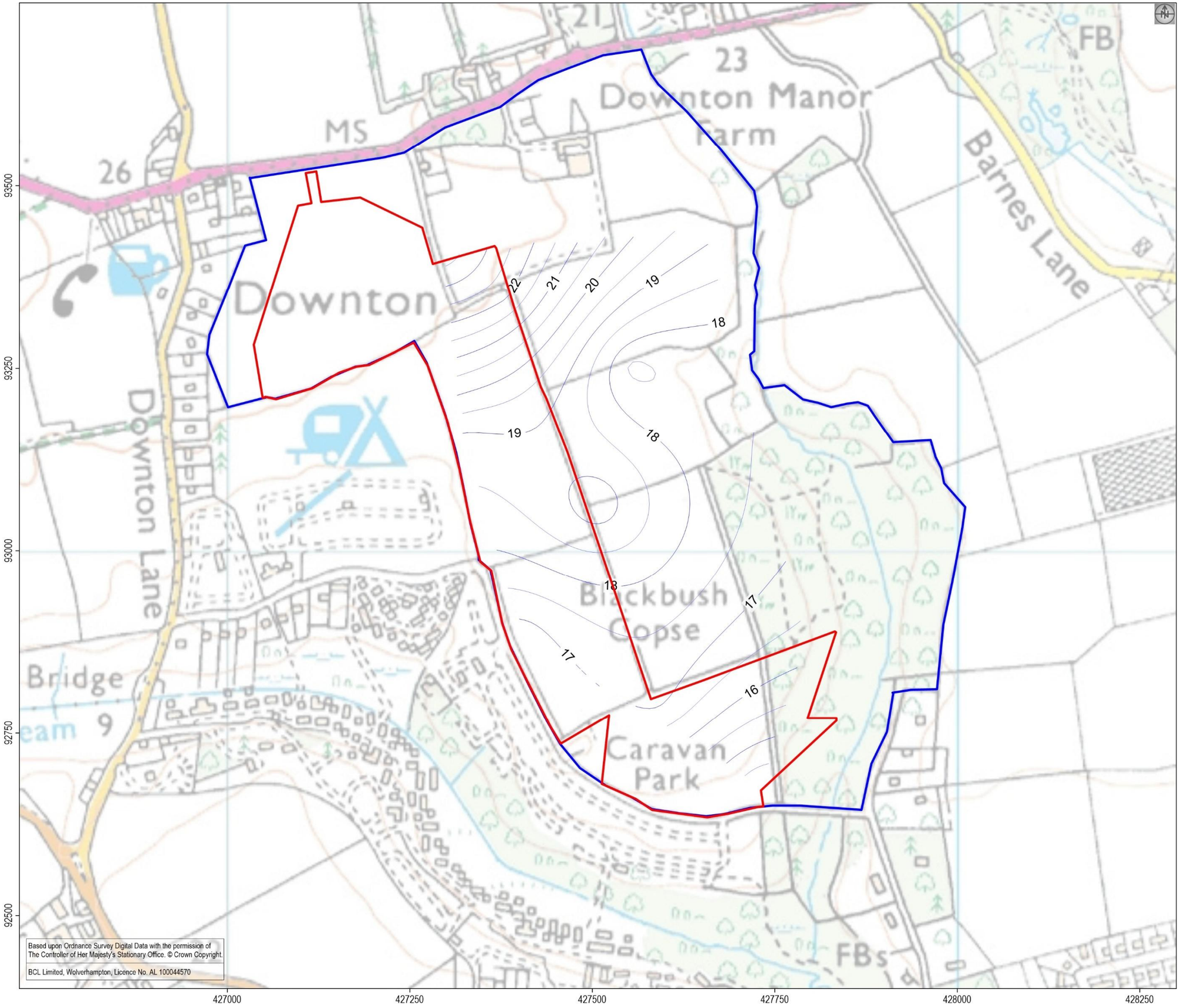

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New Milton Sand and Ballast

Downton Manor Farm Quarry, Downton, Hampshire

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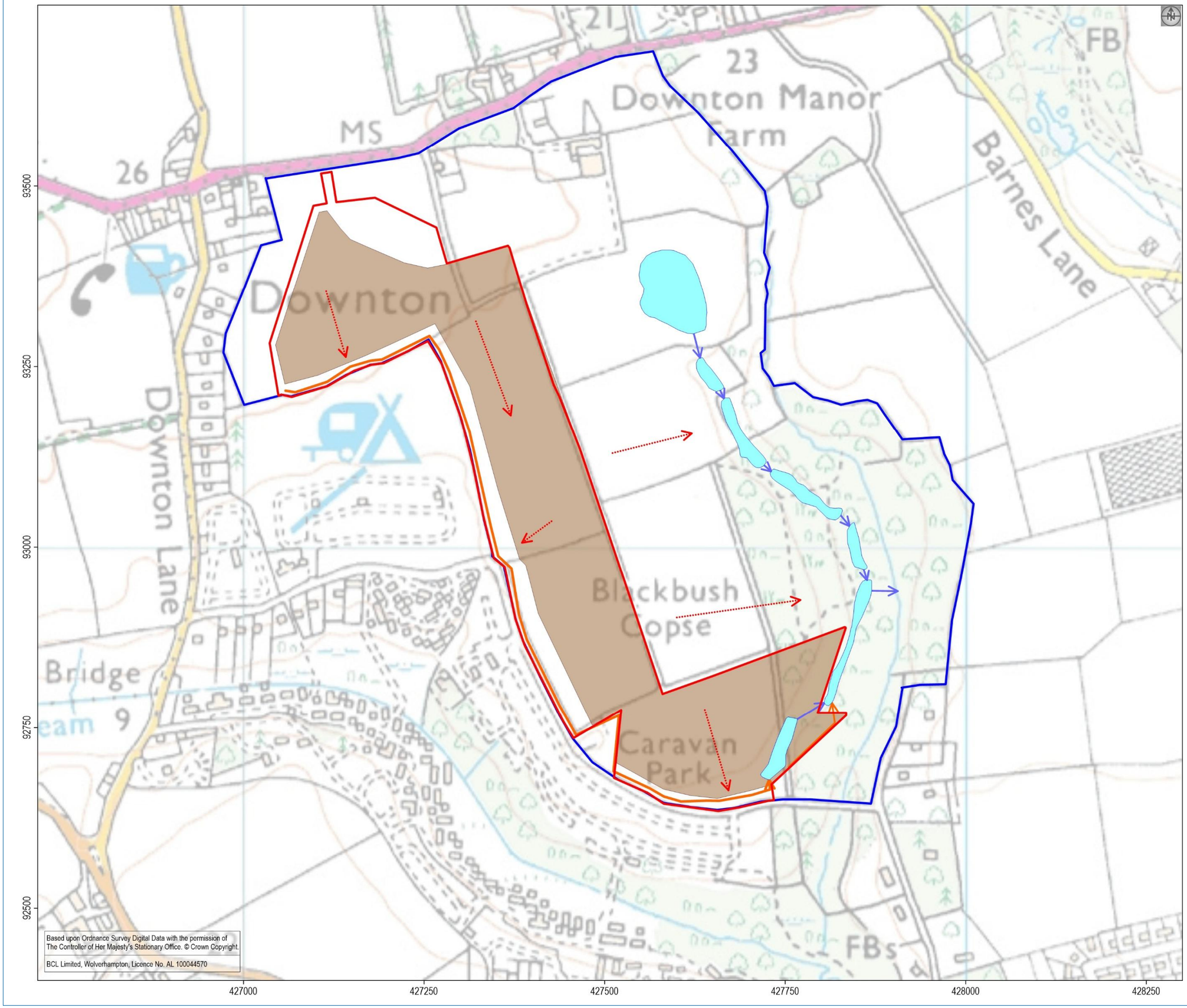
Figure 10 Average Groundwater Elevations

Drawn By: PS	**Scale: 1:5,000**
Date: 11/03/2021	**Format: A3L**



Site Boundary

Western Extension

Recovery Operation

Restoration Lakes

Surface Runoff

Ditch Flow

Piped Flow

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Figure 11 Restoration Water Management

Drawn By: PS	**Scale: 1:5,000**
Date: 11/03/2021	**Format: A3L**